



**Results of the user need survey:
Stakeholders' expectations about the ForestWard
Observatory**

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Executive summary

1. The aspirations of a pan-European forest observatory that can facilitate access to monitoring data and encourage data sharing needs to be informed by the expectations of a broad range of stakeholders.
2. As the first step of co-designing the ForestWard Observatory with relevant actors, an online 'user needs' survey was conducted between December 2023 and April 2024 to understand stakeholders' current data use in relation to forest management, and to discover their expectations. Questions covered three main themes: personal background, current data use related to forest management, and future data needs and expectations towards the Observatory.
3. 60 respondents completed the survey, 26 experts from within the FORWARDS consortium and 34 external stakeholders, including forest managers, policymakers, public administration officers, forest monitoring experts, and researchers.
4. Main findings related to current data use:
 - a. Depending on the context, the personal background and the given task, forest experts utilise diverse types of data when making their decisions.
 - b. Data on forest area, composition, removals, and forest growth are used by the most respondents, followed closely by data on forest stock, disturbances and climate related information.
 - c. Data on biodiversity, pests and diseases, and socio-economic aspects were reported to be particularly difficult to obtain (if sought to be obtained) from existing databases.
 - d. Despite the general patterns of current data use explained above, differences in perceived data accessibility were found between FORWARDS researchers and external stakeholders. FORWARDS researchers proved to be at an advantage when accessing data on climate change, disturbances and biodiversity, while data on socio-economic factors and removals were perceived to be easier to obtain by external experts.
 - e. National data sources (e.g. national land survey data) were reported as the most frequently used information sources.
5. Findings related to future data needs and expectations:
 - a. The top three challenges of forest monitoring at the EU level were the weak alignment between forest monitoring and various EU/national policies, the weak availability of timely information on European forests, and the lack of transparency and availability of data for multiple stakeholders.
 - b. Climate change impacts and context-specific (locally tailored) resilient forest management practices were the two most important knowledge needs mentioned by respondents where data availability should be improved.
6. Expectations towards the ForestWard Observatory:
 - a. Respondents would welcome timely and accurate decision-support for localized forest management decisions based on these data.
 - b. To enable the widest use of the ForestWard Observatory in the future, data should be fine grain, covering the continent (or at least the EU member states), and should be open source, available ideally in multiple languages.
7. As a synthesis, we argue that the ForestWard Observatory can play an important role in providing easy access to scientific data on forests' vulnerability to disturbances, biodiversity decline and climate change, if it is accessible widely and without a paywall, and if it shares timely and fine grain information.

1. Introduction

Forests and society can transform, mitigate and adapt to climate-induced changes. This requires, however, suitable forest management practices, based on timely and reliable information. The ForestWard Observatory - a European observatory for forests' climate change impacts which is being set up by the Forwards project - will operate as a long-lasting practical tool to support decision-making:

- at local and sub-national scale to deliver more operational information for local climate smart forestry and restoration management practice, and
- at national and European scale to provide a strategic perspective of disturbances, future risks and critical vulnerabilities and threats to European forests.

As a first step of co-designing the ForestWard Observatory with stakeholders and potential future users, and in order to understand the niche to be filled by the Observatory, a survey was launched between December 2023 and April 2024. The objective of the survey was twofold: first, to understand which information sources are currently used as the basis of forest-related decisions; and second, to outline how (through which functions, in which format, etc.) the ForestWard Observatory could support decision making the most efficiently. This report shares the results of this survey.

The survey was designed by Task4.2 leader ESSRG, in collaboration with other project partners, especially WP5 leaders who are responsible for designing the ForestWard Observatory. Knowing that several previous and on-going projects have run similar data collection campaigns recently, we first studied the results of previous campaigns (e.g. the EFINET survey on relevant forest variables and their adequate spatial and temporal scales, and the User needs and requirement baseline report of the Forest Carbon Monitoring project). We also made attempts to align this survey with the aims of the FORWARDS Task4.4 questionnaire on forest managers' attitudes towards climate smart forestry. Consequently, to avoid overlaps and stakeholder fatigue, this user needs survey was designed with a narrow focus on data requirements that support decision making, and targeted a strictly defined stakeholder group, namely decision makers, administrative bodies and experts engaged in forest-related decision making at the European or national levels. Survey questions are presented in Annex 1.

The survey was launched in December 2023 using Google Forms and closed in April 2024. A database of over 260 contacts across Europe was created containing official (publicly available) contacts of umbrella organizations (such as Forest Europe, EUSTAFOR, ENFIN, FSC, WWF etc.), relevant EU administrative bodies (such as DG Clima, DG Agri, DG Environment, EEA, etc.), and national decision makers (official contact points of ministries responsible for forest management). The list of contacts was created based on desk-top research: first key organizations were identified, then official contact points were searched for via an extensive internet search. Invitation to the survey was circulated to this contact list via email, incl. several reminders. Additionally, the survey was advertised through the project's social media channels (LinkedIn and X), and project partners were also asked to circulate the survey invitation among their networks. As an appreciation of respondents' contribution to the project, Amazon vouchers were offered to every 10th respondent who completed all the questions. Despite all these efforts, the response rate remained very low (below 10%), providing only weak reliability of the results. Therefore, we decided to combine the survey with an expert elicitation and invited FORWARDS project partners to share their views on the same questions. In the end we obtained over 60 responses across Europe and were able to carry

out a comparison of needs and perceptions of project partners versus other stakeholders. Descriptive statistics (frequencies, averages, modes, etc), crosstabs and correlations were run in SPSS, while figures were drawn in MS Excel.

2. Key characteristics of the respondents

Altogether 64 respondents completed the survey. The first respondent completed the survey as part of a testing phase, and another three indicated no direct involvement in any forest-related activities. These four responses were therefore eliminated from the sample, and the remaining 60 responses were analysed. Out of the 60 responses, 34 were submitted by external stakeholders and 26 came from within the FORWARDS consortium. Figures 1-3 show the age, gender, and geographical representation of the respondents. The sample is relatively diverse in terms of age but skewed towards male respondents indicating the gendered nature of forest-related activities.

