



# **Forest**





# WHAT IS FOREST?



**A collaborative and sustainable approach to forest management**



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## RESEARCH





## THE PROBLEM



Forests are important centres of biodiversity and play a key role in oxygen balance, sustaining livelihoods and various industries. Over the last few decades, the Earth has experienced a range of abrupt human-induced changes that it has not been able to assimilate, and climate change has become the main threat to many ecosystems, especially forests.

Climate change is the direct consequence of the emission and concentration of greenhouse gases, especially CO<sub>2</sub>, which causes the earth's temperature to increase more and more over the years, to such an extent that it is worrying. To be precise, the global temperature has risen by 1.18°C compared to 1900 and it is predicted that, if action is not taken in time, the temperature will rise exponentially until its effects become irreversible. But it is not only a question of temperature; climate

change also affects rainfall patterns, longer periods of drought, stronger storms, loss of natural resources, melting of the poles... In addition, this problem directly affects forests, increasing the risk of fires, tree mortality due to long droughts and loss of biodiversity.

However, although climate change is a serious problem that must be considered, humans are responsible for another of the main problems that the humanity are facing: the deforestation and the land resources exploitation. Today, unfortunately, forests are deteriorating, largely due to mismanagement and changes in land use. The effects of deforestation are many and include the losses of valuable inhabitants and biological diversity, land degradation, decrease of clean water and soil erosion. Forest deterioration also contributes to the loss of valuable economic assets and livelihood opportunities.



## FOREST ABANDONMENT IN CATALONIA

Although the main problem globally is still deforestation, as can be seen in regions of Latin America or East Asia, in Catalonia the situation is very different. What is happening in the Mediterranean forests, broadly speaking, is that the overexploitation of the land has triggered a more serious problem, making the forests increasingly dense and difficult to manage due to their abandonment.

Like other Mediterranean areas, after rural abandonment during the last 80 years, Catalonia has experienced a forest transition that has been decisive for the future and preservation of forests. The forest transition is defined as the transition from contraction to expansion of forests that began because of socioeconomic reasons that led to depopulation and changes in rural areas.

According to a study conducted in 2016 with data from between 1868 to 2005 [1], the forest transition that Catalonia underwent during this period can be divided into two stages.

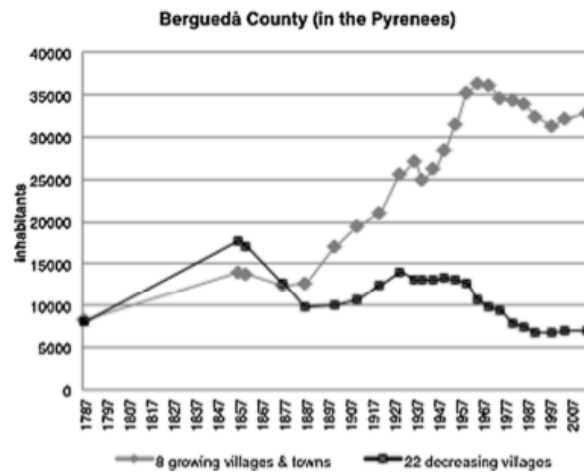
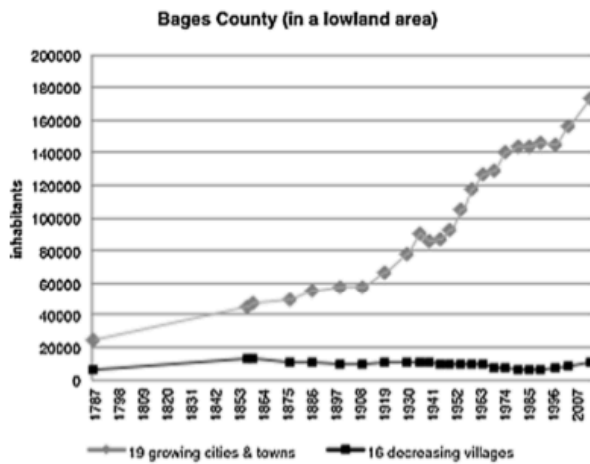
The first stage lasted until the 1950s and involved the deforestation of a

large part of the Catalan territory, although some small mountain villages already began to depopulate in the mid-19th century (in the highest and steepest areas). Reforestation began in these higher and more remote areas of the community, while in other areas farmland was expanded by overexploiting the soil (mainly vineyards until the phylloxera plague in 1880).

In the second stage, in the 1960s, extensive reforestation took place in an uncontrolled manner. The agricultural sector was transformed, and some farmers began to abandon the most alleged and less productive fields and pastures in search of better paying jobs due to urban and industrial development. Others began to use flatter and more accessible areas to mechanize and irrigate more easily, which generated greater profitability. As this widespread abandonment occurred and traditional upland uses were discontinued and forest land use intensified, forests began to grow with poor age structure, diversity, and maturity, making them more prone to fire.

In the following graph we can see the population growth in the cities (grey curve) and the decrease in the

villages (black curve) of the regions of Bages and Berguedà.



Population growth and decrease in the two Catalan counties [1]

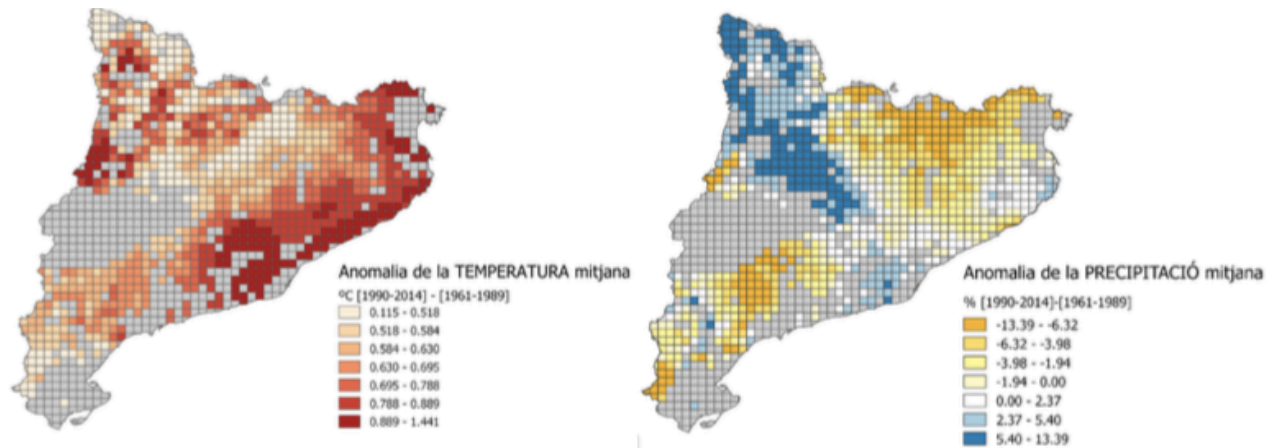
Currently, we could say that Catalan forests have entered a vicious circle: the abandonment of forests causes forest fires to become more frequent and leads to poor management of post-fire timber extraction, which is increasing. This is because forests are not adequately maintained and are less and less resistant to stronger disturbances caused mostly by fires and others caused by climate change.

On the other hand, we must consider the influence of other social aspects such as the change in customs and the rural life model. In the past, plots of land were maintained thanks to the involvement of generations of the same family since the conservation and maintenance of forests is a task that does not have immediate results and requires years of dedication. In this way, the families oversaw managing the forests, even if the profitability was not high since they were thinking of the next generations.

