

Welcome, we'll start at **10:30**

Open Access Week at CZU

24 - 26 October 2022



The decision regarding turning on your video camera is up to you. The event will be **recorded**.



Please keep your microphone **muted**. There will be room at the end of the event for questions or discussion.



Please write down your questions or comments during the event in the **chat**.



The presentation and recording will be available on our **website**.



Knihovna



Using **Open Data** from Remote Sensing for assessment of Ecosystem Health with Jakub Zelený (People in Need)





Using Open Data from Earth Remote Sensing to Assess Ecosystem Health

Jakub Zelený

CGI

Supported by
CGI IT Czech
Republic

 People
in Need

Alliance  2015
take us the eradication of poverty

Why and how to measure ecosystem health?



Data, tools and analysis which are used to estimate ecosystem health

Data acquired and processed in cooperation with

- CGI IT Czech Republic, Department of Space Technologies
- <https://www.cgi.com/ceska-republika/cs/kosmicke-technologie>


The screenshot shows the website for CGI Czech Republic, specifically the 'Kosmické technologie' (Space Technologies) page. The page features a navigation bar with the CGI logo, menu items for 'Sektory', 'Služby a Řešení', 'O nás', and 'Kariéra', and a search icon. A 'Kontakt' link and the text 'Česká republika' are also visible. The main content area includes a sub-header 'CGI Česká republika' and the title 'Kosmické technologie'. Below the title is a paragraph in Czech: 'Dodáváme projekty pro Evropskou kosmickou agenturu (ESA), podílíme se na vývoji a podpoře navigačního systému Galileo, využíváme data ze satelitů pro dálkový průzkum Země a mnohé další. Z Prahy podporujeme business s největším potenciálem pro budoucnost!'. To the right of the text is a large image of a rocket engine. Below the main text area, there is a section titled 'Právě teď hledáme' (We are currently looking for) with two buttons: 'Space Security Consultant' and 'Crypto Security Consultant'. At the bottom of the page, there are two smaller images: one showing a satellite view of a landscape with green and brown patches, and another showing a modern office building with the CGI logo on the roof.

Technical description of the data set

- National scale, **year 2021**, Source Sentinel-2 (ESA), resolution 10 m2
- Annual aggregates of
 - NDVI - Normalized Difference Vegetation Index
 - Vegetation Heterogeneity – quantifies the degree of anthropogenic interference or conversly, ekosystém self-organization
- Calculated based on measurements covering the whole **vegetation period** (march till november) using the „Area Under Curve“ equation





Towards the evaluation of regional ecosystem integrity using NDVI, brightness temperature and surface heterogeneity

Article [Private full-text](#) July 2021 · Science of The Total Environment

 Jakub Zelený ·  Daniel Mercado-Bettin ·  Felix Müller

Combining Methods to Estimate Ecosystem Integrity and Ecosystem Service Potentials and Flows for Crop Production in Schleswig-Holstein, Germany

Article [Full-text available](#) April 2020 · Landscape Online

 Jakub Zelený ·  Sabine Lange ·  Kinh Bac Dang ·  Felix Müller

How are these indicators useful to us?

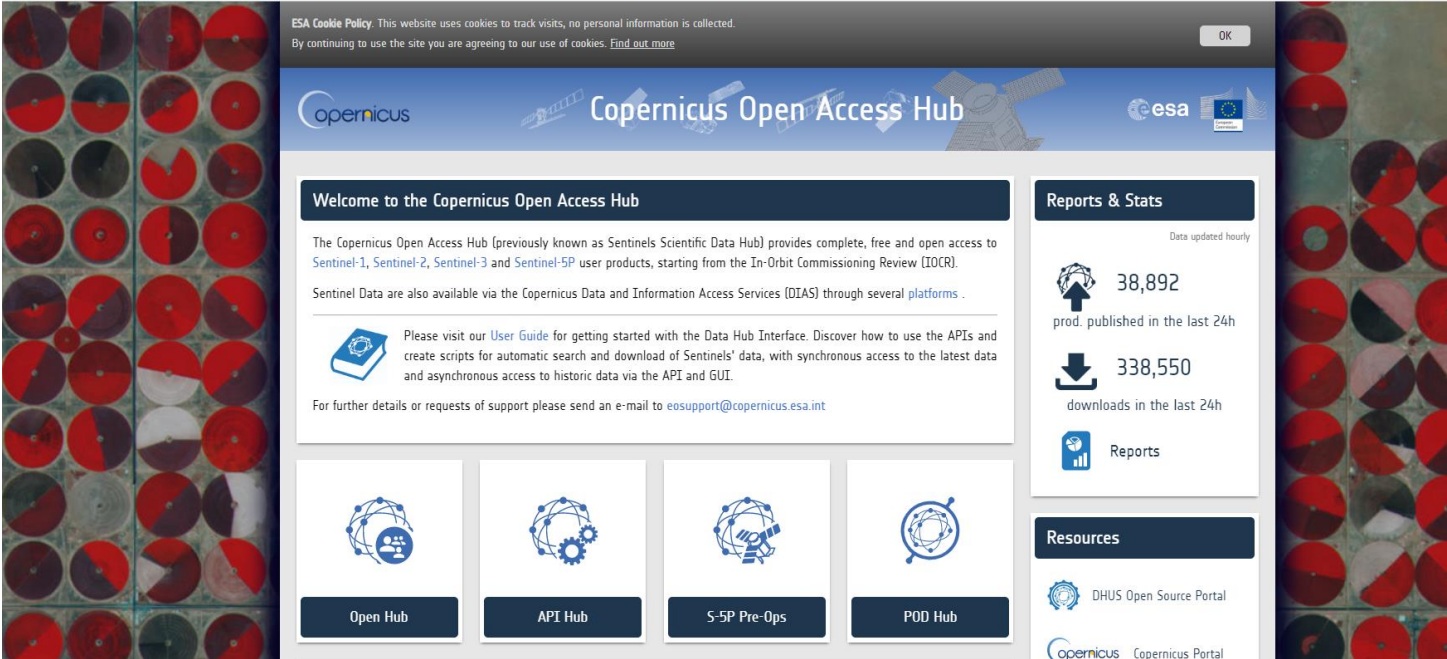
Evaluation of key environmental parameters:

- Health, performance of ecosystems, risk of ecological collapse
- Providing vital ecological functions
 - reduction of temperature gradient „cooling“, production of food, fodder, wood
- Provision of habitat for biodiversity
- Provision of ecosystem services to residents (aesthetics, recreation, sense of belonging, etc.)
- Protection against environmental risks, e.g. drought, floods, tornadoes, storms, erosion, heat island, wildfires

Key open access data and tools used







www.scihub.copernicus.eu Sentinel-2



← → ↻ scihub.copernicus.eu 🏠 ☆ 🌐 📄


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By continuing to use the site you are agreeing to our use of cookies. [Find out more](#) OK

Welcome to the Copernicus Open Access Hub

The Copernicus Open Access Hub (previously known as Sentinels Scientific Data Hub) provides complete, free and open access to Sentinel-1, Sentinel-2, Sentinel-3 and Sentinel-5P user products, starting from the In-Orbit Commissioning Review [IOCR].