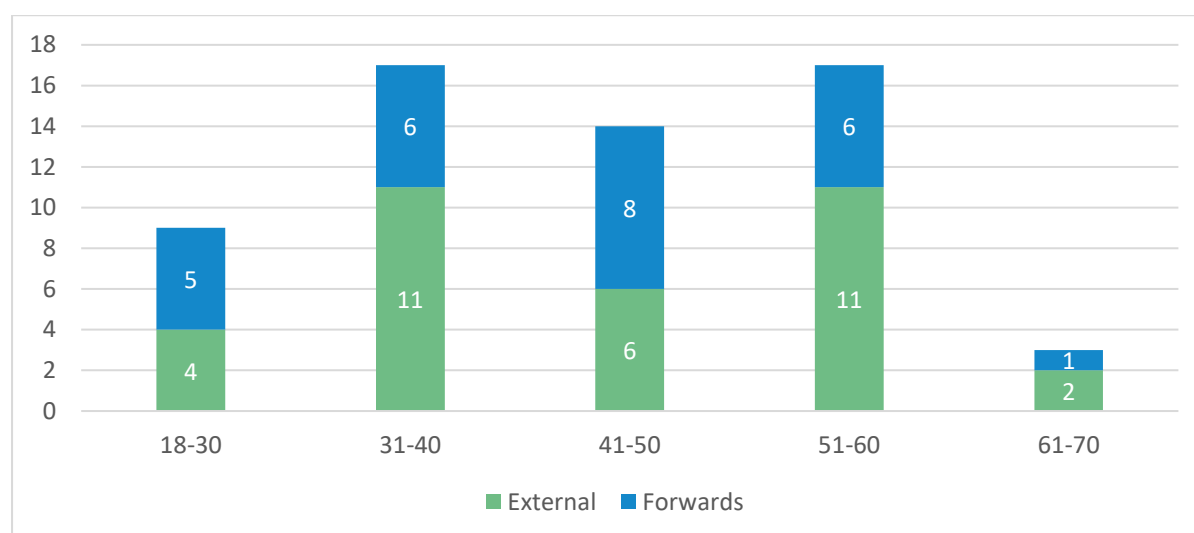


Fig.1. Number of respondents (y axis) distribution across five age groups

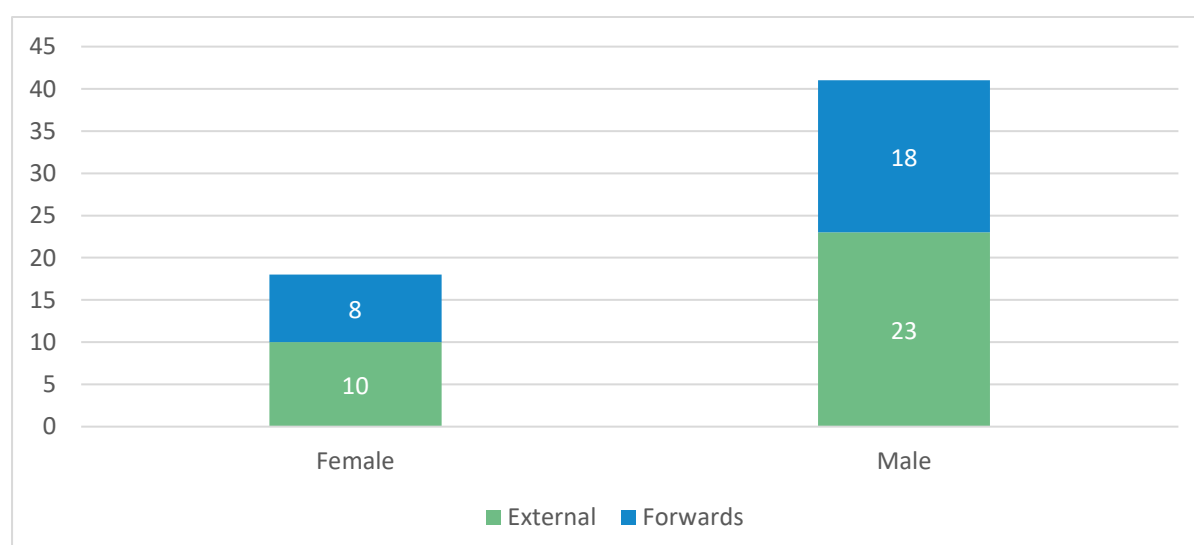


Fig.2. Number of respondents (y axis) across genders

While a large part of our respondents works internationally (either at the pan-European or the global scale), more specific geographical regions within Europe are unequally represented: one-third of the respondents have an in-depth understanding of the Central-European region (n=21), while roughly one-tenth of the respondents represent Northern and South-European countries (n=7 and n=6, respectively).

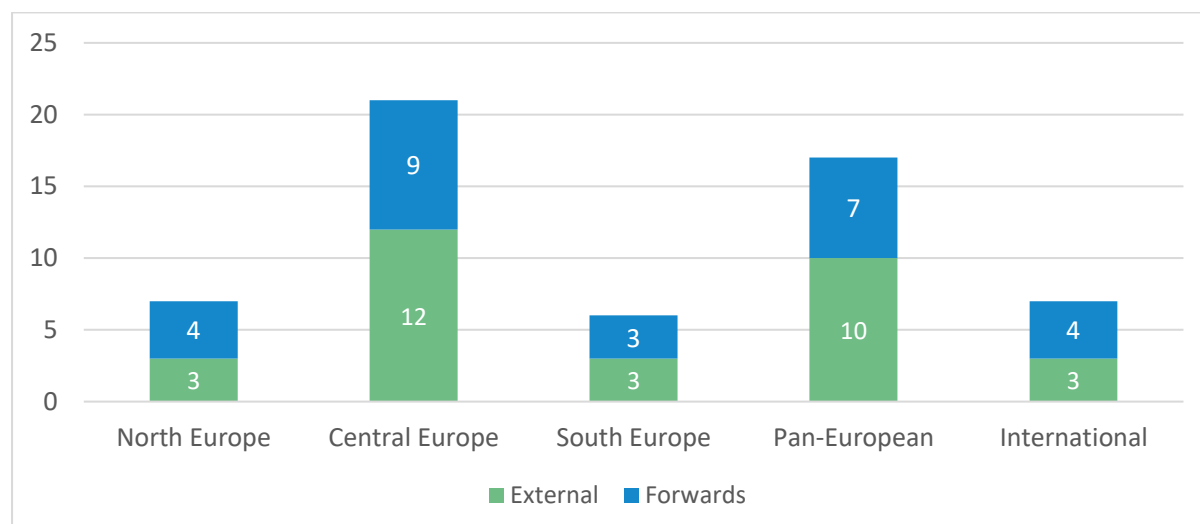


Fig.3. Number of respondents (y axis) across different geographical regions

All respondents had a BA, MA or higher level of degree, and the majority earned their degree in forestry (n=37) or ecology/biology (n=14). Regarding their professional background (Fig.4.), most respondents affiliated themselves with research (n=36, including almost all the Forwards researchers). Not surprisingly, external respondents had a more diverse background than FORWARDS researchers, including experts in management, monitoring, policy and administration (although research was overrepresented amongst external respondents as well). Among forest managers we had representatives of both private and public forests and in policymaking, as well as policy experts, we also had an advocacy group represented. Regarding the main area of expertise of respondents choosing research as their main background, we found diverse topics ranging from biodiversity and climate adaptation through to forest resource and forest health analysis and economics and rural livelihoods. The “Other” category was picked by one respondent whose main relation to forest-related activities was stakeholder engagement.

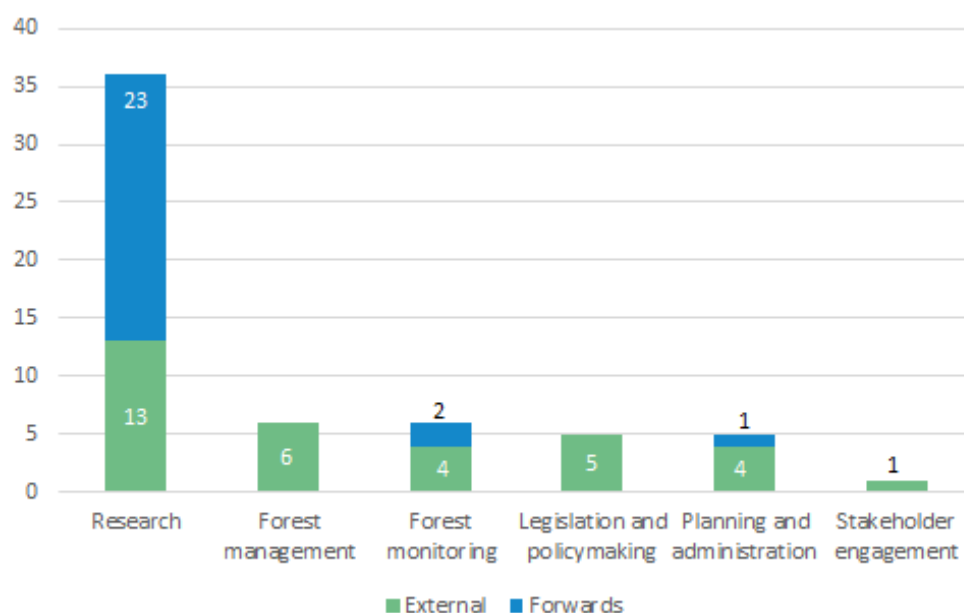


Fig.4. Number of respondents (y axis) across different professional backgrounds

Another key aspect of respondents' professional background is the geographical and administrative scales where they have the deepest level of knowledge and experience. As Fig.5. highlights, the majority of respondents were mostly engaged in forest-related activities either at the European level (n=21) or at the national level (n=17). Only a small minority had predominantly local level expertise (n=4). This was in line with our intentions – as the Task4.4 questionnaire focuses on forest owners and managers, we targeted stakeholders at higher levels.