Now, 80% of Catalan forests are private and publicly accessible, which is a problem for two reasons. Firstly, many owners inherit plots and are not aware that they own them and many of those who do know are not interested in maintaining them due to the low profitability obtained. In addition, the properties are very small, and the total number of owners is expected to be about 200,000. On the other hand, there is no law that obliges the government or the owners themselves to manage the land in case it poses a problem for the health of the forest. There is only one law that obliges the proper management of forest areas that are close to urbanizations to prevent possible fires (Decree 64/1995, Law 5/2003). Thus, if we observe the trends of recent years, even though the preservation of forests against climate change and other possible disturbances is urgent, forest management remains in the background and the situation is getting worse and worse.

It is important to highlight that there are other important factors that also influence the decline of forests, such as rising temperatures and declining rainfall. According to a study carried out in February 2020 [2], the

temperature has increased by 0.5° and 1° between 1990 and 2014, and there has been a decrease in precipitation in the northwest of Catalonia of up to 13%.

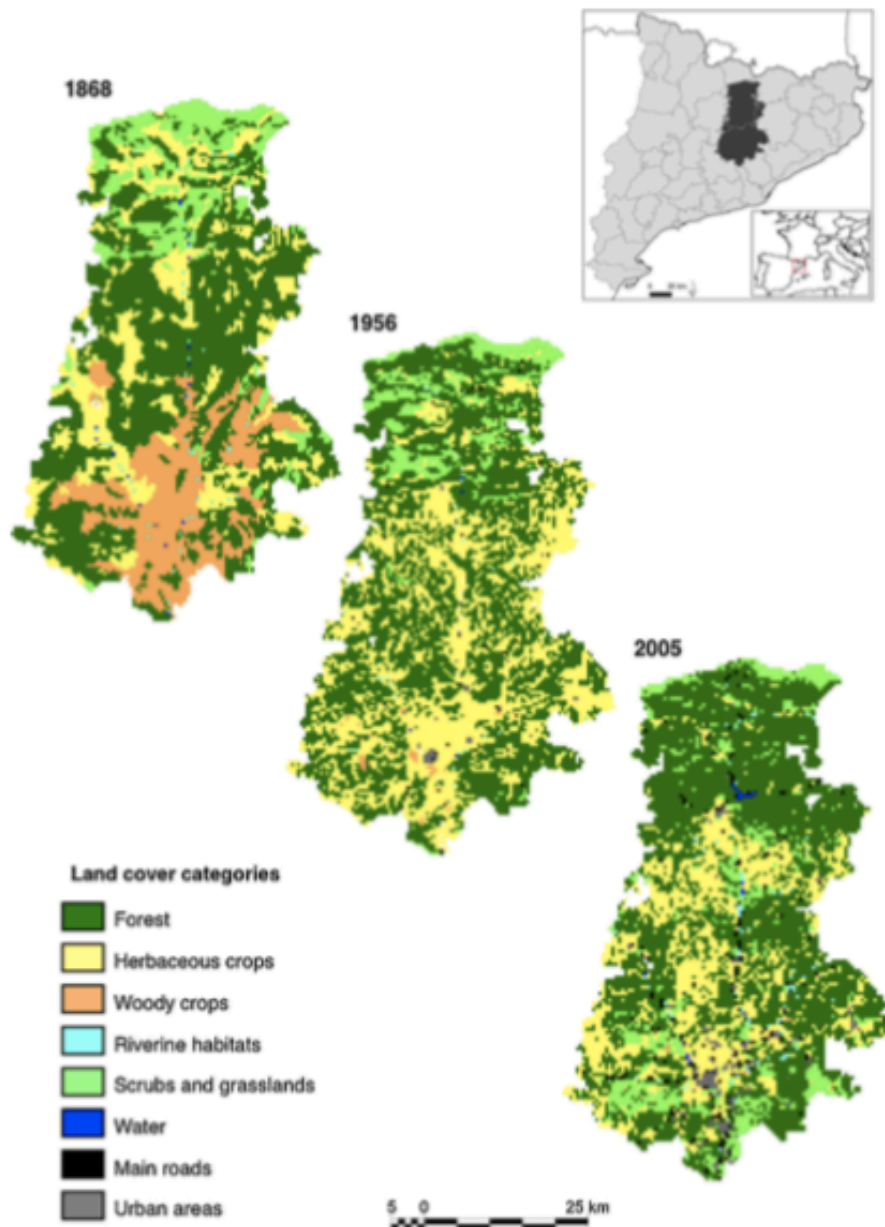


Maps of climatic anomalies of temperature (left) and precipitation (right) [2]



## DENSIFICATION OF THE FOREST

As we have explained above, the rural exodus has caused a generalized abandonment of rural areas, causing forests to become excessively dense. According to the previous study, forest cover has increased by 33.2% in the first stage (before 1950) and 45.6% in the second stage (after 1960), although the changes have been different in each of them. This can be seen in the following example of the counties of Bages and Berguedà.



*Land cover map of the two Catalan counties [2]*



The environmental impacts of deforestation are widely known, but those of forest transition (or densification) entail notable ecological effects that are not fully understood. We will briefly mention some of them.

### **Change in fire regimes**

Over the last 30 years, Catalonia has suffered four main periods of fires, and they are becoming stronger and more frequent. This prevents the areas that have regenerated after the fires from becoming mature, complex, and diverse, favouring the loss of the characteristic mosaic of the region.

### **Loss of plant and animal biodiversity**

Ecosystem services are jeopardized and hunting of some birds is made more difficult by the need for open fields with few trees.

### **Loss of the characteristic mosaic and heterogeneity**

Overexploitation of forest land has led to a rapid invasion of young, homogeneous forests, making regions dominated by older specimens, which are the most resistant to natural disturbances, scarce. Mature forests represent less than 30% of the area, so these patches must be carefully preserved.

On the other hand, holm oak and oak forests have declined by 20% in recent years and black pine forests by 43%. Their place has been taken mainly by white pine, as it is easier to regenerate after a fire. The new forests are thus very homogeneous in terms of age and species diversity, which in turn makes them less resistant to changes and disturbances caused by climate change.

Finally, forest fires and a decrease in landscape complexity can be accentuated by a lack of sustainable forest management.

**Less resilient forests and thin-stemmed trees.** Young and usually thinner forests are more prone to damage from high winds, snow, or drought. Trees with small diameters (10 - 15 cm) represent 58%, medium-sized trees (20 - 30 cm) 41%, while large trees (35 - 40 cm) do not exceed 1% of the total. This fact means that, due to the lack of forest management, the wood that can be obtained from these forests is of low quality and marketing profitability is low. We must also consider that climate change and the scarcity of rainfall also contribute to the fact that trees are born weaker and thinner, since in the same area there are more trees and water resources are the same or even lower than before.



