

# Open Data

A short introduction

LiveSciences<sup>3</sup> Summer Campus Handbook

# Content

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# What is open data?

## Definition from Wikipedia, the free encyclopedia:

*“Open Data is the idea that some data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control”*

**Basic idea:** Opening up data for wider reuse

**Aim:** Democratize ability to produce information and knowledge (rather than confining the power of data to those who can afford them)

## Two Models:

- **Push Model:** Open for anyone, anywhere, to use for any purpose → Data is online and free of licence
- **Pull Model:** Open Data by request.

**The full Open Definition** (<https://opendefinition.org/od/2.1/en/>)

...describes in detail what Open Data this means. The most important points are:

1. **Availability and open access:** The data must be available in its entirety and at no more than reasonable reproduction cost, ideally as a download from the Internet. The data must still be in a format that is fit for purpose and editable.
2. **Reuse and redistribution:** The data must be made available under conditions that allow reuse and redistribution, including use of the data with datasets from other sources.
3. **Universal participation:** Everyone must be able to use, process, and redistribute the data - there must be no discrimination against individuals, groups, or purposes of use. For example, restrictions on commercial use, or restriction to certain uses (e.g., educational institutions only), are not allowed.

**Remember:**

Datasets have a high value,  
since they are many  
recourses and expenses  
required to use them and  
give important information  
about the world!

# The Open Data Network

The goals and ideas of the open-source data movement are related to other movements, for example:

## **Open knowledge:**

Knowledge that is free to use, reuse, and redistribute without legal, social or technological restriction. There are Open knowledge organizations, such as the Open Knowledge Foundation. They have proposed principles and methodologies related to the production and distribution of knowledge in an open manner. Open Knowledge includes open data, open content and open access.

## **Open access:**

Research outputs distributed online, free of cost or other access barriers. The main focus of the open access movement is "peer reviewed research literature, mainly print-based academic journals.

## **Open content:**

Making resources aimed at a human audience (such as prose, photos, or videos) freely available. Creative Commons have allowed for the dissemination of works under a clear set of legal permissions. **BUT:** Not all Creative Commons licenses are entirely free; their permissions may vary. Since February 2008, Creative Commons licenses which are entirely free carry a badge indicating that they are "approved for free cultural works".

## **Open-source software:**

Software that is freely licensed to use, copy, study, and change the software in any way. Also, the source code is openly shared. **Example:** Qgis (Cartography), Rstudio (Statistics), Inkscape (Vector-Editing).

## **Open science:**

Goal: Make scientific research more transparent, more collaborative and more efficient. Other aspects are more open forms of collaboration and engagement with a wider audience, for example Citizen Science.

## **Open Government:**

The governing doctrine which sustain that citizens have the right to access the documents and proceedings of the government to allow for effective public oversight

# I made a list for you with the best Open-source softwares (approved by me)

Name	Alternative for...	Category	Comment
QGis	ArcGis	Geoinformation-systems (creating maps)	Has all important functions of ArcGis
InkScape	Adobe Illustrator	create vector images	Easy to use, sufficient for most things
Gimp	Photoshop	Image manipulation	Very famous and often used, Photoshop is still much better
Krita	Photoshop/ Clip Studio Paint	Digital painting and 2D animation	Since it is more intuitive to use, I prefer Krita over Photoshop
PDF24	Adobe Acrobat	PDF editing	Has all important functions of Acrobat
Scribus	InDesign	Publishing	Has all important functions, but very ugly compared to InDesign
Blender	Cinema 4D, iClone and more	3D animation	Used for real movies, but hard as fuck to learn
Canvas	Best you can get in this area	Instagram and graphic design	Some functions are chargeable
Rstudio	Standard in Life Science	Statistics	Love-Hate relationship
Notepad ++	Windows Editor	Notes and coding	I use it to validate my html code
7-zip	?	file archiver and compression	
Audacity	Adobe Audition	Audio recording and editing	
LibreOffice	Microsoft Office	Office	
OpenShot/ VideoPad	Premiere Pro/ Magix Video	Video editing	iMovie best free option for Apple

For Open Content look here: <https://www.lmz-bw.de/medien-und-bildung/medienwissen/open-content/freie-inhalte-findern/>

# History of Open Data

## In the past

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- The philosophy long established, for example in the Mertonian tradition of science.
- Rise of the term "open data" with the rise of the Internet.

## 2004

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- The Science Ministers of all nations of the OECD (Organisation for Economic Co-operation and Development) signed a declaration which essentially states that all publicly funded archive data should be made publicly available.

## 2006

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- The Open Movement started with the Guardian Newspaper Campaign „Free Our Data“ <https://www.theguardian.com/technology/free-our-data?page=4>.

## 2007

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- Following a request and an intense discussion with data-producing institutions in member states, the OECD published in 2007 the OECD Principles and Guidelines for Access to Research Data from Public Funding as a soft-law recommendation.