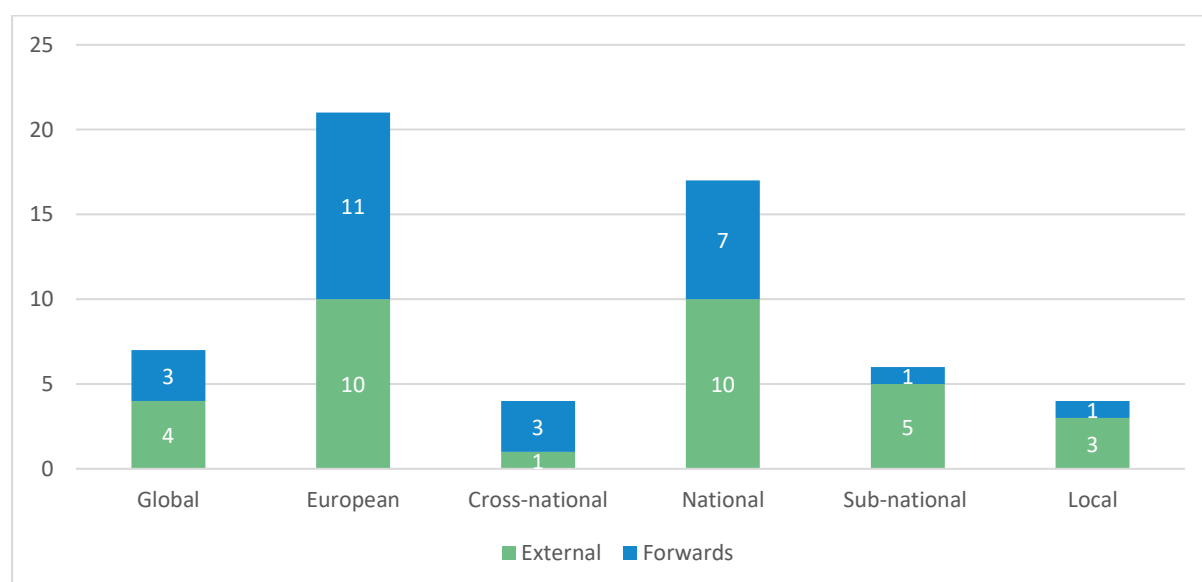


Fig.5. Number of respondents (y axis) engaged in forest-related activities at different geographical/administrative scales

3. Results

3.1. Current data use, gaps and challenges in forest-related decisions

To find the niche of the ForestWard Observatory, it is important to understand how stakeholders and experts currently use forest-related data when making their decisions. Therefore, we listed different types of data in the survey and asked respondents to indicate if they use the given type of data or not, and if yes, to indicate how easy it is for them to access the data (Fig.6.). Every respondent indicated that they use different types of data simultaneously, but there was no one data type which is used universally by all the respondents. This highlights that **depending on the context, the background and the given task, professionals combine diverse types of data** when making their decisions. Data on forest area, composition, removals, and forest growth are used by the most respondents, followed closely by data on forest stock, disturbances and climate related data. Data related to pests and diseases and socio-economic factors (e.g. forest revenues, contribution to GDP, timber market) are the least frequently used, while usage of data about biodiversity, forest structure, soil and ground-water data, institutional variables, and spatial patterns is somewhere in-between.

Considering the accessibility of the different types of data, **data on biodiversity, pests and diseases, and socio-economic aspects were reported as the most difficult to access, while forest area and climate related data were reported to be the most easily accessible**. The accessibility of the data shows a weak connection with the frequency of data use, i.e. data which are hard to obtain are less frequently used. For some data types (e.g. removals), respondents were highly polarized, that is, an almost equal number of respondents found it difficult or easy to access the given data.

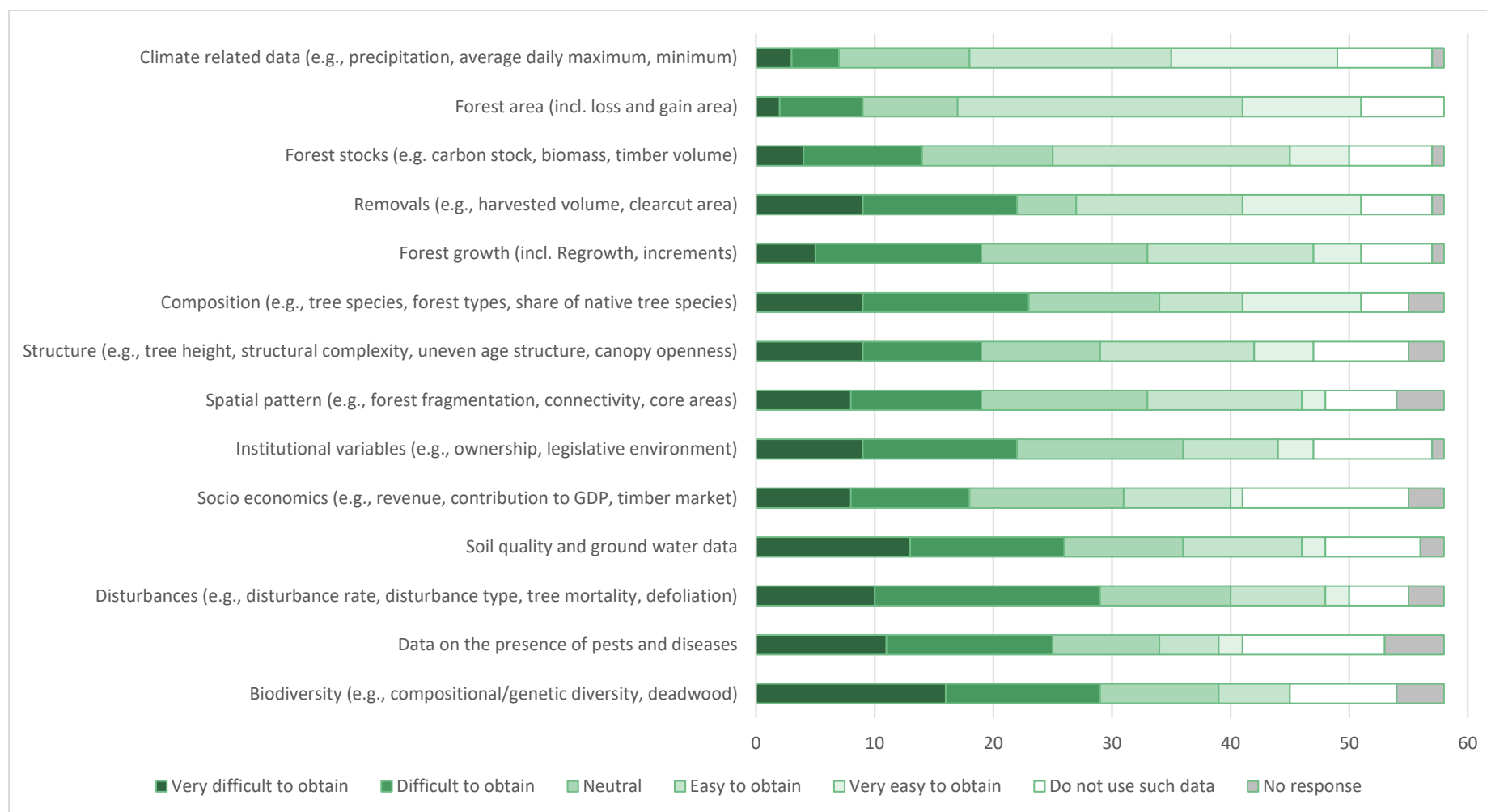


Fig.6. Use and accessibility of different types of data (n=58). Respondents were asked to indicate if they use the given type of data, and if yes, they were asked to assess on a scale of 5 how easy it is to obtain the given type of data. The x axis shows the number of respondents for each category. The y axis lists the different types of data from the most easily accessible (top) to the most difficult to obtain (bottom), based on the calculation of the average values.

For each data type we compared responses of external and FORWARDS experts. Due to the small sample size, statistically significant differences could not be observed. Still, for some data types there is a difference between the two groups in terms of how easily they can obtain data. Table 1 shows the average values of the two groups for each data type after converting responses to an ordinal scale where 1 was assigned to the response 'very difficult to obtain data' and 5 was assigned to the response 'very easy to obtain data' (this means that the higher the average value, the easier to obtain the given type of data). Forwards researchers are at an advantage when accessing data on climate change, disturbances and biodiversity, while data on socio-economic factors and removals were perceived to be easier to obtain by external experts. This suggests that the **ForestWard Observatory can play an important role in providing easy access to scientific data on forests' vulnerability to disturbances, biodiversity decline and climate change.**

Table 1 Differences in perceived data accessibility by external stakeholders and Forwards researchers

Type of data	Average values of...		Difference
	External	Forwards	
Biodiversity (e.g., compositional/genetic diversity, deadwood)	1,923077	2,421053	0,497976
Data on the presence of pests and diseases	2,333333	2,352941	0,019608
Disturbances (e.g., disturbance rate, disturbance type, tree mortality, defoliation)	2,275862	2,714286	0,438424
Soil quality and ground water data	2,538462	2,409091	-0,12937
Socio-economics (e.g., revenue, contribution to GDP, timber market)	2,84	2,3125	-0,5275
Institutional variables (e.g., ownership, legislative environment)	2,724138	2,5	-0,22414
Spatial pattern (e.g., forest fragmentation, connectivity, core areas)	2,793103	2,789474	-0,00363
Structure (e.g., tree height, structural complexity, uneven age structure, canopy openness)	2,777778	3,05	0,272222
Composition (e.g., tree species, forest types, share of native tree species)	2,8	3,047619	0,247619
Forest growth (incl. Regrowth, increments)	3,033333	2,857143	-0,17619
Removals (e.g., harvested volume, clearcut area)	3,25	2,736842	-0,51316
Forest stocks (e.g. carbon stock, biomass, timber volume)	3,266667	3,2	-0,06667
Forest area (incl. loss and gain area)	3,666667	3,619048	-0,04762
Climate related data (e.g., precipitation, average daily maximum, minimum)	3,296296	4,227273	0,930976

In response to an open question (Q2.3) respondents explained that they especially lack access to spatial data on soil characteristics and soil health, deadwood, game population (managed for hunting), disturbances and vulnerability of species or habitats, as well as ownership and economics. Those who work at the European scale mentioned having difficulties with accessing National Forest Inventories. Several respondents highlighted a lack of knowledge on ecosystem services and biodiversity, especially information on which measures to apply in different locations to better enhance biodiversity on the ground. Some respondents also mentioned that data on private forests are the most difficult to access

(independently of the data type). These qualitative responses were categorized according to the different data types listed in Q2.2 and a matrix was created showing the accessibility and the relevance of the different types of data (Fig.7). The relevance of data was estimated based on the sum of respondents mentioning the given data as being currently used in their work (Q2.2. responses) or as highly relevant but currently unused in their work (Q2.3 responses). The accessibility of data was calculated as the average values of responses to Q2.2 on how easy it is to obtain the different types of data.

