Exercise - Search for Geodatasets

Introduction

There are a multitude of digital maps and other geographic datasets (geodatasets) available on the WWW.

However, before you may utilize these resources you need to pass a few hurdles on the way:

- You will need to have an idea of where to look for the data.
- Once you have found the geodata, it is necessary to find out whether they correspond to your needs. At this point metadata (if available) often holds vital information.
- A final obstacle may be to convert the files to a format compatible with the GIS software you are using.

Metadata =
A list of useful data about a geographic dataset (e.g. data content, resolution, coordinate system, creator/owner).

Luckily, as you will find out, the situation is not as disorganized at this institute, the IGN.
Here, a great variety of Danish digital geographic resources are readily available just a few mouse clicks away.

IGN =
Dept. of Geosciences and Natural Resource Management

Objective

<u>Aim</u>:

In this exercise we will show you how to look for the geographic datasets you need and where to find them.

You will learn to:

- Search for and retrieve the geodatasets you need from the *IGN Geodata Library* (our own GIS server).
- Search for Danish assets using a web-based metadata search engine.
- Download geodata from some well-known public Danish and international geodata providers on the WWW.
- Produce some metadata.

You will also get some useful tips on how to search for geodatasets on the WWW using a common web search engine.
Finally, you will be assigned to go on a 'geodata hunt' all by yourself, using the acquired skills.

Exercise

Finding geodata at the Uni

IGN Geodata Library

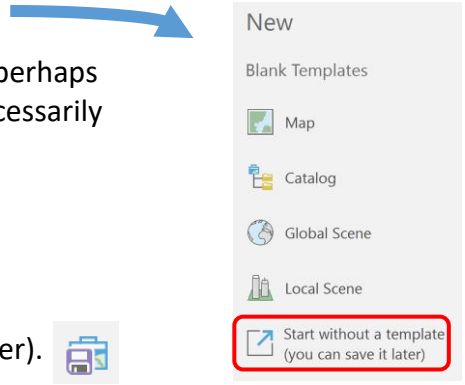
First, you will be acquainted with a very useful resource at the IGN
– the ***IGN Geodata Library*** (stored on our own GIS server).

This is a vast asset with thousands of Danish geographic datasets.
Almost all of them are nationwide, that is covering the whole country.

One neat thing – You may reach the IGN Geodata Library from inside ArcGIS Pro.

Let´s have a look at them.

1. Start ArcGIS Pro ➔ Click Start Without A Template.



(Recall that this is the entry to ArcGIS Pro, when you perhaps briefly would like to view some geodata, and not necessarily save a Project for later and long-term use.)

2. a) Add/Insert a New Map (*i.e.* a Map View).

Save your new Project:

b) Click the Save button (Small button upper left corner).

In the Save Project As window:

c) Browse to a suitable location (*e.g.* your personal H- drive).

d) Type a name of your new project (*e.g.* Exercise_MapTypes_SearchGeodatasets) ➔ Save.

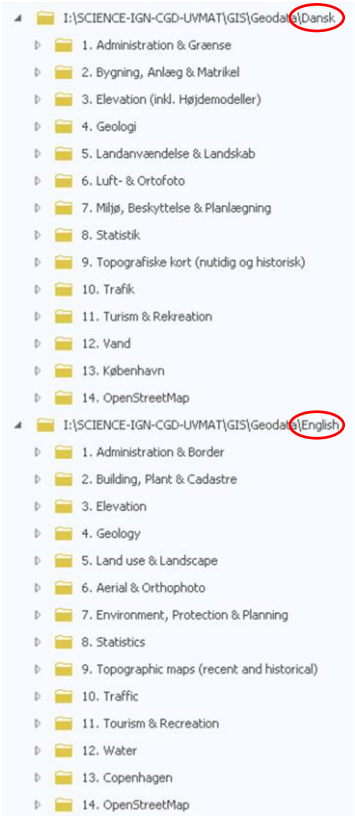


Fig 1. The catalogue structure of the IGN Geodata Library.

Connect to Folder

IGN Geodata Library

DIGIT-1a-b ➔ ➔ ➔ ➔ ➔

3. Create a Folder Connection to **I:\SCIENCE-IGN-CGD-UVMAT\GIS\Geodata** (Fig. 1).

This is the location of the IGN Geodata Library.
The library catalogue is available in English or in Danish.

Moreover, the library is organized by subjects.
For example, any forest geodata are likely to be located in the Land Use & Landscape folder, whereas any nationwide road geodata would be located in the Traffic folder.

Exercise

Now you have learnt to browse and search for and add Danish geodatasets available in the *IGN Geodata Library*. However, there may be other useful Danish geodatasets, which the institute may not keep.

Geodataset portal

One useful asset covering a range of Danish geographic datasets is a web portal provided by the SDFI
SDFI = The Agency for Data Supply and Infrastructure / Styrelsen for Dataforsyning og Infrastruktur
(Formerly: The Danish Geodata Agency/Geodatastyrelsen).

SDFI =
The Agency for Data Supply and Infrastructure

It is called the *Geodata-info.dk* (Fig. 2).

Geodata-info.dk
(in Danish and English)

Geodata-info.dk

Here you may look for Danish geodatasets using the:

- Search-for-Geodata functionality (Fig. 2a).
- Browse-by-Theme/Type/Provider etc (Fig. 2b).

You may choose language (see **red** box, top right corner).

First, you will have a look at the search functionality.

