FORESTRY CHALLENGE

Lexicon

Sentinels missions: Earth observation missions orchestrated by the European State Agency to provide the Copernicus programme with datasets on land, ocean and the atmosphere (source).

Landsat:Programme from the NASA and the USGS to provide continuous space-based data since the 70s (source)

Vegetation index: this index quantifies vegetation greenness and is a proxy for **healthy** green vegetation, dark shades of greens indicate healthy forests while shades of red indicate barren land or rocks (source).

Primary forest: Primary forests are ancient dense and wild forests among the most biodiverse, providing a multitude of ecosystem services, making them crucial to monitor for national land use planning and carbon accounting (source).

Biodiversity: the term is the contraction of „biological" and „diversity" it is the variety of animals, plants, fungi and microorganisms. 80% of the world's biodiversity is found in forests (WWF).

Case study:

You are working as a consultant for a company that operates in the field of forestry. You have been asked to get familiar with a few EO*GI platforms that allow you to use satellite data to monitor forests.
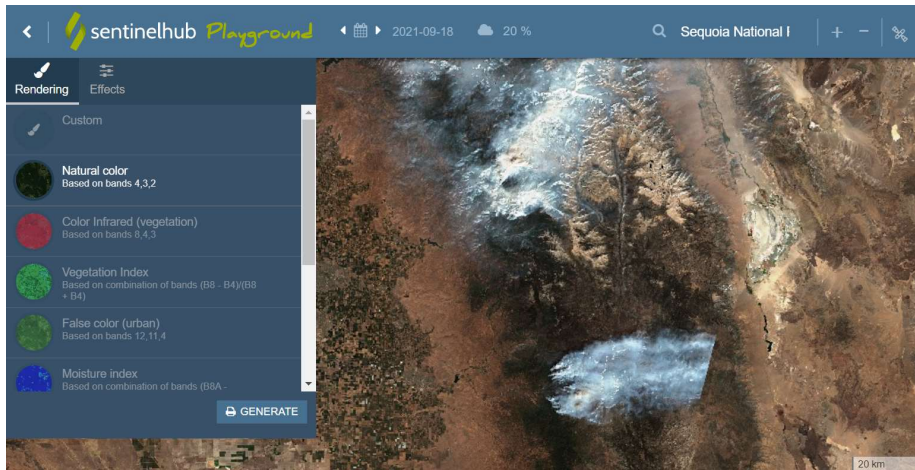
Question 1: What type of information is gathered by satellites or other remote sensing devices such as planes, helicopters, or drones about our forests? Please base your answer on the presentation from Pachama and relevant webpages such as Copernicus land monitoring service.
Tree cover, tree cover change, tree cover density, dominant leaf type, tree species, forest condition

Question 2: The platform "Sentinel playground" is a graphical interface presenting the Sentinel-2 and Sentinel-1 data and data derived from Landsat missions. This "Sentinel playground" provides satellite imagery that can be searched by acquisition date, cloud coverage at a given location. It allows the user to visualize and compare images, calculate different spectral indices based on the spectral bands. Go to the platform (link here) and search for the Sequoia National Park, California, United States in the top right.
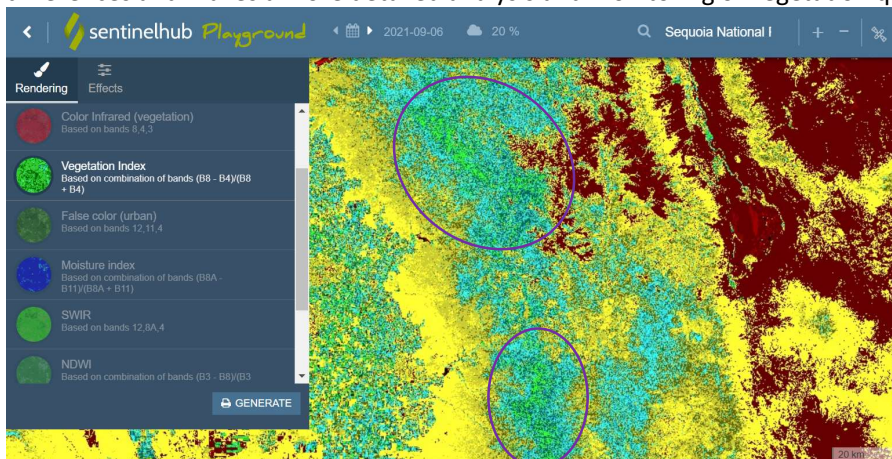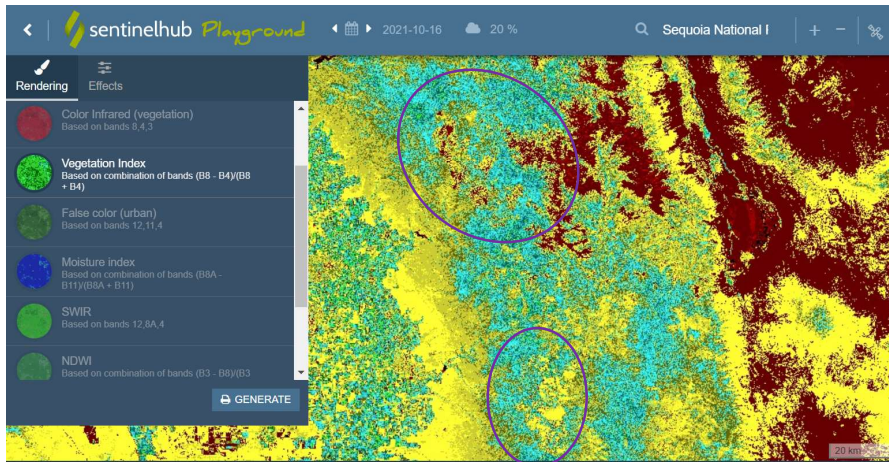   a) **Select the date of the 18ᵗʰ of September 2021 in the top left, zoom out, what seems to be happening?**
2 forest fires that later merged into the KNP Complex fire that burnt through over 34 thousand hectares and killed several of the famous giant sequoias of the park. The fires started on the 10ᵗʰ of September 2021 and are now mostly contained. Satellite imagery can help monitor forest fires that are becoming more and more frequent with climate change.
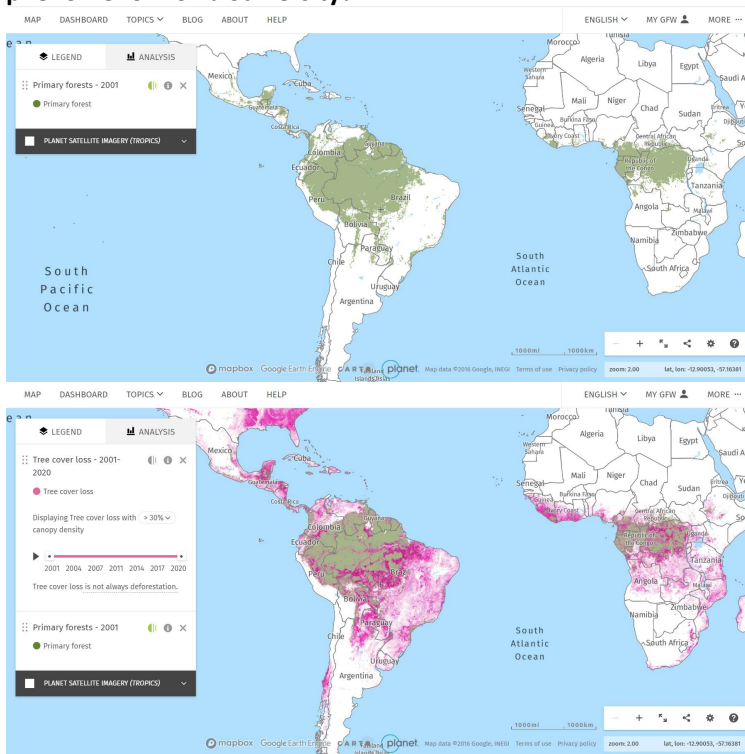
b) Select the "Vegetation index" layer on the left and take a screenshot after the fires were contained (for instance the 16th of October 2021). Repeat the operation for a date before the fires started (for instance the 6th of September 2021). What difference do you observe and why could that be?

