Gallery of images

Examples and definitions of human impact on forestry landscapes

International Institute for Applied Systems Analysis

Human Impact on Forests Campaign, 2019

Human Impact on Boreal Forests

Content

OUR TASK: Identify tree age and level of human impact on forest

Full Definitions

1 Forest with very low human impact - forest not affected by human

- **"not disturbed"** - natural forest without any disturbances within the blue box and in the distance of **1 km** (10 blue boxes) in any direction from the blue box.
- **"with human impact nearby" -** forest in the blue box is not disturbed, but there are roads situated nearby (**within 1 km in any directions from the blue box**), mainly protected forest areas belong to this class (check Bing images with labels). If we see logging within 1 km in any direction from the blue box, we chose naturally regrow forest.
- **"abandoned crops/pasture" -** blue box area used to be cropland or pasture. Nowadays it is left abandoned for more than 5 years and there are sings of natural afforestation.

"degraded or disturbed" - no human activities in the blue box or nearby (1km), but forest is disturbed due to wildfire, windthrow, flooding or insect/diseases outbreaks. We do not use this class if forest already recovered after the disturbances (most of the trees survived or new generation of trees are already in place).

2 Forest with signs of clear-cut, selective logging and forest replanting - managed forest with signs of logging or clear cuts in the blue box or nearby

- **"naturally regrow forest (incl. selective logging)"** - forest is managed (signs of clear cut and logging in the blue box or within 1 km in any direction outside from the blue box), but no planting.
- **"replanted forest"** - forest is managed and has planting origin. Replanted forest differ from the plantations by longer rotation time (over 20 years) and consists of native species
- **"regeneration type is not clear"** - forest is managed, but we are not sure if it is planted or naturally regenerated.

3 Plantations - short rotation timber plantations (20 years max) or fruit trees

- **"woody plantations"** - short rotation (20 years max) timber or energy wood plantations, e.g. willow or hybrid poplar.
- **"fruit trees (apples, nuts, etc.)"** – rear class in Boreal biome.
- **"oil palm (or other palms)" –** does not exist in the Boreal regions.
- **"not sure if tree crops or woody plantations" -** in case we cannot distinguish between timber and fruit plantations.

4 Other landscapes - trees in agriculture or urban environment

- **"Tree shelter belts, small forest patches" -** group of trees on cropland/pastures in lines or patches
- **"Agro-forestry/sparse trees on agriculture fields" -** individual trees on cropland or pasture. There should be at least 4 large trees in the blue box
- **"Shifting cultivation"** – not typical for the Boreal.
- **"trees in urban/built-up areas"** - buildings or infrastructure dominant the blue box or surroundings. Trees there serve for recreation purpose, but not for production.

Characteristics of Boreal forests:

there are similarities to Temperate forests, but some extra features as well

(1) There are evergreen forests as well as deciduous with a clear seasonality. See the example below:

(2) Majority of the forest is managed. Please check Bing images with labels to find out if this is a protected forest.

(3) Vast area of “degraded or disturbed” forest due to wildfires in Russia and Canada.

(4) Woody plantations (rotation time<20 years) – extremely rear.

These 4 themes represent different levels of human impact on forests:

1 Forest with very low human impact

Intact, primary forest. It is forest where biodiversity is not disturbed by human. There might be some paths or roads in the forest, but wild animals live there (almost) not bothered by people.

2 Forest with signs of clear-cut, selective logging and forest replanting

Human activities are visible. Parts of the forest have been cut, you can see selective logging. Because of clearcut or logging, the forest then can be naturally regrowing or replanted. Wild animals still live there and find food, but their natural habitat is disturbed.

3 Plantations (very rare)

Plantations are forests with very high human impact. Natural forests have been cleared in order to plant trees under cultivation. The natural environment of animals is replaced.

4 Other landscapes

Other landscapes also represent very high level of human impact on forests. They can look like scattered trees on agriculture fields, houses built within the forest or trees in urban areas.

Step 1: Choose age of the tree

- Young
- Middle-aged
- Mature
- Mixed
- No trees

Step 2: Choose only ONE class from the 4 themes

1 Forest with very low human impact OR

- Not disturbed
- With human impact nearby (roads, deforestation,etc)
- Abandoned crops/pasture
- Degraded or disturbed (fire, wind, insects)

2 Forest with signs of clearcut, selective logging and forest replanting OR

- Naturally regrow forest (incl. selective logging)
- Replanted forest
- Regeneration type is not clear

3 Plantations OR

- Woody plantations
- Fruit trees (olives, apples, nuts, cocoa, etc.)
- Oil palm (or other palms)
- Not sure if tree crops or woody plantations

4 Other landscapes

- Tree shelter belts, small forest patches
- Agro-forestry or sparse trees on crop/pasture field
- Shifting cultivation
- Trees in urban/built-up areas

