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Cyprus tomorrow RECOVERY AND RESILIENCE PLAN

Republic of Cyprus

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Executive Summary

This deliverable provides an overview of the process undertaken by the Green-HIT project consortium to gather and analyze user needs from diverse stakeholders. These insights serve as the foundation for defining the platform's functional requirements. Additionally, the document outlines a series of carefully crafted use cases and scenarios, derived directly from the identified stakeholder requirements, ensuring alignment with the envisioned functionalities of the platform.

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1. Introduction

Understanding and analysing user needs is crucial for the success of the project, as it uncovers insights into what different stakeholders require from the final Green-HIT platform. WP3 has thus conducted extensive interviews and questionnaires to collect their specific needs and preferences. Through these interactions, a comprehensive understanding of the platform requirements has emerged.

The user needs analysis approach employed involved engaging stakeholders in in-depth interviews and structured questionnaires to capture a range of perspectives and insights. This has allowed for better understanding needs/preferences, which may have gone unnoticed through traditional data collection methods alone. The active involvement of stakeholders early on has ensured that all requirements are accurately represented in the development of the Green-HIT platform.

Finally, the user needs have been synthesized into scenarios and use cases to illustrate how the platform will address real-world challenges and scenarios. This has allowed the project consortium to visualize the practical implications of the Green-HIT platform and ensure that it aligns effectively with the diverse needs of stakeholders.

2. User Needs Collection Methodology

To comprehensively analyze user needs, Green-HIT project partners undertook a series of strategic measures, including the organization of meetings and site visits aimed at fostering dialogue and understanding regarding forest management and monitoring needs. These interactions served as crucial forums for engaging with stakeholders and eliciting their perspectives on the functionalities and requirements of the Green-HIT platform.

In the initial phase, unstructured open interviews were conducted with managerial personnel from the Cyprus Forest Department. These interviews provided an opportunity for in-depth, qualitative exploration of stakeholder needs. Through open-ended discussions and the exploration of different perspectives, these interviews facilitated the identification of articulated needs, enriching the understanding of stakeholder expectations.

Furthermore, alongside interviews, structured questionnaires were utilized to systematically capture stakeholder insights and preferences. These questionnaires provided a structured framework for gathering feedback across a range of stakeholders, ensuring a comprehensive representation of user needs.

By employing a combination of interviews and questionnaires, the project team aimed to create a holistic understanding of stakeholder needs. This approach enabled the team to uncover both explicit and implicit needs, laying a solid foundation for the subsequent definition of platform requirements and use cases.

2.1 User Needs Interviews

A total of three (3) visits to different stations of the Department of Forests in Cyprus were carried out, and one (1) visit to the Nature Conservation Unit at the Frederick University. During these meetings, unstructured open interviews were conducted. ANNEX 1 includes the interview notes taken during the visits at the forestry department stations. Representative photos taken on site during these visits are included below.

2.2 User Needs Questionnaire

The Green-HIT user needs questionnaire was designed to cover a wide range of topics, including specific functionalities, usability, and unique requirements. Specifically, the questionnaire was designed with the Department of Forests in mind, and is split in five (5) sections:

1. Project Objectives
2. Forest Fires Monitoring and Prevention
3. Biodiversity Monitoring and Protection
4. Afforestation/Deforestation/Reforestation Monitoring
5. General questions

The questionnaire is included in ANNEX 2.

3. Identification of Users and Stakeholders

Accurate user needs gathering hinges upon the precise identification of suitable users and stakeholders. In the case of Green-HIT, the platform is tailored specifically for officers and workers within the Department of Forests, as well as other stakeholders with vested interests in forest management and monitoring (e.g., governmental authorities and the scientific community), rather than the general public. The selection process for users and stakeholders adhered to several criteria: they were chosen based on their ability to provide reliable insights into platform requirements, their accessibility for communication with project partners, and their capacity to deploy and test the platform. The table below summarizes the audiences interviewed and questioned as part of the user needs analysis carried out in WP3.