Sentinel Data are also available via the Copernicus Data and Information Access Services (DIAS) through several [platforms](#).


 Please visit our [User Guide](#) for getting started with the Data Hub Interface. Discover how to use the APIs and create scripts for automatic search and download of Sentinels' data, with synchronous access to the latest data and asynchronous access to historic data via the API and GUI.


For further details or requests of support please send an e-mail to eosupport@copernicus.esa.int

Reports & Stats


Data updated hourly


 **38,892**
prod. published in the last 24h


 **338,550**
downloads in the last 24h


 **Reports**


Resources


 [DHUS Open Source Portal](#)

 [Copernicus Portal](#)

 **Open Hub**

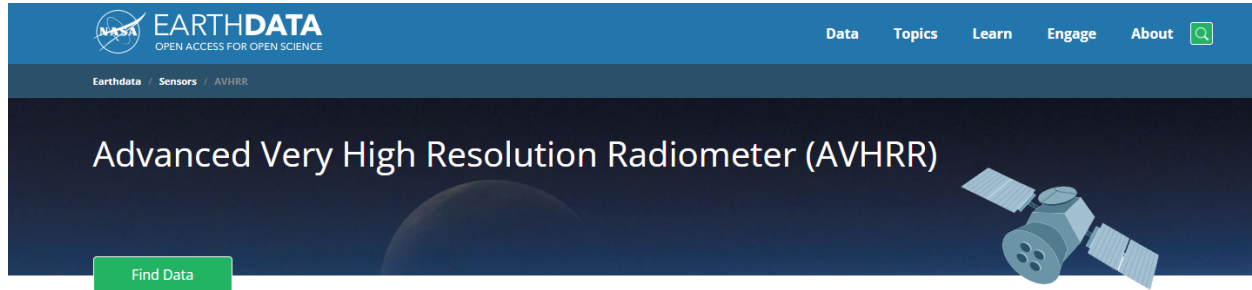
 **API Hub**

 **S-5P Pre-Ops**

 **POD Hub**

www.earthdata.nasa.gov/avhrr

AVHRR



Find Data

The Advanced Very High Resolution Radiometer (AVHRR) acquires measurements of land and sea surface temperature, cloud cover, snow and ice cover, soil moisture, and vegetation indices. Data are also used for volcanic eruption monitoring.

Specifications

Platform: AVHRR on NOAA 6 through 9, Metop A through C, TIROS-N

Sensor Type:
Spectrometers/Radiometers

Sensor Subtype: Imaging
Spectrometers/Radiometers

Platform: AVHRR-2 on NOAA 10-12, 14

Platform: AVHRR-3 on Metop A-C, NOAA 15-19

Related Links

<http://www.glass.umd.edu/introduction.htm>

MODIS and AVHRR



Home Overview Algorithms Download Contact Us

Introduction to the GLASS product algorithms

1. Leaf area index (LAI)
2. Fraction of Absorbed Photosynthetically Active Radiation (FAPAR)
3. Fractional Vegetation Coverage (FVC)
4. Broadband Albedo (Albedo)
5. Broadband Emissivity (BBE)
6. Downward Shortwave Radiation (DSR)
7. Photosynthetically Active Radiation (PAR)
8. Net Long-wave Radiation (LWNR)
9. Land Surface Temperature (LST)
10. Net Radiation (NR)
11. Evapotranspiration (ET)
12. Gross Primary Production (GPP)

<https://earthexplorer.usgs.gov/> Landsat 8 etc...

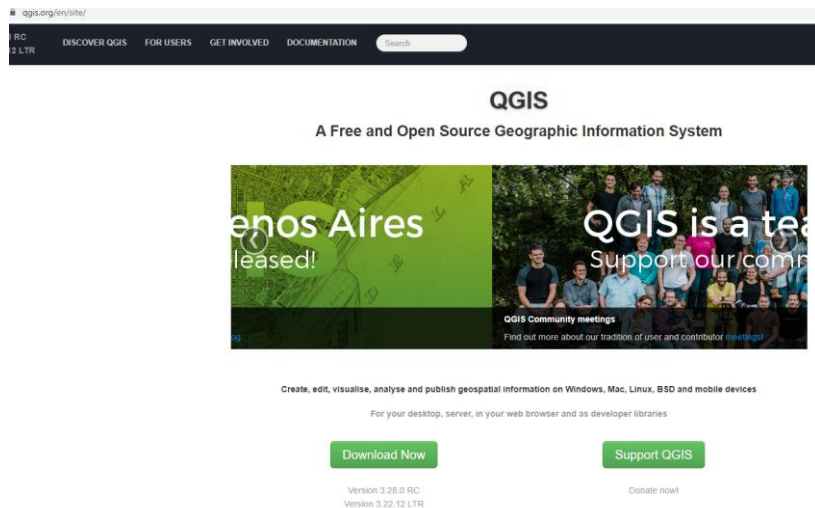
The screenshot displays the USGS EarthExplorer interface. At the top left is the USGS logo with the tagline "science for a changing world". The page title is "EarthExplorer". On the right side of the top navigation bar, there are links for "System Notification (1)", "Help", "Feedback", and "Login".