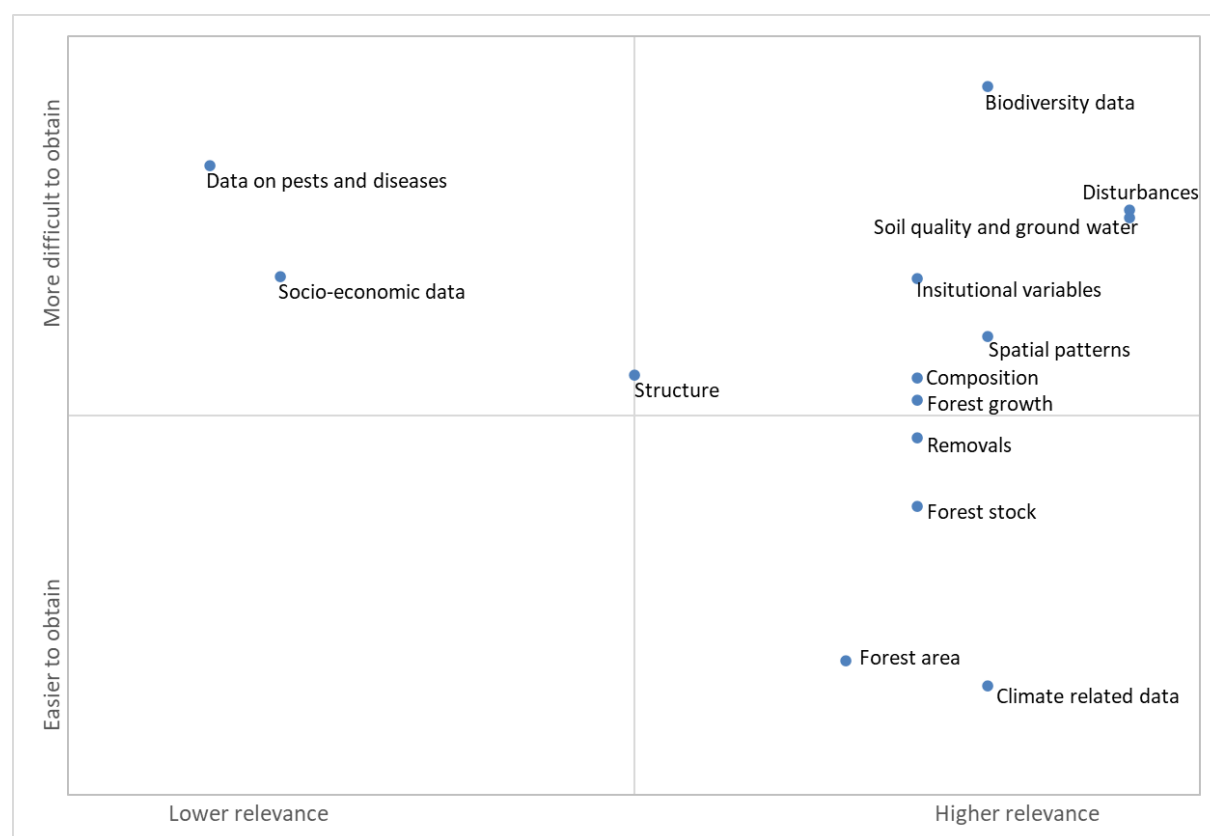


Fig.7. The accessibility and relevance of the different data types

Another crucial aspect of current data use is the source of data and information (Fig.8). **National data sources (e.g. national land survey data) were reported as the most frequently used information sources** for both external stakeholders and FORWARDS researchers, but small differences are visible in the frequency of use of other data sources. External experts rely heavily on State of the European Forests reports, consultation with experts (which is much less relevant for FORWARDS researchers), and local data sources. On the other hand, Copernicus satellite data and products were reported to be highly relevant for FORWARDS researchers, followed by State of the European Forests reports and local data sources. Additional data sources mentioned by the respondents included EUFORGEN, FAO, GBIF, HRL, ICP Forests, ICOS, JRC, LTER, NFI, SINFOR, UNECE, as well as Horizon projects, scientific publications and own data collection / sampling.

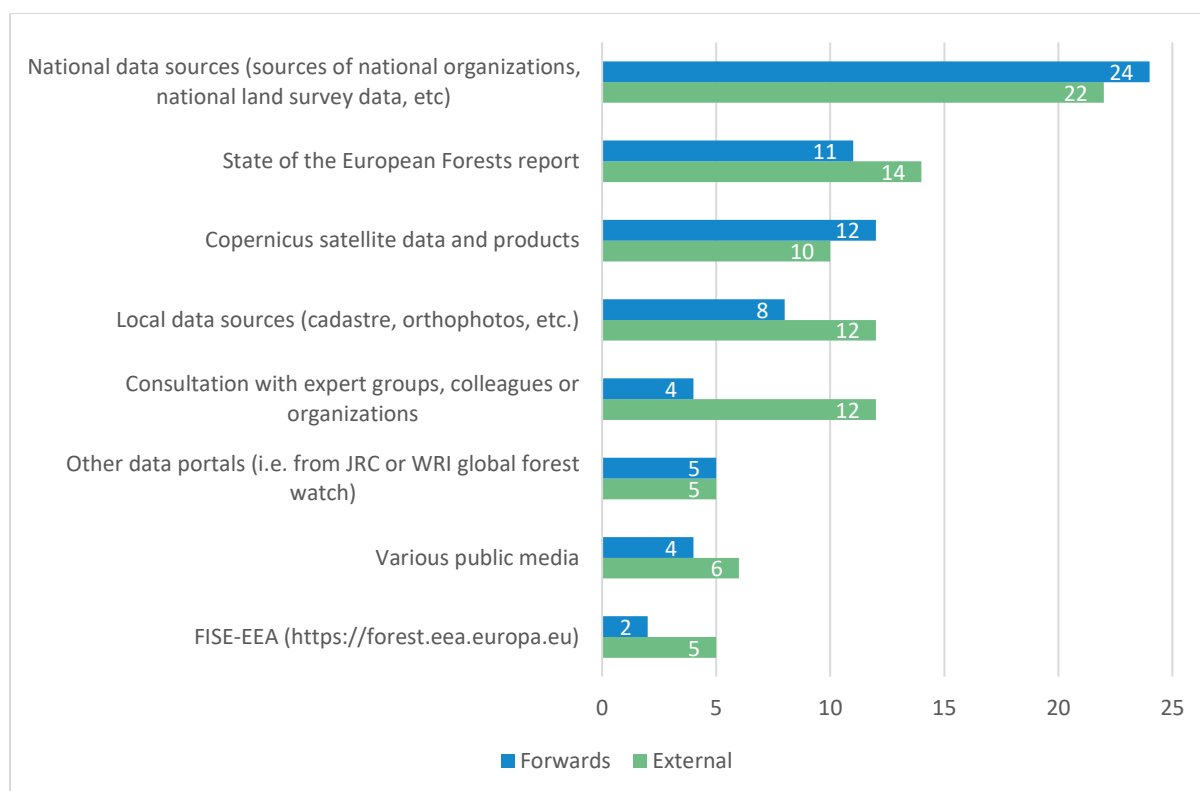


Fig.8. Sources of data and information used more and less frequently by respondents. Each respondent could pick maximum three data sources which she uses the most frequently (x axis shows the number of respondents selecting the given data source).