- None of the above

Tree age

Visual estimate of the size of trees in comparison with surroundings

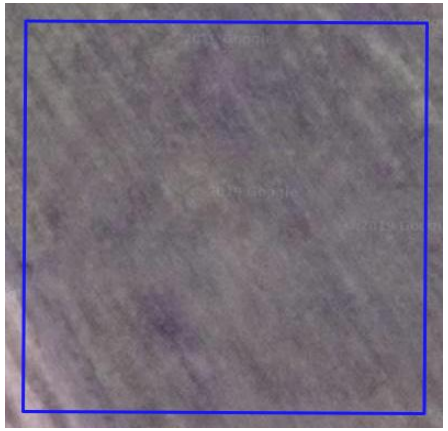
Young

Middle-aged

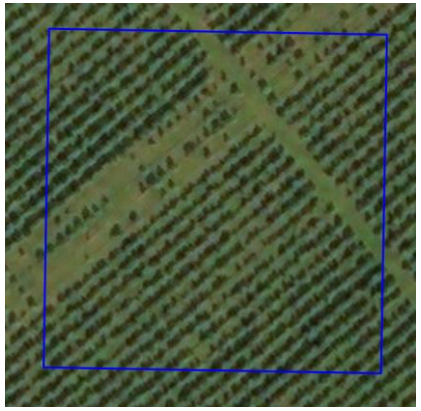
Mature

Mixed

No trees



Young

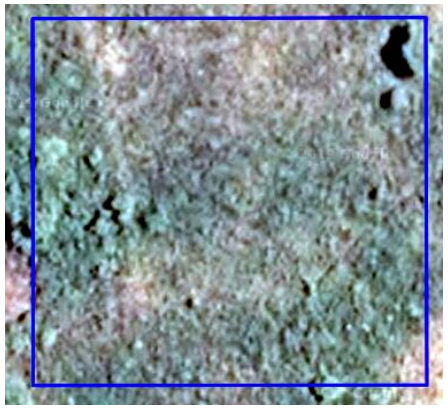


Middle-aged

Mature

Mixed

No trees



We use mixed tree age when we see minimum 20% area with different tree age inside the blue box.

1. Forest with very low human impact

Forest with very low human impact

- Not disturbed
- With human impact nearby (roads, deforestation,etc)
- Abandoned crops/pasture
- Degraded or disturbed (fire, wind, insects)

1. Forest with very low human impact

Not disturbed

On this example you can see mature forest in Russia, which is not disturbed. There are no signs of human interference or non-human disturbance neither in the blue box, nor in the surroundings (in 1 km. distance to all directions). We use the most recent available image to prove our decision.

1. Forest with very low human impact

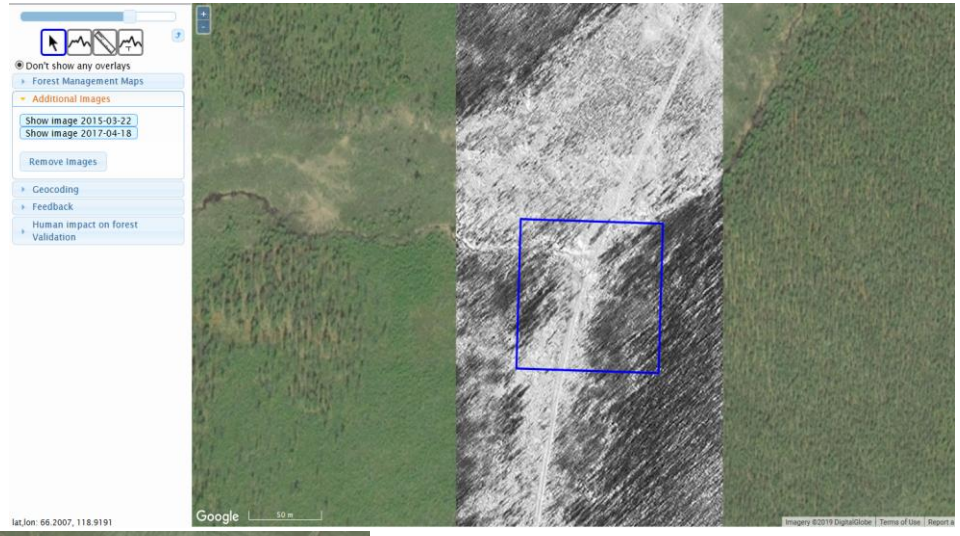
With human impact nearby

Here you see mature forest in Russia. There is a road under the blue box, but the box itself is not disturbed and there are no signs of tree harvest within 1 km. in all directions from it.

1. Forest with very low human impact

With human impact nearby

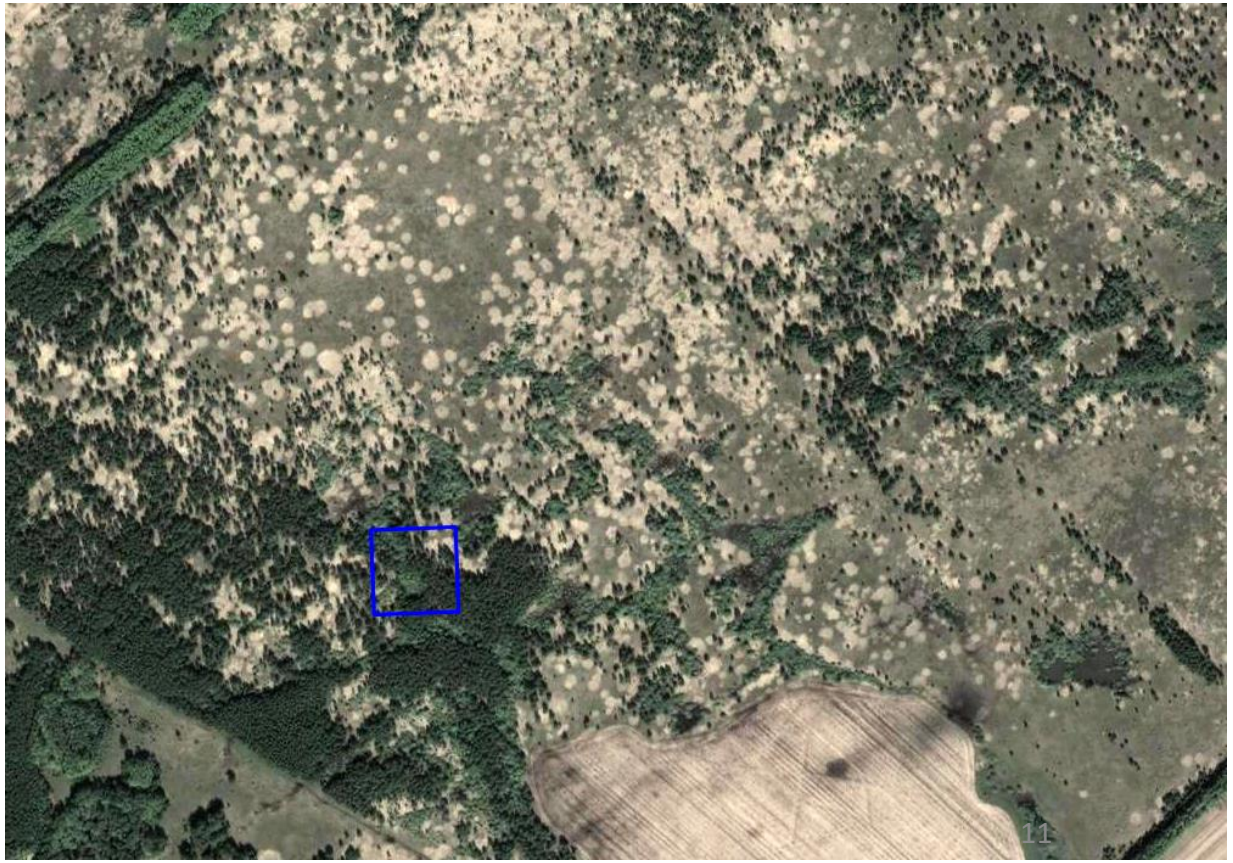
This is an example of forest with human impact nearby. Clearly, the road intersects the blue box, but there are no signs of intensive human activities around, the landscape is very natural. In this case the road is not used for logging. We do not see any forest management (cutting or planting) in surroundings (even 100 km away from the box). Boreal ecosystems are very vulnerable and scares from a single car pass may remain for decades. The human impact here is very low.



