Geospatial standards for UK authoritative data providers

A UK set of standards and priorities

Preliminary consultation and recommendations

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Edward Lewis, Peter Parslow

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For further information on this report

Please contact: Peter Parslow

Telephone :   care of OS +44 (0) 3453 75 75 95
Email: os.data@os.uk

Preface

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Glossary

Data & Data Services

Term	Description
3D Data	Any type of vector or raster data where the geospatial object is represented in three dimensions (x,y,z). Typically example would be 3D models of buildings.
Coordinate reference system	A standard used in vector and raster datasets to reference the position of a geospatial object in relation to the earth's surface. Different coordinate reference systems exist to allow for appropriate positional accuracies at different scales.
Encoding	The file format standard for data transfer often denoted by filename extension or media type identifier e.g. .csv .json .gpkg
Raster Data	A geospatial dataset where ethe object is represented as a coverage, typically a grid or mesh. Common examples include satellite imagery and the outputs of numerical simulations
Spatial-temporal data	Any type of vector or raster data where the geospatial object varies with time. This can, for example, include changes in land use over time but commonly applies to environmental phenomena such as temperature, or water level,
Styles	Standards that specify how a data should be portrayed, usually for humans to read and understand. Can be applied to both vector and raster data. An example would be to style "motorways as blue" or "high temperatures as red"
Vector Data	A geospatial dataset where the object that is represented as series of related coordinates. Examples can include a single point for single tree, a polygon for the boundaries of a forest, or a line for a path or road.
Web Service / API	An online service standard providing web documents (HTML, JSON, XML) / a computing interface defining interactions between software intermediaries.

Standards Development

Term	Description
Geospatial data standard	Any standard normalising the creation and use or a numerical representation of the real-world. This chiefly includes the content, structure and encoding of a dataset, but also includes the management and technology governing its lifecycle such data capture, processing, catalogues, distribution and archive.
Official Standard	Standards that are developed by Standards Development Organisations (SDOs) with legal and recognised standing such as the [International Standards Organisation (ISO)] (https://www.iso.org/home.html).
De facto standard	A standard that is commonly used but may not be official. They mainly originate from industry and their use has been expanded into the wider community for practical reasons. A good example of a de facto standard is Shapefile which is very common.
Open standard	UK Cabinet Office have a policy paper on Open Standards principles – Open Standards principles – GOV.UK (www.gov.uk) Open standards are developed by a SDO to which membership is open, and the standard is available to the public for developing compliant products (with or without some license fee). They are not controlled by a single vendor. The key points which qualify standards openness are: ● membership to the developing organisation is sufficiently open, thus allowing users to influence the development of standards ● public availability of the standard once it is completed, and ● possibility to use it free of charge for any purpose. The use of Open standards in a user application should be free and without restrictions and the necessary documentation should be available on fair and equitable terms. Standards that do not respect this principle of openness were not selected in this profile
Proprietary	Proprietary standards or privately owned standards that are controlled by one company. When a proprietary standard is widely used, it becomes a de facto standard even though it is not governed by a SDO,

Local	Local standards - can be considered as a standard within a specific organization but is not in use in the international community
Proposed	a standard that has an active working group and may have had a pilot program or engineering report but is not yet an Emerging standard.
Current	A standard of the latest issue or amendment and not superseded, obsolete or cancelled. The status usually applies to standards for equipment or processes that are up-to-date or are in-general use
Supported	A standard of the latest issue or amendment and not superseded, obsolete or cancelled. However the status usually applies to standards which are not in general use but are supported for legacy reasons or mandate.
Emerging	A standard is considered emerging if it is sufficiently mature to be used within the definition of future planned systems
Superseded	A standard that has been replaced by a later issue or amendment. They may be superseded by either the same document with a higher issue or amendment level, or by an entirely different standard
Obsolete	Standards that contain accurate information at the date of being made obsolete but are no longer applicable to equipment or processes. Provided that subsequent information has not invalidated the content, an obsolete standard could still be of use to historic systems or processes, but risks must be identified and mitigated by the User in a Standardization Management Plan.
Cancelled	A standard that has been totally withdrawn from service and is not to be used. A particular revision or issue of a document can be classified as cancelled and the next issue or revision of the same document can supersede the cancelled document.
DSA	Data Standards Authority
OSB	Open Standards Board
GDS	Government Digital Service
OGC	Open Geospatial Consortium
W3C	World Wide Web Consortium

Further terms and descriptions can be found on the [hosted Geospatial Glossary](#)

Executive summary

This document makes recommendations on geospatial standards for UK data providers. These recommendations are based on two rounds of stakeholder engagement which were managed by Ordnance Survey during late 2020 and early 2021, as part of the Public Sector Geospatial Agreement. The first round involved thirty two data publishers (primarily authoritative public sector data providers) . The second round obtained input from about one hundred data users.

The input was evaluated and considered to make the following recommendations. The recommendations should be considered as part of an evolving appraisal/approach to geospatial standards going forward with the agility to respond to both user needs and technological advances in the sector.

Recommendations for the government

- The continued review and adoption of UK GEMINI metadata standard
- Further review and adoption of several stable geospatial data standards to the Open Standards Board for adoption as recommended for use in government. These are : GeoJSON, GeoPackage, GeoTIFF.
- The government advice on Comma Separate Values (CSV) data needs a small addition to standardise the approach when using it for location data - making use of the Well-Known-Text (WKT) representation of geometry.
- The government advice on Coordinate Reference Systems (CRS) needs a minor correction/enhancement,
    - Currently does not specify EPSG code for WGS84 making it ambiguous as multiple CRS use the WGS84 datum.
    - Addition of two other reference systems to be added to the government guidance on CRS: the British National Grid, and the spherical system used in most web mapping.
    - Include guidance on how positional accuracy requirements vary with the expected purpose of the data, and how different CRSs enable different accuracies at different locations.
- Government should coordinate responsibilities to manage change to the technical specifications of the UK SDI, including UK input to INSPIRE

Recommendations for data publishers

- There are standards which data publishers want to use where adoption is currently low. It is suggested that further engagement would be beneficial with data users (training, demonstrating benefits of change) and / or with the software developers who provide tools to those users:
    - GeoPackage and GeoJSON (and even GML) as a migration path from ESRI Shape files

- API delivery (OGC WMS & WFS and OGC APIs) as a migration from download and even hard media delivery, while accepting that some data users have actual needs to managing data in their own infrastructure

Actions to take forward with data publishers, coordinating involvement with standards development
- There are standards where several UK data publishers would like to facilitate the rapid completion and adoption of those standards. It would be useful to coordinate UK involvement in the standards development projects, which are all occurring at OGC:
  - OGC API Tiles,
  - OGC API Maps and Styles
  - OGC API Records
- In addition to generic GI standards, there are a wide range of domain specific standards that are both important in their own right and support how generic standards are implemented in specific domain areas. These can therefore also be considered for adoption and promotion and also integration between domains (e.g. GI and construction). Examples include:
  - Land Administration Domain Model (ISO 19152);
  - IHO S-57 & S-100 for marine navigation;
  - OGC (& ISO 19170) Distributed Global Grid System;
  - ISO 19142 Land Cover Classification System.
  - ISO 19650 series (Building Information Management)
  - ISO 37100 series (Smart Cities).
  - INSPIRE Thematic Data Specifications.