The main content area is divided into two sections. On the left is the "Search Criteria" panel, which includes the following elements:

- 1. Enter Search Criteria**: A section with instructions: "To narrow your search area, type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the help documentation), and/or choose a date range."
- Geocoder**: A section with a "KML/Shapefile Upload" button, a "Select a Geocoding Method" dropdown menu (currently set to "Feature (GNIS)"), and "Search Limits" text: "The search result limit is 100 records, select a Country, Feature Class, and/or Feature Type to reduce your chances of exceeding this limit."
- Feature Selection**: Two buttons for "US Features" and "World Features". Below are input fields for "Feature Name" (with a note "use % as wildcard"), a "State" dropdown menu (set to "All"), and a "Feature Type" dropdown menu (set to "All"). There are "Show" and "Clear" buttons.
- Map Interaction**: Radio buttons for "Polygon", "Circle", and "Predefined Area". Below are "Degree/Minute/Second" and "Decimal" radio buttons. A message states "No coordinates selected." There are "Use Map", "Add Coordinate", and "Clear Coordinates" buttons.
- Date Range**: A section with "Cloud Cover" and "Result Options" buttons. At the bottom, there are input fields for "Search from" and "to" in the format "mm/dd/yyyy".

On the right is the "Search Criteria Summary (Show)" section, which contains a satellite map of the central United States. The map shows states including South Dakota, Nebraska, Iowa, Missouri, Wisconsin, Illinois, and Minnesota. Major cities like Pierre, Sioux Falls, Sioux City, St. Paul, and Minneapolis are labeled. A coordinate box in the top right of the map displays "(45° 39' 36\" N, 102° 56' 30\" W)". There are zoom in (+) and zoom out (-) buttons.

OA Geographic Information Systems



The screenshot shows the QGIS website homepage. At the top, there is a navigation bar with links for 'DISCOVER QGIS', 'FOR USERS', 'GET INVOLVED', and 'DOCUMENTATION', along with a search bar. The main heading is 'QGIS' followed by the subtitle 'A Free and Open Source Geographic Information System'. Below this, there are two featured images: one on the left with the text 'Buenos Aires released!' and one on the right with the text 'QGIS is a team' and 'Support our community'. Underneath the images is a section for 'QGIS Community meetings'. At the bottom, there are two buttons: 'Download Now' and 'Support QGIS'. Below the 'Download Now' button, it lists 'Version 3.28.0 RC' and 'Version 3.22.12 LTR'. Below the 'Support QGIS' button, it says 'Donate now!'.

qgis.org/en/site/

RC
2 LTR

DISCOVER QGIS FOR USERS GET INVOLVED DOCUMENTATION Search

QGIS

A Free and Open Source Geographic Information System

Buenos Aires released!

QGIS is a team
Support our community

QGIS Community meetings
Find out more about our traditions of user and contributor meetings

Create, edit, visualise, analyse and publish geospatial information on Windows, Mac, Linux, BSD and mobile devices

For your desktop, server, in your web browser and as developer libraries

Download Now

Support QGIS

Version 3.28.0 RC
Version 3.22.12 LTR

Donate now!



The screenshot shows the SNAP Download page. The background features a satellite in space and a view of Earth. The main heading is 'SNAP Download'. Below the heading, there is a 'DOWNLOAD' button with a home icon. The text below reads: 'Here you can download the latest installers for SNAP and the Sentinel Toolboxes. Data provision is available to all users via the [Sentinel Data Hub](#).' This is followed by a section for 'Current Version' which states 'The current version is 9.0.0 (29.06.2022 15:00 UTC)'. Below this, there is a link to 'For detailed information about changes made for this release please have a look at the release notes of the different projects: [SNAP](#), [S1TBX](#), [S2TBX](#), [S3TBX](#), [SMC](#), [Toolbox](#)'. At the bottom, there is a paragraph: 'We offer three different installers for your convenience. Choose the one from the following table which suits your needs. During the installation process, each tool from the installation. Toolboxes which are not initially installed via the installer can be later downloaded and installed using the plugin manager. Please note that SN'.

DOWNLOAD

SNAP Download

Here you can download the latest installers for SNAP and the Sentinel Toolboxes.
Data provision is available to all users via the [Sentinel Data Hub](#).

Current Version

The current version is 9.0.0 (29.06.2022 15:00 UTC).

For detailed information about changes made for this release please have a look at the release notes of the different projects: [SNAP](#), [S1TBX](#), [S2TBX](#), [S3TBX](#), [SMC](#), [Toolbox](#)

We offer three different installers for your convenience. Choose the one from the following table which suits your needs. During the installation process, each tool from the installation. Toolboxes which are not initially installed via the installer can be later downloaded and installed using the plugin manager. Please note that SN

<https://land.copernicus.eu/pan-european/corine-land-cover> Land cover classification data set

The screenshot displays the Copernicus Land Monitoring Service website. The header includes the Copernicus logo and the text "Land Monitoring Service". Navigation links for "Global", "Pan-European", "Local", and "Imagery and reference data" are visible. A search bar and links for "FAQ" and "Ask the service desk" are also present. The main content area is titled "CORINE Land Cover" and features a grid of map thumbnails. The thumbnails are labeled as follows:

- CLC 1990
- CLC 2000
- CLC 2006
- CLC 2012
- CLC 2018
- CHA 1990-2000
- CHA 2000-2006
- CHA 2006-2012
- CHA 2012-2018

A "User corner" section on the right lists various resources:

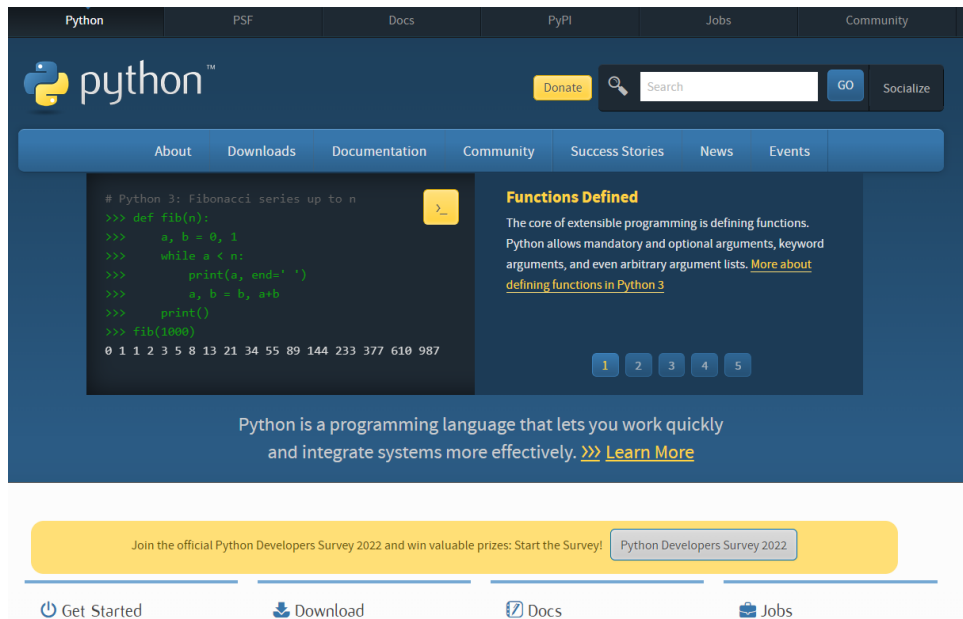
- How to access our data
- Technical library
- Factsheets
- Use cases
- Looking for National Expert products?