3.2 Expectations for the ForestWard Observatory

3.2.1 Challenges to resolve for climate resilient forestry in Europe

In the third part of the questionnaire, we asked respondents to rank 9 different challenges according to how important these are for improving European level forest monitoring (Fig.9.). **The top three challenges (according to the mode values) were the ‘closer alignment between forest monitoring and various EU/national policies’, the ‘availability of more timely information on European forests’, and the ‘increased transparency and availability of data for multiple stakeholders’** (such as policymakers, public administrators, monitoring experts and forest managers), while the least important challenge was the lack of a cloud-based flexible processing and monitoring system.

To understand if external stakeholders and Forwards researchers have different or similar priorities, we compared the average ranking of each challenge (average ranking were calculated after the ranks were transformed to a 9-item ordinal scale, where 1 means the most important and 9 means the least important option, therefore the smaller the average value, the most important the given challenge). Due to the small sample size no significant relationships could be observed, but slight differences were visible. Table 2 compares the ranking of the challenges in the two sub-samples based on the mode values and indicates the difference between the average values. This comparison highlights that the alignment between policy objectives and monitoring, and the broadening of the monitoring aims are

rather prioritized by FORWARDS researchers, while the **timeliness and the accuracy of data were perceived more important by external stakeholders.**

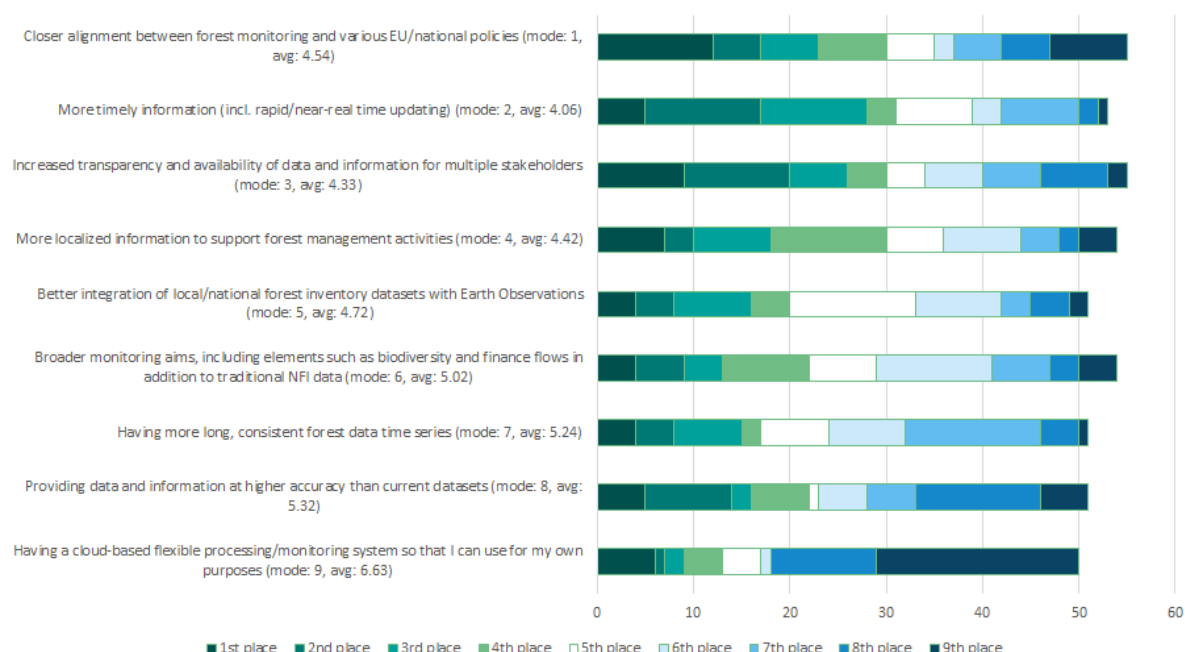


Fig.9. The relative importance of challenges to be resolved to improve forest monitoring at the European scale. Respondents could rank the challenges from 1 to 9, where 1 meant the most important challenge from their perspective and 9 meant the least important one.

Table 2 Comparing the ranked list of challenges between external stakeholders and Forwards experts (green highlights challenges prioritized higher by external stakeholders and red highlights challenges prioritized higher by Forwards researchers)

Rank by external experts (avg)	Challenge	Rank by Forwards researchers (avg)
1 (3.83)	More timely information (incl. rapid/near-real time updating)	3 (4.36)
2 (4.27)	More localized information to support forest management activities	4 (4.61)
3 (4.34)	Increased transparency and availability of data and information for multiple stakeholders	2 (4.32)
4 (4.74)	Better integration of local/national forest inventory datasets with Earth Observations	5 (4.68)
5 (4.84)	Closer alignment between forest monitoring and various EU/national policies	1 (4.13)
6 (5.04)	Providing data and information at higher accuracy than current datasets	8 (5.68)
7 (5.14)	Having more long, consistent forest data time series	7 (5.36)
8 (5.23)	Broader monitoring aims, including elements such as biodiversity and finance flows in addition to traditional NFI data	6 (4.73)
9 (6.45)	Having a cloud-based flexible processing/monitoring system so that I can use for my own purposes	9 (6.90)

3.2.2. Future data needs

Respondents were also asked about which specific data and information they need the most for their decisions (Fig.10.). No significant differences were found between the needs of external and FORWARDS experts: both groups identified **‘climate change impacts’ and ‘context-specific (locally tailored) resilient forest management practices’ as the two most important knowledge needs**. This is in line with answers given to our previous questions on which type of data respondents use the most frequently, and highlights that even though climate related data is relatively easy to access and already used, experts in the field would benefit from a one-stop-shop where different types of data are accessible and accompanied by decision support (i.e. information on possible management options considering the available data).

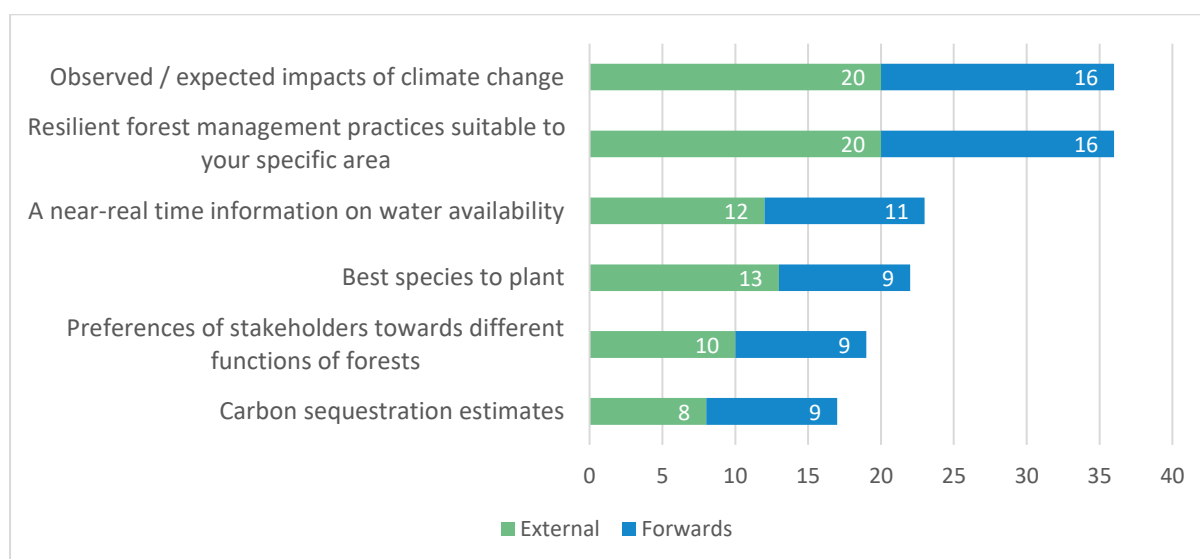


Fig.10. Data needs of external and Forwards experts to be met by the ForestWard Observatory

Regarding the ideal spatial resolution of data (Fig.11.), high (below 10 metres) and medium (between 10-30 metres) resolution was preferred by respondents.