1. Forest with very low human impact

Abandoned crops/pasture

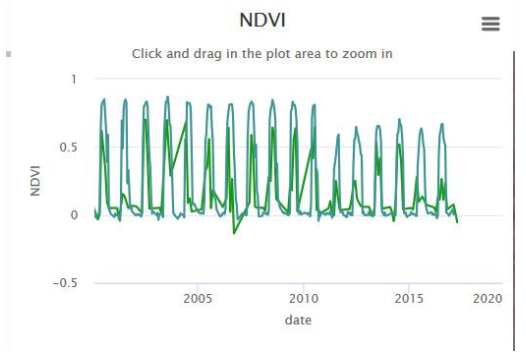
Below you see examples of abandoned cropland in Russia. One can recognize the shape of agriculture fields with natural afforestation on them.



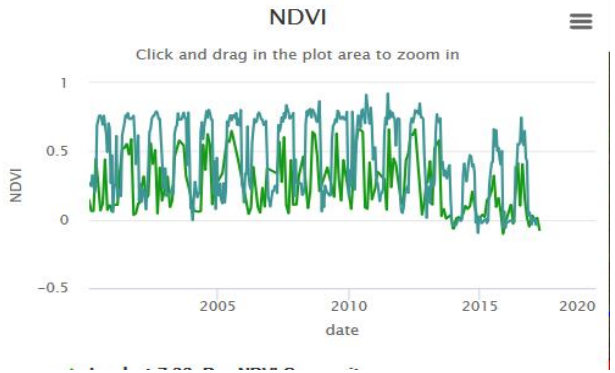
1. Forest with very low human impact

Degraded or disturbed forest – common in Boreal forests

On this example we see degraded forest in Russia. This show also the low NDVI values after 2010. If you zoom out in Geo-Wiki, you can see that lots of wild fires happened there (the brown areas).



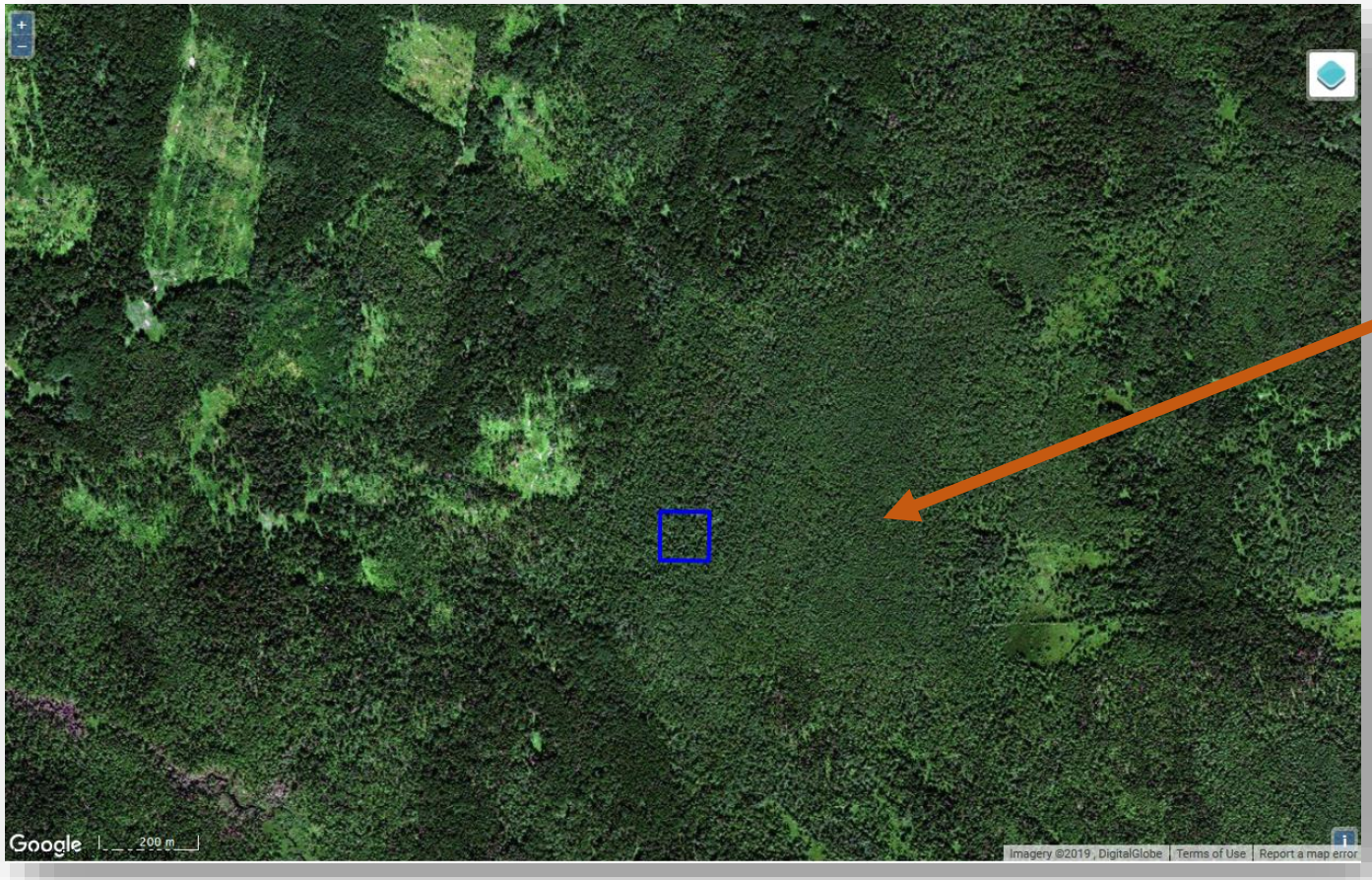
This is image from Canada. You see that most trees are brown, highly affected from fire, which as you can see from the low NDVI values very likely happened around 2013.