## Nowadays

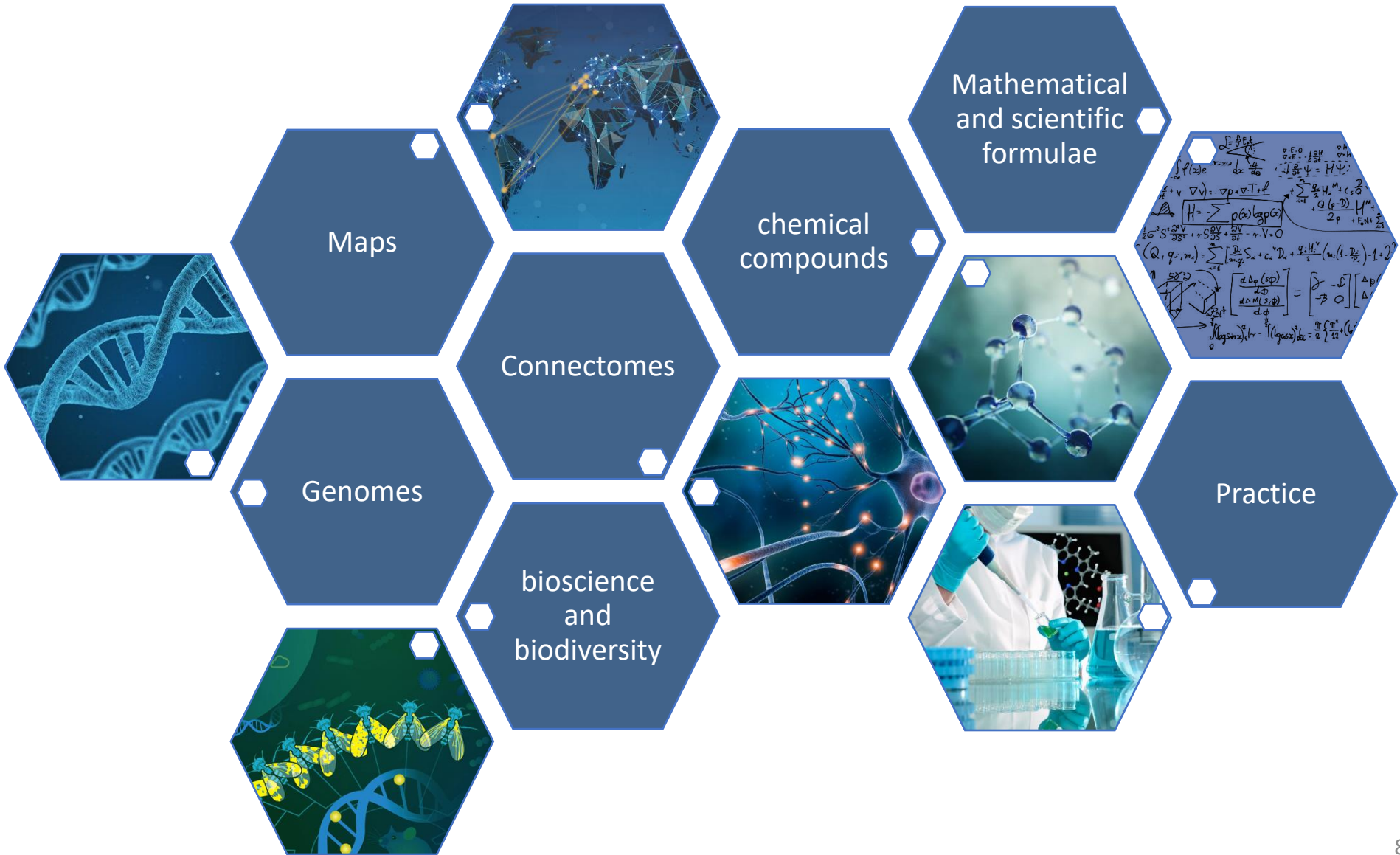
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- Challenge nowadays for Open Data providers: Not just presenting raw data, but also data that is understandable, meaningful and useful.

*“(...)government-funded and approved agencies such as the are government-owned agencies; they collect data on our behalf. So why can't we get at that data as easily as we can Google Maps or the Xtides program? Even though the Offices are designated as trading funds (...), substantial parts of their income comes from the public sector; meaning, in effect, they are part-paid by taxes. Yet they charge for that data, with onerous copyright restrictions that prevent the re-use of the data. That restricts innovation and artificially restricts the number and variety of organizations that can offer services based on that most useful data - which our taxes have helped to collect.”*

Open data can take different forms. Generally, the term includes:

# Type of open data



pictures from pixabay.com

# Sources of Open Data



## Science

First initiative to create a database of electronic bibliography of open access data: **Educational Resources Information Center** (ERIC) in 1966.

In the same year: MEDLINE- Free access online database managed by the National Library of Medicine and the National Institute of Health (USA)- bibliographical citations from journals in the biomedical area → later called **PubMed**; Currently over 14 million articles.

Well-known Open Data Project in Science: Human Genome Project. It was a major initiative that exemplified the power of open data. *“All human genomic sequence information should be freely available and in the public domain in order to encourage research and development and to maximize its benefit to society”.*



## Gouvernement

The United Nations Sustainable Development Goal 16 advocates for public access to information as a criterion for ensuring accountable and inclusive institutions.

Open government data (OGD) = public publishing of government datasets → made available through online platforms. Proponents of OGD argue that easily accessible data pertaining to governmental institutions allows for further citizen engagement within political institutions. OGD principles require that data is complete, primary, timely, accessible, machine processable, non-discriminatory, non-proprietary, and license free.



## Non-Profit Organizations

Many non-profit organizations offer access to their data, as long it does not undermine privacy rights.