A banner at the bottom of the page reads: "Check out our new [dashboard](#) and see how CORINE Land Cover data can help you to understand the changes in the land cover around you."

This Site Uses Cookies

Futrher OA tools used to proces the OA data

- Python
 - www.python.org
- OA Python libraries
 - GDAL/OGR
 - Sentinelsat
 - NumPy
 - Etc.



The screenshot shows the Python.org website. At the top, there are navigation links for Python, PSF, Docs, PyPI, Jobs, and Community. Below this is a search bar with a 'GO' button and a 'Socialize' button. A main navigation bar contains links for About, Downloads, Documentation, Community, Success Stories, News, and Events. The main content area features a code editor on the left with the following Python code:

```
# Python 3: Fibonacci series up to n
>>> def fib(n):
>>>     a, b = 0, 1
>>>     while a < n:
>>>         print(a, end=' ')
>>>         a, b = b, a+b
>>>     print()
>>> fib(1000)
0 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987
```

On the right, there is a section titled 'Functions Defined' with the text: 'The core of extensible programming is defining functions. Python allows mandatory and optional arguments, keyword arguments, and even arbitrary argument lists. [More about defining functions in Python 3](#)'.

Below the code editor, there is a navigation bar with buttons labeled 1, 2, 3, 4, and 5. At the bottom of the main content area, there is a text block: 'Python is a programming language that lets you work quickly and integrate systems more effectively. [>>> Learn More](#)'.

At the very bottom, there is a yellow banner with the text: 'Join the official Python Developers Survey 2022 and win valuable prizes: Start the Survey!' and a button labeled 'Python Developers Survey 2022'.

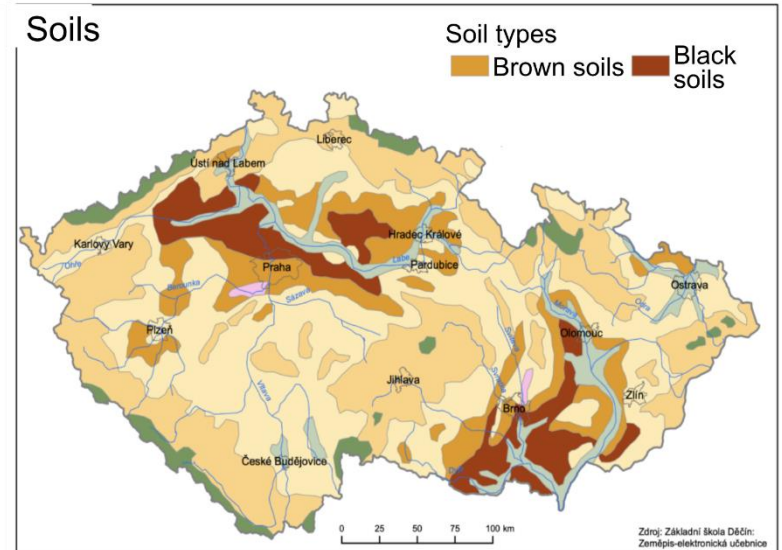
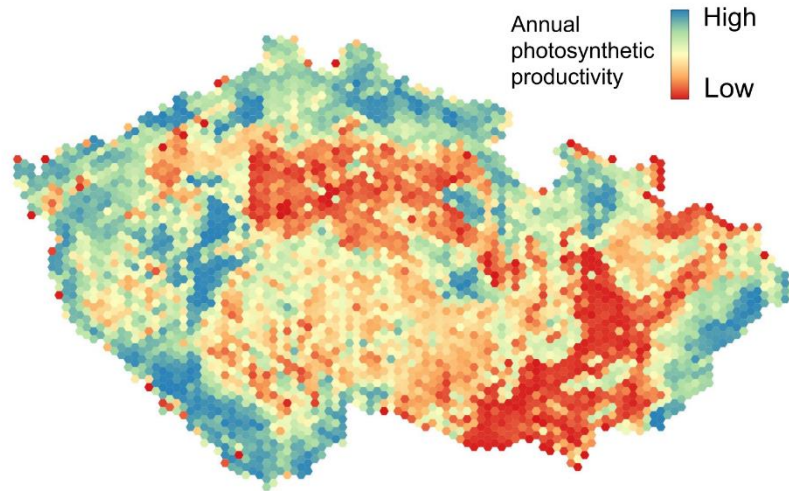
The footer contains four navigation links: 'Get Started', 'Download', 'Docs', and 'Jobs'.