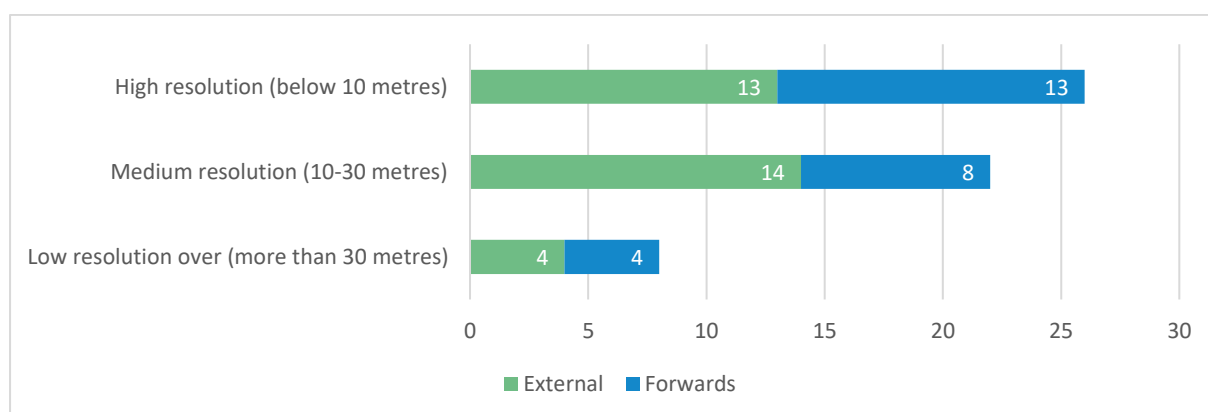


Fig.11. Ideal spatial resolution of data accessible through the ForestWard Observatory

Regarding the ideal spatial coverage of data (Fig.12.) a remarkable difference could be observed between preferences of external experts and FORWARDS researchers. **External experts preferred local, subnational and national data coverage** over higher spatial scales, while Forwards researchers thought that the ForestWard Observatory should offer a

European spatial coverage. This caveat can be overcome if data across all European countries are available at the same level of accuracy (and therefore both local to national and European-level data coverage can be guaranteed).

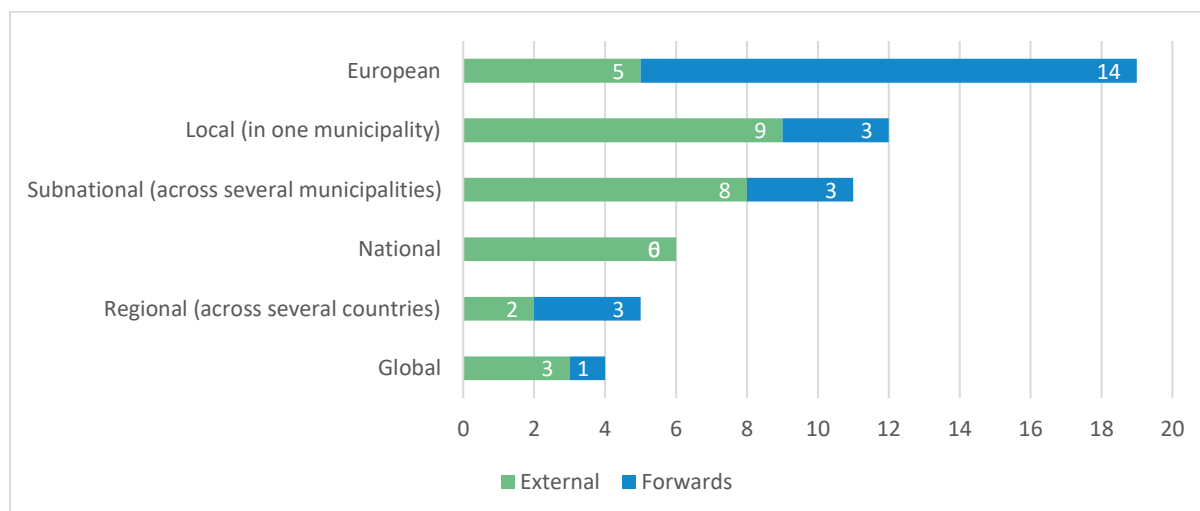


Fig.12. Ideal spatial coverage of data accessible through the ForestWard Observatory

Regarding respondents' preferences on how frequently to update the data (or how frequently they would access the platform for updated information) (Fig.13.) FORWARDS researchers were found to be more ambitious requiring near-real time data updates, while most external stakeholders opted for annual updates. This is in slight contradiction with the question where respondents were asked to rank the challenges of current European forest management, and where external respondents ranked timeliness and accuracy of data as more important than FORWARDS researchers (although these challenges were only in the middle range).

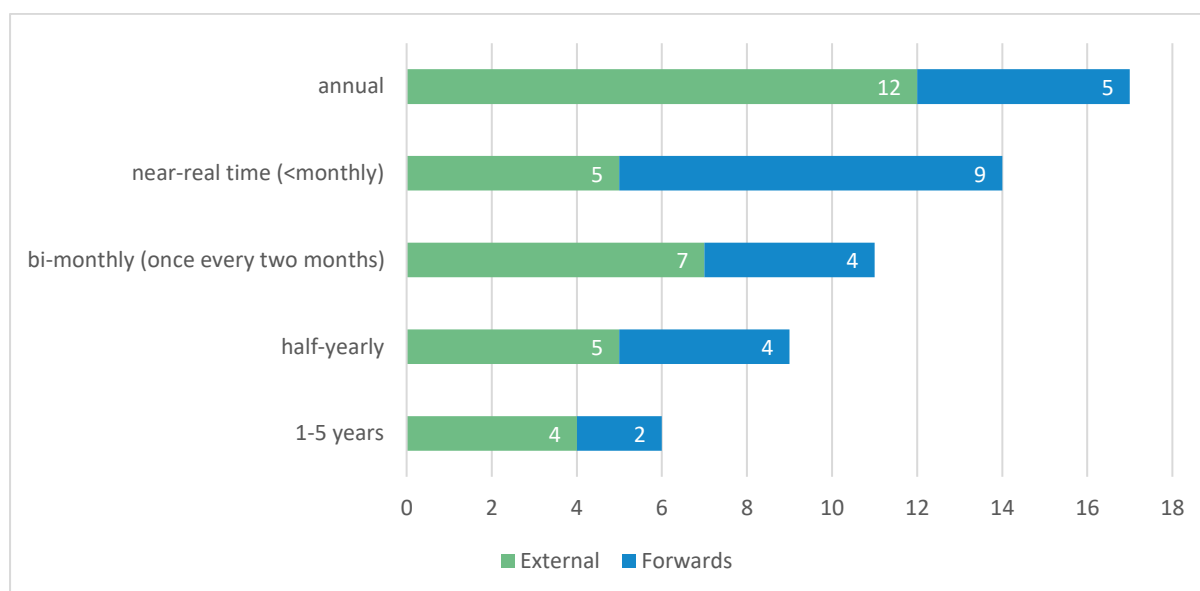


Fig.13. Ideal frequency of updating the data in the ForestWard Observatory (number of respondents can be seen on the x axis)

3.2.3. Expectations for the user interface

The last couple of questions of the survey focused on the expected user experience of the ForestWard Observatory. A bit more than half of the respondents (n=31) suggested that the Observatory should be made available in more languages, not just in English (Fig.14.). This is reinforced by our observation that some of the contacted experts refused to participate or asked for special support in answering the questions of this survey because of language barriers. Therefore, **if the Observatory truly aims to provide support to decision makers from local to national and European-scale, multiple language solutions should be investigated.**

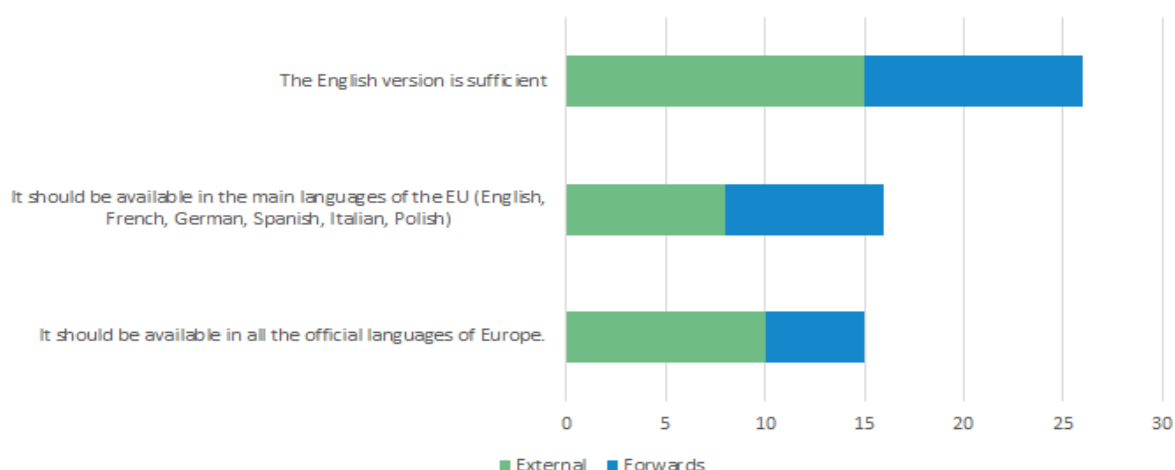


Fig.14. Preferred language(s) of the ForestWard Observatory (number of respondents are indicated at the x axis)

Considering the user interface (Fig.15), the majority of respondents preferred a dynamic interface which provides online accessible information and decision support. The second most popular option – especially among external stakeholders – was FAIR (Findable, Accessible, Interoperable and Reusable) and free access to the datasets through the Observatory, but no considerable difference was observable in the preferences towards the other technical options. Newsletters or media outputs were considered unimportant by FORWARDS researchers, but still a quarter of external respondents would like to receive information from the Observatory through such channels.