Interview & Questionnaire Audiences	Main representative(s)	Date
Officers & Workers @ Department of Forests, Management Offices	Andreas Christou, Chief Conservator of Forests	24/02/2023
Officers & Workers @ Department of Forests, Ayios Nikolaos Forest Station	Fanos Papadiofantous, District Forest Officer	15/03/2023
Officers & Workers @ Department of Forests, Platania Forest Station (Troodos Forest District)	▪ Loizos Loizou, District Forest Officer ▪ Minas Papadopoulos, Assistant District Forest Officer	16/03/2023
Members of the Nature Conservation Unit @ Frederick University	▪ Kostas Kadis, head of Nature Conservation Unit, Ex-Minister of the Environment ▪ Dr. Nikolas Eliadis, member of Nature Conservation Unit, International Biogeography Society, American Botany Society, and Cyprus Forestry Association ▪ Constantinos Kounnamas, member of Nature Conservation Unit	19/03/2023

4. Requirements Analysis, Synthesis and Prioritization

Once the questionnaires and interviews were conducted, the collected data was carefully analysed and synthesized. This involved identifying common themes, recurring needs, and potential conflicts among the perceived requirements. The data analysis phase aimed at providing a clear and structured understanding of what different user groups and stakeholders expect from the Green-HIT platform.

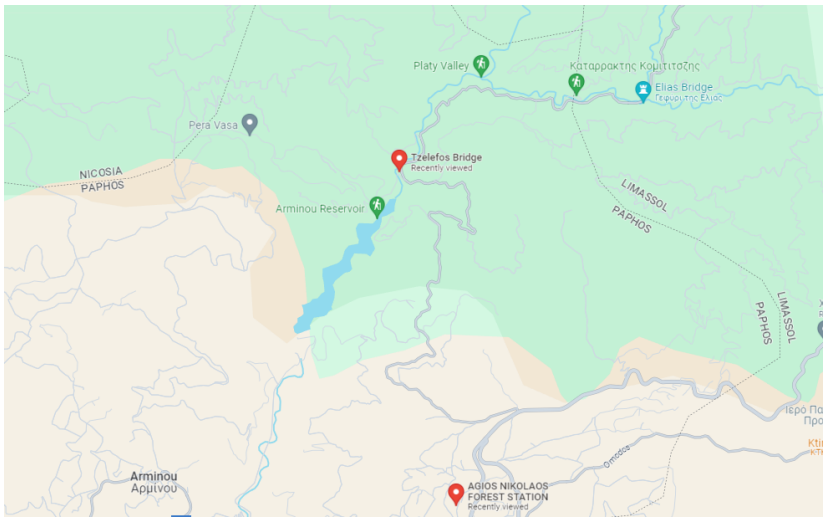
Not all requirements are of equal importance, and it is essential to prioritize them. Some requirements may be critical for the core functionality of the platform, while others may be considered enhancements. Prioritization ensures that development resources are allocated efficiently and that essential features are addressed first. Apart from prioritization, it is essential to define Use Cases (UC) and Scenarios (SC) to better manage the different pillars/modules of the Green-HIT project, which include the following:

- Fire Prevention, Detection, and Reaction Module.
- Illegal Logging and Hunting Module.
- Green-HIT Forest Monitoring.
- Deforestation/Afforestation/Reforestation Recommendation Module.
- Forest Accounting & Inventory.