Results from detailed assessment of current state - Sentinel-2



Key results

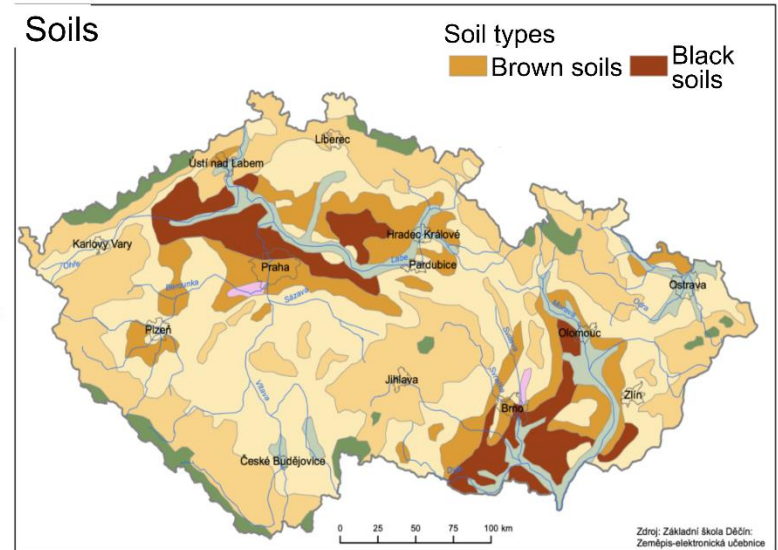
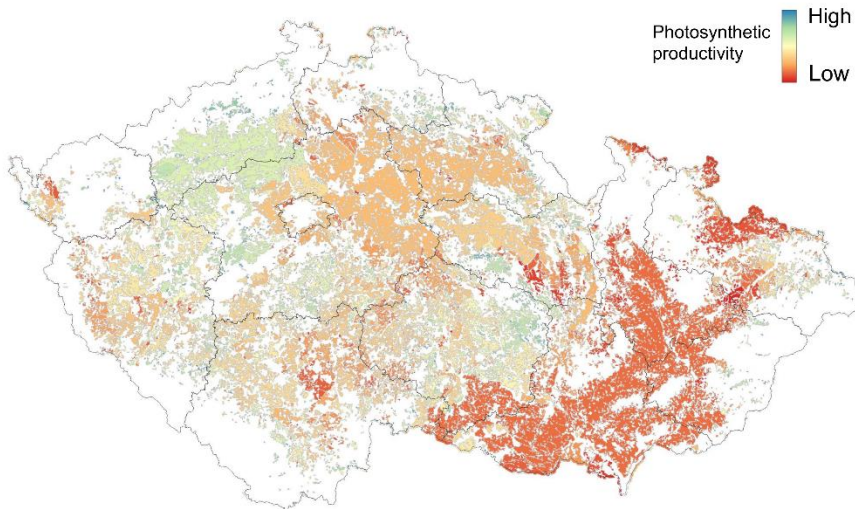
- The most fertile areas of the Czech Republic are the least photosynthetically productive
- Unfertile soils and mountainous areas most photosynthetically productive



Paradox in agriculture

- The more fertile the soil, the lower the production of food, fodder, etc.
- The conclusion is also confirmed by data from the CZSO – S Morava, the lowest yield per ha

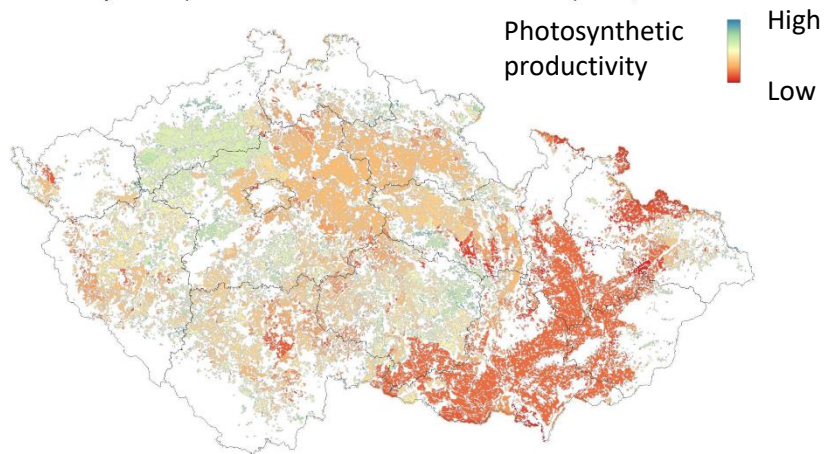
Annual photosynthetic productivity of CROPLANDS in the Czech republic, year 2021.



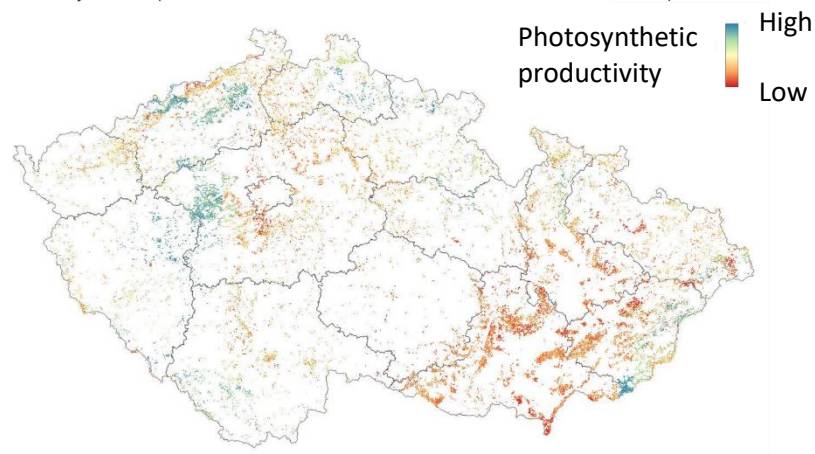
How healthy are our forests?

- Same paradox for deciduous and mixed forests - the more fertile the area, the lower the forest productivity

Arable lands



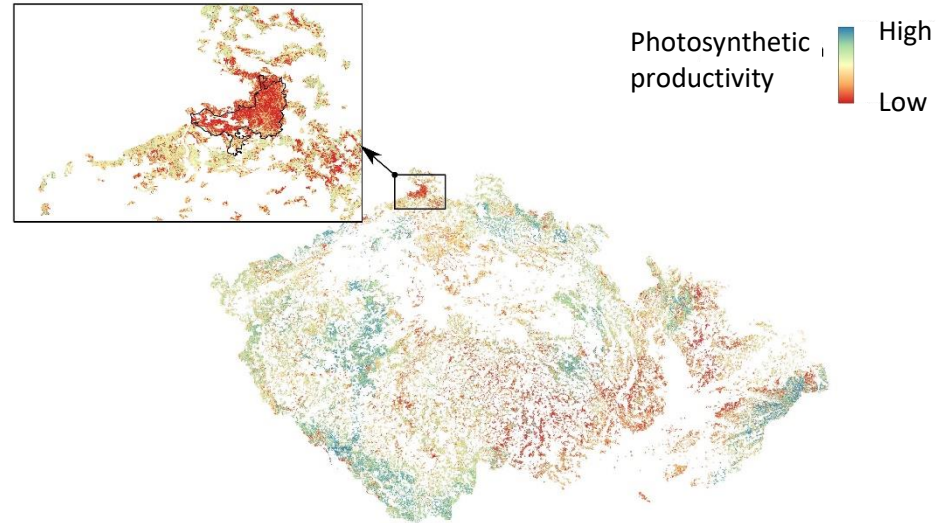
Forests (deciduous and mixed)