In comparison to for-profit corporations, they do not seek to monetize their data.

For example:

- OpenNWT launched a website offering open data of elections.
- CIAT offers open data to anybody, who is willing to conduct big data analytics in order to enhance the benefit of international agricultural research
- DBLP offers its database of scientific publications from computer science as open data.

# Where to use open data



## Entrepreneurship and Innovation

→ To find out more about a product, a customer segment or countries to expand to or use the data to develop new innovations.



## Science

→ To compare own data with open data, use open data as starting point for a scientific question, add data to own data and even to answer scientific questions, use as a source for information.



## Journalism

→ Use as a source for information to inform public about trends, developments and problems.



## Politics

→ Strengthening active citizen participation, Paradigm shift requires a cultural change in state and administration, Modernization of administration in an increasingly open world, Increasing political legitimacy



## Individual

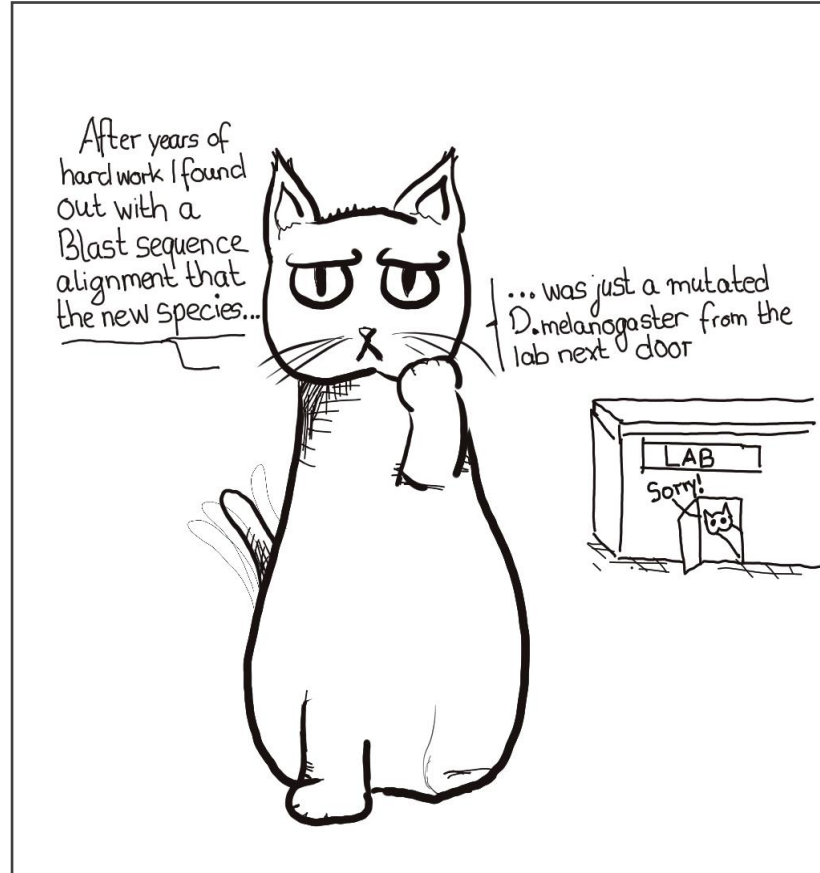
→ Helping for making decisions, for example which product to buy or which party to choose

# Why is open data important for me?

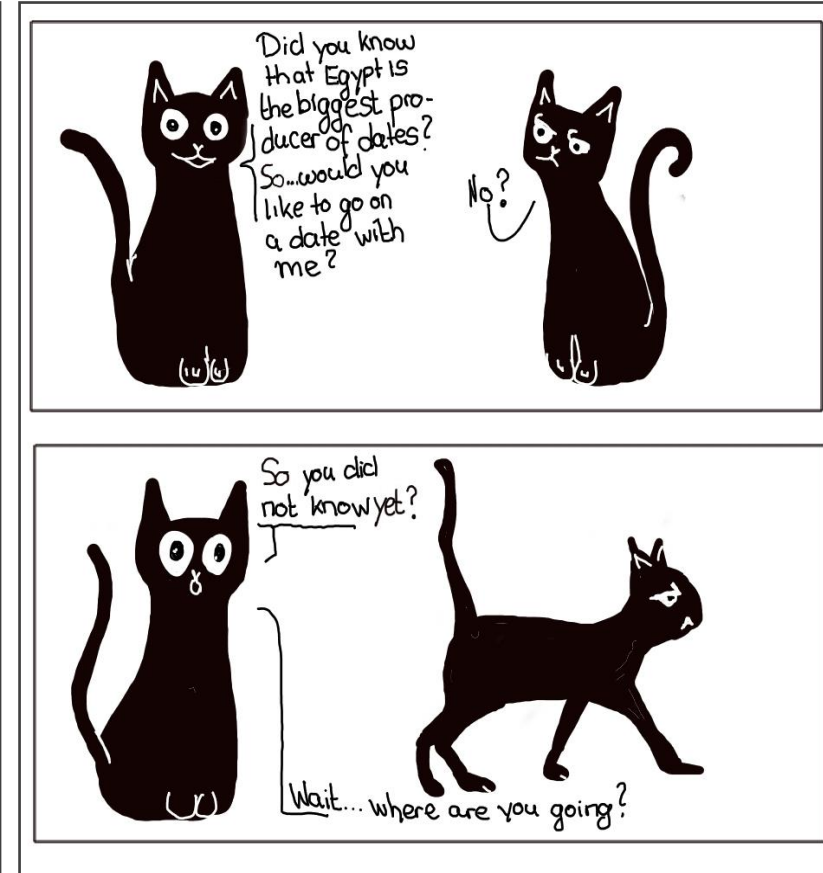
You can use open data  
for developing your own business...