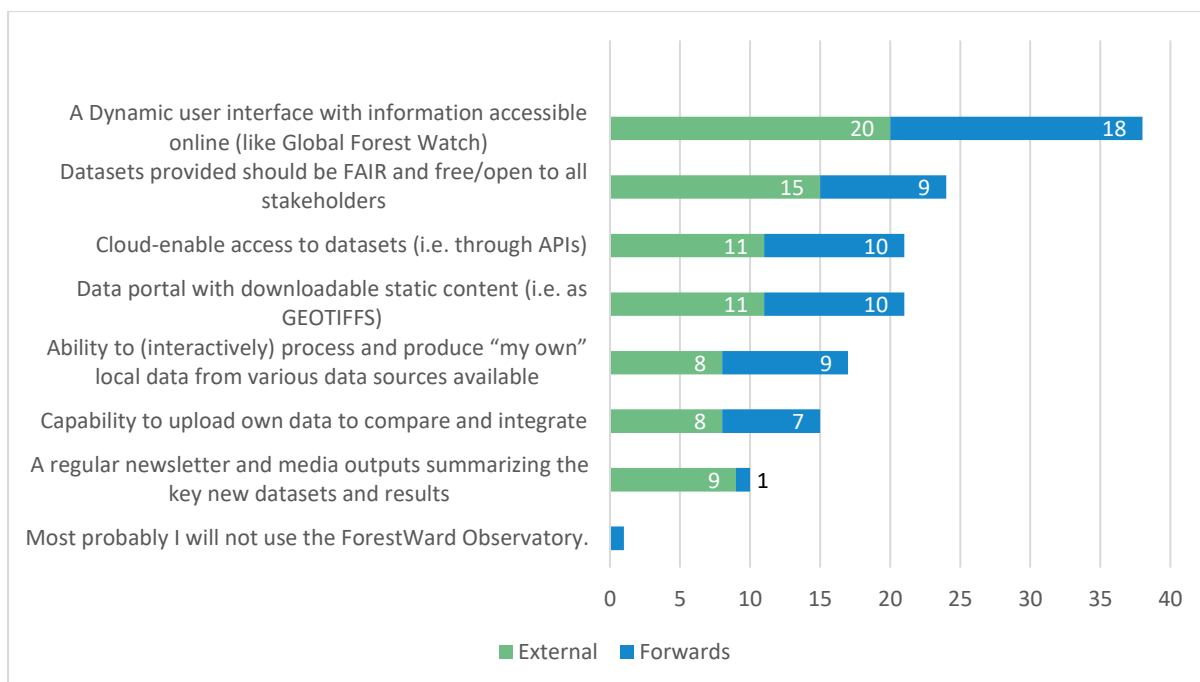


Fig.15. Preferred interfaces through which external and Forwards experts would like to access and use the ForestWard Observatory (respondents could select multiple options, x axis shows the number of respondents picking the given option)

Lastly, and as a summary, Fig.16. shows the self-estimated probability of using the Observatory either for accessing data and information, or for uploading and sharing own data. Overall, the results suggest positive expectations towards the Observatory – around 70% of the respondents would ‘definitely’ or ‘probably’ use it in the future (although they did not have a full picture of the Observatory functionalities when they completed the survey). However, there is a higher probability that future users will use the Observatory passively, i.e. they will download information but not necessarily share their own data or knowledge.

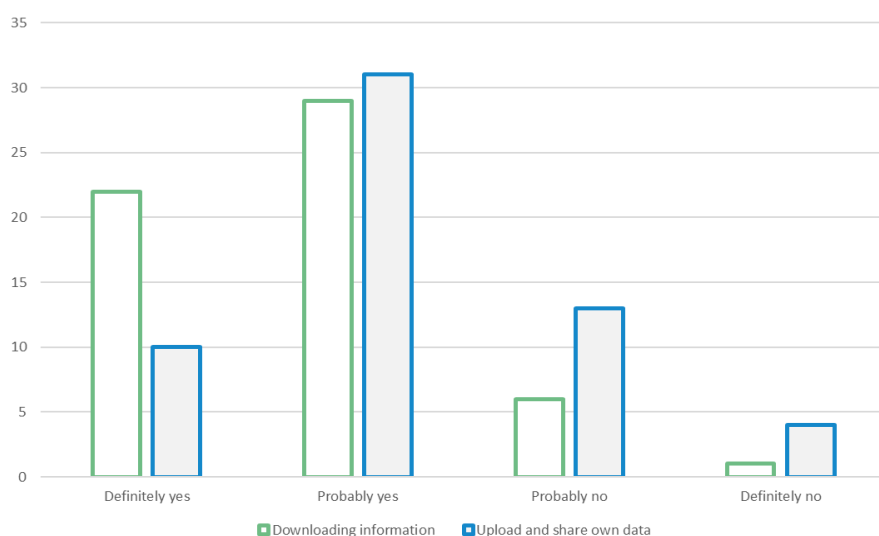


Fig.16. Self-estimated probability of using the ForestWard Observatory for accessing and sharing data and information (y axis shows the number of respondents)

4. Concluding remarks

60 respondents from across Europe answered our survey regarding their current data use, data needs and expectations with regard to the ForestWard Observatory, including external stakeholders and FORWARDS researchers. Key findings are listed below:

- Currently, respondents mainly rely on national data sources and combine different types of data from different sources to meet their information and knowledge needs.
- Many respondents highlighted difficulties of accessing data, especially data and information on soil, biodiversity and disturbances, but external experts and FORWARDS scientists found different types of data more or less accessible.
- Both of these findings highlight that an interface where different types of data are accessible, and where sharing information across diverse disciplines and types of expertise is possible, could fill an existing gap and could make decision making on forests easier.
- This is also underlined by the fact that several respondents expressed their need for decision-support style information, i.e. data and knowledge on what types of species to plant in different localities to best adapt to (or mitigate) the impacts of climate change.
- However, to enable the widest use of the ForestWard Observatory, data should be fine grain, covering the continent or at least the EU member states, and should be freely accessible, ideally in multiple languages.
- Based on self-estimated probabilities of future use, there is significant demand for such a dynamic user interface following the specifications above, although potential users are more comfortable with using data than sharing their own.

This report provides input to FORWARDS WP5 and is the first step of co-designing the ForestWard Observatory. As a follow-up exercise, we have already organized a visioning workshop within the consortium where priorities for the Observatory were identified (Annex 2), and the need for strong collaboration with other ongoing projects were emphasised. The major limitation of this study was its low response rate. To broaden our understanding of user preferences we have already started a collaboration with the Monifun project which organizes stakeholder workshops on data needs, allowing quantitative information from this user need survey to be complemented with qualitative information from the workshops.

5. Annex 1: The questionnaire

Introduction about the project

Forests and society can transform, mitigate and adapt to climate-induced changes. This requires, however, suitable forest management practices, and timely and reliable information based on which these management practices can build on. The ForestWard Observatory – a European observatory for forests climate change impacts – will operate as a long-lasting practical tool to support decision-making:

- at European and national scale to provide a strategic perspective of disturbances, future risks, and critical vulnerabilities and threats to European forests;
- at regional and local scale to deliver more operational information for local climate smart forestry & restoration management practice.

This survey aims to discover the needs of the potential users of the ForestWard Observatory. Our aim is twofold: first, to understand which information sources are currently used as the basis for forest-related decisions; and second, to outline how (through which functions, in which format, etc.) the ForestWard Observatory could support decision-making the most efficiently. Filling the survey requires approximately 15 minutes.

We appreciate your contribution and your valuable insight deserves a reward. Complete our survey before April 30th. Every tenth respondent, answering all the questions, and providing a valid email will receive an Amazon voucher worth 40 euros.