Other recommendations require more investigation:

- Vocabularies: To support semantic interoperability, many data publishers use standard vocabularies, but there is no overall convergence on any particular vocabulary. There scope to consider either common vocabularies or a common approach to vocabularies.
- Many publishers want to publish in RDF / linked data, but only 14% of users said they used it. The W3C/OGC Spatial Data on the Web Best Practice may also fall in this category, but first needs further discussion with data publishers as to why few of them specifically use it.

Introduction

UK Geospatial Strategy and Ordnance Survey

The Geospatial Commission released the UK's Geospatial Strategy in 2020. The strategy recognises under Mission 1 and Mission 2 that standards have a key role to play in unlocking value from Location Data. The convergence of policies, standards, technologies, and reference datasets will better allow stakeholders to discover, access, visualize, integrate, apply and share quality location-based information from different organisations, and to different data users. Standards are therefore vital for improving the quality of our geospatial infrastructure and making our key geospatial data more FAIR (Findable, Accessible, Interoperable & Reusable).

Working collaboratively with the Geospatial Commission, GeoX and Partner Bodies, Ordnance Survey provides UK leadership in international geospatial standardisation, and regularly provides input into the development of geospatial information standards (IST/36, OGC, UK GEMINI). Through their work with the GC and as part of the Public Sector Geospatial Agreement (PSGA), Ordnance Survey (OS) embarked on the creation of a priority UK geospatial standards set.

The work for this report originally started under the AGI, with a workshop facilitated by OS in 2018, involving the Geo6 organisations, plus Defra, Met Office, Ministry of Defence, Office of National Statistics, and OGC. The consensus of this workshop was primarily around data access. A significant number of standards (>100) were currently in use across government when organisations were surveyed at a BSI event also in 2018; There was recognition this diverse offering could be rationalised towards a set of priority data standards, improving interoperability between systems for stakeholders.

This is a first step towards having a recognised geospatial data standards catalogue for reference by UK geospatial data creators and providers. Evidence from other countries (e.g. Netherlands, United States) suggests that such a managed set of standards for their geospatial data is very beneficial.

Current Guidance

General
The UK government provides guidance on Open Standards to use in government –

- https://www.gov.uk/government/collections/open-standards-for-government-data-and-technology
- https://www.gov.uk/service-manual/technology/working-with-open-standards

Including a set of recommended standards:

- https://www.gov.uk/government/publications/open-standards-for-government

There is also a clear process for how the government chooses open standards, and how new open standards can be suggested, to improve public services – https://www.gov.uk/guidance/choosing-open-standards-for-government,. This utilises the alphagov GitHub presence: alphagov/open-standards: Collaboration space for discussing and exploring technical and data standards (github.com)

The existing UK government recommended standards cover a limited selection of the data types used in the geospatial arena but none are specifically focused on geospatial data transfer formats, although there are recommendations on standards which can be applied to geospatial data for example:

- Exchange of location point
- Metadata
- Persistent resolvable identifiers
- Identifying property and street information
- Describing RESTful APIs with OpenAPI 3

The Government Digital Service provides guidance stating "Use the Unique Property Reference Number (UPRN) and the Unique Street Reference Number (USRN) to identify geographic locations". UPRN and USRN are defined in BS 7666 which is the basis of the GeoPlace specification for transferring local address & street gazetteer information from local authorities to GeoPlace, who consolidate it into the National Address Gazetteer. BS7666 is a profile of ISO 19160

The technical requirements of the INSPIRE Regulations 2009[1] are easiest to comply with by using the INSPIRE Data Specifications which are detailed geospatial data standards for particular geospatial themes such as transport networks, land use and natural risk zone amongst others.

Coordinate Reference Systems
The UK government currently issues guidance related to sharing location data on addressing and Coordinate reference systems (CRS) both within government and externally, and on metadata.

In the UK there is already guidance on CRS by GDS:

- use WGS84 for worldwide geographic location points
- use ETRS89 (EPSG::4258) for Europe"

This does not specify EPSG code. Recommended CRS and EPSG codes are provided in Table 1.

Table 1. Recommend CRS

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[1] The INSPIRE Regulations 2009 (legislation.gov.uk) as amended in 2012, 2018, and 2020, and equivalent Scottish Regulations (collectively, the "UK SDI").

Standard	Custodian	Comments
EPSG:4326	EPSG (IOPG)	World Geodetic System 1984, used in GPS. The international standard geographic CRS
EPSG:4258	ESPG (IOPG)	Specified in INSPIRE as ETRS89-GRS80h
EPSG:3857	ESPG (IOPG)	WGS 84 / Pseudo-Mercator, The defacto standard projected CRS
EPSG:27700	ESPG (IOPG)/Ordnance Survey	OSGB 1936 / British National Grid. The defacto UK projected standard CRS

Metadata

[UK Government guidance](#) currently suggests using Dublin Core and schema.org to "describe the contents of a comma-separated values (CSV) file, spreadsheet or other file type containing data you publish."[2] While data.gov guidance specifies using DCAT or UK GEMINI, the UK standard for spatial metadata. UK GEMINI is based on ISO 19115 and satisfies the requirements of INSPIRE.

UK GEMINI is in the process of being approved as a UK government standard and will be supported as a priority data standard. UKGEMINI does have dependencies on other standards such as Dublin Core vocabularies and to maintain compatibility with ISO19115.

Also for marine data in the UK, a community standard based on UK GEMINI has been developed, the MEDIN discovery metadata standard[3].

Linked data

Geospatial data can also be linked data, the pinnacle of sharing data (Figure 1:), where structured data is interlinked with other data, making both more useful and is built on standard web technologies (HTTP, RDF & URI's). However, implementation can often be technically challenging which is why many organisations get "stuck" providing beyond 3-star data services.

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[2] https://www.gov.uk/government/publications/recommended-open-standards-for-government/using-metadata-to-describe-tabular-data-for-publishing & https://www.gov.uk/government/publications/recommended-open-standards-for-government/using-metadata-to-describe-tabular-data-for-publishing

[3] MEDIN discovery metadata standard | MEDIN – Marine Environmental Data and Information Network
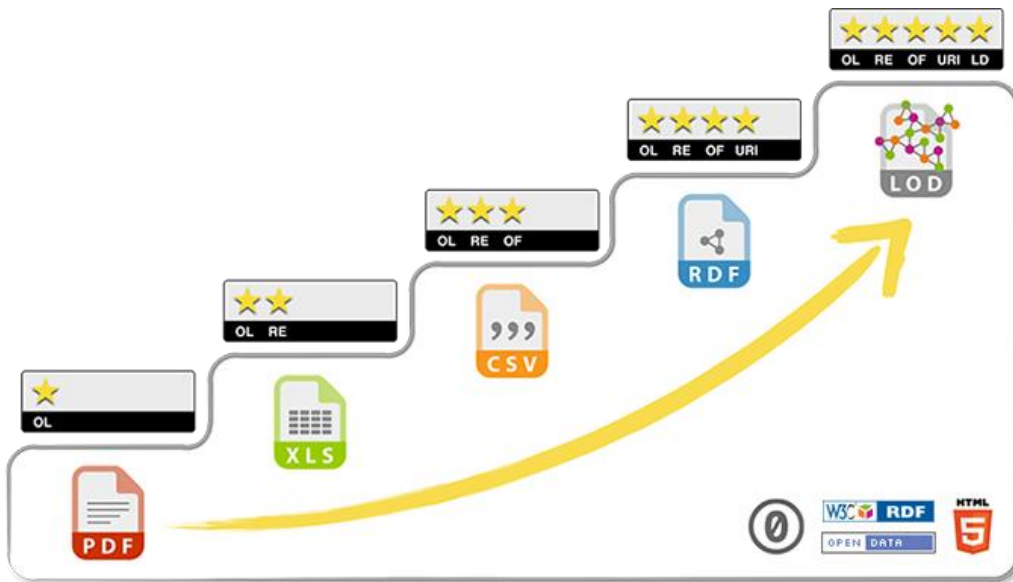
Figure 1:   5 Star scheme for data sharing [4]

Linked data is provided as RDF which has several encodings including, Turtle, N-Triples, JSON-LD (Table 2).