2. Forest with signs of clear-cut, selective logging and forest replanting

Naturally regrow forest

This is an example of mature, naturally regrow forest in Russia. We see logging activities closer than 1 km. away from the blue box. Even if the forest inside the blue box is intact, we still consider this forest as naturally regrow, because in many cases it has production purposes.



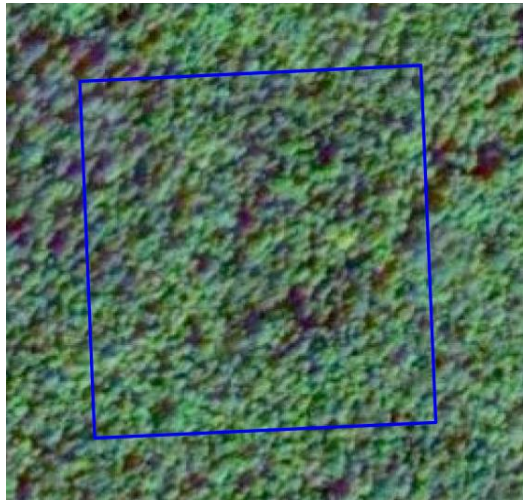
Forest with signs of clearcut, selective logging and forest replanting

- Naturally regrow forest (incl. selective logging)
- Replanted forest
- Regeneration type is not clear

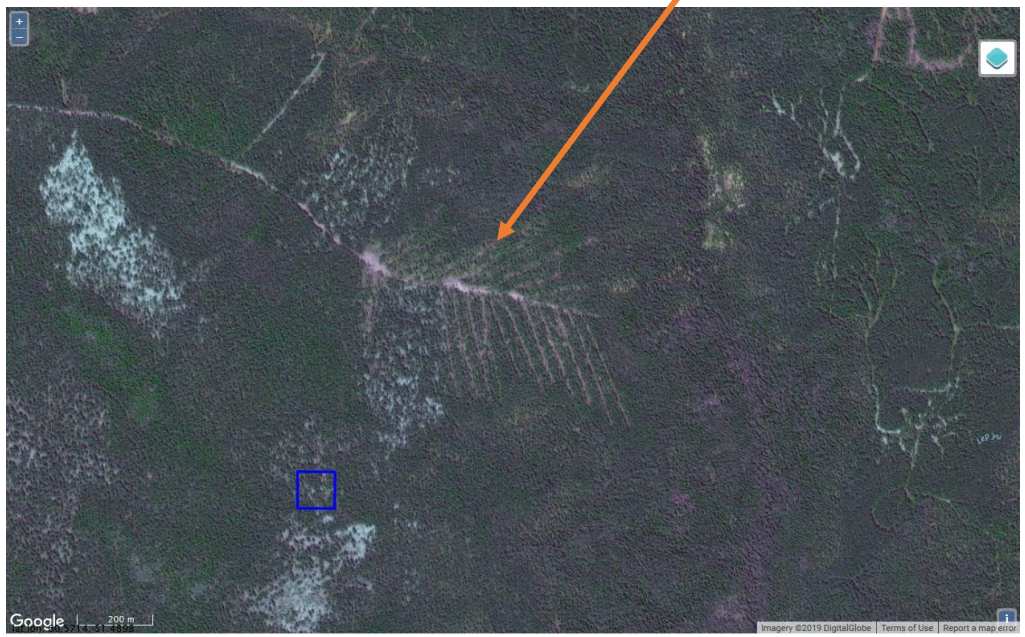
2. Forest with signs of clear-cut, selective logging and forest replanting

Naturally regrow forest

Example of naturally regrow forest, two locations from Russia:



You can see such landscapes in Russia and Canada. It looks very much like replanted forest, because people perform thinning, but it is naturally regrow in the most cases.



Forest with human impact nearby (roads, deforestation etc.)
is very different from
Naturally regrow forest (incl. selective logging)