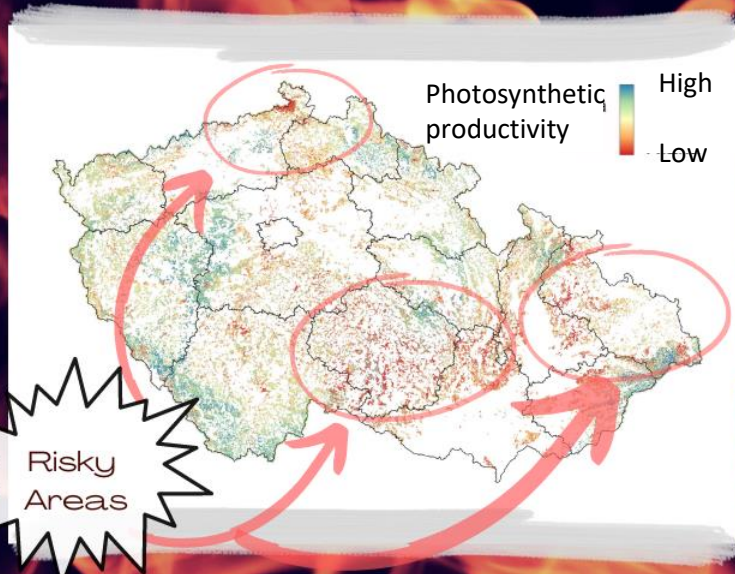
How healthy are our forests?

- The data show areas where forests are in a critical state – NP České Švýcarsko, Vysočina and Zlín Region
- Coincidentally, there was a fire in České Švýcarsko National Park this year. The state of these forests was already critical in 2021
- The forests in the Vysočina reg are in the process of disintegration due to the bark beetle calamity
- Forests surrounding the Moravian basin are under stress
- Data corresponds to maps of fire risk, drought exposure and bark beetle infestation

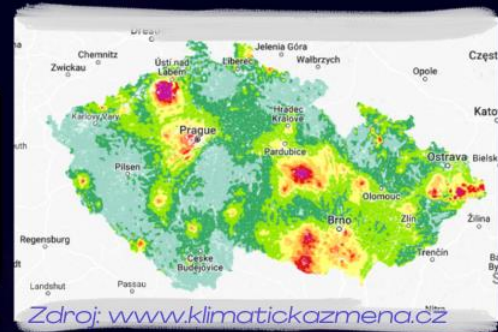
Forests (Coniferous and mixed)



WOULD YOU BUY A PROPERTY IN THE AREA OF HIGH ENVIRONMENTAL RISK?



Map of high risk of fire



Bark beetle map 2021



Findings from a national assessment

Detailed current (yr. 2021) data highlight two fundamental risky areas:

- **South Moravia** from the point of view of overall environmental security, while the cause is overall deforestation of the landscape, its drying and soil degradation. The whole of Polabí is in a similar, albeit less serious state, while the causes are the same
- Coniferous and mixed forests in the **Vysočina region and the Moravian-Silesian region**, while the local forests are massively infested by bark beetle + highest risk of fire occurrence was modelled here.

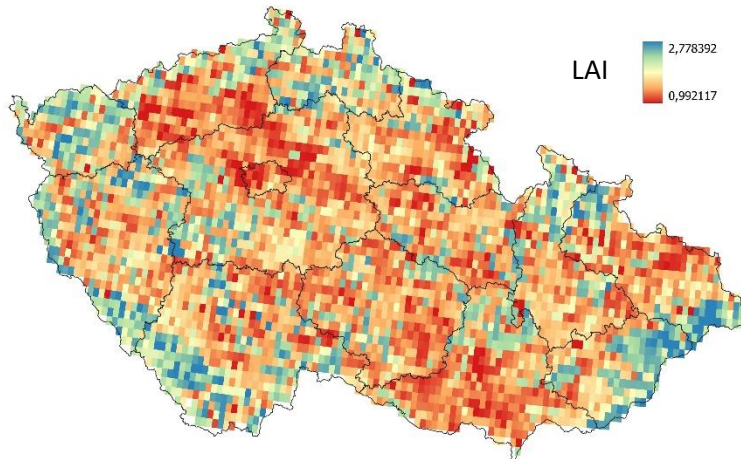
Results from a long-term assessment - AVHRR



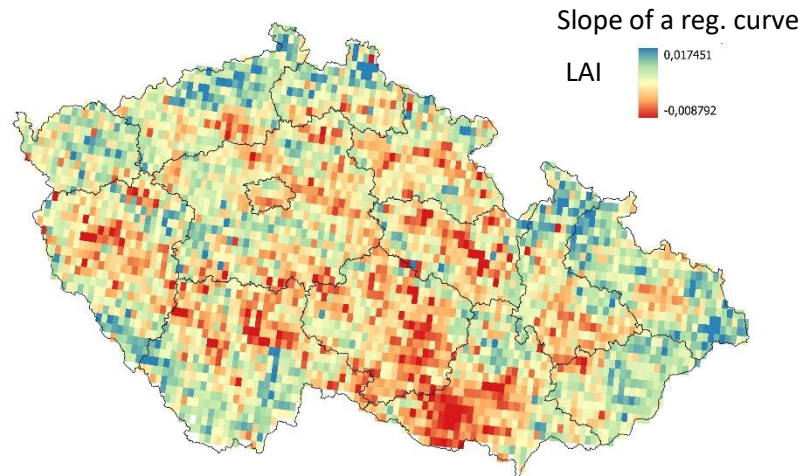
Current status and change in the Leaf Area Index over the last 40 years

- Equivalent map of photosynthetic productivity, lowest annual leaf area in the lowlands
- Increase in LAI caused by climate change induced longer vegetation period
- Since 1981, LAI had decreased in certain areas, especially in S Moravia, but increased in mountaneous areas

Current state (yr. 2018)