Ordnance Survey, British Geological Survey, HM Land Registry, Office for National Statistics and Department for Environment, Food and Rural Affairs all already provide some of their data as linked data via their own data portals/API's.

The UK government does not have any recommended open standards for delivering linked data currently. However stakeholder engagement indicates in the geospatial community there is little appetite for use of linked data, the cause of this is unknown at this stage but the leading Geospatial software tools currently have limited support for using linked data directly. Further investigation into the lack of demand for linked-data should be undertaken before any data standards interventions are considered.

Standards Recommendations

Based on our assessment, the following tables of standards and recommendations should be supplied to the DSA/OSB/GDS for review and approval.

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[4] 5-star Open Data (5stardata.info)

Metadata – UK GEMINI

UK Gemini is currently mandated for use by UK public sector geospatial data providers but further training in creating records and the broader organisation metadata framework is required to facilitate greater implementation. Plugins for ArcPro & QGIS are suggested as a way of promoting adoption.

Table 2: Suggested National Priority Geospatial Metadata Standards

Standard	Standard Theme	Encoding (default or recommended)	Custodian	UK Gov Influence	Maturity	Type	Current Version	Comments
UKGEMINI	Schema	XML [XML11]	AGI	Yes	Current	Official/ Open	2.3	Profile of ISO19115/39 mandated for use by public sector

Data Transfer Formats

The following to be submitted for use as Open Standards for Government

Table 3: Suggested National Priority Geospatial Encoding Standards

Encoding (default or recommended)	Standard	Geospatial data type	Custodian	UK Gov Influence	Maturity	Type	Current Version of standard	Comments
JSON	GeoJSON & Mapbox Styles	Metadata, Vector, Coverage, Styles	IETF	No	Current	Official/ Open	August 2016	[RFC7159] [RFC7946], To also include CoverageJSON
GPKG	GeoPackage	Vector/Raster	IOGC	Yes	Current	Official/ Open	1.3	
CSV [RFC4180]	CSV [RFC 4180] + WKT	Vector	IETF + OGC	No + Yes	Current	Official/Open	1.2.1/ISO/IEC 13249-3:2016	Using WKT & UTF-8 in geometry attributed CSV files

TIFF	GeoTIFF	Raster	OGC	Yes	Current	Official/Open	1.1	Including Cloud Optimized GeoTIFF
XML [XML11]	SLD	Styles	OGC/ISO	Yes	Supported	Official/Open	3.3/ISO 19136:2007	Mandated in INSPIRE and default in legacy systems
XML [XML11]	GML	Vector	OGC/ISO	Yes	Supported	Official/Open	3.3/ISO 19136:2007	Mandated in INSPIRE and default in legacy systems
netCDF-4/HDF5	NetCDF	Raster/Coverage	UCAR	No	Current	Proprietary/De facto	4.7.4	

Coordinate Reference Systems (CRS)

The information on Exchange of location point – GOV.UK (www.gov.uk) should be amended to specify the EPSG codes of the two already listed CRS to provide clarity (EPSG:4326 & EPSG:4258).

Two further CRS (EPSG:3857 & EPSG:27700) should be added as optional but suggested CRS for data distribution.

Table 4: Suggested National Priority Geospatial CRS Standards

Standard	Geospatial data type	Custodian	UK Gov Influence	Maturity	Type	Current Version	Comments
EPSG:4326	All	ESPG (IOPG)	No	Current	Official	2007-08-27	World Geodetic System 1984, used in GPS. The international standard geographic CRS
EPSG:4258	All	ESPG (IOPG)	No	Current	Official	2018-02-16	Specified in INSPIRE as ETRS89-GRS80h
EPSG:3857	All	ESPG (IOPG)	No	Current	Official	2015-11-25	WGS 84 / Pseudo-Mercator, The defacto standard projected CRS

Standard	Geospatial data type	Custodian	UK Gov Influence	Maturity	Type	Current Version	Comments
EPSG:27700	All	ESPG (IOPG)/ Ordnance Survey	Yes	Current	Official	2010-03-30	OSGB 1936 / British National Grid. The defacto UK projected standard CRS

Machine to machine interfaces (APIs)

Stakeholder engagement identified a key challenge to implementing API's are:

- Knowledge gap in implementing and maintaining
- Insufficient/inappropriate infrastructure/software

Table 5: Suggested National Priority Geospatial API Standards in priority order.

Standard	Geospatial data type	Encoding (default or recommended)	Custodian	UK Gov Influence	Maturity	Type	Current Version
OGCAPI-Features	Vector	GeoJSON, GML	OGC	Yes	Current	Official/ Open	1.0/ISO 19168-1:2020
OGCAPI-Tiles	Vector, Raster	GeoJSON, TilesJSON, GeoTIFF, JPEG, GMLJP2, PNG	OGC	Yes	Emerging	Official/ Open	0.0.1
WMS	Raster	GIF, PNG, JPEG, TIFF	OGC	Yes	Current	Official/ Open	1.3
OGCAPI-Maps	Raster	JPEG, PNG, GMLJP2	OGC	Yes	Emerging	Official/ Open	0.0.1
OGCAPI-Records	Metadata	XML, JSON	OGC	Yes	Emerging	Official/ Open	DRAFT
OGCAPI-Styles	Styles	SLD, JSON(MapBox)	OGC	Yes	Emerging	Official/ Open	1.0 DRAFT

Standard	Geospatial data type	Encoding (default or recommended)	Custodian	UK Gov Influence	Maturity	Type	Current Version
OGCAPI-EDR	Spatio-temporal data	GeoJSON, CoverageJSON	OGC	Yes	Emerging	Official/ Open	0.9
SensorThingsAPI	Spatio-temporal data	GeoJSON	OGC	Yes	Current	Official/ Open	1.1

Table 6: Other standards to keep under consideration

Standard	Geospatial data type	Encoding (default or recommended)	Custodian	UK Gov Influence	Maturity	Type	Current Version
Spatiotemporal Asset Catalogue	Metadata, Vector, Raster, Coverage	JSON	Radiant Earth Foundation	No	Current	Open	v1.0.0-beta.2
OGCAPI-GeoVolumes (PROPOSED)	3D Model/Point Cloud	3D Tiles/JSON/glTF	OGC	Yes	Emerging	Official/ Open	DRAFT

Other Standards

1. We propose a government-hosted vocabulary server similar to the NERC vocabulary server, with responsibility for hosting vocabularies used across the Geo6 and others which can be integrated in their data offerings. This would also support other challenges such as machine-readable licencing.

Methodology for the identification of Geospatial Standards Needs

Priority standards were first selected using the 7 principles for selecting open standards from the UK Cabinet Office policy paper on [Open Standards principles](#):

1. Open standards must meet user needs.
2. Open standards must give suppliers equal access to government contracts.
3. Open standards must support flexibility and change.
4. Open standards must support sustainable cost.
5. Select open standards using well-informed decisions.
6. Select open standards using fair and transparent processes.
7. Specify and implement open standards using fair and transparent processes.