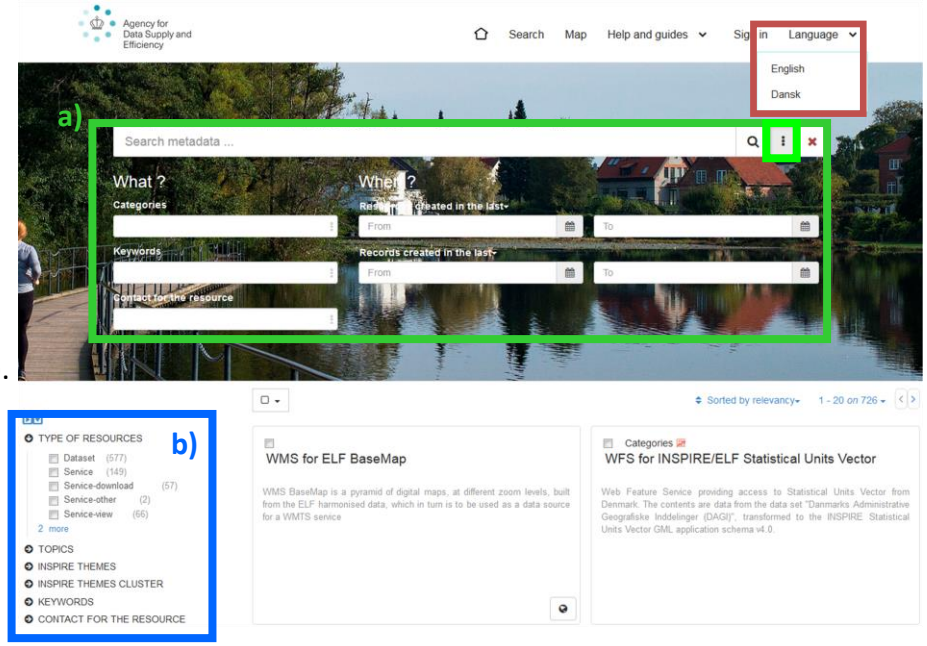


Fig. 2 The Geodata-info.dk portal. a) The search and b) browse functionalities.

4a) Initially, there is only a single empty field, where you may type any search word.

i) Type 'skov' ('forest' in Danish), then press the magnifier button

The relevant hits are displayed below. If you like, you may narrow the hits down to the most relevant ones:

ii) Click the ⋮ button (see light green box, inside Fig. 2a).
The window is expanded so that you may filter your search output by Category, Keyword, Provider and Time.

iii) Try narrowing down the hits by selecting the 'Miliøstyrelsen' among the Providers/Contact for the resource
➔ Press the magnifier button, once again

Miljøstyrelsen
(Environmental Protection Agency)

Exercise

4b) To the left is a panel (Fig. 2b), where you may browse for geodata using one or a combination of criteria, including:

- Type of Resource
- Inspire Themes (according to the Inspire Directive)
- Year
- Format *etc*

5. When you are done filtering ➔ Click on one of the hits to the right:
You are then directed to a new web page (Fig. 3).

Here, you may view the spatial extent of the geodata (Fig. 3a).

You will also find some valuable information about the dataset, including (Fig. 3b):

- How to download/access
- In what way you may use it (legal)
- Data quality (scale) *etc*

Perhaps most important of all, there is contact information to the creator/owner/provider of the geodata, in case you need to find out some more details about the data.

Display/Download:

- *Geodata*
- *Metadata*

Metadata =
A list of useful data about a geographic dataset (e.g. data content, resolution, coordinate system, creator/owner).

DIGIT-2 ➔ ➔ ➔ ➔ ➔

Two other things to keep in mind regarding geodata resources available on the WWW are – Time & Money:

- Time – If the geodata are not readily downloadable, you may need to contact the geodata provider by e-mail. Sometimes everything may run smoothly, at other times you may expect considerable handling time (*e.g.* depending on how busy the contact person is, and the mode of geodata transport; ftp, a USB via ordinary post).
- Money – The geodatasets are not necessarily for free (gratis). However, from 1st Jan. 2013, the basic national geodata are effectively free to download from the SDFI.

Download geodata from the SDFI:
https://dataforsyningen.dk/data

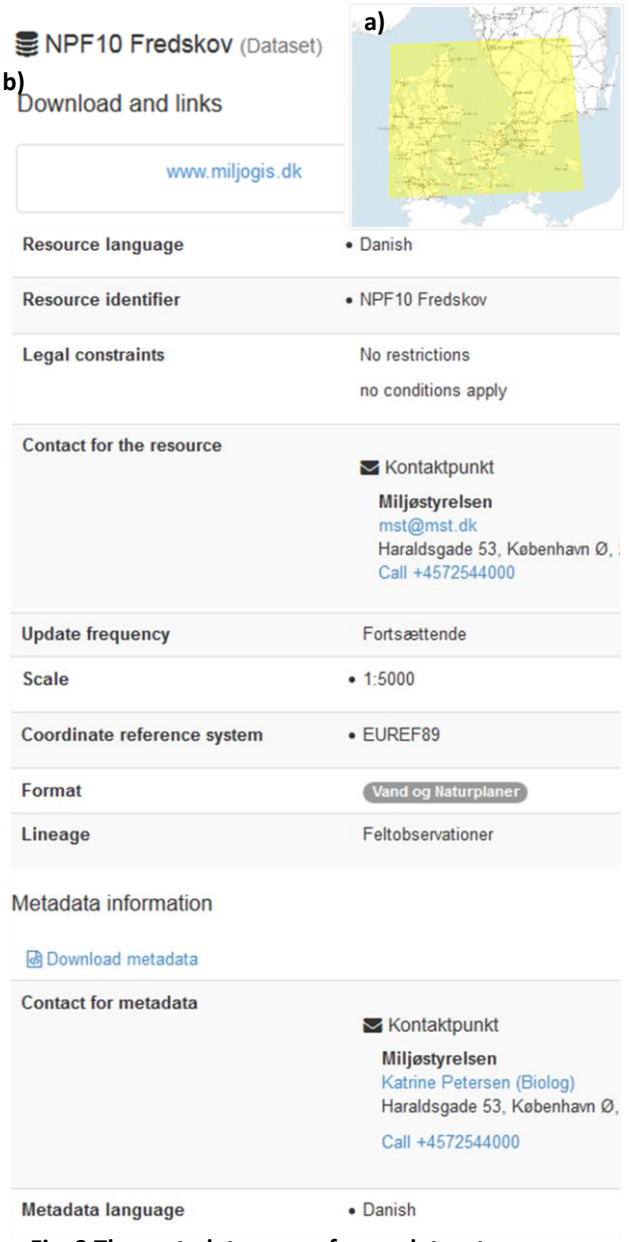


Fig. 3 The metadata page of a geodataset found through the Geodata-info.dk

Exercise

Danmarks Miljøportal (only in Danish)

Probably one of the most widely used assets covering national geodata is a webGIS service called Danmarks Miljøportal (*i.e.* 'The Danish Environmental Portal') (Fig. 4).