The vegetation index layer shows healthy vegetation before the fire in the areas circled on the pictures, characterized by the green colour. A month later, the screenshot at the same location shows that these two green stripes are gone and the colour of the index is now yellow or even red indicating unhealthy vegetation or bare ground. This is not as clear looking at aerial photos whereas the index highlights these differences and makes a more detailed analysis and monitoring of vegetation quality and recovery possible.

Question 3: The platform "Global Forest watch" provides information about forest changes, deforestation, climate, biodiversity across the world. Go to the platform ([link here](link)) and select a layer showing the primary forests, take a screenshot of where they are in the world.
Now add a layer for forest loss and take a screenshot of the new map.
What do you notice when looking at the two layers? Please develop on the consequences of this phenomenon for biodiversity?

The forest loss happens in the tropics specifically where primary forests are located. The causes of forest loss are multiple: wood harvesting for local needs (cooking, heating, building) , harvest of protected rare and expensive species for foreign markets, uncontrolled forest fires, conversion into farm land etc. The

removal of trees from primary forests is a huge issue for the local biodiversity as primary forests hosts a variety of ecosystem and organisms that are specific to these areas and depend on them to survive.

Question 4: Based on the presentation from Pachama and your experience with the platform(s), list some stakeholders that can benefit from EO*GI applications in the forest sector and give examples of these benefits for each stakeholder.

Stakeholders	Benefits
Forest managers, foresters at different levels	Near real time monitoring of the forests, less on-site observation, alert system when illegal logging occurs…
Administration at national, regional and local level	Planning the different land-uses, monitoring the use of the forests, forecasting the direction of forest fires to protect their citizens…
Scientists	Data for environmental modelling, historical data, large datasets…
Citizens	Ability to enjoy nature safely, protection of the forests that we like, CO2 sequestration…
Biologists, Ecologists	…
Decision makers, Politicians	…

Question 5: Conclude on the advantage of using satellite data as opposed to on site observations in forestry related use cases.
The main advantages in using satellite and remote sensing data in forestry are the following:
- Satellite-born remote sensing offers a synoptic view (general view of a whole) where you can look at the landscape level instead of the small measuring plot level,
- Remote sensing data in particularly Sentinel and Landsat data are freely available, so cost effective data gathering
- Allow to assess the forest status over the remote and not accessible areas),
- Access to archive, historical satellite data allows to go back in time and for example compare the current status with the past, it allows to see the evolution/ go back in the past,
- Remote sensing data is acquired under fixed conditions following a homogenous procedure and can therefore be more reliable and consistent than man-collected data,
- Excluding the costs of designing and launching the satellites, using the already existing data is inexpensive compared to on-site measurements,
- The provision of data products and services increases which reduces the need for experts to treat the data > end users can use intuitive platforms or apps based on satellite and RS data without having to know the technicalities,
- (Source)

Bonus question:
Look at the following platform and compare with the other ones: Global Forest Change, what different elements related to forestry and land use can you observe?
This is an open question where the students should go and see the different layers or information available in each platform and discuss which is in their opinion easier to use, has more information etc.