To shortlist potential standards, stakeholder engagement was vital. Two rounds of stakeholder engagement were completed, initially with data publishers, followed by data users. The aims of this engagement were:

- To develop an initial list of priority geospatial data standards
- To gain greater understanding of how geospatial data is delivered and ingested currently
- To understand how stakeholders would like to access/transfer geospatial data in the future.

Individuals at key public sector data publishing organisations were invited to comment on an early draft of the survey document and help define the initial list of standards. The organisations invited to participate were:

Ordnance Survey (OS)	NERC: Environmental Information Data Centre
Valuation Office Agency	United Kingdom Hydrographic Office
NERC: British Oceanographic Data Centre	Finance NI
British Geological Survey	NERC: National Geoscience Data Centre
Transport Scotland	Defra
NERC: Centre for Environmental Data Analysis	Welsh Government
Coal Authority	NERC: Polar Data Centre
Scottish Government	Met Office

Cabinet Office: Geospatial Commission	Office of National Statistics (ONS)
Improvement Service	Edinburgh University
MOD (Joint Services)	Sedgemoor District Council
Cabinet Office: Government Digital Service (GDS)	Environment Agency
	Open Geospatial Consortium
Greater London Authority	Tameside Metropolitan Borough Council

To assess the validity of the list the public were then invited to take part in an online survey hosted by The AGI ([AGI: Association for Geographic Information](#)). The survey was shared widely through the AGI social media channels, the Open Data Institute, British Geological Survey, Royal Geographical Society, Ordnance Survey, Government Data Quality Hub, MEDIN Network, DEFRA, UKGeoForum & OSGeo UK. The survey was also shared with the QGIS UK User Group, and 3 mailing lists with over 500 members. The survey is provided for reference in Annex 1.

Identified User Needs for Geospatial Standards

Data Publishers

There were direct responses from the following data publishing organisations; the full results can be found in Annex 2:

1. GDS
2. Geospatial Commission
3. OS
4. BGS
5. DEFRA
6. Transport Scotland
7. MET Office
8. ONS
9. OGC

Survey Findings:

- There were 16 responses from 9 organisations to the online survey circulated amongst data publishers (Annex 1).

- Only 50% of organisations are confident they currently use standard vocabularies, however among those that do, there are >20 in use.

- Over 80% of organisations were aware of GDS open standards guidance, the government data quality framework and the government service standard but only 68% use or reference these in their own strategy/roadmap or business plans. Indicating further work and outreach needs to be done in this area (Annex 2).

- 75% of organisations were aware of the **W3C/OGC Spatial Data on the Web Best Practices** however only one organisation uses or references this in their own strategy/roadmap or business plans. It is suggested this document is referenced by government and its findings included in the same outreach as above (Annex 2).

Overview of responses related to standards from stakeholder feedback:

- Support for the OGC/W3C Spatial Data on the Web Best Practice document

- Publishers would like to see CityGML treated distinctly from GML (they were not in the stakeholder survey)

- The importance of INSPIRE Data Specifications as the use of these is legally mandated within the UK, although they have not been widely implemented.

- Continued support for WMS/WFS/CSW as they are currently the recommended routes to implementing INSPIRE in the UK (and sharing data more generally via UKSDI). Concern that changing this may have significant implications for data publishers across the public sector and may lead to new burdens for local government that would need funding.

- Clarification of CRS to be used across government would be welcomed

- In addition to the standards themselves, we will need to provide guidance, training / hand holding to get them into wider use.

- "It's good that the "standards" includes some controlled lists / vocabularies / reference data. These need a different sort of governance from the standard specifications themselves."

- "IST/36 is aware of some interest in UK government departments in a couple of other emerging standards areas:
  - ISO 19170 / OGC Distributed Global Grid System – ONS & Met Office have expressed some interest
  - ISO 19142 – Land Cover Classification System & Land Use Classification System – Defra expressed some interest
  - ISO 19152 – Land Administration Domain Model – HM Land Registry, Registers of Scotland, and Ordnance Survey have all expressed interest."
- The report covers a wide range of standards not all of which are adopted to the same degree – e.g. linked data is still pretty niche – it would be good to separate out the obvious 'musts' from the 'coulds'. It would be good to acknowledge marine standards too"

- We wholly support initiatives like this, which removes the burden on regional government / Combined Authorities

- International components/SDOs need more acknowledgement: OGC, W3C, UN GGIM, OASIS (e.g. CAP, ODATA), IETF (e.g. GeoJSON, RFC3339), IANA (media types etc for content negotiation), WMO, ICAO, ITU, BIPM/IERS, ISO/IEC, EU, Unicode, etc

- Although the recommendations of the report are well intended and the benefits very much understood by our organisation I believe there will be a sense from Local Gov that much of this is repeating what has been tried with INSPIRE and data.gov.uk, of which a great deal of time and effort has been invested in and now feels lost. In relation to metadata standards, we are moving from UK Gemini to INSPIRE as our software provider (ESRI) no longer provides a UK Gemini editor tool. In addition, relative to when INSPIRE was initiated, we are working with far fewer resources and any change which is required to be brought about will be challenging, with limited direct benefit to ourselves.

- Good insight into National Priorities.

Data Users

There were 99 responses to the online survey, gathered over 4 weeks. The full results can be found in Annex 4.

<u>Survey Findings</u>

Most users would still choose a file download over connecting to an API or Web Service.

Common reasons for not using API's/Web Services:

- I prefer to work with standard interfaces and standard formats, bespoke APIs are a barrier to access and interoperability;
- Don't know how;
- Many datasets are not provided as APIs (and web services) despite legislation (i.e. INSPIRE);
- Need to retain archive versions of data for audit purposes;
- APIs/Web services don't exist for the data I need, or need to use data offline;
- Often they're not supported by certain software clients, or only partially supported!
- Organisational technical limitations;
- Often need large area coverage for bulk analysis – APIs are often limited or throttled, bulk download often more convenient. Open data licensing is most important, then an automatable access method (direct download with a stable URL or API with reliable service);
- Like to be able to work offline at times.

File formats for data exchange Top 5:

- Shapefile (Not an official/open standard)
- GeoPackage
- GeoJSON
- GeoTIFF

Only 23% of respondents use standard vocabularies (Annex 4) while 29% said standard vocabularies were important to their organisation. Used vocabularies include:

- NERC vocabulary server
- GEMET
- Those embedded within Scottish Spatial Data Infrastructure
- CF Standard Name,
- CSDMS Standard Names,
- Scientific Vocabulary Ontology
- ISO 19115
- S-57
- schema.org
- MOD Geospatial Metadata Profile (v2.0) code list
- MEDIN vocabularies
- GeoSciML
- O&M
- ISO,
- BIM, authoritative sources for code lists
- LGS
- INSPIRE
- MEDIN
- Scottish Standard Geography Code Register,
- WoRMS
- FAO
- AFIS

Overview of responses related to standards from stakeholder feedback:

- Generally, whilst there may be standards in existence, they are not adhered to within local government. Policy/legislation is often so poor that there is no requirement to capture data in a standard format, so it is not. Serious effort needs to be undertaken to persuade/make/tell local government to adhere to existing standards, and these must be backed up with legislation and financial resources
- Pragmatism and ease of understanding and implementation are key
- OGC do great work
- Good quality web map services that are current, standardised and easy to access will be key to future GIS implementation in Translink. What about the Inspire Data Standards?
- Standards in my space (spatial/time series data) are not sufficiently mature for widespread uptake, and recent evolutions into json and json-ld are not complete. Recent developments in OGC API mean standards might have a better REST-based basis to become more useful / usable soon, but

there are still a lot of things that need to come into place (json-ld, vocabs, sensor standards and APIs).