Forest with very low human impact

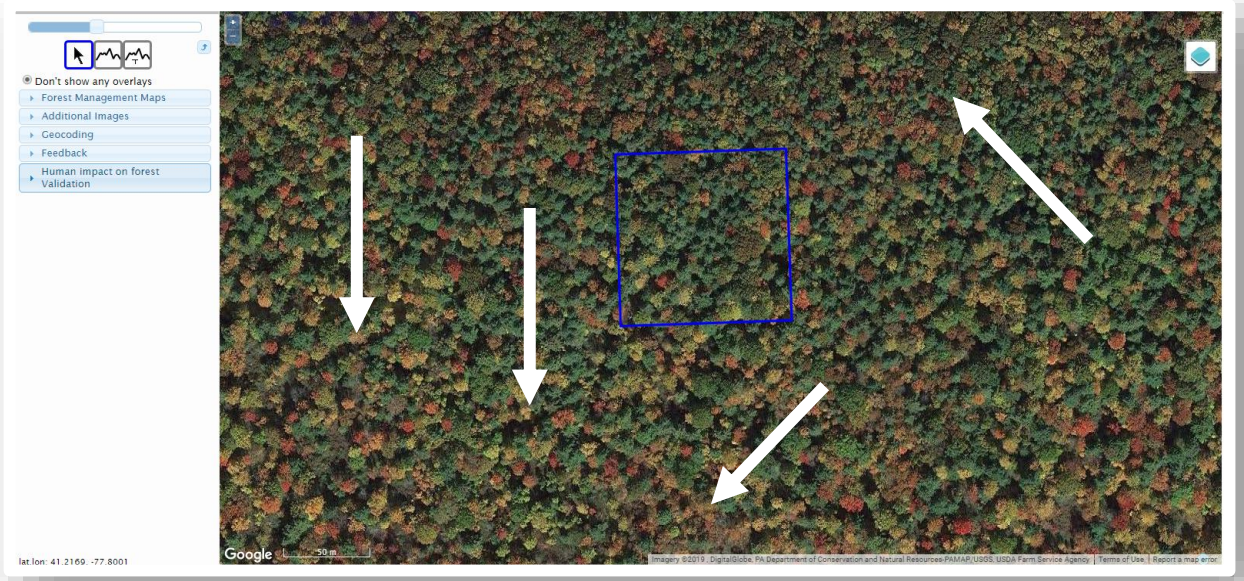
- Not disturbed
- With human impact nearby (roads, deforestation,etc)
- Abandoned crops/pasture
- Degraded or disturbed (fire, wind, insects)

≠

Forest with signs of clearcut, selective logging and forest replanting

- Naturally regrow forest (incl. selective logging)
- Replanted forest
- Regeneration type is not clear

This is primary forest, <u>mature</u> tree age, with very low human impact nearby. The white arrows show small forest roads. Choose this class when you observe signs of human activities within 1 km. in all directions from the blue box, but **no** human activities in the blue box. The forest must be primary, not cut, not replanted.



Here the forest was cut. Inside the blue box, new trees are growing but there are few mature trees, so we identify their age as <u>mixed</u>. This is <u>naturally regrow</u> forest. Very often there are replanted forests, croplands or urban areas close to forests of this class.

2. Forest with signs of clear-cut, selective logging and forest replanting

Replanted forest

We define replanted forest as every forest, which has longer rotation time than 20 years! Typically it consists of native species (i.e. oak, pine trees, spruce), which need long time to get mature.

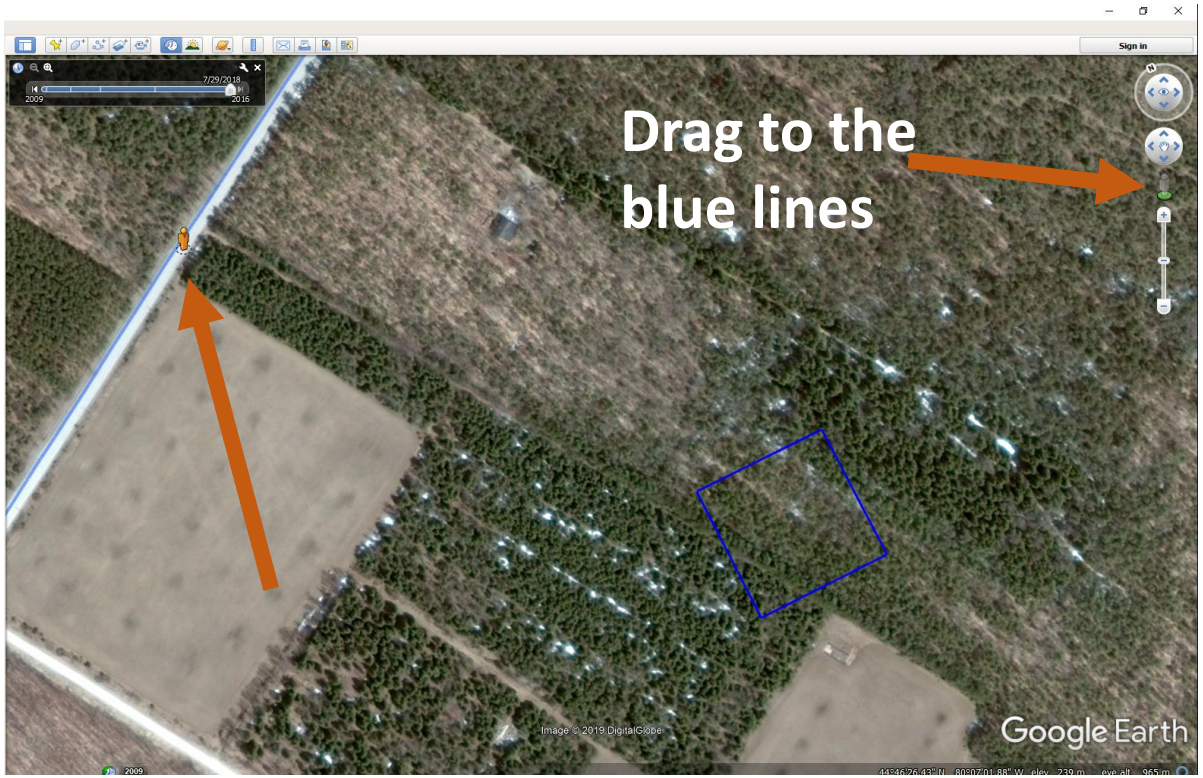
On the image you see replanted (thinned) forest in Finland. Such forests are also common in Sweden and Norway. The landscape shows intense forest management. Trees have long rotation time, it can come up to 80 years.