4.1 Proposed Use Cases & Scenarios

Use case locations 1 (UC1) – Ayios Nikolaos Forest

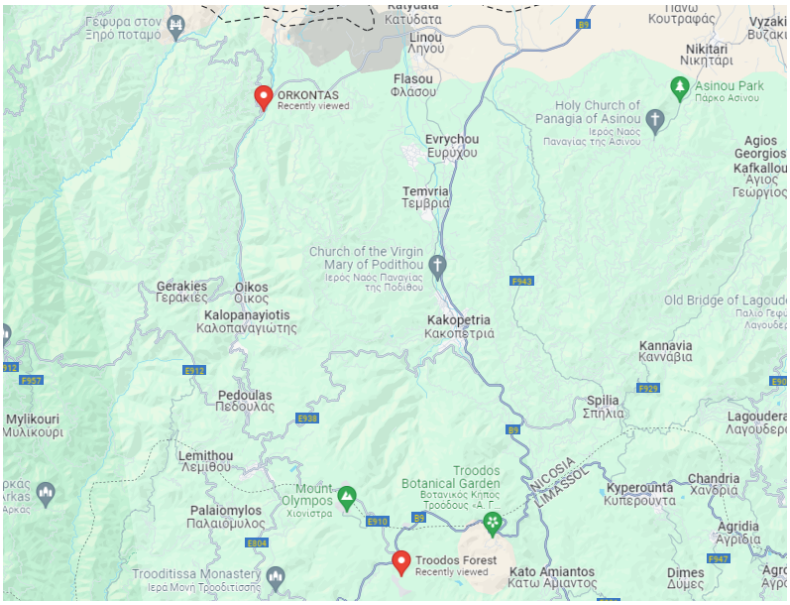
1. Tzelefos Bridge Fire Blind Spot
2. Treis Elies Fire Blind Spot
3. Mylikouri Fire Blind Spot
4. Omodos Fire Blind Spot



Ayios Nikolaos Forest

Use case locations 2 (UC2) – Troodos Forest

1. Mantres Fire Control Area
2. Orkonta Illegal Logging Area
3. Chrysovrisi Trail
4. Persefonis Trail



Troodos Forest

The proposed Scenarios (SC) based on the Use Cases (UC) locations are:

1. Fire Management:
   - SC1.1: Prevention
   - SC1.2: Detection
   - SC1.3: Reaction
2. Forest Management:
   - SC2.1: RE/De/Af/-forestation
   - SC2.2: Forest Inventory/Mapping
   - SC2.3: Illegal Logging and Hunting Detection, Biodiversity Protection

A summary of the user needs analysis, synthesis, and prioritization is presented in Table 1, which includes references to *User Needs*, *Use Cases (UC)/Scenarios (SC),* and *Contributing Tools & Equipment*.

	User Need	**UC/SC**	**Contributing Tools** & **Equipment**
1	Prevention of fire.	UC1/SC1.1 UC2/SC1.1	Custom end-nodes/sensors with dual Sat/Terrestrial communication, Weather stations, Smoke sensors, Sat Images, Platform.
2	An early fire detection system for specific areas that are considered blind spots since they are not visually accessible from the current forestry department outposts.	UC1/SC1.2 UC2/SC1.2	Custom end-nodes/sensors with dual Sat/Terrestrial communication, Weather stations, Smoke sensors, Thermal cameras (or other), UAVs, Platform.
3	A system that can monitor the presence of motorized vehicles in specific paths and areas where their access and presence is prohibited.	UC2/SC2.3	Noise/Sound sensors, Platform.
4	A system that can detect illegal hunting and logging activities in specific paths and areas where this is prohibited.	UC1/SC2.3 UC2/SC2.3	Noise/Sound sensors, Platform.
5	A fire detection system that can be deployed in existing outposts, which are manned only during the days; thus, the areas they cover are uninspected during the night.	UC1/SC1.2 UC2/SC1.2	Custom end-nodes/sensors with dual Sat/Terrestrial communication, Weather stations, Smoke sensors, Thermal cameras (or other), Platform.
6	Early visual access to all areas of responsibility for reviewing alerts, threats, and for general patrolling.	UC1/SC2.2 UC2/SC2.2	UAVs, Platform.
7	Reaction to fire incidents.	UC1/SC1.3 UC2/SC1.3	Custom end-nodes/sensors with dual Sat/Terrestrial communication, Weather stations, Smoke sensors, Thermal (or other) cameras, UAVs, Platform.
8	Measure related parameters/indicators for biodiversity and RE/De/Af/-forestation to	UC1/SC2.1 UC2/SC2.1	Custom end-nodes/sensors with dual Sat/Terrestrial communication, Soil

	better understand the forests and their needs.		sensors, Water Quality sensors, Sat Images, UAVs, Platform.
9	Exploit the usage of custom end-nodes/ sensors to enhance both sensing and coverage capabilities especially for high-risk blind-spot locations.	UC1/SC1.1, 1.2, 1.3 UC2/SC2.1,2.3	Custom end-nodes/sensors with dual Sat/Terrestrial communication, Platform