- I do believe standards are needed and should be widely adopted. However, I think that a consistent approach to standards across domains is needed. Some time it feels as if everyone tries to reinvent the wheel that hinders integration and multidisciplinary approaches
- We need greater interoperability between land and marine
- Needs more alignment in construction standards re OGC, BIM etc
- Some want data downloads, some want API access. I would love to see more consistency, more open standards and less proprietary lock-in.
- The many data standards in use provide a high barrier to entry for non-expert users, and it will be worth investing efforts at national level to highlight and prioritize one or two of the many options, with appropriate training material.
- OGC API work looks promising. Line-oriented text data (CSV+WKT, GeoJSON-LD) fits well with some data-science toolkits.
- Standards that actually tell me how to apply knowledge rather than specifying technicalities would be welcome
- Accessibility and interoperability are important
- Can be time consuming to apply especially metadata standards and from a university perspective the resources have not been allocated to dedicate to proper geospatial management e.g. archiving, metadata and building robust spatial data infrastructure for efficient data sharing across the organisation.
- need the government to design procurement processes to stop locking the (environmental) sector into proprietary environmental modelling software. Now is a great time to do this as we have to revise environmental policies after leaving the EU.
- Implemented aspects of ISO 19157 for recording measures and forming responses on data quality. Lack of use of consistent schema specifications in local government and understanding of implications of changing them all the time. More info on peoples schemes. Exported shapefiles kill field name meanings as aliases not used, etc.
- We're supportive of industry standards and implement them wherever possible

Assessment of User Needs

Standards

To make a standard useful for something, there needs to be additional documentation: business rules, procedures to incentivise their use as they can be more challenging to implement than proprietary solutions which have integrated workflows. The status of a standard should be regularly reviewed, this may be the role of a national body or the devolved administrations for their jurisdiction.

There is broad agreement between providers and users on open standard data transfer formats and upcoming OGCAPI's with the highest priority being:

- GeoJSON
- GeoPackage
- GeoTIFF
- CSV + WKT
- OCGAPI
  - Features
  - Tiles
  - Maps

There is also agreement on the importance of metadata and using UK Gemini. The biggest difference in data providers and users for the future is attitudes to RDF/Linked Data with providers as a priority but the community do not seem interested.Users do seem to have appetite for utilising API's further in their workflows where possible, but further training will be required (as OS is currently doing with Data Hub workshops) and working with software vendors to better support this way of working.

Software and APIs

Not all software vendors support the standards fully, limiting data findability, interoperability, and reusability. This supports the government guidance to use open source solutions where practical as these often implement the standards faster and more completely than proprietary solutions.

Where an open source solution is used, it's possible to engage directly and contribute to the project so it meets the needs of the UK geospatial community, e.g. build a plugin for QGIS to allow creation and editing of UK Gemini Metadata.

For both data providers and users, central authoritative documentation of how to create services and use the standards for leading software platforms. This may not necessarily mean writing and hosting the

documentation with GDS or GC, but could be references where to find this information – likely from the software vendor's online documentation.

Vocabularies

Publishers are not commonly utilising Standard dictionaries/data dictionaries or vocabularies as often as they would like, which impacts data findability and interoperability The UK government does not currently maintain an independent repository of vocabularies, although some public bodies do maintain vocabulary services, BGS, BODC. Although the proportion using vocabularies is low, those that do use them heavily. There's scope for increased usage with better client integration and training.

Further Considerations

The following should also be considered in the context of operational and strategic roll-out of the recommendations

1. Investigation and decision on formal governance of a national priority standards set
   - Who: Determine which organisation in the UK, and overseas, is best placed to lead each priority standard
     - Geospatial Commission
     - Ordnance Survey
     - IST36
     - OGC with allocated time from UK data providers
   - How:
     - Mirror W3C/OGC Best Practice
     - Biennial/quadrennial review
     - Horizon scanning of emerging standards & ways of working

2. Common approaches to data quality – both improving quality and reporting it.
   - Data quality standards and certification

3. Feedback from other national data infrastructure initiatives who were not included in the stakeholder engagement, including:
   - National Infrastructure Commission
   - Centre for Digital Built Britain

4. Review other more conceptual ("logical model", "semantic") standards which may be a priority for government:
   - ISO 19170 / OGC Distributed Global Grid System – OS, ONS & Met Office have expressed some interest

- ISO 19142 – Land Cover Classification System & Land Use Classification System – Defra expressed interest
- ISO 19152 – Land Administration Domain Model – HM Land Registry, Registers of Scotland, and Ordnance Survey have all expressed interest.
- ISO 19157:2013 Geographic information – Data quality – in use at OS, but other organisations including BGS have expressed an interest.

Identification of key reference datasets with consideration of the sustainable access, use and governance of these through integrated policy and governance.

Appendices

Annex 1: Questionnaire: National Priority Standards

National Priority Standards Set

*   Required

*   This form will record your name, please fill your name.

[   ]

About you

1.Who do you work for? *

☐Government

☐Academia

☐Industry

2.Does your organisation publish/deliver data? *

☐Yes

☐No

3.What is the name of your organisation? *

Data Publishers

4. Do you use standard vocabularies (ontologies, taxonomies, dictionaries)? *

☐ Yes

☐ No

☐ Maybe

5. If you do use standard vocabularies, which do you use?

schema.org (http://schema.org), wikidata, nerc vocabulary server, inspire code lists, GeoSciML, O&M, WaterML etc.

6. Do you currently use/offer any of the following standards *

☐ UKGEMINI

☐ RDF

☐ GML

☐ GeoJSON(-LD)

☐CSV + WKT Geometries

☐GeoPackage

☐GeoTIFF

☐NetCDF

☐SLD

☐OGC API-Features/WFS

☐OGC API-Tiles/WMTS

☐OGC API-Maps/WMS

☐OGC API-Records/CSW

☐OGC API-Environmental Data Retrieval/WCS

☐SensorThingsAPI/Sensor Observation Service

☐OGC API-Styles

☐OGC API-Coverages/WCS

☐Spatio-Temporal Asset Catalogue

☐ 3DTiles/glTF/X3D/i3s

☐Other

7. Is your organisation considering adopting any of the following standards in the future? *

☐UKGEMINI

☐RDF

☐GML

☐GeoJSON(-LD)

☐CSV + WKT Geometries

☐GeoPackage

☐GeoTIFF

☐NetCDF

☐SLD

☐OGC API-Features/WFS

☐OGC API-Tiles/WMTS

☐OGC API-Maps/WMS

☐OGC API-Records/CSW

☐OGC API-Environmental Data Retrieval/WCS

☐SensorThingsAPI/Sensor Observation Service

☐OGC API-Styles

☐OGC API-Coverages/WCS

☐Spatio-Temporal Asset Catalogue

☐ 3DTiles/glTF/X3D/i3s

☐None of these

☐Other

8. If your organisation is involved in standards development of any of the previously mentioned standards (or others) please list the standards in Q6 if your organisation is involved in their development... *

9. Is your organisation aware of recently released Government Data Quality Framework? *

https://www.gov.uk/government/publications/the-government-data-quality-framework (https://www.gov.uk/government/publications/the-government-data-quality-framework)