...for assignments or your thesis....



...or for cool party facts.



 Studentlife\_as\_a\_cat

# Open Data in different countries

Various organizations are monitoring the worldwide use of Open Data. Not every country has free access to open data, but it is considered as an important building block of a democracy as well as an important driver of new innovations.

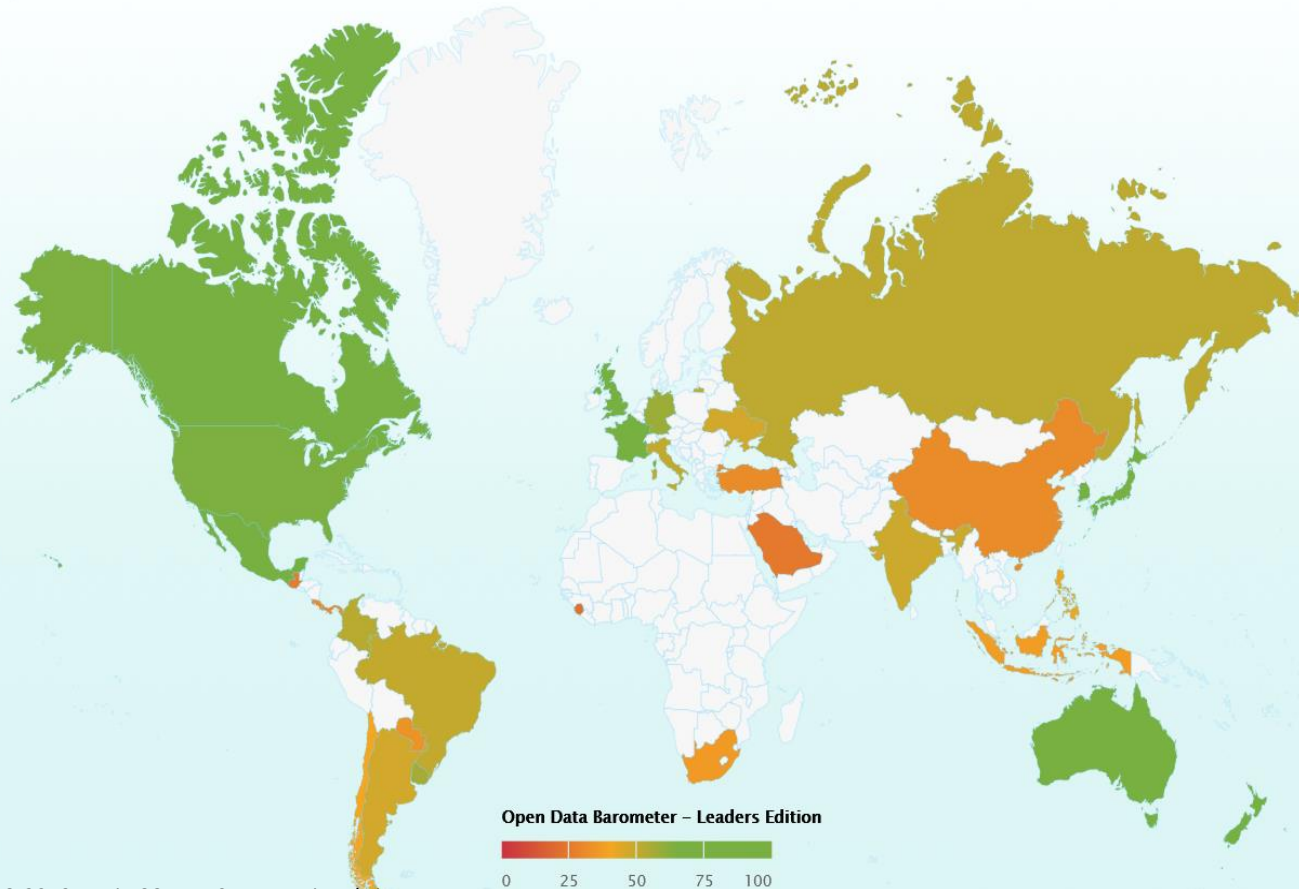
I would like to introduce you to the two most important institutions in the following:

- 1) Open Data Barometer
- 2) Global Open Data Index



Author of the picture: Anna-Lena Müsch; License: CC BY 4.0

# 1) Open Data Barometer (ODB)



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Screenshot of the interactive Worldmap on the Open Data Barometer website,  
[https://opendatabarometer.org/?\\_year=2017&indicator=ODB#](https://opendatabarometer.org/?_year=2017&indicator=ODB#) (12.01.2022) from World Wide Web Foundation.




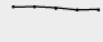

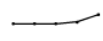











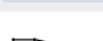



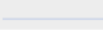




- Aims to uncover the true prevalence and impact of open data initiatives around the world.
- Analyses global trends and provides comparative data on governments and regions using an in-depth methodology that combines contextual data, technical assessments and secondary indicators.