Table 1: *User Needs/Requirements for Green-HIT.*

5. Conclusions

In conclusion, the user needs analysis conducted for Green-HIT marks a significant step towards the platform's success. By engaging with stakeholders and meticulously analysing their responses, we have gained valuable insights into their respective needs and expectations from the platform. The findings of this analysis will serve as a guide, informing the design and objectives of Green-HIT to ensure it effectively addresses the needs of governmental organizations, forest-dependent communities, the scientific community, and forest-related industries. Moving forward, this understanding of user needs will be instrumental in steering the development process, ultimately resulting in a platform that makes a meaningful impact in forest management and monitoring.

ANNEX 1

1. Meeting at the Department of Forests Management Offices – 24/02/2023

Green-HIT participants: Ayis Iacovides (IACO), Andreas Constantinides (FRC), Michalis Stylianou (CYRIC), Constantinos Constantinou (IACO).

In the context of WP3, a meeting was held with the deputy director of the Department of Forests (DF) at the DF central offices, where the project and its objectives were presented. A brainstorming session then followed between the different participants of the meeting on which sectors should the project focus on data gathering, analysing, and availability for the forest management personnel. It was decided that the project should focus on three different axes: Forest fires monitoring and prevention, Biodiversity monitoring and protection, and Afforestation/Deforestation/Reforestation monitoring.

Based on this 3-axis objective, the participants of the meeting with the guidance of Mr. Andreas Christou, identified three different forest areas in which the project's outcomes would be helpful for the forest management personnel.

- Forest fires monitoring and prevention:

Regarding the topic of forest fires prevention, Mr. Andreas Christou suggested that the forest area of the Diarizos valley would be an ideal case. Diarizos valley is located in the South-eastern part of Paphos District, in the western-southwestern foothills of Troodos Mountain. It's included in the European nature protection area network "Natura 2000" as a Special Conservation Area and a Special Protection Area. Mr. Christou mentioned the existence of some "blind spots" within this area, where the local forest observatories do not have direct visual contact. This fact renders a fire outbreak at these points very dangerous, as the delay in detecting a forest fire can have serious consequence in the effort to extinguish it. One of these "blind spots", located at the base and periphery of the Arminou dam in the area, is considered by the personnel of the DF as quite dangerous due to the frequent visitation by amateur fishermen who often light fires illegally for recreational purposes. It was also discussed how smoke detection sensors could be installed in the area as well as cameras in strategic points with good view of the area and in a way to avoid vandalism or theft. Mr Christou suggested that we contact the manager of the Ayios Nικolaos Forest station Mr. Fanos Papadiofantous so we can discuss with him further details.

- Biodiversity monitoring and protection:

During the discussion between the project partners concerning the biodiversity topic, Mr Christou mentioned the problem of biodiversity disturbance inside nature trails by ATV's (quad bikes) and motorcycles where access by motorised vehicles is prohibited, especially at Troodos Forest area.

The Troodos range is the predominant geological and morphological feature on the island. It is covered mostly with natural forests. To the west it extends to the Paphos district and to the east it stretches over large parts

of Lefkosia, Lemesos and Larnaka districts. Troodos forest has been declared as a National Forest Park in 1992. It is also included in the European nature protection area network "Natura 2000".

The monitoring of important species of flora or/and fauna within the Troodos Forest was also discussed, such as for example Chionodoxa lochiae population monitoring with cameras and recording of its developmental stages. Sensors could also be installed which will record environmental data such as temperature, humidity, soil data etc.

Mr Christou suggested that we contact the Troodos District Forest Officer Mr. Loizos Loizou.

- Afforestation/Deforestation/Reforestation monitoring:

Concerning the Afforestation/Deforestation/Reforestation monitoring topic Mr Christou suggested as a good example, the two main forest fires that took place in the forest region of the Akamas peninsula and some reforestation measures took place. The first case of forest fire, started at a large private plot north of Lara region and entered the state forest, burning a part of the Juniper's Forest of the area. The second case started near the Smigies excursion area and was extinguished north from there, towards Halavros area.