## THE CHALLENGE



**How might we encourage people and forest communities to manage the forest in a collaborative and sustainable way?**

## CONCEPT DEVELOPMENT





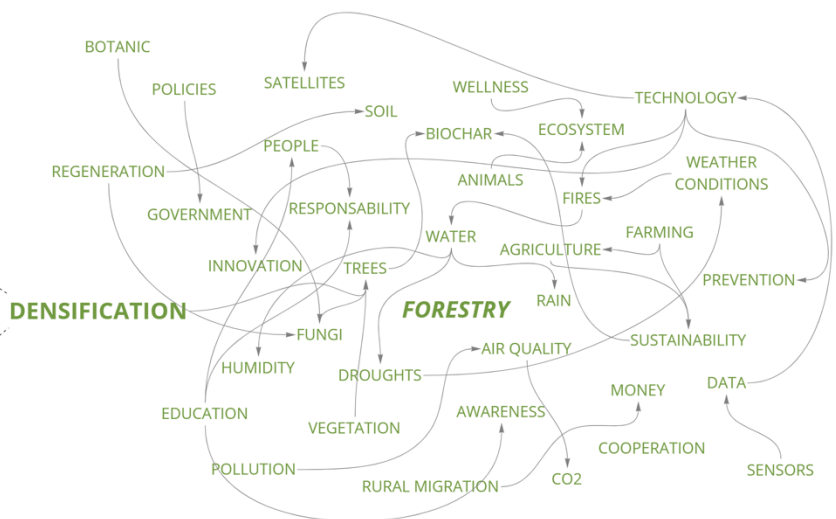
## RESEARCH AND EMPHATIC LEARNING

As seen before, our problem based in Catalonia relies on the densification of forests due to the rural migration in the last 100 years. We know that more than 80% of the forests are private and owners don't have a picture of their forest and sometimes they don't even know that they have one. This is a big problem because if the people that can do something to improve the situation does not have knowledge of it, nothing else makes sense. And for owners that actually know about their forests, if forests are not profitable for them, they won't have incentives to manage it.

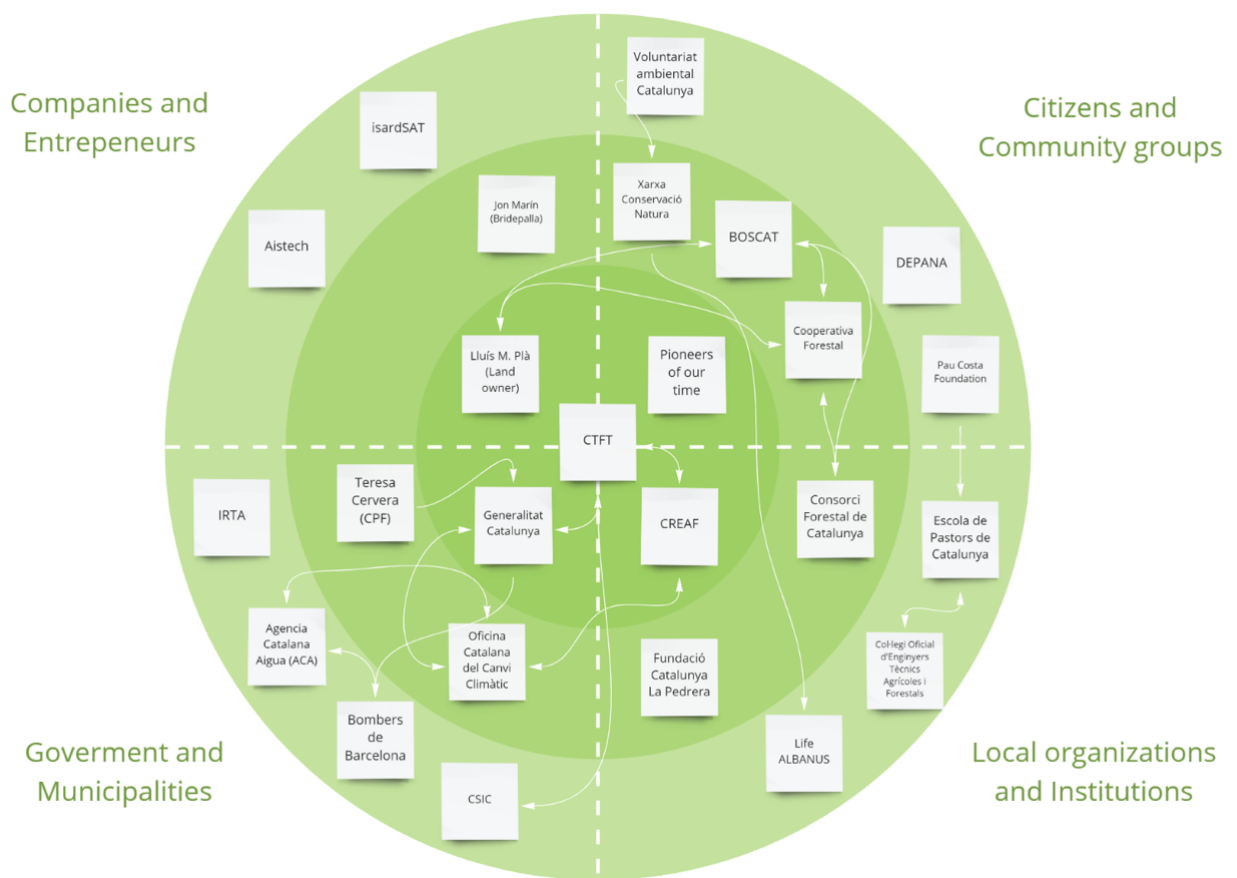
First, we need to improve communication between parts implicated in the process of manage a forest. We need to think in a systematic way, on a large scale and as a transition process. Governments should contact the people who own the land, so they can know how large their properties are and which are the problems to tackle in each zone, and owners should have incentives to manage their forest.

Secondly, we need to stop this rural migration providing jobs and infrastructures in these rural areas (jobs such as cutting the small and weak trees, dealing with plagues, cleaning the undergrowth...). This means also make attractive to private companies to invest in the zones of need to put money on the chain.

Lastly, forests should be managed consciously and locally, analysing the soil and the environment to provide the best management solutions as possible, in the less invasive way and with the less resources as possible. Giving the local people tools and a platform to grow their own economy and systems we can focus the attention back to these abandoned lands. Forests can provide many products that have been misused such as biochar, for instance. Giving back to the local community is an important issue as getting them involved in the land by offering them work.



Getting to know the problematic can be difficult if we don't talk to the right people and hear their worries and needs. An empathic approach can help understanding the wicked problems deeply and directly from the people involved.



Experts, workers, and local people give us insights from different points of view, which provide us with lots of valuable information to get started with.

{See experts interview transcription in the appendix}.