It is commonly known as just 'Miljøportalen' and is located at:

https://arealinformation.miljoeportal.dk/distribution/

Here you may view and download environmental geodata (*e.g.* nature and wildlife reserves, Natura 2000 areas).

However, the name The Danish Environmental Portal is a bit misleading.
The content is not restricted to only environmental data.
A whole range of other themes are also available, for example:

- Administrative borders
- Local and Municipality plans (proposed and adopted)
- Groundwater interest areas
- Nature resource areas
- Data associated with agriculture

MiljøPortalen – Browse and Navigate geodata

6. You may pan and zoom the map just by using the mouse or touch pad.

DIGIT-3a-b ➔ ➔ ➔ ➔ ➔

Further map navigation tools are available after clicking 'Værktøjer' (Fig. 4, red box).

Shortly, you will learn how to download the geodata you are interested in.

But first you need to get acquainted with the MiljøPortalen application.

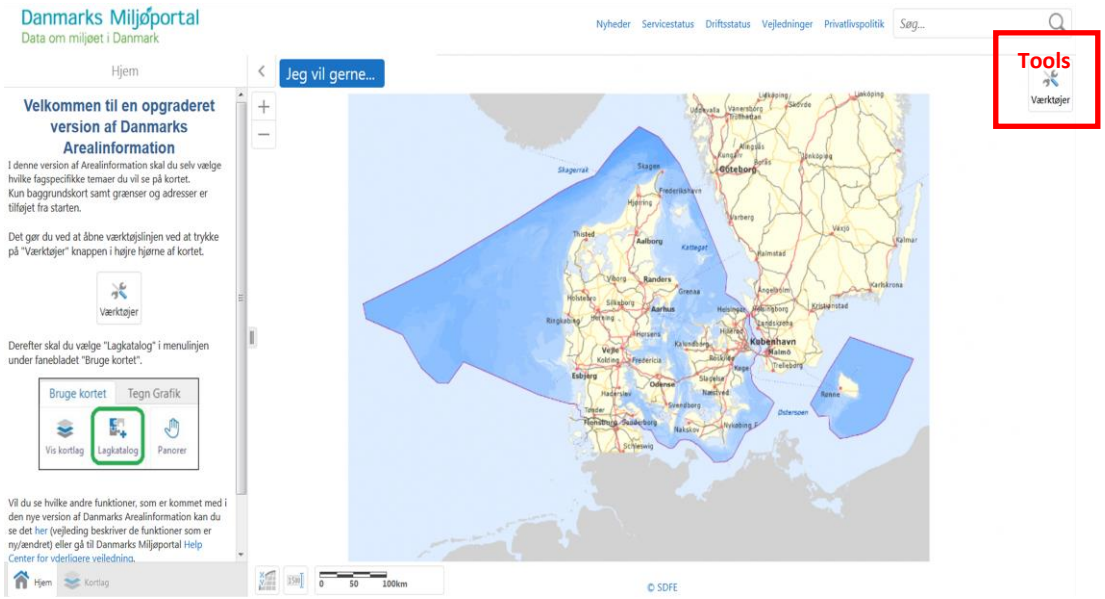


Fig. 4 The Danish Environmental Portal (Danmarks Miljøportal in Danish). A webGIS application that enables citizens to view and download public geodata associated with environment, local planning and natural assets.

Exercise

MiljøPortalen – Download geodata

Disclaimer!
Sometimes the service breaks down.
If it stalls, just skip the download.

Metadata

MiljøPortalen – View metadata

MiljøPortalen – Access Local and Municipality Plan

PlandataDK

After you have added some extra map layers, they are listed in the left pane within their themes (Fig. 5).

7. Try to download some geodata.

(Remark:
Not all the geodata layers are available to download directly from the MiljøPortalen.)

Metadata are (often crucial) information about geodata.
Generally they contain information on:

- How and when the data were produced
- The geographical extent
- The quality
- The file format
- How to contact the owner/provider

Accordingly, the metadata may help you to get a picture if you would need the geodata for your project, and if it is worth downloading them in the first place.

8. Check out some metadata using the MiljøPortalen.

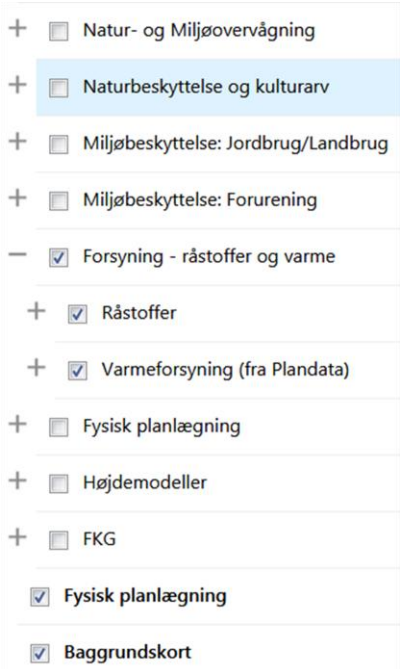
Another valuable function of the MiljøPortalen webGIS application is to view and download a Local or Municipality plan (Fig. 6).

In a Local or Municipality Plan you may read about the intentions and restrictions regarding land use in a specified area.