Covering 30 governments in this Leaders Edition, the Barometer ranks governments on:

- Readiness for open data initiatives.
- Implementation of open data programs.
- Impact that open data is having on business, politics and civil society.

The Open Data Barometer focuses on those governments who have adopted the Open Data Charter or those who, as members of G20, have signed up to the G20 Anti-Corruption Open Data Principles — which are themselves based on the Charter Principles. These 30 governments should — having made specific commitments — be leaders in the space.

[https://opendatabarometer.org/?\\_year=2017&indicator=ODB](https://opendatabarometer.org/?_year=2017&indicator=ODB)

Country	Score OUT OF 100	Score Change SINCE FIRST EDITION	Score Trend OVER PAST EDITIONS	Readiness OUT OF 100	Implementation OUT OF 100	Emerging Impact OUT OF 100
 Canada <a href="#">See details</a>	76	18 ▲		86	87	55
 United Kingdom <a href="#">See details</a>	76	-4 ▼		83	89	57
 Australia <a href="#">See details</a>	75	17 ▲		79	84	62
 France <a href="#">See details</a>	72	17 ▲		84	77	55
 Korea <a href="#">See details</a>	72	25 ▲		82	67	67
 Mexico <a href="#">See details</a>	69	33 ▲		79	67	62
 Japan <a href="#">See details</a>	68	24 ▲		78	68	58
 New Zealand <a href="#">See details</a>	68	5 ▲		79	72	52
 United States of America <a href="#">See details</a>	64	-11 ▼		79	76	37
 Germany <a href="#">See details</a>	58	2 ▲		76	72	27
 Uruguay <a href="#">See details</a>	56	23 ▲		71	70	28
 Colombia <a href="#">See details</a>	52	25 ▲		69	60	28
 Russia <a href="#">See details</a>	51	10 ▲		62	59	32

The Open Data Barometer ranks countries on a list based on a score.

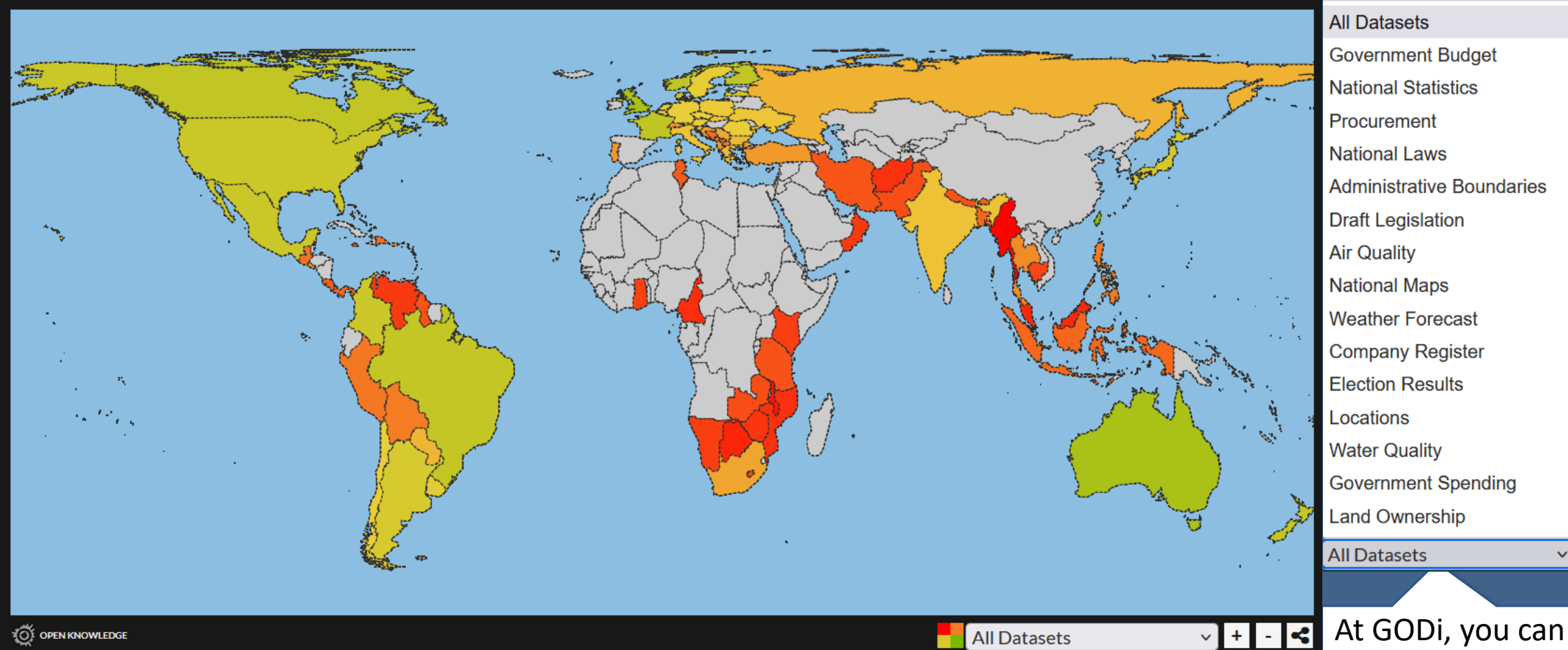
In the last years, in many countries the score went up (=governments are publishing more and more use of open data for accountability, innovation and social impact) for nearly every G20 state except United Kingdom and US.