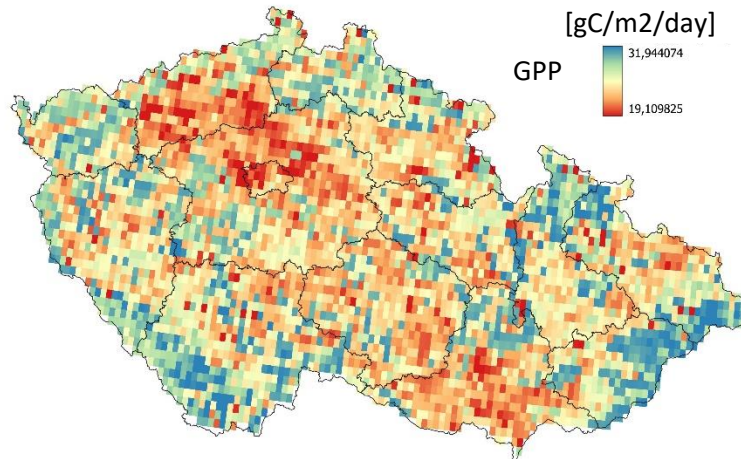
Change btw. yrs. 1981 - 2018



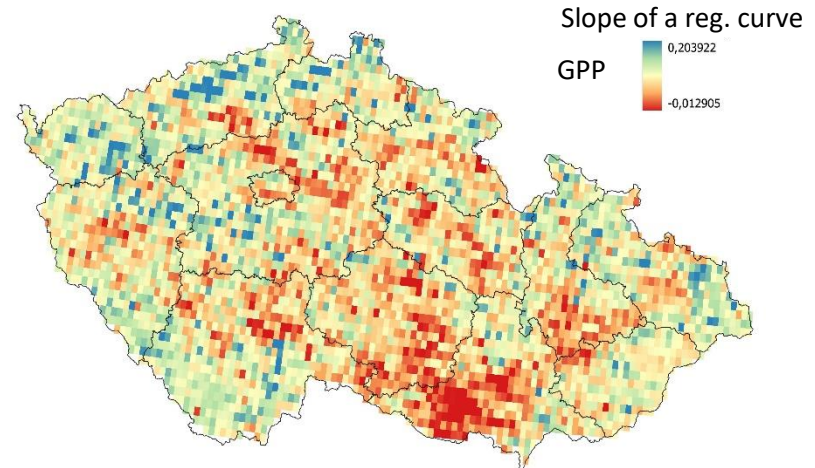
Current status and change in Gross Primary Productivity over the past 40 years

- Corresponds to the amount of food, fodder, wood produced
- The most fertile areas the least productive and productivity has been declining for the past 40 years! This is a long-term trend caused by soil degradation and the destruction of landscape elements. The trend will continue!

Current state (yr. 2018)



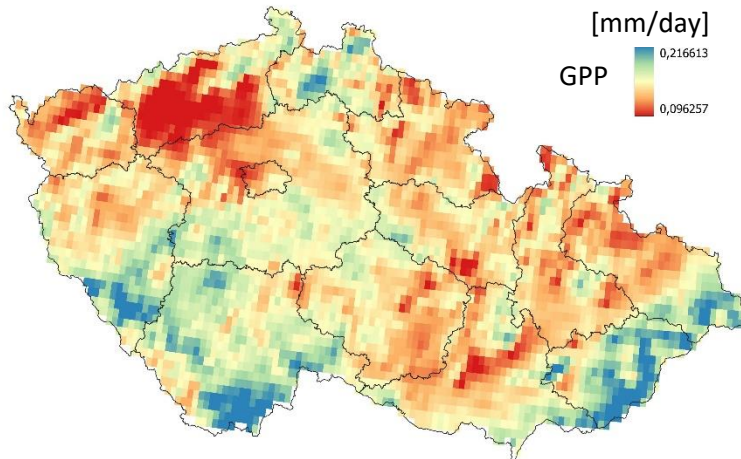
Change btw. Yrs. 1981 - 2018



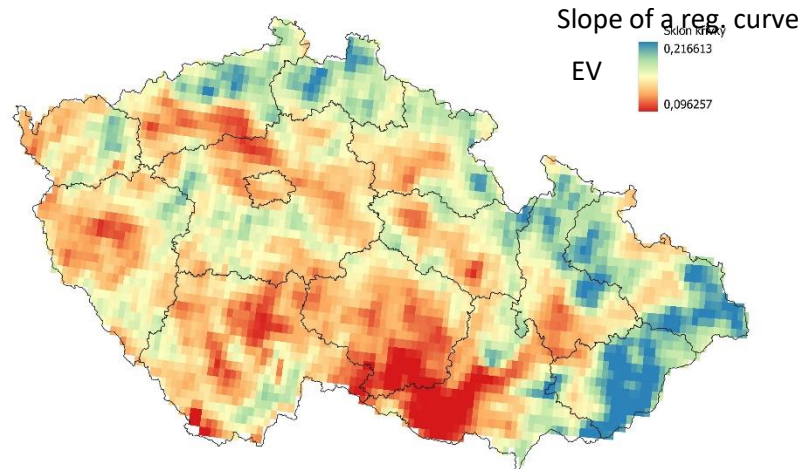
Current status and change in Evapotranspiration over the last 40 years

- Evapotranspiration – quantifies the volume of water that flows through ecosystems. The higher the better
- Climate warming causes higher evaporation from soil and vegetation = higher evapotranspiration. Only healthy ecosystems are able to respond to warming with increased evapotranspiration, unhealthy ones do not „catch up" and their evapotranspiration stagnates. From this point of view, the Beskydy are "healthy".