9. Try out the service of accessing a Local or a Municipality Plan.

PlandataDK is a sister webGIS application providing a similar service as the Miljøportalen.
You may check it out at your own free will at:

https://kort.plandata.dk/spatialmap?



Selectable themes:

Nature and Env. monitoring

Nature protection and Cultural heritage

Nature protection: Agriculture

Nature protection: Pollution

Supply: Raw material and Heat

Subthemes

Physical planning: Plans

Elevation models

Municipal geodata

Physical planning: Adm. borders

Basemaps/Background images

Fig. 5 The left pane presenting the list of geodata themes. Checking a checkbox displays the theme objects in the map.

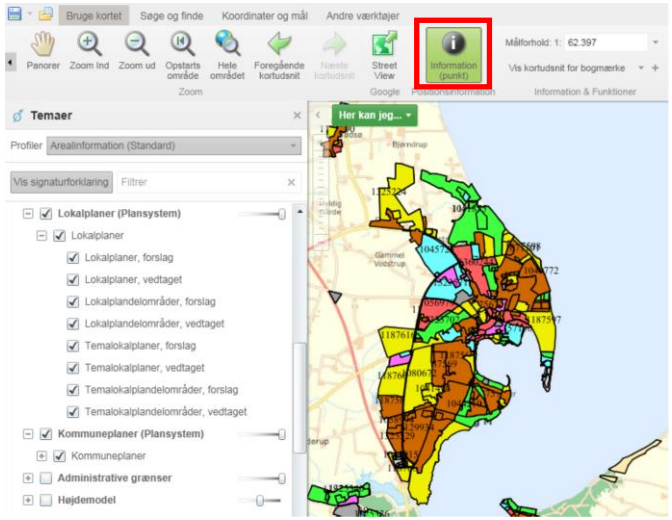


Fig. 6 Coloured polygons are indicating areas associated with a local or municipality plan.

Exercise

This far we have only presented Danish geodatasets.
But what if you need to produce a simple map of the World, or Scandinavia?

ESRI

ESRI, the company which has developed the GIS software you are using – ArcGIS Pro –
offers a vast library of geodatasets you may use.
Among these are contour maps of countries, regions, continents etc.

I:\SCIENCE-IGN-CGD-UVMAT\GIS\Geodata\ESRImaps

You will find some of them on the institute I drive at:

I:\SCIENCE-IGN-CGD-UVMAT\GIS\Geodata\ESRImaps

Use your skills

DIGIT-4 ➔ ➔ ➔ ➔ ➔

10. You will add a world geodata layer to ArcGIS Pro and change its projection.

a) Start ArcGIS Pro, then add a geodataset called 'World Map.lyr'
from *I:\SCIENCE-IGN-CGD-UVMAT\GIS\Geodata\ESRImaps\2018**World** .

A world map is displayed in the Data View (Fig. 7a).

GCS =
Geographic Coordinate System

b) Check the coordinate system of the Data Frame called 'Map'.

IMPORTANT!
A new ArcGIS Pro project automatically 'adopts' the coordinate system of the FIRST layer of geodata that is added.

WGS 1984 =
World Geodetic System 1984

Use your skills

World Mercator

c) Change the Data Frame to the **Mercator** projected coordinate system (Fig. 7b).

What differences can you tell between the two?

IMPORTANT!
It is important, though, to realize that changing the projection by this technique is just a way of changing the *display*.
The inherent coordinate system of the World Map.lyr is still set to WGS 1984.

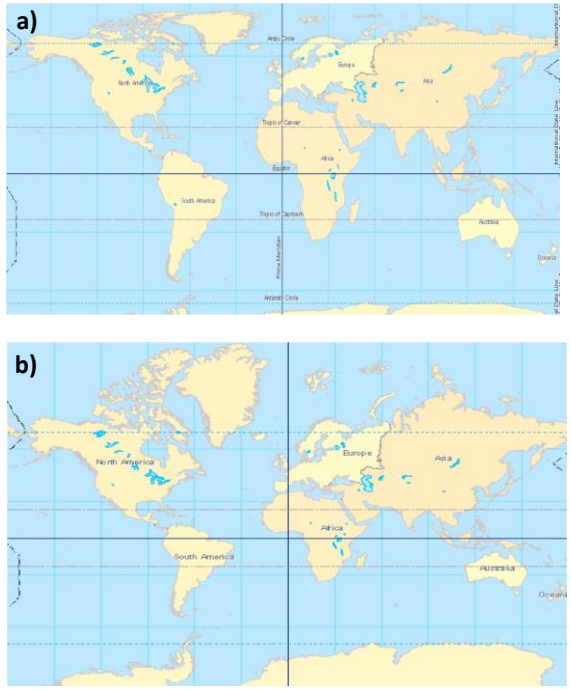


Fig. 7 World maps represented by a) the WGS 1984, and b) the Mercator projected coordinate systems, respectively.

'Basemaps' is an online utility already integrated within the ArcGIS Pro software.
The layers may for example serve as a background during your processing of your own geodata in ArcGIS Pro (Fig. 8).

Shift Basemaps

11. Add some Basemaps

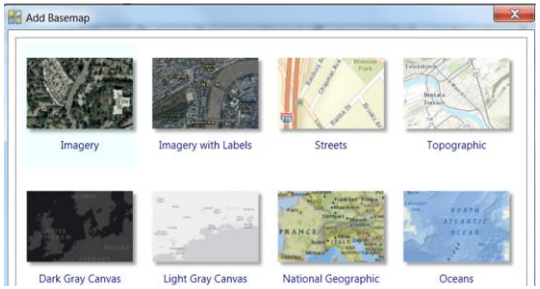


Fig 8. The ArcGIS Basemaps gallery

Exercise

Geodata and the WWW

Finding geodata on the WWW is not very hard.
Just use a common web browser and some suitable keywords, and you will end up with abundant of hits.
There are literally hundreds of geodata providers out there.