**STEF VAN DOGEN**  
CEO  
*Pioneers of our time*



**TERESA CERVERA**  
Forest property center  
*Generalitat de Catalunya*



**ENRIC VADELL**  
Subdirector of forest management  
*Generalitat de Catalunya*



**JORDI VAYREDA**  
Researcher  
CTFC



**LLUÍS COMAS**  
Researcher  
*CREAF*



**LLUÍS PLÀ**  
Land owner



**JON MARÍN**  
Designer and botanic  
*Bridepalla*



**CARLOS EIKEL DELGADO**  
Forest technician  
*Pioneers of our time*



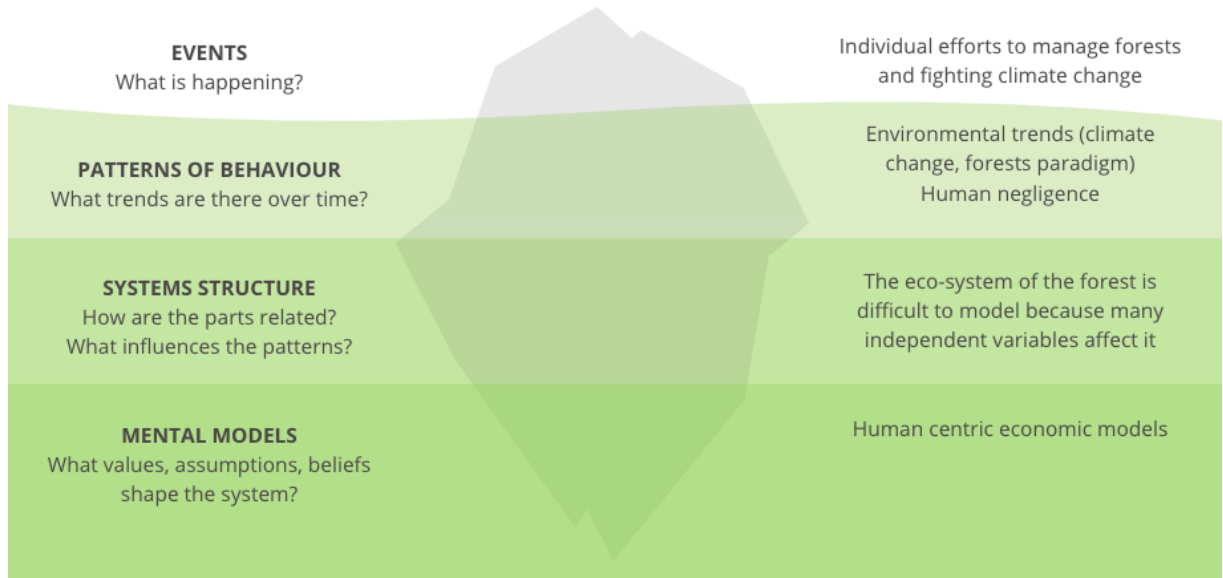
## RESEARCH AND ANALYSING TOOLS

In order to get valuable insights from the information it's important to filter and analyse it through different tools that help us ask the right questions and focus on the most creative and less obvious solutions. It's important to know what has been done, what did work out and what didn't; out of the box ideas are born from unusual thinking flows, usually helped by a thoughtful methodology.

### Impact gap mapping

CHALLENGE MAPPING	IMPACT GAPS	SOLUTIONS MAPPING
The are not deforestation in Catalonia, there are densification (increase of 60% of the forest in the last 100 years)	Use wood from small trees to create compost or biochar / fuel	Fire Flocks to prevent fires
80% of the forest of Catalonia are private property, but they are small plots of land distributed among many owners	Get valuable products from pines, fungi and sap	Introducing new species to help biodiversity
The fields in some areas aren't profitable and people move to areas near the city. The abandoned fields become forests	Make rural living accesible	Cutting the weak and unnecessary trees to help densification
The forest is becoming denser and more trees are growing than the water can supply, it's easier for it fire up	Create conscience about forest management	Including the community living in the forest as their
A young forest grows very fast at first, but then begins to compete for resources and grows uniformly and weakly	Involve rural town halls in forest management	Generating tourism in rural areas
We will not be able to have certain forests in 30 years due to climate change	Diversify the species of the forest to get a better ecosystem	Growing edible forests
Land owners have no money to manage their properties		Clean the forest to create grassland
There are a lot of pines in Muga Valley, so diversification is needed		
Lack of laws requiring an owner to follow a protocol or maintain the property		
Lack of water leads to higher three mortality and leads to increasing of CO2 emissions		
Loss of the mosaic and biodiversity of an specific area		

## Iceberg model





## CONTEXT EXPLORATION



*Visit to the Muga Valley to learn more about the mission and the activities of Pioneers of Our Time, one of our main stakeholders.*

A crucial part of our research came from the visit to the Muga Valley, where we could speak first-hand with the forest technicians of Pioneers of Our Time, one of our main stakeholders working on forest management and promoters of rural tourism. Great notes were taken and most importantly, our initial hypothesis was validated: densification was the main issue of the forest and it caused plagues and fires to grow and get almost impossible to control, so managing these areas is crucial to succeed in our challenge.





## OTHER EXISTING SOLUTIONS

There are other projects that are involved in the preservation of the forest. Also, we can see that there are a public data base provided by the research centres, but there are not any service that put in common all these different aspects. We briefly mention some of them.



### ForManRisk

The objective of the project is to improve forest management techniques for forests with regeneration problems linked to climate change and develop tools for better fire risk prevention by optimising, in particular, the coordination and efficiency of operations.

### Laboratori forestal

Is an initiative of CREAM and CTFC to make available to the public, expert or beginner, the information and data related to forests generated by the two research centres. The available data have been pre-processed by researchers and technicians from both centres in order to minimise errors in the processing of the raw data.



### LIFE Biorgest

The goal of the projects is to improve the biodiversity of the most representative Mediterranean forests, develop new measures for the promotion of forest biodiversity, develop innovative financing mechanisms, transfer the techniques, indicators and measures developed to the main agents involved in forest management (owners, managers, forest administration, companies) to promote their adoption and disseminate the results and raise awareness in society of the importance of improving biodiversity.



## SOLUTION





# PROPOSAL

As mentioned before, working on tackling only one issue from without thinking systematically won't lead as anywhere. Getting all the actors involved in the forest management is crucial if we want to make a difference and really combat this issue. This service can help landowners get involved as well as governments get the land managed with the help of investors and local workers.



  
**Designing the system**  
How does it work?

Notifying the properties so they get studied and analysed for their best management, contacting, and offering local workers to help with these activities and providing an investment platform for companies to fund these initiatives with the local government are the key points of our proposal.



## THE SERVICE

This service solves this problem of communication or lack of knowledge in landowners and involve the people needed in the forest management chain, while providing local infrastructure to the forest. With this platform also we offer transparency, because all the people (locals or not) can access to the current state of forestation in Catalonia and see the evolution.

Land owners and government specialists upload information



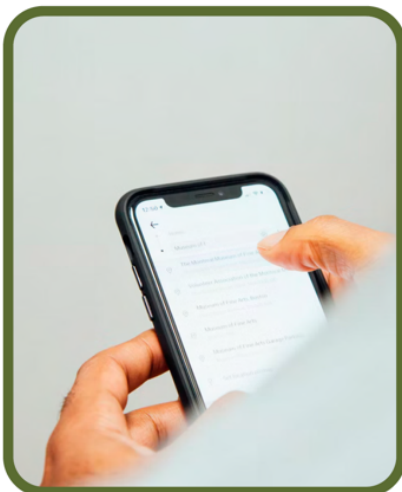
1

Citizens and organizations have free access to all information



2

Investors get access and direct connection to land owners



3

Valuable local products get sold to interested customers transparently



4



# THE PLATFORM

We will design a platform to be able to carry out this service and it has three parts:

### Map with better resolution

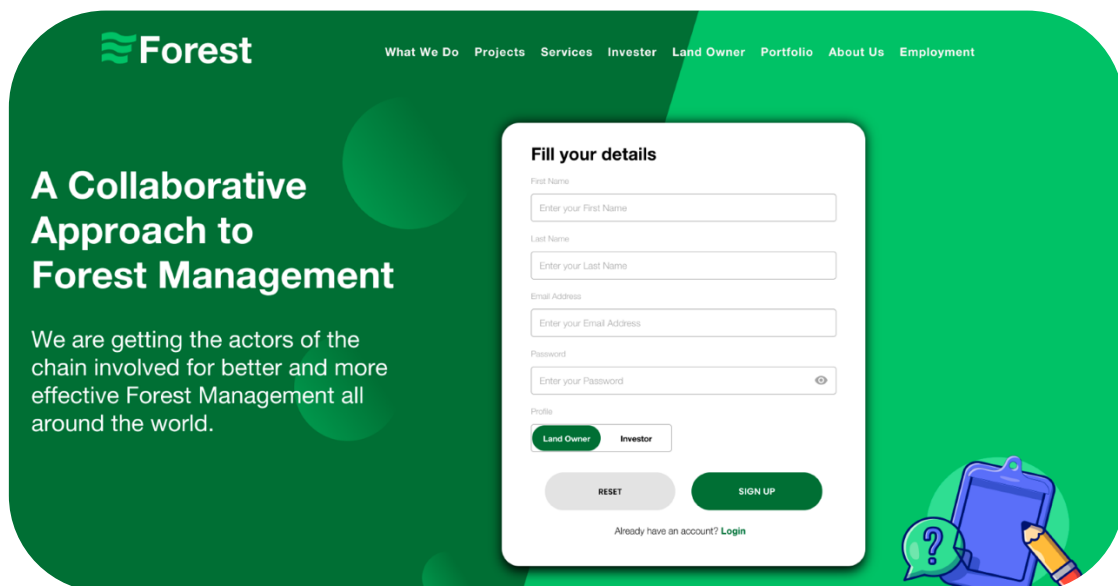
An interactive map that allows any people to see the current state of the forest. It can show the evolution of the forest through time and do some predictions of the future. Also, it can be zoomed in as far as the resolution enables it.

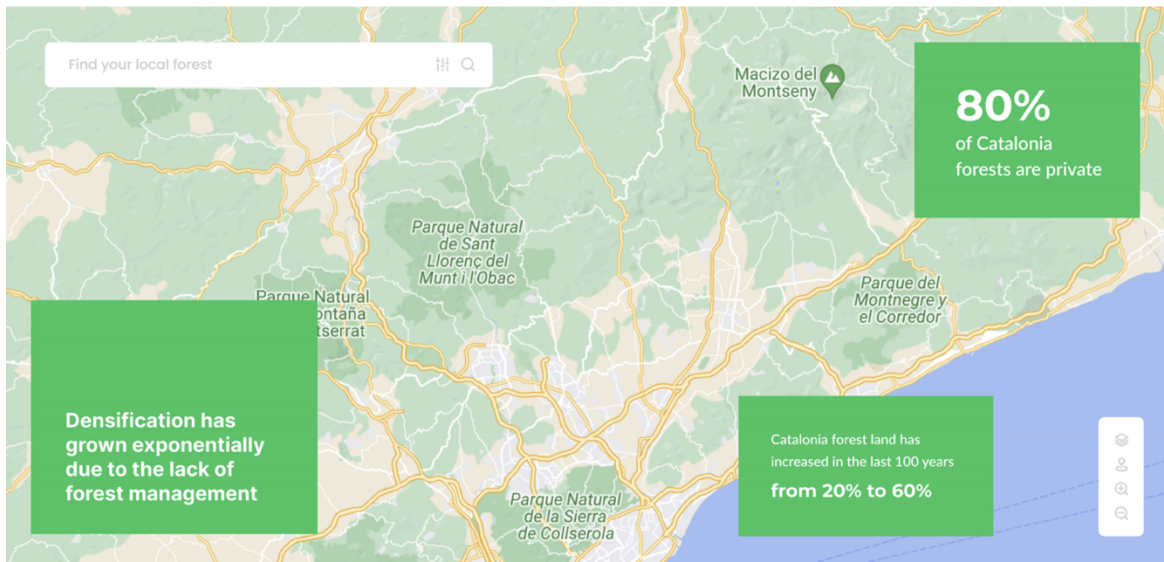
### Authentication of landowners and companies

Landowners and companies will have its own space in the platform, owners will have a custom map of their forests and will have a picture of what is being performed. In the other hand, companies will have a list of actions to invest and their rewards in carbon credits.

### Job offers

Any local people can fill a form and apply to a job offer that will be posted





**Land Owner**  
 Lorem ipsum dolor sit amet, consectetur adipiscing elit.  
 Amount to be needed \$200,000

**Land Owner**  
 Lorem ipsum dolor sit amet, consectetur adipiscing elit.  
 Amount to be needed \$200,000

**Land Owner**  
 Lorem ipsum dolor sit amet, consectetur adipiscing elit.  
 Amount to be needed \$200,000

## Governments

- Offers tax reductions and carbon credit to investors, and give notice to the owners about their land
- Manages forests in a responsible and effective way, reducing fire risks

## Land owners

- Give access to the land to forest technicians
- Get aware about their existing properties and their land managed effectively to make profit

## Forest technicians

- Offer the service of forest management by cutting trees
- Get jobs locally in rural areas

## Investors

- Finance the management of the forests
- Get carbon credit and tax reductions from the governments

# BUSINESS MODEL



# BUSINESS MODEL CANVAS







## VALUE PROPOSITION

### LANDOWNERS

**We improve the economic value of your forests by providing innovative external financing and bringing innovations into your hands.**

Landowners are struggling to maintain their lands for many reasons such as less financial incentives, high labour costs, difficulties in obtaining governments' subsidies, and not knowing about the state of their forests. We offer to these owners external financing from private companies to maintain their forests and innovative solutions from our research partners and start-ups.



### BUSINESSES

**We support your carbon neutral journey and provide you with transparency in your spending while offering better environment by sustainable management of forest.**

Countries' legislators created policies that demands businesses to achieve net zero carbon emissions from their operations. While some companies have started this journey others are still confused about how to start. We will provide these companies with a carbon credit exchange platform that offers a traceable carbon credit to a single tree. Making these companies spending more effective and transparent.



## HYPOTHESIS TESTING

Here we analyse the business hypothesis to show which areas pose the biggest challenge to our proposal.

### Customer value proposition

*What unmet needs the venture will serve?*

For businesses is the need for transparency in their spending, as most of companies invest in initiatives that either have low transparency or have a negative impact on the long run. Our targeted segment of landowners need external financial income to maintain their forests.

*What will be the minimum product at lunch?*

The carbon credit exchange platform only through web application, the geographical scope will be targeted in one forest in Muga Valley Catalonia.

### Technology and operations

*What activities we are required to develop?*

We need to develop expertise in Geospatial modelling and data integration. For support activities such as marketing and sales will be essential during the market launch.

*Can we scale the operations?*

The platform model allows us to scale our operations however the main challenge will be in infrastructure needed in the ground to support our activities such as ground IOT sensors and drones.

### Go to market plan

*What mix of direct and indirect channel will our company have?*

We will use direct channel only to attract and serve our customers in both sides of the platform.

*Does the venture have strong incentives to race for scale?*

We must take advantage of our FMA to attract as much landowners

as we can. The increase of lands under our management will reduce our need for external financing and increase our abilities to attract bigger companies to use our platform.