2. Forest with signs of clear-cut, selective logging and forest replanting

Replanted forest TIPS for validation

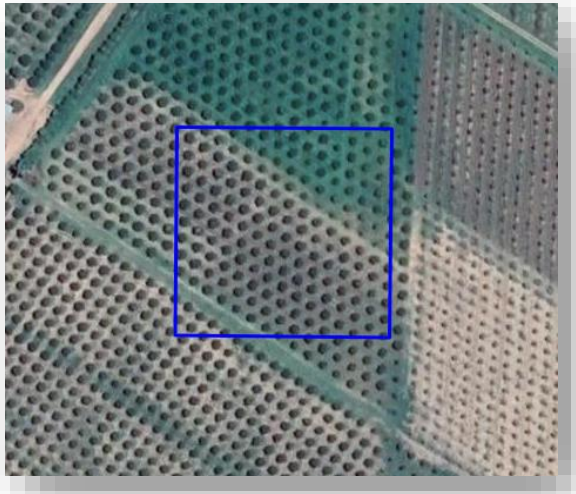
Always use Geo-Wiki zoom button to see where you are located

Use Google Earth *history view* to see if the forest was planted, when it was planted and also to track changes; use Street view to have a look at trees, see below:

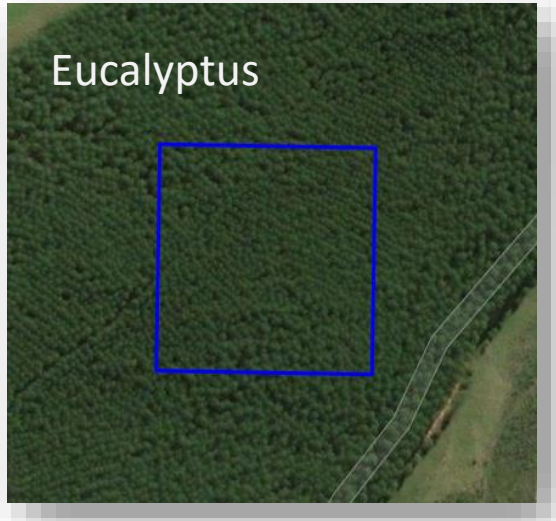


3. Plantations (very rare class)

Fruit trees



Woody plantation



Oil palms
not usual for temperate, boreal zones

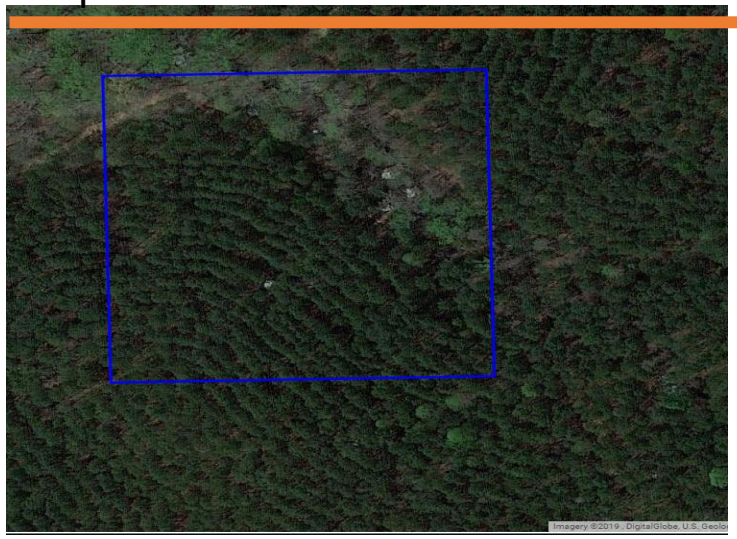
Not sure if tree crops or woody plantation

Fruit Trees & Replanted Forest

Fruit Trees

Fruit trees are not very dense planted. They are not so big trees, reach usually up to 2-3 meters height. Also they are often separated through tree shelter belts. Fruit trees are also not planted on vast areas.

Replanted Forest



Replanted types of trees are usually bigger, when they reach matureness they are huge, have big crowns and are very tall. They are planted denser. If the forest is thinned (like the second image), we can look at the Google Earth history view to track changes.