Finding the geodata that is adequate for your purpose, however, is a much more difficult task.
For example, you may have been lucky enough to find a geodata provider with exactly the kind of data you need, covering exactly the area you are interested in.
Still, there may be quite a few hurdles to pass before you eventually are able to use them.
Common considerations are:

- Are the geodata for free (gratis)?
- Is the resolution and data quality high enough?
- What is the geodata format (and may it be transformed to the format you are able to use, without data loss)?

Many of these questions may be answered by the metadata, which (hopefully) is provided by the geodata owner.

In a moment you will try out yourself to find and download some geodata, but first you will be introduced to three well-organized providers of free geodata – one covering Europe, and two with worldwide data.

EEA = European Environmet Agency

A) EEA – is an agency of the European Union, providing environmental geodata.

USGS = US Geological Survey

B) USGS – is a federal US science organization.
Provides worldwide geodata on climate, environment, natural resources, land use.

C) WorldClim – is a collaboration between various institutes.
Provides worldwide geodata on climate (*e.g.* temperature, rainfall) and elevation.

Exercise

In the next couple of pages are instructions to download geodata from each of the geodata provider websites.
You only need to try out **one** of the three. (Shortcut: EEA, USGS, WorldClim)

EEA

12. Download geodata from:

A) **EEA** (http://www.eea.europa.eu/)

i) Use the URL to enter the website (Fig. 9).

ii) In the Main menu, click 'Analysis and Data' then 'Datahub' (Fig. 9).

Fig. 9 The EEA website. The red box indicates the entry to 'Analysis and Data'.

iii) Next, using the search function (Fig. 10a), type 'Land Cover Change' ➔ Search.

A range of items related to Land Cover Change areas are listed below.

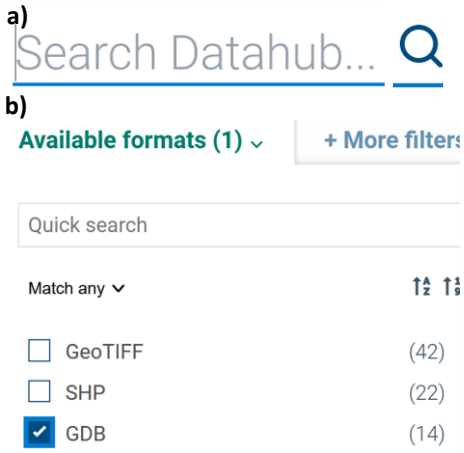


Fig. 10 The EEA datahub search function.

At this point, however, you may not know whether the data are proper geodata (*e.g.* a shapefile), or merely table data (*e.g.* an excel worksheet).
Fortunately, there is a filter mechanism available:

iv) Expand 'Available Formats' ➔ Check the 'GDB' option (Fig. 10b).

This is the geodatabase (.gdb) file format, which you have been introduced to earlier.
ArcGIS Pro is compatible with nearly all the file formats presented in the filter, like GeoTiff, Shapefile, Geopackage. Some data are available in several formats, so that you may download the one that works best in your GIS software.
It is an advantage if you know what type of data each GIS file format represent, though.

Data format conversion

Loss of data quality

For example, if you intend to do an analysis based mainly on vector data, the download of the GeoTiff format means that you will receive raster data. So, in order to include the raster data in your analysis, you may have to convert them into vector format. The conversion between data formats, often result in loss of data quality.

v) Click the 'Corine Land Cover' item in the list.
Here, you may select land cover from various years, and for each year/page, there are links to metadata.

Troubleshooting ➔➔➔➔➔
You will need to register.

vi) Select the 'Download' link ➔ You will be asked to login/register to the EU service. The delivery is by Email link.
This is not uncommon for official geodata providers, and this process may be swift (or not...).
In this case, the whole process may take minutes to days. No hurry, you are not going to submit this material.

You may download geodata for the entire EU or define an area.

When you are done, you may proceed to the final task.
The result of the final task is to be handed in. To the Final Task.

Exercise

(*cont.*)

USGS
- US Geological Survey

12. Download geodata from:

B) **USGS** (http://www.usgs.gov/)

This is the general entrance to a vast 'library' of geodata, maps and various web services, covering not only the USA but also the rest of the world (Fig. 12).

The EarthExplorer

For this exercise, though, we are especially interested in one of the webGIS services - *The EarthExplorer*.
Using this service you may download huge amounts of geodata – in particular satellite imagery.
The datasets are continuously updated with new images. (You may find both current and historical data)
Many datasets are available for free (gratis), but not all.

Fig. 12 The USGS website holds a great variety of geodata from all over the world

Register ➔ ➔ ➔ ➔ ➔ ➔
To be able to download data you will need to register.
To do so, click the Login *button, located in the right end of the top Menu bar.*

i) Enter the EarthExplorer webGIS service from https://earthexplorer.usgs.gov/

ii) The new page is providing a four-step process to download geodata (Fig. 13, red box).