*What mix of free and paid demand generation methods will our company employ?*

We expect to rely more into paid demand generation in the form of search engine optimization and paid advertisements on social networks targeted to landowners. The free demand generation will be based on case studies and research papers published through the website and other partners websites for building search authority.

### Cash flow formula

*What are our company revenues streams?*

The platform will provide two revenue streams to finance operations

- Transaction fees: we will charge 2% as transaction fee from each credit sold through the platform. We assume that 10 million credits can be sold each year with average price of 10€ per credit.  
Transaction revenues =  $10M * 10€ * 2\% = 2$  million €.
- Subscription fees: collected from landowners in monthly basis for the services provided to them. We anticipate having 10K owners to join our platform in Catalonia with subscriptions fees of 20€.  
Subscription fees =  $10K * 20€ * 12 = 2.4$  million €.

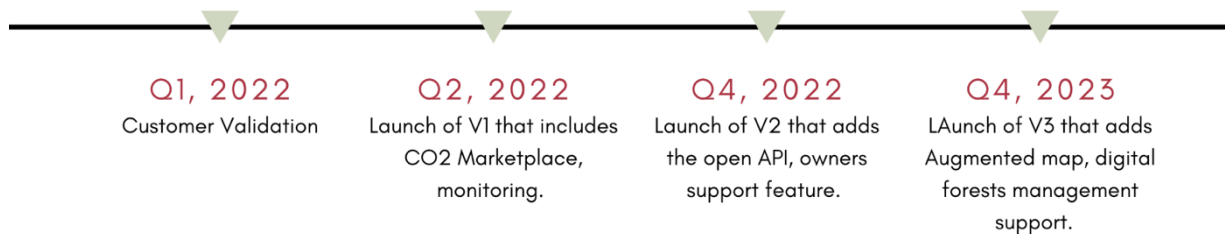
*How will our contribution margins, capital investment, and fixed costs will change overtime?*



The main capital investment will be during the product launch and this investment will reduce according to the expected growth. We assume a growth rate of 100% in the first five years relying on our firm's first mover advantage. This growth will need to be accompanied by optimising on our fixed expenses on employees' salaries by streamlining the sales

funnel and leveraging network effects. Our contribution margin is expected to reduce marginally in the starting period as it requires improvement in sensory systems and large orders to reduce the variable cost per transaction. During business modelling we will validate these assumptions by accurate numbers.

## Product pipeline



## TECHNICAL DETAILS



## SENSORS

In order to compute more accurate maps, we will use different technologies. We will combine IoT: which will give us a real connection in the forest (and will send the data to the central server) with LiDAR sensors and drones. To see the evolution in the forest we will use satellite images. There's a sample script of how we compute this evolution.

### Description of the sensors

- LIDAR: this can detect subtle topographic features such as river terraces and river channel banks, to measure the land-surface elevation beneath the vegetation canopy, to better resolve spatial derivatives of elevation, and to detect elevation changes between repeat surveys. LiDAR uses active sensors that illuminate the surface of interest by emitting laser pulses at a very high repetition rate. A receiver measures the intensity of the reflected energy and records the time delay between the transmitted and backscattered pulses. Since laser pulses travel at a known speed (the speed of light), the distance between the sensor platform and the illuminated surface is determined. The platform is equipped with a GNSS positioning system so each pulse reflection (generally referred to as a return) is stored as a x, y and z data point.
- IoT: this technology enables us to interconnect devices through internet. Also, can measure temperature, moisture, pressure and wind directions, and others.

### Location of the sensors

- GROUND: in the ground will be IoT sensors computing the soil moisture to reinforce the vegetation densification data. They will also measure temperature and wind directions and send an alert if there's high risk of fires (and show it into the map). This data will be sent to the central server.
- AIR: drones will have IoT capabilities, which must be of longest reach, since we need to communicate in a space of the order of hundreds of meters, also we need to communicate in rural areas (with less Base Stations), so we will use the 3G mobile communication standard. The drones will fly through the forests and periodically do the mapping, those will create a net and send this data to a central server. This data combined with satellite analysis of a vegetation index (NDVI) will enable us to do a map of a better resolution than 1m.



## ANALYSIS OF DENSIFICATION SOFTWARE

This program implemented by Matlab takes images by satellite of Catalonia and computes the area that there's vegetation.

Packages used: *Image Processing Toolbox*.

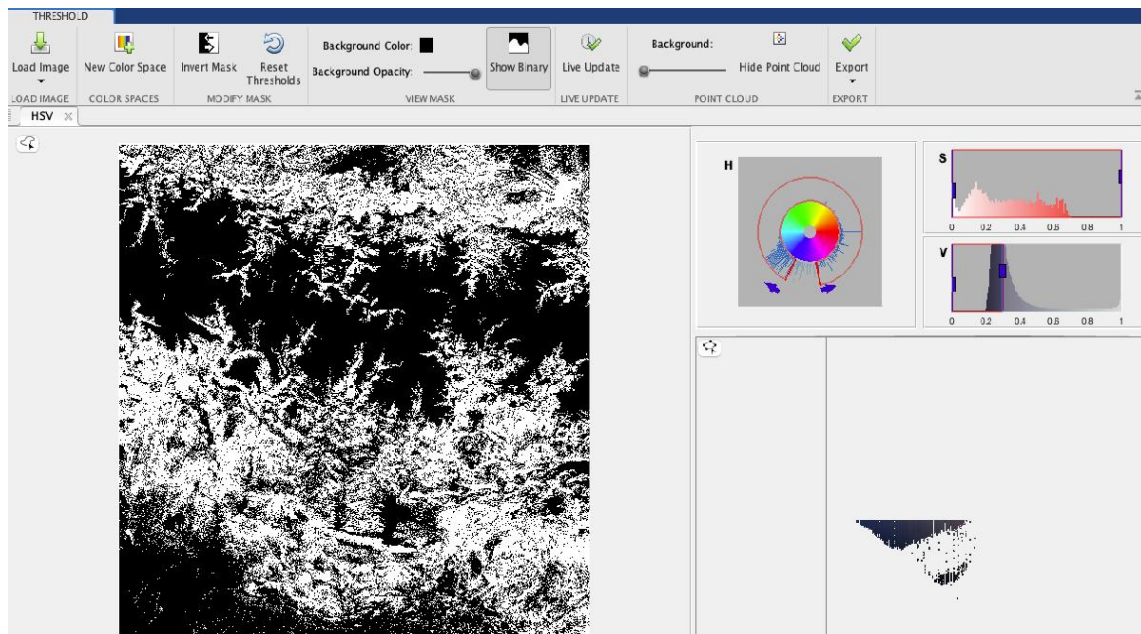
### Importing images

The import at the program of the satellite images. Ideally in our platform this would be done automatically taking images from the Generalitat de Catalunya's website. The 2016 image is from March, the 2019 and 2022 images are from January, and the 2020 image is from February.

```
year2016 = imread("201603_0  
.jpg");  
year2018 = imread("201801_0  
.jpg");  
year2020 = imread("202002_0  
.jpg");  
year2022 = imread("202201_0  
.jpg");
```

### Finding the threshold

In order to find a threshold, as our satellite images have a lot of similar-contrasted colours but the difference between trees and ground is in the hue, we used the Colour Thresholder tool in Matlab software to decide a threshold. We've done it for the image of 2018, but this mask can apply to all images, since hue is similar in all of them. Then, we export this threshold as a function called *maskDef*. This function will return two parameters: the mask itself and the original photo masked.