☐Yes

☐No

10. Is your organisation aware of the Open standards for government data and technology guidance? *

https://www.gov.uk/government/collections/open-standards-for-government-data-and-technology (https://www.gov.uk/government/collections/open-standards-for-government-data-and-technology)

☐Yes

☐No

11. Is your organisation aware of the Government Service Standard? *

https://www.gov.uk/service-manual/service-standard (https://www.gov.uk/service-manual/servicestandard)

☐ Yes

☐ No

12. Does your organisation use/reference open standards for government or service standard in its strategy/roadmap/business plan or similar? *

☐ Yes

☐ No

☐ Don't know

13. Is your organisation aware of the Open Standards Board? *

https://www.gov.uk/government/groups/open-standards-board (https://www.gov.uk/government/groups/open-standards-board)

☐ Yes

☐ No

14. Is you organisation aware of the Data Standards Authority? *

https://www.gov.uk/government/groups/data-standards-authority (https://www.gov.uk/government/groups/data-standards-authority)

☐ Yes

☐ No

15. Is you organisation aware of the W3C Spatial Data on the Web Best Practices? *
https://www.w3.org/TR/sdw-bp/ (https://www.w3.org/TR/sdw-bp/)

☐ Yes

☐ No

16. Does your organisation use/reference W3C Spatial Data on the Web Best Practices in it's strategy/roadmap/business plan or similar? *

☐ Yes

☐ No

17. If your organisation does not currently implement API's/Web Services what is the challenge for your organisation to do so?

☐ Insufficient/inappropriate infrastructure/software

☐ Knowledge gap in implementing and maintaining

☐ Other

18.Any comments/thoughts on the draft National Priority Geospatial Standards report

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

Microsoft Forms

Annex 2: Data publishers summary results

National Priority Standards Set

16	11:41	Active
Responses	Average time to complete	Status

1. Who do you work for?

● Industry	2	
● Government	15	
● Academia	1	

2. Does your organisation publish/deliver data?

● Yes	15	
● No	1	

3. What is the name of your organisation?

1	
Responses	Latest Responses

4. Do you use standard vocabularies (ontologies, taxonomies, dictionaries)?

🔵	Yes	8
🟠	No	3
🟢	Maybe	5

5. If you do use standard vocabularies, which do you use?

11
Responses

Latest Responses

"schema.org, nerc vocabulary server, inspire code lists, GeoSciML"

*"GEMET, inspire code lists, Gemini, Addressbase Premium, .gov.uk regis...*

6. Do you currently use/offer any of the following standards

	Standard	Count
🔵	UKGEMINI	13
🟠	RDF	4
🟢	GML	8
🔴	GeoJSON(-LD)	6
🟣	CSV + WKT Geometries	8
🟤	GeoPackage	9
🟣	GeoTIFF	9
⚪	NetCDF	4
🟡	SLD	2
🔵	OGC API-Features/WFS	9
🔵	OGC API-Tiles/WMTS	6
🟠	OGC API-Maps/WMS	10
🟢	OGC API-Records/CSW	5
🔴	OGC API-Environmental Data ...	2
🟣	SensorThingsAPI/Sensor Obse...	1
🟤	OGC API-Styles	0
🟣	OGC API-Coverages/WCS	2
⚪	Spatio-Temporal Asset Catalo...	0
🟡	3DTiles/glTF/X3D/i3s	0
🔵	Other	7
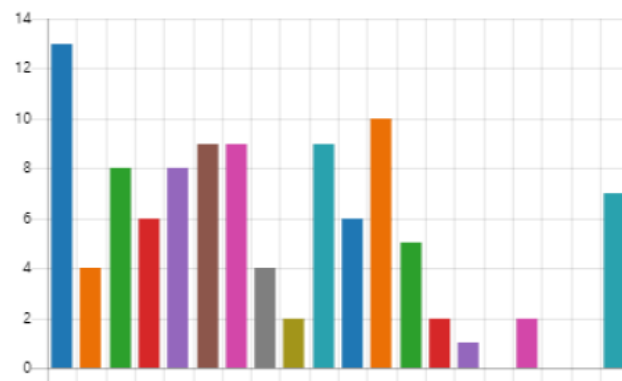
7. Is your organisation considering adopting any of the following standards in the future?

Standard	Count
UKGEMINI	6
RDF	7
GML	1
GeoJSON(-LD)	4
CSV + WKT Geometries	3
GeoPackage	6
GeoTIFF	4
NetCDF	2
SLD	1
OGC API-Features	6
OGC API-Tiles	6
OGC API-Maps	6
OGC API-Records	5
OGC API-Environmental Data ...	3
SensorThingsAPI	4
OGC API-Styles	4
OGC API-Coverages	3
Spatio-Temporal Asset Catalo...	2
3DTiles	6
None of these	2
Other	7
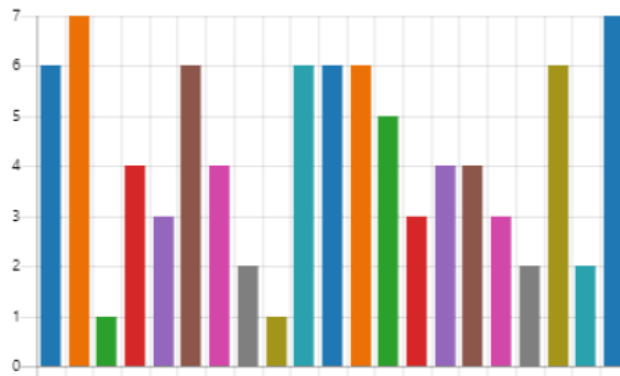
8. If your organisation is involved in standards development of any of the previously mentioned standards (or others) please list the standards in Q6 if your organisation is involved in their development...

16

Responses

Latest Responses

"UK Gemini"

"N/A"

"n/a"

9. Is your organisation aware of recently released Government Data Quality Framework?

- ● Yes   14
- ● No   2

10. Is your organisation aware of the Open standards for government data and technology guidance?

- ● Yes   13
- ● No   3

11. Is your organisation aware of the Government Service Standard?

- ● Yes   13
- ● No   3

12. Does your organisation use/reference open standards for government or service standard in its strategy/roadmap/business plan or similar?

●	Yes	11
●	No	4
●	Don't know	1

13. Is you organisation aware of the Open Standards Board?

●	Yes	13
●	No	3

14. Is you organisation aware of the Data Standards Authority?

●	Yes	14
●	No	2

15. Is you organisation aware of the W3C Spatial Data on the Web Best Practices?

●	Yes	12
●	No	4

16. Does your organisation use/reference W3C Spatial Data on the Web Best Practices in it's strategy/roadmap/business plan or similar?

🔵	Yes	1
🟠	No	15

17. If your organisation does not currently implement API's/Web Services what is the challenge for your organisation to do so?

🔵	Insufficient/inappropriate infr...	3
🟠	Knowledge gap in implementi...	4
🟢	Other	6

18. Any comments/thoughts on the draft National Priority Geospatial Standards report

8
Responses

Latest Responses
"Good insight into National Priorities. "

Annex 3: Data user survey

National Priority Geospatial Standards Set - User Survey

As part of defining the national priorities for geospatial data standards, we would like to understand better how users interact with geospatial data now, and want to in the future. Ordnance Survey will analyse the results on behalf of the Geospatial Commission.

* Required

This work is focused on data consumers use of Geospatial data in the UK.

We acknowledge data consumers may also be data producers.