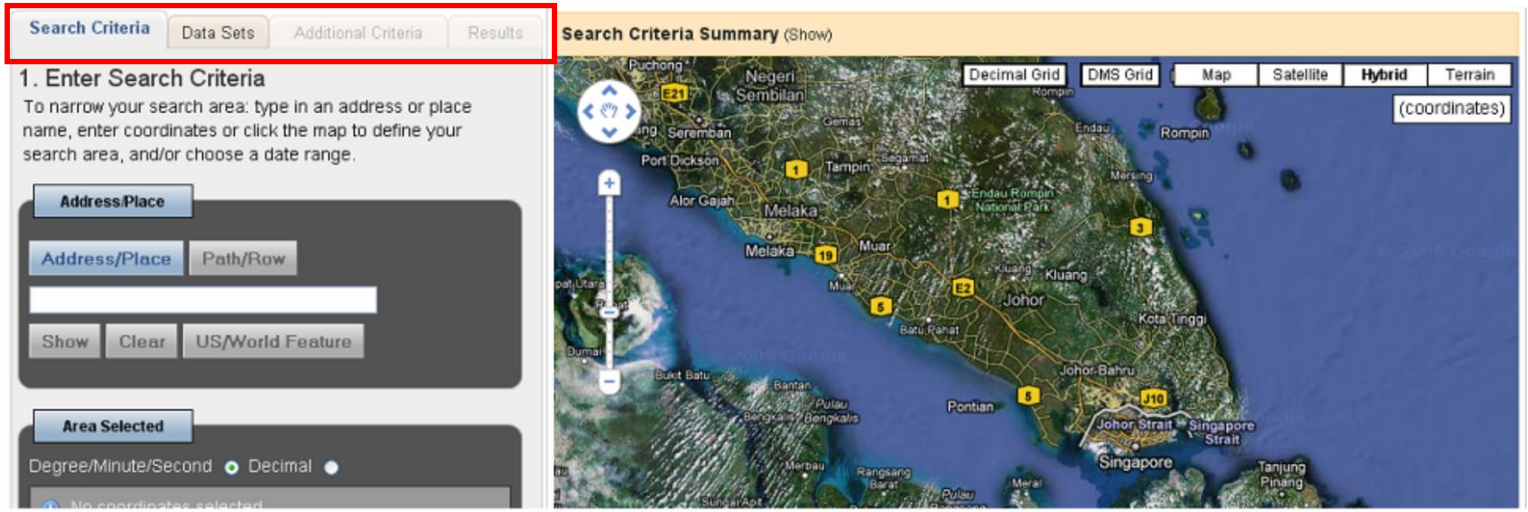


Fig. 13 The four-step process to download geodata from the USGS website (indicated by a red box).

Exercise

(*cont.*)

12. Download geodata from the **USGS**:

USGS

Actually, you will take four-step process in a different order, and start with second tab, the 'Data Sets' tab.

Step 1: 'Select Your Dataset(s)'

This choice is made beneath the 'Data Sets' tab (Fig. 13).

First, how do you know what kind of geodata are available?
Answer: In the left panel is a list with various themes: 'Aerial Imagery', 'Digital Line Graphs' etc.
As you can tell from their names, these themes suggest that the geodata may come in various formats (*e.g.* vector lines, or rasters like aerial photos and topographic maps).
Within each of these themes are several types of geodata.

iii) To view the available geodatasets within a theme, expand a theme by clicking a icon.

iv) Then, the best way to find out the content of a particular geodata is to check their metadata.
This is done by clicking the icon next to a geodata name.

v) Clicking the icon will display the geographic extent of the downloadable geodata. (Very useful function!)

As you may have noticed, there may be the icon next to a geodata name.
This symbol represents geodata which cost to download.

You will now proceed to download some geodata .
The process is started by simply checking a checkbox of the geodata you are interested in.

During this exercise there is one more thing you will need to consider
– the USGS website is American.
Consequently, geodata are most certainly available for the North American continent.
If you would like to download geodata from a 'remote' place, however, then you may need to assure yourself that there really *are* some geodata available. The way to do this is to check more geodata checkboxes.

vi) Check a few checkboxes from various themes (but only those that come with no charge).

Exercise

(*cont.*)

12. Download geodata from the **USGS**:

USGS

This choice is made beneath the 'Search Criteria' tab.

Step 2: 'Enter Your Search Criteria'

This choice is preferably made using the map, although you may type in the geographic coordinates.

First, locate your area of interest (AOI).

vii) You may do this either by typing a name, or by using the zoom tool and pan (Fig. 14, red box).

You may also choose whether you would like to navigate the map using a 'Map/Kort' or 'Satellite' as background (Fig. 27, blue box).

Next, delimit the extent of the area of interest.

AOI = Area Of Interest

viii) You may do this by clicking on the map.
Click as many times as you need to delimit the AOI.
The result is indicated by a red polygon (Fig. 14).

You will find that the corner points of the polygon appear as lat/long points in the left panel.

You may also restrict your search in time.

Step 3: 'Search >>>'

The search for geodata starts immediately as steps 1-2 are done. Check under the 'Results' tab.
The search may take a while.

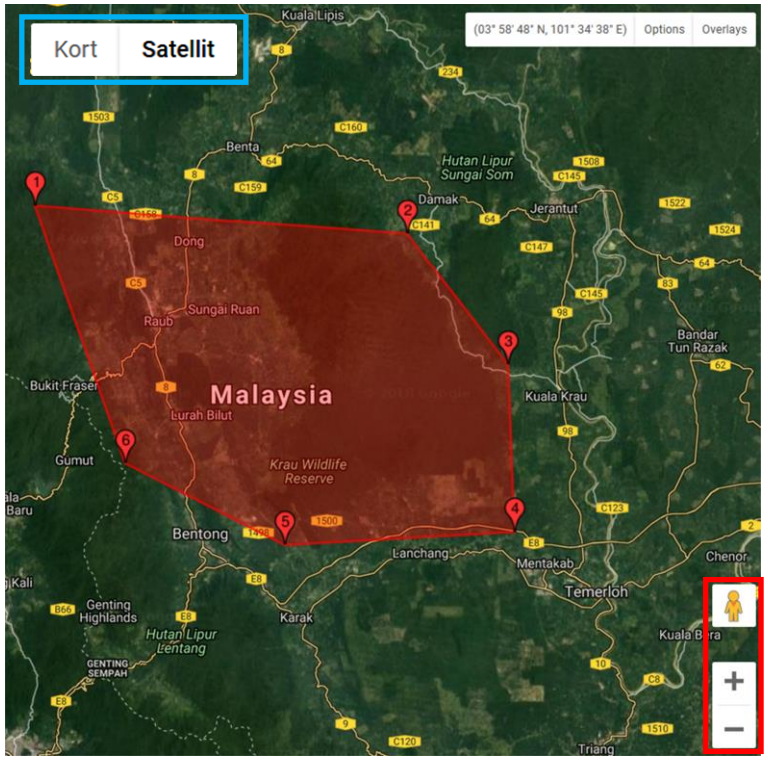


Fig. 14 Delimiting the area of interest (AOI) using the the map tools.