## 2) Global Open Data Index



- The Global Open Data Index (GODI) is the annual global benchmark for publication of open government data, run by the Open Knowledge Network. The crowdsourced survey measures the openness of government data according to the Open Definition.
- By having a tool that is run by civil society, GODI creates valuable insights for government's data publishers to understand where they have data gaps. It also shows how to make data more useable and eventually more impactful. GODI therefore provides important feedback that governments are usually lacking.

<https://index.okfn.org/about/> (*Public Domain*, Author: Open Knowledge Foundation)



Screenshot of the interactive Worldmap on the Global Open Data Index website, <https://index.okfn.org/place/> (15.01.2022) from Open Knowledge Foundation.

Similar to the Open Data Barometer, the Global Open Data Index measures the use and amount of Open Data in a country, as seen in the map.

At GODi, you can also look at individual Open Data parameters in specific topics.

→ Nice to find out, if Open data of a specific topic is available in your country

Rank	Place	Government Budget	National Statistics	Procurement	National Laws	Administrative Boundaries	Draft Legislation	Air Quality	National Maps	Weather Forecast	Company Register	Election Results	Locations	Water Quality	Government Spending	Land Ownership	Score
1	Taiwan	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	90%
2	Australia	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	79%
2	Great Britain	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	79%
4	France	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	70%
5	Finland	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	69%
5	Canada	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	69%
5	Norway	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	69%
8	New Zealand	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	68%
8	Brazil	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	68%
10	Northern Ireland	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	67%
90	Antigua and Barbuda	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	5%
90	Malawi	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	5%
92	Barbados	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	4%
92	Saint Kitts and Nevis	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	4%
94	Myanmar	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	1%

- GODI also ranks the countries based on a score
- More countries are evaluated
- Evaluation based on several Open Data parameters

Try to find out how your county is ranked!



# Arguments for Open Data

## *"Data belongs to the human race"*

- Public money was used to fund the work and so it should be universally available.
- It was created by or at a government institution (this is common in US National Laboratories and government agencies).
- Facts cannot legally be copyrighted.
- Sponsors of research do not get full value unless the resulting data are freely available.
- Data are required for the smooth process of running communal human activities and are an important enabler of socio-economic development (health care, education, economic productivity, etc).
- In scientific research, the rate of discovery is accelerated by better access to data.
- Making data open helps combat "data rot" and ensure that scientific research data are preserved over time.
- Statistical literacy benefits from open data. Instructors can use locally relevant data sets to teach statistical concepts to their students.
- Open Data can prevent Fake News and the spread of alternative facts.
- Strengthen trust in the government since all actions of the government are viewable and therefore strengthen democracy.
- Drives scientific research.
- Improves the development of new innovations and new businesses.



# Arguments against Open Data

- Government funding may not be used to duplicate or challenge the activities of the private sector (e.g. PubChem).
- Open data may lead to exploitation of, and rapid publication of results based on, data pertaining to developing countries by rich and well-equipped research institutes, without any further involvement and/or benefit to local communities (helicopter research); similarly, to the historical open access to tropical forests that has led to the disappropriation ("Global Pillage") of plant genetic resources from developing countries.
- The revenue earned by publishing data can be used to cover the costs of generating and/or disseminating the data, so that the dissemination can continue indefinitely.
- Collecting, 'cleaning', managing and disseminating data are typically labor- and/or cost-intensive processes – whoever provides these services should receive fair remuneration for providing those services.
- Sponsors do not get full value unless their data is used appropriately – sometimes this requires quality management, dissemination and branding efforts that can best be achieved by charging fees to users.
- Often, targeted end-users cannot use the data without additional processing (analysis, apps etc.) – if anyone has access to the data, none may have an incentive to invest in the processing required to make data useful (typical examples include biological, medical, and environmental data).
- There is no control to the secondary use (aggregation) of open data.
- Problems often arise because these are commercially valuable or can be aggregated into works of value.
- High expense and recourses required to produce datasets → Data have a very high value.

# How to cite Open Data?

- The citation method is in general different for different sources. Some sources have a specification how they want to be cited.
- Many FAO publications carry a recommended citation. Some web pages and tools include a Cite button, which will generate an automatic citation. Alternatively, follow the recommended formats for publications and e-products and databases/datasets.
- Standards for the citation of data are not uniformly agreed upon and have yet to be codified by the National Information Standards Organization (an organization that sets technical standards for other bibliographic materials). However, many data providers and distributors and some style manuals do provide guidelines. Some of these instructions are listed on this guide.
- Always ask your supervisor how he want to have the source cited!

**Author:** Who is the creator of the data set? Can be an individual or a group of individuals(In case of Open Data it will be probably an organization).

**Title:** What name is the data set called, or what is the name of the study?

**Edition or Version:** Is there a version or edition number associated with the data set?

**Date:** What year was the data set published? When was the data set posted online?

**Editor:** Is there a person or team responsible for compiling or editing the data set?

**Publisher and Publisher Location:** What entity is responsible for producing and/or distributing the data set? Also, is there a physical location associated with the publisher? A data set can have both a producer and a distributor.