About You

1. Are you based in/primarily work with data from, the United Kingdom of Great Britain and Northern Ireland? *

☐ Yes

☐ No

2. Who do you work for? *

☐ Academia

☐ Government

☐ Medium/Large Company

☐ Micro Company/Self-Employed/Freelance

☐ Small Company (<50 Employees)

3. What is the name of your organisation?

4. Which archetype fits you best? *
An archetype is a label assigned to one or more groups of users after generalising their responses to questions on their personal and professional characteristics. This work was completed by the Geospatial Commissions Data Discoverability Project Part 2

☐ Solution innovator (Consultant, Technical Director, Senior Product Manager, Head of Data Centre)

☐ Investigator (Statistical Analyst, Academic Researcher, Consultant)

☐ Strategic lead (Business Owner, Head of Service, Director)

☐ Data expert (Software Developer, Data Scientist, Statistician)

☐ Story tellers and Consumers (Journalist, General Public)

☐ Spatial Data Expert (GIS Professionals, Data Research Consultant, Geographic/Spatial Information Manager)

Data Users

5. How do you usually work with GIS data?
You can choose more than one option.

☐ Desktop Client (QGIS, Arc Pro)

☐ GIS as a Service (ArcGIS Online/Mapbox)

☐ Web Servers (MapServer/GeoServer/Enterprise)

☒ Software Frameworks/Libraries (OpenLayers/LeafletJS/GeoPandas)

6. How do you prefer to access geospatial data? *
Please drag in preference order

Connect to API
Connect to Web Service (WMS, WFS, WCS etc)
File Download

7. If you don't connect to web services or APIs to access data, what is the barrier in doing so?

APIs/Web Services don't exists for the data I need/Organisation technical limitations/Client software doesn't support this/ Other?

8.Preference of file format to receive vector data *

	Low	Medium	High
GML	◯	◯	◯
Shapefile (.shp, .shx & .dbf +)	◯	◯	◯
GeoPackage	◯	◯	◯
GeoJSON(-LD)	◯	◯	◯
CSV + WKT Geometry	◯	◯	◯

9.Preference of file format to receive raster data? *

	Low	Medium	High
JPEG/JPG	◯	◯	◯
TIFF/GeoTIFF	◯	◯	◯
GeoPackage netCDF	◯	◯	◯

ASCII Grid	○	○	○
JPEG2000	○	○	○
Portable Network Graphics (PNG)	○	○	○

10. **Do you currently use any of the following standards? ***

This could be for receiving/sending data or for data analysis and processing.

☐UKGEMINI

☐RDF

☐GML

☐GeoJSON(-LD)

☐CSV + WKT Geometries

☐GeoPackage

☐GeoTIFF

☐NetCDF

☐SLD

☐OGC API-Features/WFS

☐OGC API-Tiles/WMTS

☐OGC API-Maps/WMS

☐OGC API-Records/CSW

☐OGC API-Environmental Data Retrieval/WCS

☐SensorThingsAPI/Sensor Observation Service

☐OGC API-Styles

☐OGC API-Coverages/WCS

☐Spatio-Temporal Asset Catalogue

☐ 3DTiles/glTF/X3D/i3s

☐Other

11. Are you considering using any of the following standards in for your work the future? *

☐UKGEMINI

☐RDF

☐GML

☐GeoJSON(-LD)

☐CSV + WKT Geometries

☐GeoPackage

☐GeoTIFF

☐NetCDF

☐SLD

☐OGC API-Features/WFS

☐OGC API-Tiles/WMTS

☐OGC API-Maps/WMS

☐OGC API-Records/CSW

☐OGC API-Environmental Data Retrieval/WCS

☐SensorThingsAPI/Sensor Observation Service

☐OGC API-Styles

☐OGC API-Coverages/WCS

☐Spatio-Temporal Asset Catalogue

☐ 3DTiles/glTF/X3D/i3s

☐None of these

☐Other [   ]

12. Do you use Linked Data (RDF, N3, Turtle or GeoJSON-LD) *

☐Yes

☐No

☐Maybe

13.Do you use standard vocabularies (ontologies, taxonomies, dictionaries)? *

☐Yes

☐No

☐Maybe

14.Are standard vocabularies important to you/your organisation? *

☐Yes

☐No

☐Maybe

15. If you do use standard vocabularies, which do you use?

schema.org (http://schema.org), wikidata, nerc vocabulary server, inspire code lists, GeoSciML, O&M, WaterML etc.

16.Any other comments on Geospatial Data standards?

Annex 4: Data Users Summary Results

National Priority Geospatial Standards Set - User Survey

99
Responses

08:04
Average time to complete

Active
Status

1. Are you based in/primarily work with data from, the United Kingdom of Great Britain and Northern Ireland?

● Yes	66
● No	33

2. Who do you work for?

● Micro Company/Self-Employe...	7
● Small Company (<50 Employe...	5
● Medium/Large Company	16
● Government	24
● Academia	17

3. What is the name of your organisation?
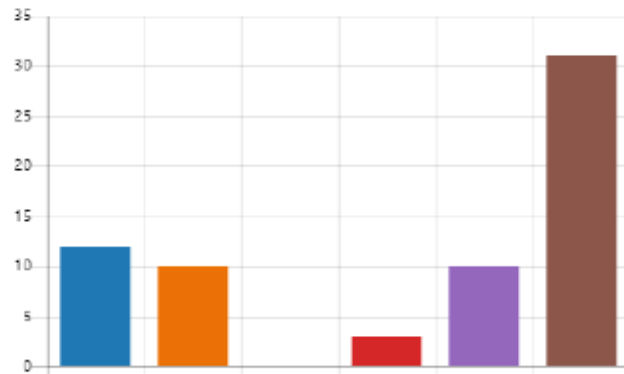
58
Responses

Latest Responses
"UCL Energy"
"Pixalytics Ltd"
"Scottish Government (Marine Scotland Directorate)"

4. Which archetype fits you best?

- 🔵 Data expert (Software Develo...   12
- 🟠 Solution innovator (Consultan...   10
- 🟢 Story tellers and Consumers (J...   0
- 🔴 Strategic lead (Business Owne...   3
- 🟣 Investigator (Statistical Analyst...   10
- 🟤 Spatial Data Expert (GIS Profes...   31
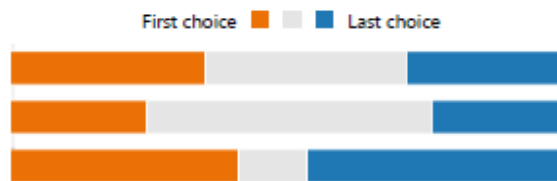
5. How do you usually work with GIS data?