Exercise

USGS

(*cont.*)

12. Download geodata from the **USGS**:

Step 4: 'Download'

The search process may take some time to load, depending on the number of geodatasets you have checked.
Eventually a Search Results window appears (Fig. 15).
Now you may go through the Results Summary list to view which geodata are available for this particular area of interest (Fig. 15).
Available geodata are displayed as thumbnails.

ix) To start the downloading process, click one of the  symbols.

When the geodata is several hundreds of MB in size you will get a warning message. Please refrain from downloading then.
Sometimes it may take a while until something happens.
–Be patient, there are a lot of people using this service.
Eventually, you will be asked to save the file.

x) Accept to save the file.

Now, the actual download starts.
In the download bar you may view the progress.

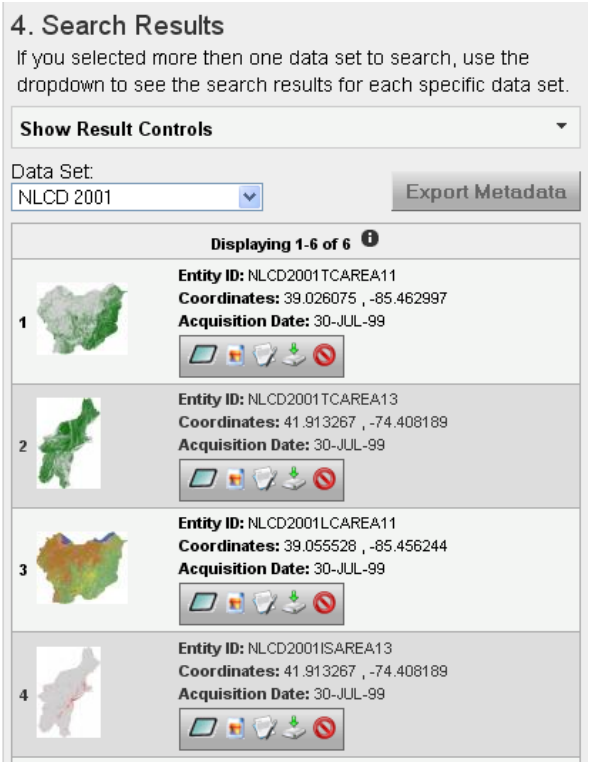


Fig. 15 The Search Result window displaying which geodatasets are available in the area of interest.

xi) If the size of the file is too large (> 50 MB), or if the download is too slow, stop the download.

xii) Instead, try to download another geodata (Start all over from step *x)* above).

xiii) Finally, start ArcGIS Pro and add the downloaded/saved file.
(Sometimes the file arrives as a compressed .tar.gz file. You may use the program 7-zip to unpack it.)

When you are done, you may proceed to the final task.
The result of the final task is to be handed in. To the Final Task.

Register ➔ ➔ ➔ ➔ ➔ ➔

To be able to download data you need to register.

1. In the pop-up window, click the Registration process link.
2. Create User name and Password
3. Click the Submit and Continue button and proceed with the registration.

Exercise

(*cont.*)

12. Download geodata from:

WorldClim

C) **WorldClim** (http://www.worldclim.org/)

i) Use the URL to enter the website.

ii) Click the 'Download' button (Fig. 16a).

iii) In the page that opens, you may choose to download climate geodata from 'Historical' and 'Historical Monthly' conditions, or projected conditions into the 'Future' (Fig. 16b).

iv) Click the 'Historical monthly weather data' link ('Historical' also means near current conditions).

v) In the page that opens, you may download temperature or precipitation data for a given ten-year period (Fig. 16c).

Here, you will also find a few more pieces of information:

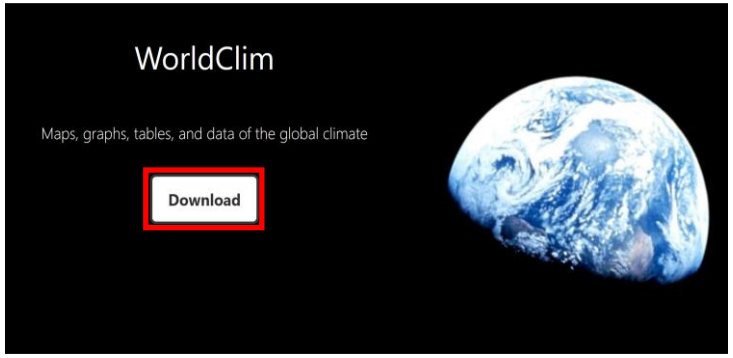
- The type of geodata and file format (*i.e.* Raster, GeoTiff *.tif*).
- The image resolution (*i.e.* 2.5 arc-minutes ~21 km^2).

vi) To start downloading, click one of the hyperlinks.