The **producer:** The organization that sponsored the author's research and/or the organization that made the creation of the data set possible.

The **distributor:** The organization that makes the data set available for downloading and use.

- You may need to distinguish the producer and the distributor in a citation by adding explanatory brackets, e.g., [producer] and [distributor].
- Some citation styles (e.g., APA) do not require listing the publisher if an electronic retrieval location is available. However, you may consider including the most complete citation information possible and retaining publisher information even in the case of electronic resources.

**Electronic Retrieval Location:** What web address is the data set available at? Is there a persistent identifier available? If a DOI or other persistent identifier is associated with the data set it should be used in place of the URL.

# Examples for Open Data in Life Sciences

Where can I find what kind of open data in which format?

In the following you can find some examples for Open Data in the internet.

Also check out the Open Data Link Sheet (PDF document), where you can find even more links to helpful pages 😊!

# A) FAOSTAT

<http://www.fao.org/faostat/en/#home>

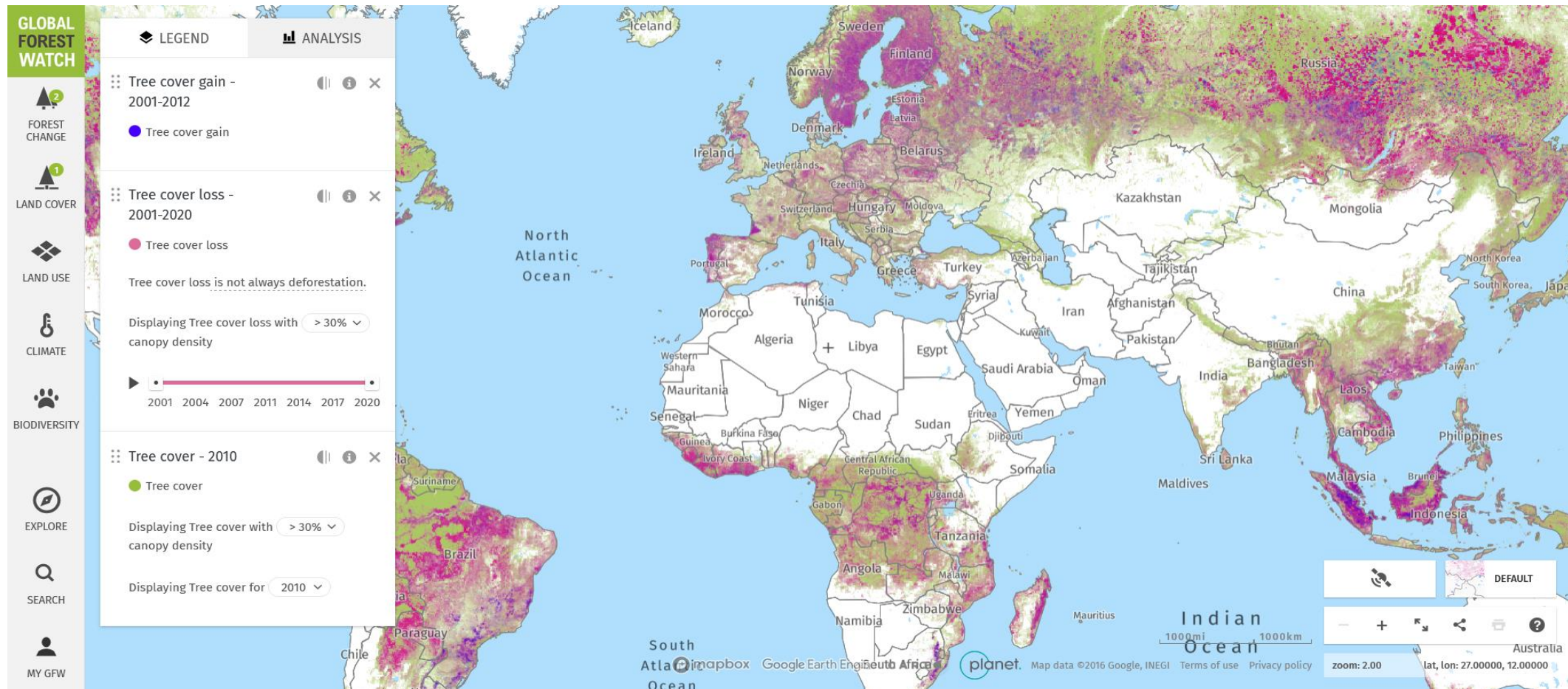
- ❖ FAO (Food and Agriculture Organization of the United Nations) is an organization under the umbrella of the United Nations. The FAO pursues the goal of food security and, in this context, access to sufficient high-quality food for a healthy life. FAOSTAT provides free access to FAO data and analysis based on FAO data.
- ❖ FAOSTAT provides country data on nutrition, agricultural and forestry production. When browsing through the data, it is also presented visually through maps and charts.
  - Data for over 245 countries and territories and covers all FAO regional groupings from 1961 to the most recent year available.



© FAO 2022

# B) Global Forest Watch <https://www.globalforestwatch.org/>

Starting in 1997 Global Forest Watch (GFW) is an online platform that provides data and tools for monitoring forests. You can download the data in different forms and you can even edit the maps in QGIS or ArcGIS.