The Akamas peninsula occupies the westernmost tip of Cyprus, covering an area of 17,000 hectares approximately. It's included in the European nature protection area network "Natura 2000" as a Special Conservation Area and a Special Protection Area (CY4000010 and CY4000023).

Mr Christou also added that deforestation in the area due to overgrazing was observed mainly around the livestock facilities and in paths that lead to waterers, which is quite natural.

Satellite images of the areas affected by the forest fires inside the Akamas peninsula, should be gathered at different time periods (Remote sensing) and continue monitoring the evolution of the flora within these areas and then compare its evolution from the first year of recording to the most recent.

Mr Christou suggested that we contact Costas Papageorgiou, senior conservator of forests, head of fire protection and forest engineering.

2. Meeting at Ayios Nikolaos Forest Station – 15/03/2023

Green-HIT participants: Ayis Iacovides (IACO), Andreas Constantinides (FRC), Michalis Stylianou (CYRIC), Constantinos Constantinou (IACO).

In the context of WP3, a meeting was held at the Ayios Nikolaos Forest station with the head of the Forest station Mr. Fanos Papadiofantous, where the project and its objectives were presented. Ayios Nikolaos is located in the Eastern part of Paphos District, Southwestern foothills of Troodos Mountain. It has under its jurisdiction the Diarizos valley, which is included in the European nature protection area network "Natura 2000" as a Special Area of Conservation and a Special Protection Area (Koilada Diarizou – CY4000003 and CY4000020).

In a previous meeting (24/02/2023) which was held at the DF management offices at Nicosia, the deputy director of the Department suggested that we should meet with the head of the Ayios Nikolaos forest station to analyse with the personnel the dangers that they face in their jurisdiction (especially the Diarizos valley) concerning the prevention of forest fires.

The forest station personnel informed the project partners that even the fact that there are two Forest Observatories (FO) at their disposition (Kefalos and Kollatzia FOs) plus the contribution of a third observatory (Ayios Ioannis FO) located at another station's jurisdiction, there are still some "blind spots" within the area where the FOs do not have direct visual contact. In case of an outbreak at those "blind spots", the forest fire could be detected at a later stage becoming uncontrollable, due to the very dry conditions of Cyprus climate, the terrain and the difficulty in accessing areas inside the valley.

The Forest station personnel was particularly concerned for one of the "blind spots", located at the base of Arminou dam in Diarizos valley and considered as quite dangerous due to the frequent visitation by amateur fishermen who often light fires illegally for recreational purposes.

During the meeting, it was suggested by Ayis Iacovides that the coordinates of the FOs mentioned be shared with the project partners, and IACO could carry out a preliminary work on GIS by analysing the relief of the area and identifying all "blind spots" that the FOs cannot cover. A discussion followed between the project participants and the DF personnel, analysing the types of sensors that could be used to help the DF personnel to improve its observational range and add innovative systems to the process of forest fires monitoring. It was suggested by Michalis Stylianou to install antennas at the FOs and analyse which areas are covered by the network. The participants agreed that it would be very helpful if cameras were installed in strategic places in the area where the "blind spots" will be covered, and the personnel could be alerted if any illegal fires were detected. It was agreed that the cameras would be installed in safe places to avoid vandalism or theft. Smoke detection sensors could also be installed in strategic places where access is difficult, or visibility is low.

The use of a UAV was also mentioned in the discussion, which could play a role in the sensors' signal confirmation, for example if a sensor sends a signal of high smoke density, the UAV with the click of a button will be able to take off, fly over the sensor's location, and send live video footage back to the Forest station or FO, and confirm if there is indeed a forest fire or not. It will then be able to automatically land back to its base.

After the discussion, all project partners with the head of the Ayios Nikolaos forest station, visited one of the Forest Observatory (Kefalos FO), were the issues discussed during the meeting could be analysed on-site.