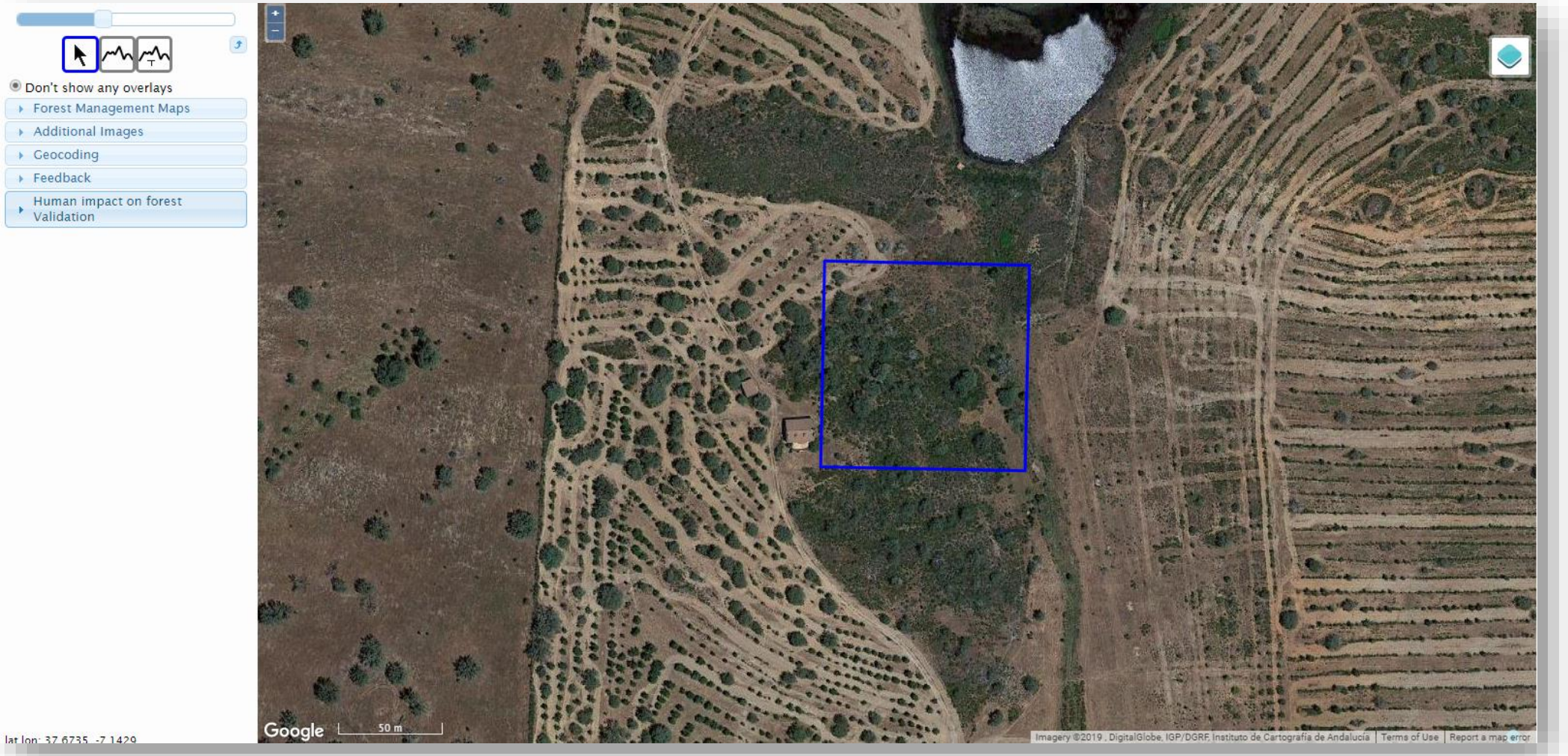
4. Other landscapes

Tree shelter belts, small forest patches

Below you see tree shelter belts with mature tree age in Ukraine.
Tree shelter belts are corridors of trees less than 20 meters wide. However tree shelter belts in South America make exception, here corridors can be up to 50 meters wide, or more.

Tree shelter belts, small forest patches

This is an example for small forest patches in Portugal.

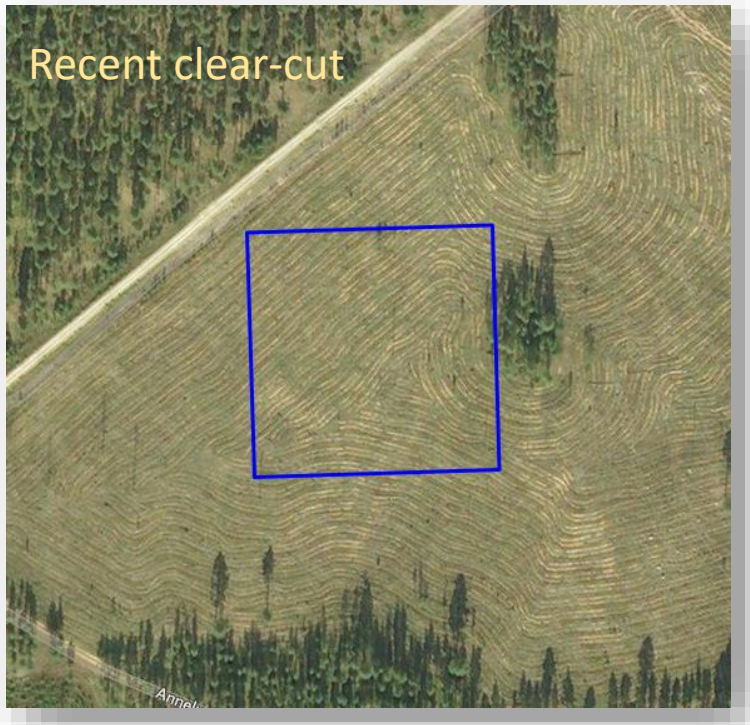


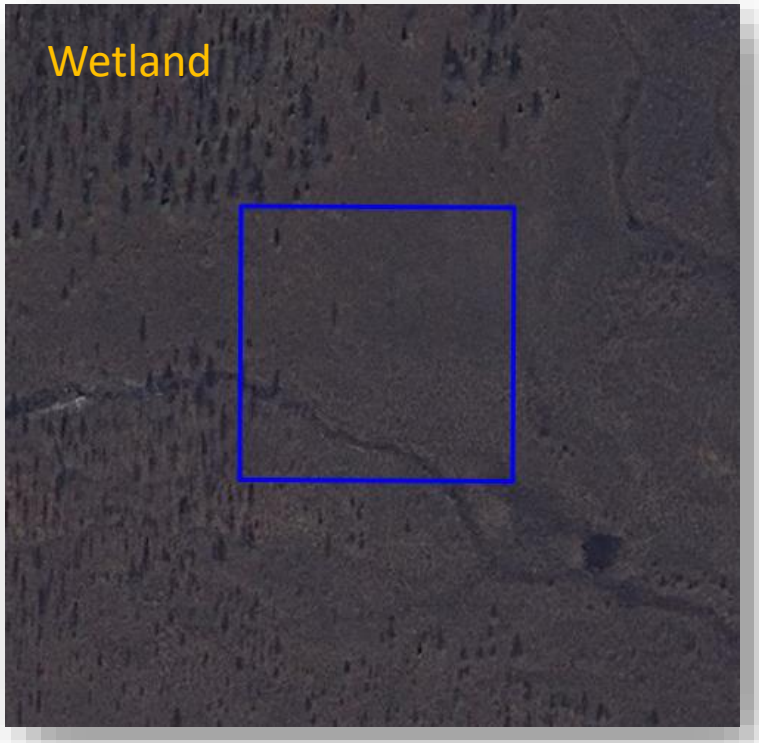
Trees in urban/built-up areas

Example for mature trees in urban/built-up areas in Jamaica.