Current state (yr. 2018)



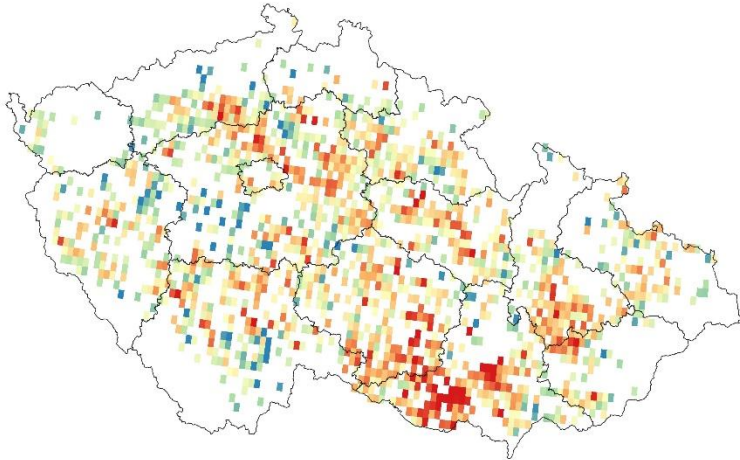
Change btw. Yrs. 1981 - 2018



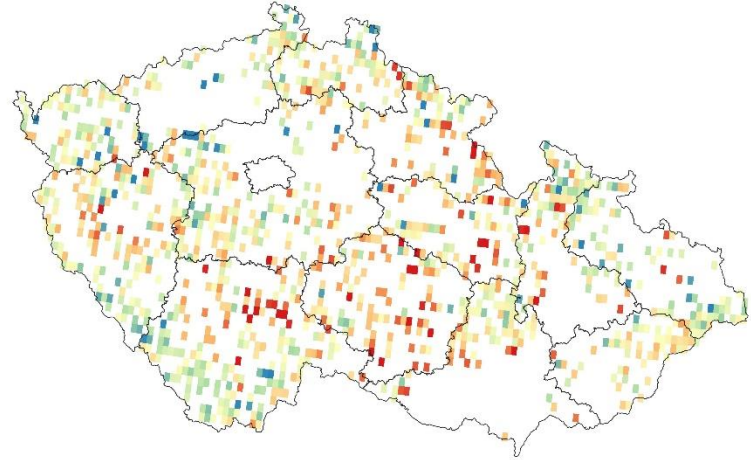
Change in Gross Primary Productivity over the last 40 years (1981 – 2018)

- A sharp decline in the productivity of **agricultural areas**, especially in South Moravia, and secondarily in the lowlands in general
- A sharp decline in the productivity of **forest areas** in the South Bohemian, Pardubice and Vysočina regions

Agricultural lands



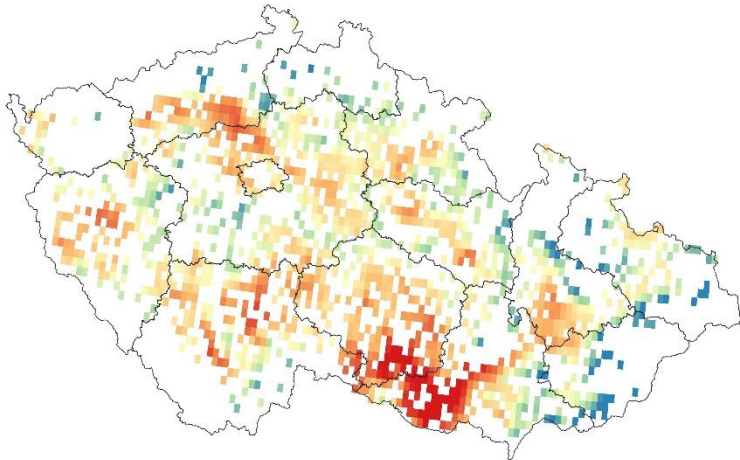
Forests (coniferous and mixed)



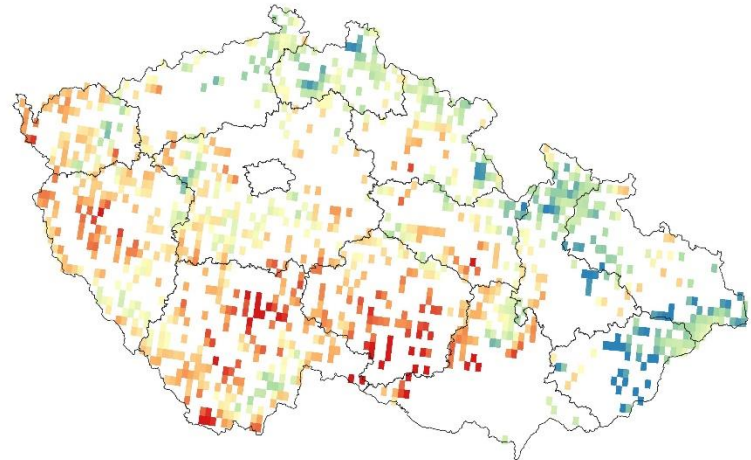
Change in Evapotranspiration over the last 40 years (1981 – 2018)

- Despite the general increase in evapotranspiration due to warming, the **agricultural areas** of the Czech Republic show the lowest increase = the ability to respond to warming is practically zero, which signals an increase in stress on agricultural areas and their degradation
- **Forests** in the Plzeň and South Bohemian Regions in the Vysočina region are exposed to a higher level of stress due to warming in the long term, which is related to their death (barkwood, etc.) and the increasing risk of fires. This trend will continue, which will result in the death of entire forest complexes. On the contrary, the forests in the Beskydy are coping relatively "well" with the warming

Agricultural lands



Forests (coniferous and mixed)



Summary of data from long-term monitoring

- The ill state of the Czech landscape is not a short-term phenomenon, but a **long-term trend** that will accelerate in the near future
- There is a threat of complete **degradation of agricultural lands** and the **disintegration of forest bodies**, especially coniferous and mixed forests (e.g. Vysočina region)
- The reason is the **warming and exposure of the landscape** to extreme weather due to deforestation and systematic degradation of the landscape by industrial farming and forestry
- The maps highlight places with **increased environmental risk** due to the degradation of ecological functions that protect the landscape from extremes (tornadoes, drought, fires, erosion, etc.)

Some general conclusions

- In the last 40 years or so, the Czech landscape has been losing its bioproductive potential and ecosystem functions due to poor management
- This is the result of landscape drying, ecosystem stress, their disintegration, soil degradation and a general transformation of the characteristic conditions for life
- Czech Republic currently is on about 50% of its potential bioproductive potential, i.e. if we managed the ecosystems effectively, it would be possible to capture up to twice the total solar energy
 - In the form of food, fodder, wood, biomass for energy purposes
- This is a massive drop of solar energy utilization = uncaptured energy turns into heat and degrades the landscape
- If managed well, would potentially produce a huge amount of biomass in the landscape, e.g. for the purposes of electricity, food, fodder, wood etc.

Thank you for your attention



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