3. Meeting at Platania Forest Station (Troodos Forest District) – 16/03/2023

Green-HIT participants: Ayis Iacovides (IACO), Andreas Constantinides (FRC), Andreas Pamboris (FRC), Michalis Stylianou (CYRIC), Constantinos Constantinou (IACO).

In the context of WP3, a meeting was held with the at Platania Forest station with the head of the Troodos Forest District Mr. Loizos Loizou and Assistant District Forest Officer Mr Minas Papadopoulos, where the project and its objectives were presented. Troodos National Forest Park is located in the heart of Troodos mountain range and was designated as a National Forest Park in 1992, aiming to safeguard its sustainable use and to perpetuate the values and functions of the area: ecological, scientific, recreational, hydrological and economic. The greater part of the park has been included in the European network of protected areas "Natura 2000", named "Ethniko Dasiko Parko Troodous" as a Special Area of Conservation and a Special Protection Area (CY5000004), since 2004.

During a previous meeting (24/02/2023) which was held at the DF central offices at Nicosia, the deputy DF director (Mr. Andreas Christou), suggested that we should meet with the head of the Troodos Forest district in order to analyse the problems and challenges that they face in their jurisdiction (especially within the Troodos National Forest Park) concerning human (Fires, illegal logging, illegal entry of motor vehicles into forest nature trails and closed forest roads) activities which put the rich biodiversity of the area in danger.

The forest station representatives informed the project partners that there is indeed a problem with illegal entry of motor vehicles inside nature trails and closed forest roads. The project partners suggested that this issue could be solved with the installation of acoustic sensors in selected points which will be able to identify the sound of the vehicles and then send a signal, alerting the DF personnel. The sound sensors must be covered by wireless network and for that reason it was asked to the DF personnel to determine geographically the area that could be covered by sensors to calculate the number of sensors that will be used, and the number of antennas used to cover the network. In order to install the antennas, it is necessary to have access electricity and internet network. It was suggested by the project partners that the antennas or cameras should be installed in fenced and controlled by the DF areas to avoid vandalism and theft. A map with the DF facilities (such as observatories) was requested. Also, a map with areas that illegal logging was recorded was also asked, to see if it is possible to install sensors (acoustic or camera) that can alert the DF personnel of activities of this nature are taking place.

Concerning forest fires which are also a real danger for the Troodos National Park, an area was specifically mentioned by the DF representatives (Dymes valley area – Dymes/Pelendri communities' area), which is considered very dangerous for forest fires outbreaks because of human activities and lack of permanent monitoring. An installation of a camera in a strategic point could be helpful for forest fire prevention.

Another suggestion of DF representatives was the installation of cameras in DF fire trucks so that in case of fire, the DF coordination teams could have images of the situation on the field. Also, the possibility of GPS sensors that would be placed in DF personnel uniforms on the field and only in the case of a forest fire, in order to rapidly being detected in case of disorientation was discussed.

The use of an UAV was also mentioned in the discussion, which could be used for different reasons:

- The first could be the control of the demarcation line between the state forest and private properties. In many cases, owners of private properties, usually bordering the state forest, enter the bordering state land to exploit a larger surface. The UAV could fly over the demarcation line at regular time intervals to identify any violation points with the help of satellite images that can be provided by ERATOSTHENIS Centre of Excellence (ECoE), partner of the project.
- It could also play a role at detecting illegal burnings of grasses and pruning during the autumn near the Koutrafas community area. The presence of the UAV, said Mr Loizou, will discourage locals from setting illegal fires at the area and will reduce the chances of forest fire outbreaks by human activities.