*The interface of the threshold tool*

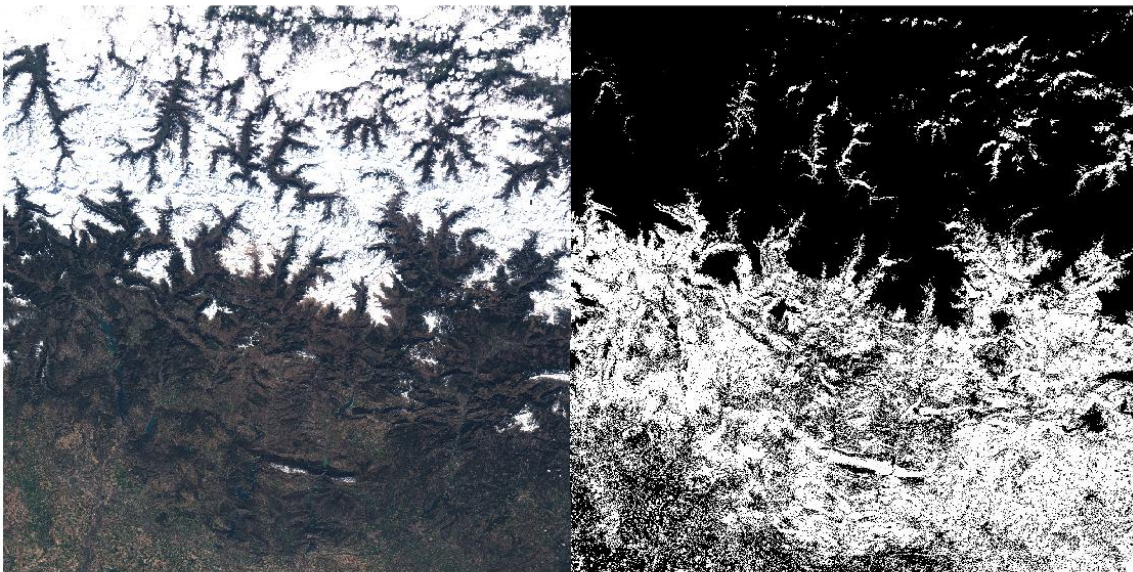
### Applying the mask on each photo

We apply the function of masking that we described earlier. Also, as an example we show the pairs of raw photography - mask to validate that our masking function is working well.

The mask function creates a matrix of the same dimensions as the image. This matrix has 1's (white) on parts of forest and 0's (black) on parts that are no forest.

```
mask2016 = maskDef(year2016);  
pair2016 = imshowpair(year2016,  
mask2016, "montage");
```

We implement the same code but change the year for each case above (year2018, year2020 and year2022). As we can see, the forests areas are selected in each image fairly well.



Year 2016. Left raw satellite image, right mask matrix

### Computing the forestation area

First, we must know which is the size of the pixel in the reality. Since we know that the pixel is equivalent to 30 m<sup>2</sup> in the reality, knowing that the image is 5000 x 5000 pixels, we deduce that area photographed is 150 km<sup>2</sup>, and then, the resolution in km<sup>2</sup>/pixel is

```
resol = 15/(5000*500);
```

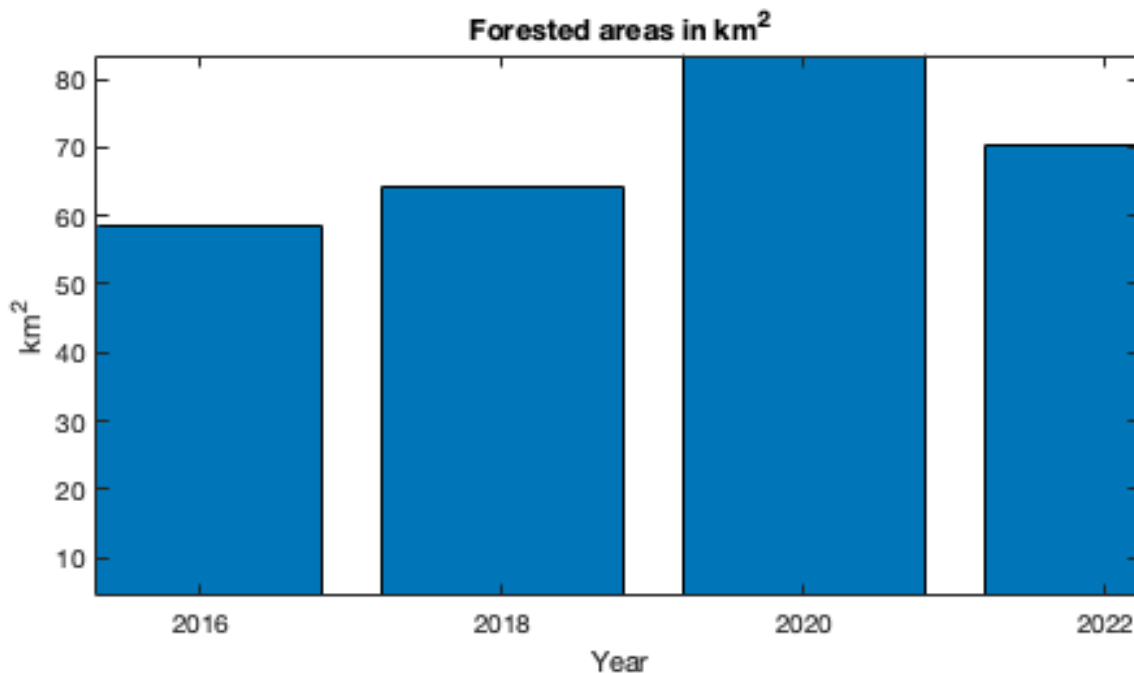
This is the computation of the area of the forests. It is done by adding all 1's in the masks and then converting this number into km<sup>2</sup> using the resolution.

```
areaPixels2016 = sum(  
regionprops("table", mask2016,  
"Area").Area);  
areaKm22016 = (areaPixels2016  
*resol);  
areaPixels2018 = sum(  
regionprops("table", mask2018,  
"Area").Area);  
areaKm22018 =(areaPixels2018  
*resol);  
areaPixels2020 = sum(  
regionprops("table", mask2020,  
"Area").Area);  
areaKm22020 = (areaPixels2020  
*resol);  
areaPixels2022 = sum  
(regionprops("table", mask2022,  
"Area").Area);  
areaKm22022 = (areaPixels2022*  
resol);
```

### Plotting the graph of forestation

Finally, we have the computation of the final graph. In x axis we have the years and in y axis the area in km<sup>2</sup> of forests.

```
years = 2016:2:2022;  
bar(years,[areaKm22016,  
areaKm22018, areaKm22020,  
areaKm22022])  
title("Forested areas in km{2}")  
xlabel("Year")  
ylabel("km{2}")  
axis tight
```



*Final graph of forested areas*

As we can see the evolution of forestation is clear until 2020, but in 2022 it's a bit less than in 2020. This probably is due to the months photographed are between January and March, so there's snow in the Pyrenees that have a big impact on the computation (is counted as no forest since it's white). There were other parts of Catalonia in other images but were mostly of sea and were zones with less forests. Also, we have data since 2015, and doing it by two years we would have had only 3 photos to compare in the summer.