- 🔵 Desktop Client (QGIS, Arc Pro)   62
- 🟠 GIS as a Service (ArcGIS Onlin...   30
- 🟢 Web Servers (MapServer/Geo...   29
- 🔴 Software Frameworks/Librarie...   29

6. How do you prefer to access geospatial data?

First choice 🟠 ⬜ 🔵 Last choice

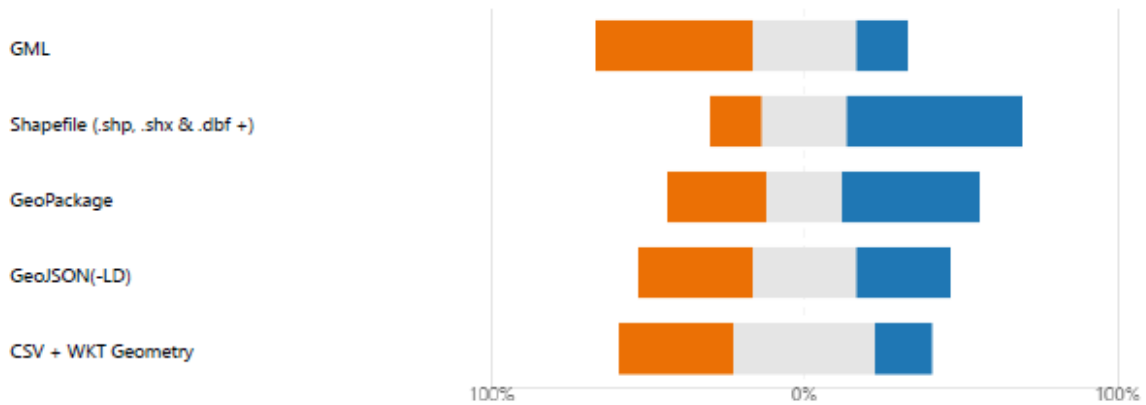| Rank	Options
1	Connect to API
2	Connect to Web Service (WM...
3	File Download

7. If you don't connect to web services or APIs to access data, what is the barrier in doing so?

37
Responses

Latest Responses

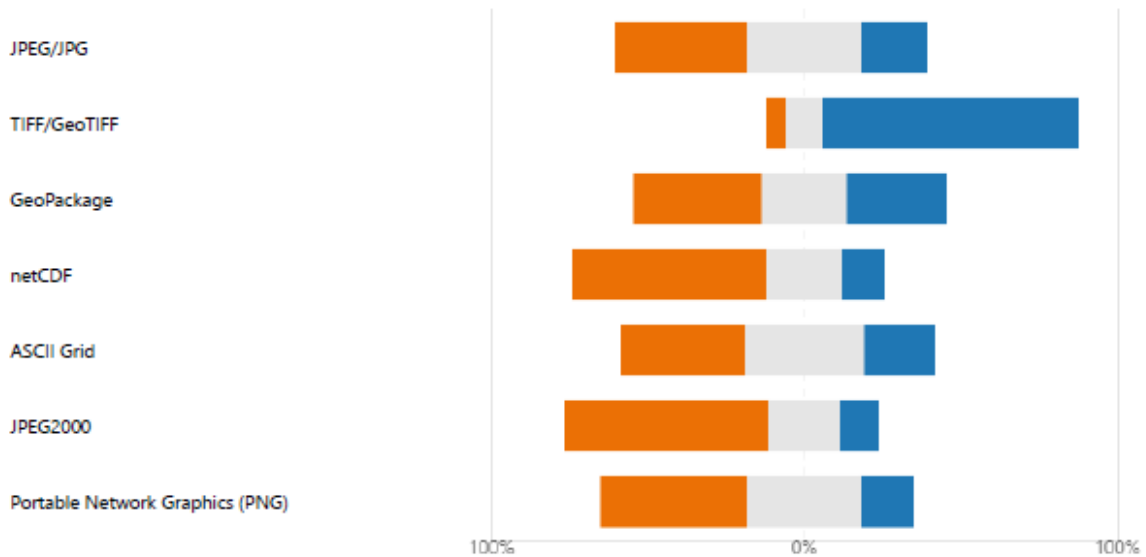*"Need to manually confirm what data coverage exists and which API t...*

## 8. Preference of file format to receive vector data

Legend: ■ Low ■ Medium ■ High

Categories (top to bottom): GML, Shapefile (.shp, .shx & .dbf +), GeoPackage, GeoJSON(-LD), CSV + WKT Geometry

Axis: 100% — 0% — 100%

9. Preference of file format to receive raster data?

Legend: ■ Low ■ Medium ■ High

Categories (top to bottom): JPEG/JPG, TIFF/GeoTIFF, GeoPackage, netCDF, ASCII Grid, JPEG2000, Portable Network Graphics (PNG)

Axis: 100% — 0% — 100%

10. Do you currently use any of the following standards?

Standard	Count
UK Gemini (Metadata)	27
RDF	7
GML	26
GeoJSON(-LD)	29
CSV + WKT Geometries	33
GeoPackage	35
GeoTIFF	47
NetCDF	15
SLD	12
OGC API-Features/WFS	24
OGC API-Tiles/WMTS	19
OGC API-Maps/WMS	29
OGC API-Records/CSW	8
OGC API-Environmental Data ...	11
SensorThingsAPI/Sensor Obse...	3
OGC API-Styles	5
OGC API-Coverages/WCS	7
Spatio-Temporal Asset Catalo...	1
3DTiles/glTF/X3D/i3s	5
Other	5
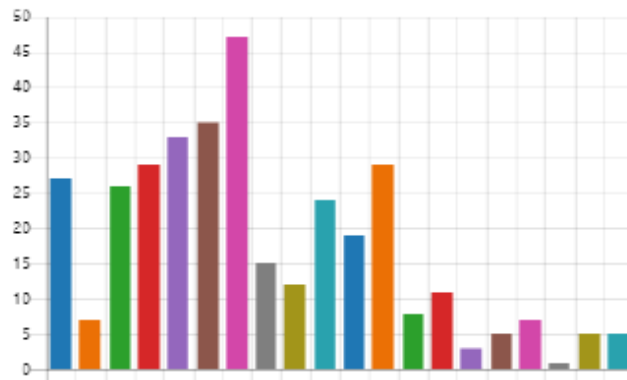
11. Are you considering using any of the following standards in for your work the future?

Standard	Count
UK Gemini (Metadata)	21
RDF	4
GML	15
GeoJSON(-LD)	19
CSV + WKT Geometries	17
GeoPackage	23
GeoTIFF	19
NetCDF	4
SLD	4
OGC API-Features	18
OGC API-Tiles	16
OGC API-Maps	16
OGC API-Records	11
OGC API-Environmental Data ...	12
SensorThingsAPI	10
OGC API-Styles	11
OGC API-Coverages	11
Spatio-Temporal Asset Catalo...	7
3DTiles	5
None of these	15
Other	6
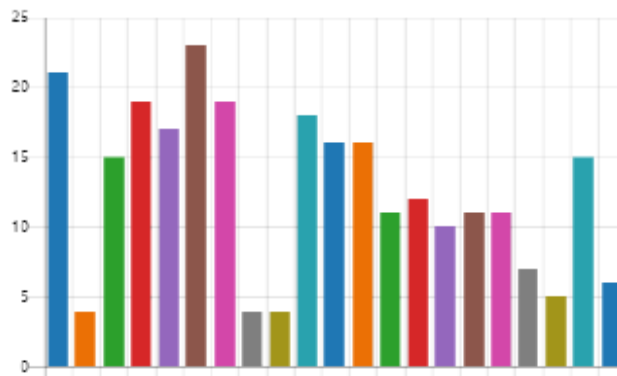
12. Do you use Linked Data (RDF, N3, Turtle or GeoJSON-LD)

Insights

Answer	Count
Yes	9
No	43
Maybe	14

13. Do you use standard vocabularies (ontologies, taxonomies, dictionaries)?

- Yes — 23
- No — 28
- Maybe — 15

14. Are standard vocabularies important to you/your organisation?

- Yes — 29
- No — 18
- Maybe — 19

15. If you do use standard vocabularies, which do you use?

24
Responses

Latest Responses
"inspire code lists, MEDIN, Scottish Standard Geography Code Register,...

16. Any other comments on Geospatial Data standards?

24
Responses

Latest Responses