ANNEX 2

Questionnaire for GREEN-HIT Project Requirements Gathering (Feb and Mar 2023)

1. Please rate the importance of "offering prevention, detection and reaction to forest fires" project objective. (Scale: 1 - Not Important, 5 - Very Important) *

- ◯ Very important
- ◯ High
- ◯ Moderate
- ◯ Low
- ◯ Not important

2. Please rate the importance of "providing afforestation and/or reforestation recommendations" project objective. (Scale: 1 - Not Important, 5 - Very Important) *

- ◯ Very important
- ◯ High
- ◯ Moderate
- ◯ Low
- ◯ Not important

3. Please rate the importance of "protecting forests from illegal logging and hunting" project objective. (Scale: 1 - Not Important, 5 - Very Important) *

- ◯ Very important
- ◯ High
- ◯ Moderate
- ◯ Low
- ◯ Not important

4. Please rate the importance of "monitoring forests and forest areas" project objective. (Scale: 1 - Not Important, 5 - Very Important) *

- ◯ Very important
- ◯ High
- ◯ Moderate
- ◯ Low
- ◯ Not important

5. Please rate the importance of "offering forest mapping and inventory by collecting, combining and analyzing field data and remote sensed data." project objective. (Scale: 1 - Not Important, 5 - Very Important) *

- ◯ Very important
- ◯ High
- ◯ Moderate
- ◯ Low
- ◯ Not important

6. Are you aware of "blind spots" where forest fires are difficult to detect? *

- ◯ Yes
- ◯ No

7. What measures do you think should be taken to address these "blind spots" and improve forest fire detection in the area? *

Enter your answer

8. How concerned are you about the risks posed by "blind spots" in terms of forest fire prevention? *

- ◯ Very concerned
- ◯ Concerned
- ◯ Neutral
- ◯ Not concerned

9. Do you support the idea of sharing Forest Observatory coordinates with project partners for GIS analysis to identify "blind spots" and forests sizes? *

- ◯ Yes
- ◯ No

10. Do you believe that smoke detection, weather sensors and cameras should be installed in areas with difficult access or low visibility for early fire detection? *

- ◯ Yes
- ◯ No

11. Are you aware of the challenges related to human activities such as illegal logging, illegal entry of motor vehicles into nature trails, and other activities endangering the biodiversity of the forest parks? *

- ◯ Yes
- ◯ No

12. Do you agree that ATV's (quad bikes) and motorcycles pose a threat to biodiversity in a forest area? *

- ◯ Strongly agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly disagree

13. Do you support the installation of acoustic sensors in selected points to identify the sound of vehicles and send signals to alert the Forestry Department personnel about illegal motor vehicle entry? *

- ◯ Yes
- ◯ No

14. What other actions do you believe should be taken to mitigate the impact of motorized vehicles on nature trails and biodiversity in the forest area? *

Enter your answer

15. Which important species of flora or fauna should be monitored, and how would you suggest monitoring them within the forest? *

Enter your answer

16. Do you support the use of sensors to monitor environmental and soil parameters in specific areas to protect plant species? *

- ◯ Yes
- ◯ No

17. Do you agree with the choice of the Akamas peninsula as a case study for afforestation, deforestation, and reforestation monitoring? *

- ○ Strongly agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly disagree

18. What specific observations or recommendations do you have regarding afforestation and deforestation in the Akamas peninsula? *

Enter your answer

19. Should satellite images of the affected forest areas peninsula be gathered and monitored for evaluating the evolution of flora and forested areas? *

- ○ Yes
- ○ No

20. What role do you think UAVs should play in forest fire monitoring, and what are the potential challenges or benefits of their use? *

Enter your answer

21. How do you feel about the idea of using UAVs to confirm sensor fire alerts and provide general patrolling image footage? *

- ○ Supportive
- ○ Neutral
- ○ Concerned
- ○ Not supportive

22. Is there electricity available at your Forest Observatory Office? *

- ◯ Yes
- ◯ No

23. Is there internet coverage at your Forest Observatory Office? *

- ◯ Ethernet
- ◯ WiFi
- ◯ 2G/3G
- ◯ 4G/5G
- ◯ No

24. Is there internet coverage in the forest? *

- ◯ 2G/3G
- ◯ 4G/5G
- ◯ No

25. What is the desired sensor data collection frequency? *

- ◯ 1 hour
- ◯ 12 hours
- ◯ 24 hours
- ◯ 1 week

26. What is the desired sensor data measurement accuracy? *

- ◯ Very accurate
- ◯ Accurate
- ◯ Somewhat

27. Please share any additional comments or suggestions regarding the GREEN-HIT project.

Enter your answer