## APPENDIX





## EXPERTS INTERVIEW TRANSCRIPTION

**Teresa Cervera** is a researcher of the Forest Property Centre (CPF) of Generalitat of Catalonia, and they gave us a general vision of the situation of Catalan forests based in a study that she carried out with other experts called *Forest Transition*.

The main problem in Catalonia is not the deforestation, is the densification of the forests. This is due to forest transition that we can split in two sections.

Firstly, the fields in some areas are not profitable and people move to areas near the city that has larger and more profitable fields. The field is abandoned, and that area becomes forest. We loss biodiversity but maybe other species appears and are more resistant to perturbances.

Secondly, the forest is becoming denser, and more trees are growing than the water can supply. If a fire breaks out, it's easier for it to spread.

The consequences of these problems are loss of the characteristic mosaic, stressed forests, increasing of trees mortality...

Other interesting insights

- The 80% of the forest in Catalonia are private property and there are 200.000 owners (this is so difficult to manage)
- The only case in which we can speak of deforestation in Catalonia is in areas where there are repeated fires, but they are a small number.

**Enric Vadell** is the forest management subdirector of Generalitat of Catalonia and he explained us that there are four problems caused by the abandonment of the forest that Generalitat considers: managing (lack of management leads to fires, and

fires lead to higher fuel loads), water (there is a problem with the densification of the forest because they send a lot of water to the atmosphere and keep very little), biodiversity (the old forest has good characteristics in terms of resilience and product quality, but it also loses biodiversity in some cases) and economy (the main problem is that forests are abandoned because the product is not of good quality). The forest resources are extracted in cascade: the highest quality wood goes to the best paid economic activities and the lowest quality wood is destined for shredding to make biomass.

**Jordi Vayreda** and **Lluís Comas** are researchers of Centre for Ecological Research and Forestry Applications (CREAF) and Jordi worked on one of the most important reports of the forest transition in Catalonia, the *FOREStime*.

They told us that maybe in the future we will have another type of mosaic in which forests retain less CO<sub>2</sub> and for less time. But we must also ask ourselves the following question: is it more effective to capture CO<sub>2</sub> or to stop burning fossil fuels to produce it? The planet, through the seas and forests, recaptures 50% of the CO<sub>2</sub> emitted, what happens if the ecosystem loses this capacity?

In the past, some areas were exploited in a way that only favoured the growth of a certain species (the one that was most productive), causing the other species to move out. Now we have very uniform mosaics with species of only one type, so we must try to regenerate the mosaic to diversify (the species that may be in that ecosystem typically



grow alone, but we can help them regenerate faster). Forests in Catalonia tend to be mixed, but poor management has caused us to lose the mosaics.

Sometimes, we think that climate change is the main problem of forest deterioration, but an abrupt human-induced change is sometimes worse, for example, when 200 years ago we allocated an area of forest to agriculture, and this still has effects today.

**Eloi Beules** works in the forest management department of Generalitat of Catalonia.

He explained us that there is an increase of forest areas from 20% to 60% of the Catalan territory in the last 100 years and all the individual research that has been carried out over the years (fires, biodiversity, pests, soil) has concluded the same thing: forest decline

The transition from one type of forest to another that is better adapted to the climatic conditions is very dangerous, because the nature regulates itself with perturbations, fires, pests, species substitutions (very slow), ... But is the human being who does not allow all these processes to take place. Can you imagine this scenario for 50 years?

Silvicultural pathway is the process through which you act on the vegetation to achieve a final structure that you want. This process is done by nature, but for example, if we know that in 30 years we will have a totally different landscape, instead of nature doing it in its own way (fires, pests, etc.), we can help to change it. Nowadays these itineraries do not exist to make the transition to these scenarios that will occur with climate change.

The fact that 80% of the forest are private property has important

problems and impediments. If we design an action plan for fires in a specific area and we conclude that the main points for actions are in different properties, we must ask the owner if we can carry out this action plan from his property. The owner can decide whether to do it or not, since there is no law that requires the owner to submit to the action plans that are designed.

The law does not require owners of strictly forested plots to manage and care for the land, only those in urban areas, but it is still the responsibility of the urbanization, not the owner of the plot. The last forest plots of the urbanizations are focus of fires (Decree 64/1995, Law 5/2003).

In the past, forests were profitable, and people worked them because they either had an economic benefit or they did not lose money. The operation of the forest world is always working the same: the product encourages action, so the key is the product revaluation.

**Lluís Plà** is a landowner who has a small plot of land near the MONTSENY area. They told us that there are subsidies for forest management, but they are very limited and are given to a certain number of people. He would like the Generalitat to provide more subsidies. The main task that he does is to maintain the soil to prevent understory vegetation from growing, as this is what causes fires more easily. But it is true that he performs these tasks voluntarily, but there are many owners that don't care the forest or simply do not bother to manage it.

**Carlos Eikel** is a forest technician that work in the Muga Valley project of Pioneers of Our Times. He and his partner could explain us that

currently, the less quality wood is used for biomass, but there is no other profitable application. In addition, there are areas that are difficult to access, so this is another problem that they must face it. In the Muga Valley there are a lot of pines, so they try to cut down the pines and leave the other species (oaks, fruit trees...). But this is a large process, because it's not just about cutting down trees, they must prepare the soil, control the re-growth of these species and once the meadow is obtained, to maintain the area. There are many young people looking for work in the field, but the conditions are bad, and they end up going elsewhere. In addition, housing near these areas is expensive and young people cannot afford it, so this fact makes more difficult the situation.

**Jon Marín** is a botanic, designer and CEO of *Bridepalla*. He gave us

some insights of what's happening with the forests in Catalonia. Most of them are private properties with public access. There is no regulation concerning how much people go into the forests and what they do there. Being private and high maintenance, they are not profitable now and stay untouched, so the densification happens. Usually, forests are living entities that auto-maintain itself, but with the lack of diversity in landscapes it just grows and weakens.

Another huge problem is the new tendency of planting trees as CO2 offsets for companies. This is problematic in many levels: from the lack of diversity, it generates to the fact that usually you invest tons of resources in them to grow and they only start keeping the CO2 when they reach about 30 years of growth.



## CONTACTS / SOURCES

### **Generalitat of Catalonia**

Enric Vadell – Subdirector of Forest Management  
Teresa Cervera – Forest Property Centre (CPF)  
Eloi Beules i Ors – Forest and Resources of Barcelona

### **Forestry Technology Centre of Catalonia (CTFC)**

Míriam Piqué Nicolau – Multifunctional Forest Management  
Mario Beltrán Barba – Sustainable Forest Management

### **Centre for Ecological Research and Forestry Applications (CREAF)**

Jordi Vayreda Durán – Forestry and Ecosystem Researcher  
Lluís Comas Boronat – Forestry and Ecosystem Researcher

### **Catalan Agency of Climate Change**

Gabriel Borrás Calvo – Responsible in Adaptation Area

### **Nature Conservation Network**

Mathias Brummer – Forest Management

### **Pioneers of Our Times**

Stef Van Dogen – Cofounder and CEO  
Carlos Eikel Delgado – Forest technician

### **AISTECH**

Guillermo Valenzuela – Forest monitoring

### **Pau Costa Foundation**

Jordi Vendrell – General Manager

### **Bridepalla**

Jon Marín – CEO, botanic and designer

Lluís Plà – Landowner



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