Example for mature trees in urban/built-up areas in Sri Lanka

None from the above

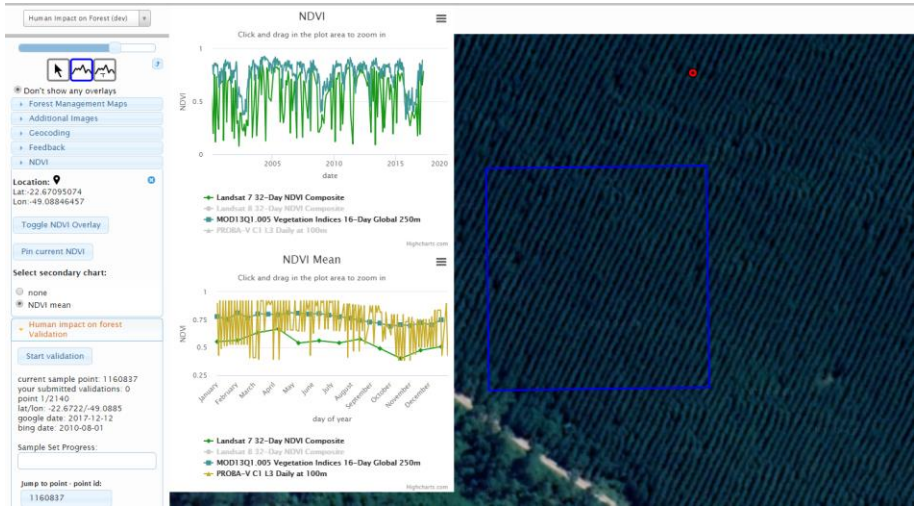




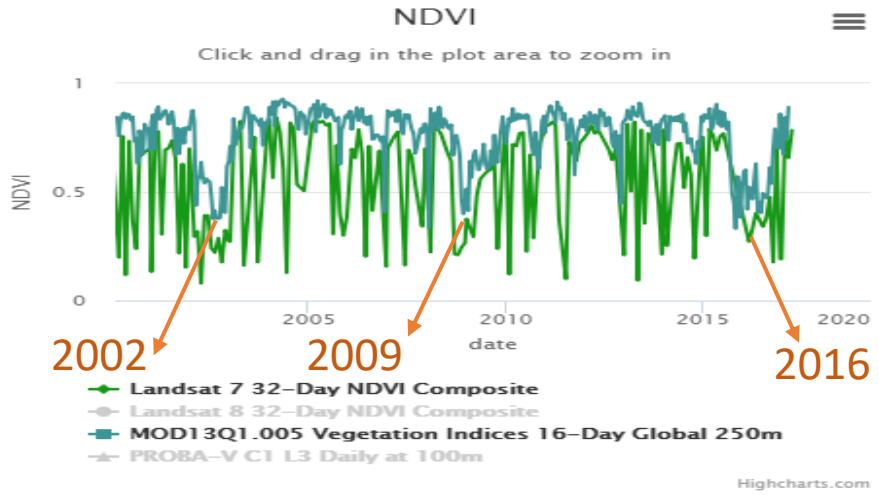
NDVI tool (Normalized Difference Vegetation Index)

In certain cases you can also use the NDVI tool, an index of greenness showing dynamics of vegetation for a certain location. Below is an example of eucalyptus plantations in Africa. Here NDVI indicates the short rotation time of the plantation, less than 10 years (see e.g. 1, 2). The lower values show that the trees were cut in 2002, then eucalyptus trees were replanted, grew mature and in 2009 were cut again and replanted. In 2016 they were already mature - cut again, and replanted - rotation. Historical imageries from Google Earth (see e.g. 3) confirm the same observation.

1



2



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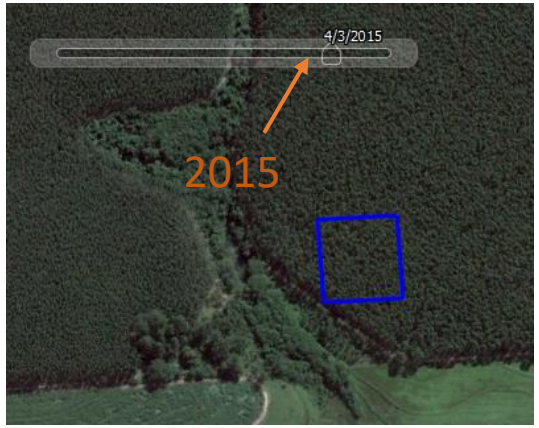
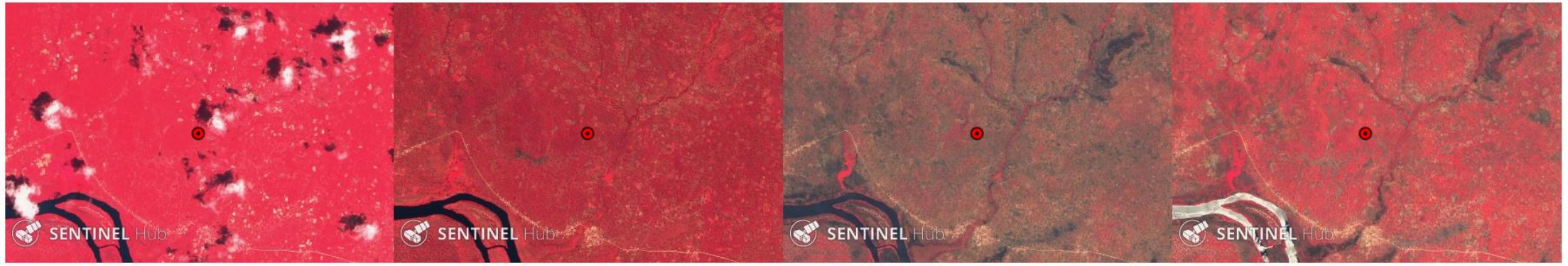


Time Series Sentinel Hub

Another tool which may be useful in certain cases as well, is Sentinel Time Series derived form Sentinel Hub. Below you can see images from 2016 and 2017 during the different seasons in Zambia, Africa. The intensive red color shows that there are mostly green trees or vegetation. There are no major changes in the landscape during 2016 as you can see. In 2017 we observe that forest was cut and big irrigation system was built. We can identify the gradual development of the irrigation system, where people probably pump out water from the river in order to irrigate crops.
In general we use Sentinel Hub to track changes in landscapes.

2016



2017