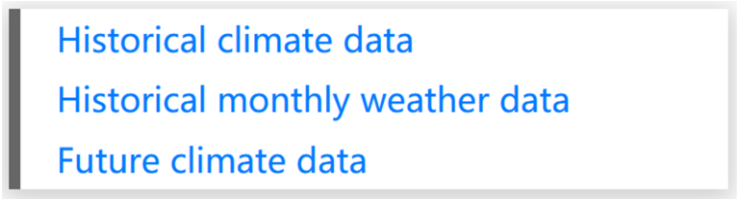
vii) If you choose the 'Historical Climate Data' link (Fig. 16b), the geodata are not as close to current conditions (1970-2000). However, what you gain is a:
- Wider variety of variables (*incl.* bioclimate, wind speed, solar radiation, water vapor, temp., precipitation)
- Higher resolution (*e.g.* at best 30 arc-seconds ~1 km)

Tip: To ensure the process is fast, you may consider downloading one with a low resolution (*e.g.* 10 arc-minutes).

a)



b)



c)

years	minimum temperature	maximum temperature	precipitation
1960-1969	tmin_1960-1969	tmax_1960-1969	prec_1960-1969
1970-1979	tmin_1970-1979	tmax_1970-1979	prec_1970-1979
1980-1989	tmin_1980-1989	tmax_1980-1989	prec_1980-1989
1990-1999	tmin_1990-1999	tmax_1990-1999	prec_1990-1999
2000-2009	tmin_2000-2009	tmax_2000-2009	prec_2000-2009
2010-2018	tmin_2010-2018	tmax_2010-2018	prec_2010-2018

Fig. 16 a) The WorldClim website. The red box indicates the entry to 'Download' of geodata. b) You may download climate and elevation geodata from 'current', 'future' and 'past' conditions. c) WorldClim geodata are compatible with the ArcGIS software.

Exercise (*cont.*)

12. Download geodata from the **WorldClim**:

The geodata is downloaded as a compressed (zipped) folder.

i) Locate the downloaded folder.

ii) Use the 7-zip software to unpack the folder content, and save it to the hard drive (*e.g.* C:/Temp/).

iii) Finally, start ArcGIS Pro and add the downloaded satellite image (Fig. 17).

When you are done, you may proceed to the final task.
The result of the final task is to be handed in. To the Final Task.

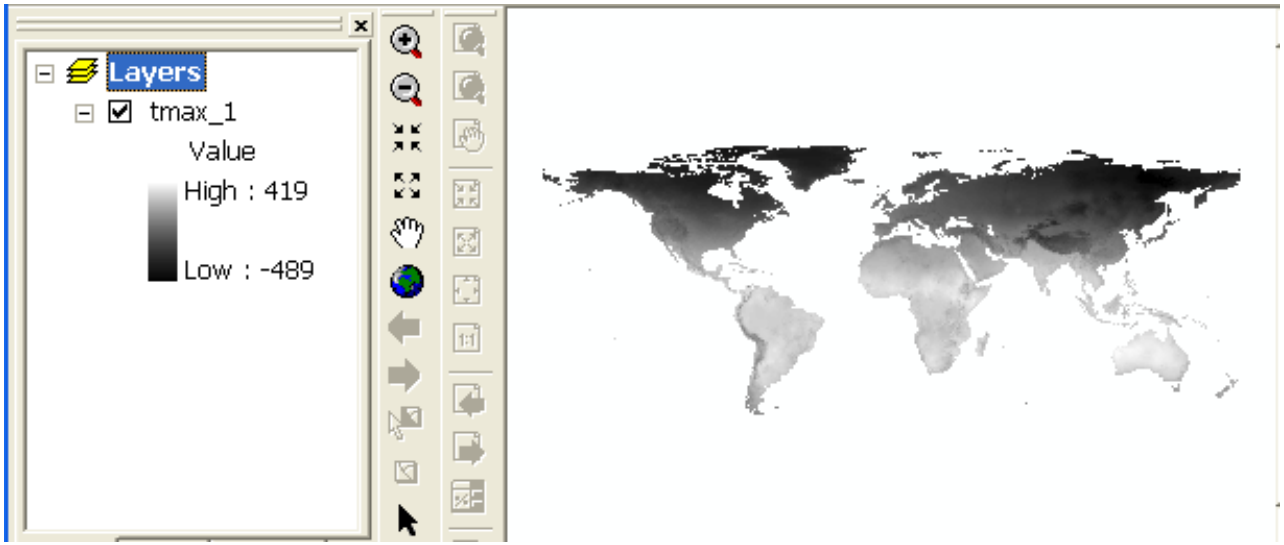


Fig. 17 Worldwide climate data (Max. Temperature) downloaded from the WorldClim website, displayed using ArcGIS.

Exercise

Final task

DIGIT-5 ➔ ➔ ➔ ➔ ➔

Final task

Notice!

Now, you´re on your own for a moment.
You will search for and download some other free geodata from the WWW (*i.e.* **not from the websites in this exercise**).
The outcome of your effort should be summarized in a word document and handed in digitally
(*i.e.* uploaded to the E-learning environment – the Absalon). Only one member of a group needs to upload the result.

The document shall include answers to the following questions:

1. What **keywords** did you use (for your successful search)?
2. What´s the **web address** (URL) of the webpage from where you downloaded the geodata?
3. What **organization/company/person** provided the geodata?
4. What **type** of geodata do they provide? Landuse? Elevation? Climate? …
5. What is the **geographic extent** of the geodata? Worldwide? The city of Mumbai?
6. What is the **format** of the geodata? Vector data? Satellite images? If unsure you may write the file extension of the downloaded geodata files (*e.g.* .shp, .tiff, .asc).
7. When were the geodata produced? **Date**?
8. Can you tell anything about the **resolution** of the geodata? At what scale were they produced? Pixel size?
9. How may you **contact** the provider of the geodata? That is, not the e-mail address to the organization as a whole, but rather more specific (like the personal e-mail address of an employee).
10. What are the **names** of your group members (incl. **personal student numbers** and **e-mail addresses**)?
11. A **screendump** of the geodata you downloaded and opened in your GIS software.

Metadata

By doing this you are actually generating some very useful metadata. ☺

A useful tip:
When you enter a (sometimes messy) website that you suspect is providing geodatasets:
- Look for keywords in the menu list like: '*download*', '*datasets*', '*maps*' etc, and then click such links.

You are encouraged to find something that you may need for your own project in this course or another you are taking.
Some words of advice, though. Try to succeed in downloading the geodata directly by yourselves.
There is limited time to try contacting a geodata provider. Sometimes he/she may respond quickly, more often not.

Thanks for your attention!