Screenshot of the interactive Worldmap on Global Forest Watch website, <https://www.globalforestwatch.org/> (12.01.2022), World Resources Institute

# C) GovData- Open Data Germany <https://www.govdata.de/>

GovData is the data portal for Germany. In GovData you can find a wide variety of data from all areas of public administration. Anyone can use them and work with them as long as you understand German, because the data is just available in German.

## Stöbern Sie in diesen Kategorien



Bevölkerung und  
Gesellschaft  
(10964)



Bildung, Kultur und  
Sport  
(4974)



Energie  
(4560)



Gesundheit  
(1811)



Internationale Themen  
(118)



Justiz, Rechtssystem  
und öffentliche  
Sicherheit  
(4803)



Landwirtschaft,  
Fischerei,  
Forstwirtschaft und  
Nahrungsmittel  
(7864)



Regierung und  
öffentlicher Sektor  
(13839)



Regionen und Städte  
(10049)



Umwelt  
(14148)



Verkehr  
(7879)



Wirtschaft und Finanzen  
(8982)



Wissenschaft und  
Technologie  
(5044)

# D) Biological genetic data <https://blast.ncbi.nlm.nih.gov/Blast.cgi>

Blast = Basic Local Alignment Search Tool

BLAST finds regions of similarity between biological sequences. The program compares nucleotide or protein sequences to sequence databases and calculates the statistical significance.

Use: → Find genetic material like your own to find taxonomy, help to design primers for PCR, find conserved domains, find proteins highly like your query, find genetic data to create taxonomic trees.

The screenshot shows the BLAST main page with the following elements:

- BLAST®** logo in the top left.
- Navigation links: [Home](#), [Recent Results](#), [Saved Strategies](#), [Help](#).
- Basic Local Alignment Search Tool** section with a description: "BLAST finds regions of similarity between biological sequences. The program compares nucleotide or protein sequences to sequence databases and calculates the statistical significance." and a [Learn more](#) link.
- NEWS** section with a message: "A new feature was added to Primer-BLAST. We now offer the ability for user to run primer-blast from NCBI assembly page..", dated "Tue, 23 Feb 2021 12:00:00 EST" with a [More BLAST news...](#) link.
- Web BLAST** section with three main options:
  - Nucleotide BLAST**: nucleotide → nucleotide (represented by a DNA double helix icon).
  - blastx**: translated nucleotide → protein (represented by a blue arrow pointing right).
  - tblastn**: protein → translated nucleotide (represented by a blue arrow pointing left).
  - Protein BLAST**: protein → protein (represented by a protein ribbon structure icon).

# Overview of Open Data in Life Science (also available more beautiful as PDF document)

Category	Organisation	Internet	Country/Area	Topic
<b>Food and Agriculture</b>	FAO	<a href="http://www.fao.org/faostat/en/#home">http://www.fao.org/faostat/en/#home</a>	Worldwide	Everything
	godan	<a href="https://www.godan.info/">https://www.godan.info/</a>	Worldwide	Videos and information
<b>Forestry</b>	Global Forest Watch	<a href="https://www.globalforestwatch.org/">https://www.globalforestwatch.org/</a>	Worldwide	Land use and Forest change Maps
	Forestry Commission Great Britain	<a href="https://www.forestryresearch.gov.uk/tools-and-resources/fthr/open-data/">https://www.forestryresearch.gov.uk/tools-and-resources/fthr/open-data/</a>	Great Britain	Statistics and Data sets
<b>Governmental</b>	GovData	<a href="https://www.govdata.de/">https://www.govdata.de/</a>	Germany	Society, Environment, International
	European Union	<a href="https://data.europa.eu/en">https://data.europa.eu/en</a>	Europe	Society, Environment, International
<b>Climate (Change)</b>	Private Collection from different sources	<a href="https://openclimatedata.net/">https://openclimatedata.net/</a>	Worldwide	Climate Change
	NOAA Climate.gov	<a href="https://www.climate.gov/maps-data/datasets">https://www.climate.gov/maps-data/datasets</a>	Worldwide, focus on U.S.	Climate Change
<b>Biodiversity</b>	GBIF	<a href="https://www.gbif.org/">https://www.gbif.org/</a>	Worldwide	Biodiversity
	Systema Naturae	<a href="https://www.systemanaturae.org/">https://www.systemanaturae.org/</a>	Worldwide	Wildlife Conservation
<b>Maps and Cartography</b>	esri	<a href="https://livingatlas.arcgis.com/en/home/">https://livingatlas.arcgis.com/en/home/</a>	Worldwide	Geographic information
	Open Street Map	<a href="https://www.openstreetmap.de/">https://www.openstreetmap.de/</a>	Germany, available for other countries	Maps
	ldbv	<a href="https://www.ldbv.bayern.de/englisch.html">https://www.ldbv.bayern.de/englisch.html</a>	Bavaria	Geographic information
<b>Genes and Genoms</b>	National Center for Biotechnology Information	<a href="https://blast.ncbi.nlm.nih.gov/Blast.cgi">https://blast.ncbi.nlm.nih.gov/Blast.cgi</a>	\	Nucleotids and proteins
	CGIAR Genebank Platform	<a href="https://www.genebanks.org/about/">https://www.genebanks.org/about/</a>	\	Crop and Plant genes



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