If you have any questions, please contact Eszter Kelemen (FORWARDS Task4.2 leader) at kelemen.eszter@essrg.hu

Information on data management

This survey is anonymous, and your participation is fully voluntary. You can quit the questionnaire anytime. Your answers will be consulted only by the FORWARDS consortium researchers and will not be passed on to third parties. Data will be securely stored at ESSRG Nonprofit Ltd's official online workspace (Google Space managed by the consortium member ESSRG) and will be analysed in an aggregated form. No contact details will be asked for unless you explicitly indicate your willingness to be informed about the project at the end of the survey.

Please click the box below if you agree to participate.

Section 1. Background information

Q1.1. What is your involvement in forestry (Please indicate, the main, most typical area)?

- I work in forest management
- I work in forest-related legislation and policy-making
- I work in forest-related planning and administration
- I work in forest-related research and monitoring
- I am not involved in forestry → END SURVEY

Q1.2. What is your age?

- ____ years
- I prefer not to answer

Q1.3. What is your gender?

- Male
- Female
- Other
- I prefer not to answer

Q1.4. Please add at what level do you work as a forestry expert:

- Sub-national
- National

- Regional
- European
- Global

Q1.5. In which country you are working as a forestry expert (please add the most typical)? If you are working at the European-level (e.g., in an EU organization), please write Europe.

Q1.6. What type of organization are you working for primarily as expert of forestry? NGO-k?

- Public (e.g., governmental agency)
- Private (e.g., private company)
- I prefer not to answer

Q1.7. Do you have a university degree (BA, MA or PhD) in disciplines related to forest management?

- Forestry, or similar
- Ecology, biology
- Agronomy
- Other, please explain:
- I have no forest management related university degree (BA/MA/PhD)
- I have no university degree (BA/MA/PhD)
- I prefer not to answer

Section 2. Current practices

Q2.1. Please describe shortly your main task or activity related to forest management. (Open ended question)

Q2.2. What kind of forest data do you routinely use in your work? Please click all which you use, and also evaluate how easy it is to obtain the data which you use (1 means that it is very difficult to obtain, 5 means that it is very easy to obtain).

- Traditional variables (forest area, carbon stock, biomass, timber volume, increments, loss/gain area)
- Removals (harvested volume, clearcut area)
- Structure (tree height, structural complexity)
- Composition (tree species, forest types)
- Biodiversity (compositional diversity, deadwood)
- Disturbances (disturbance rate, disturbance type, tree mortality, defoliation)
- Spatial pattern (forest fragmentation, connectivity, core areas)
- Socio economics (revenue, contribution to GDP, timber market)
- Institutional variables (ownership, legislative environment)
- Climate related data (precipitation, average daily maximum, minimum)
- Soil quality and ground water data
- Data on the presence of pests and diseases

Q2.3. Is there any type of data which would be necessary/useful for your work, but currently you do not have access to it?

- No.

- Yes, please, list them: ...

Section 3. Future needs and expectations

In the FORWARDS project we prototype the ForestWard Observatory, a European observatory for forests' climate change impacts which can be used as a long-lasting practical decision-support tool. The ForestWard Observatory will provide:

- timely and detailed information on European forests' vulnerability to climate change impacts
- science-based knowledge to guide management using the principles of climate-smart forestry, ecosystem restoration, and biodiversity preservation (CSF & Restoration)
- stakeholder engagement and public participation in decision-making processes.

In the following we would like to better understand which functions such an observatory should have, and how it should be working, to help your work as much as possible.

Q3.1. Please describe the major challenges you face in your work concerning climate smart forestry and restoration. What impedes the climate resilience and good ecological status of forests? (Open ended question)

Q3.2. What kind of information or data could help you to improve the resilience of the forests your work is focusing on? Please rank the following options.

- near-real time information on water availability
- resilient forest management practices suitable to your specific area
- best species to plant
- observed / expected impacts of climate change
- preferences of stakeholders towards different functions of forests

Q3.3. What would be the ideal spatial resolution of the data available through the observatory to most efficiently support your work?

- Low resolution
- Medium resolution
- High resolution
- If you have different needs, please explain:

Q3.4. What would be the ideal spatial coverage of the data available through the observatory to most efficiently support your work?

- Subnational
- National
- Regional
- European
- Global

Q3.5. What would be the ideal temporal frequency of data available through the observatory to most efficiently support your work?

- Monthly
- Annual
- One to three yearly
- If you have different needs, please explain:

Q3.6. In your opinion, should the planned forest observatory be available in multiple languages?

- The English version is sufficient
- It should be available in the main languages of the EU (English, French, German, Spanish, Italian, Polish)
- It should be available in all the official languages of the EU.

Q3.7. Please estimate the probability of whether you would use the observatory in the future. Please evaluate it! (1 – definitely will not use it; 2 - probably will not use it, 3 – probably will use it; 4 - definitely will use it).

- Use filtered, parametrized data.
- Upload own existing data.

Q3.8. If you would like to use the ForestWard Observatory in the future, what would be the ideal way of using the information you need? You can choose maximum three options.

- Dynamic user interface with information accessible online (like Global Forest Watch)
- Cloud-enable access to datasets (i.e. through APIs)
- Data portal with downloadable static content (i.e. as GEOTIFFS)
- Datasets provided should be FAIR and free/open to all stakeholders
- Capability to upload own data to compare and integrate
- A regular newsletter and media outputs summarizing the key new datasets and results
- Ability to (interactively) process and produce “my own” local data from various data sources available
- Most probably I will not use the ForestWard Observatory.

Q3.9. If you have any further remarks or suggestions, please add them (Open question)

Do you work on activities related to the Forwards project, or belong to the Forwards consortium?

- Yes → END SURVEY
- No

Thank you for your cooperation! If you would like to receive further news about the ForestWard Observatory and the FORWARDS project, please provide your name and email (your name and email address will not be linked to your responses).

- Your name
- Your email address

If you would like to take part in the promotional [campaign](#), please provide your email (your email address will not be linked to your responses).

- I accept the rules of the campaign (tick box)
- Email address

6. Annex 2: Report of the visioning workshop

On the 14th March 2024 a face-to-face visioning session was organized as part of the FORWARDS annual consortium meeting. The major aim of the session was to define the scope of the ForestWard Observatory. The overarching questions informing the session focussed on:

- Who are the main users of the Observatory?
- Which of the Observatory's products/outcomes are our stakeholders interested in?
- Which products/outcomes do we focus on in Forwards WP5?

To respond to these questions, we applied a future oriented approach (visioning) combined with role playing elements, in order to let project partners freely brainstorm about useful outputs (without getting stuck by technological barriers at this early phase of the co-design process), and to let them empathize with project stakeholders and potential users of the Observatory (see the detailed session plan in the next subsection). Session participants were randomly grouped into seven different stakeholder groups. Each group was asked to imagine that they are in the year 2030 by when several legislative changes have been accepted and the ForestWard Observatory has been up and running. Then, groups were asked to take on the shoes of the given stakeholder group and identify themselves with a specific person belonging to the stakeholder group. Group members needed to respond to questions from this individual (role-based) perspective and agreed responses had to be recorded in a Miro board. Results were finally discussed in plenary.

As the screenshot of the Miro board indicates, forest managers, policy actors and conservation actors were considered as having medium-relevance for the ForestWard Observatory, while NGOs and citizen groups, academics and researchers, as well as forest industry players were perceived as the main target groups. Lower relevance was partly due to the fact that some groups showed a varied interest in the Observatory. For instance, in the forest managers and owners group, some roleplayers (based on their fictive profile) suggested they would use the Observatory as they received access through trusted sources (e.g. interest group representatives or FISE), while others felt that the Observatory is too scientific and distant from their everyday work or that they cannot adapt their management approaches to new scientific insights due to lack of resources. This highlights that potential user groups can be very diverse (even considering the same types of stakeholders) and that accessibility, clear communication, and embeddedness into trusted networks have a crucial role in attracting users.

Different stakeholder groups have different interests in the Observatory (notes based on the AI support tool of Miro):

- **Forest managers** can benefit from the Observatory's services and functions to make informed decisions regarding forest management, assess vulnerability to disturbances, and target their efforts in the woods.
- **National and regional level policy actors** can utilize the Observatory to gather information on forest-related trends, risks, and disturbances. It can also help them prioritize different forest areas/types for targeted activities and support decision-making processes.
- **Conservation actors** can gain valuable insights into biodiversity trends, monitoring of temporal dynamics of forest ecosystems, and information on protected status of forests

through the Observatory. This information can aid conservation efforts and contribute to effective forest management practices.

- **NGOs and citizen groups** can leverage the Observatory to access transparent information on forest management, including publicly accessible forest management plans, disturbance areas/time series of forest cover, and maps with public access information and trails. This data can support their advocacy work and enable them to identify trouble hotspots.
- **Academics and researchers** can benefit from the Observatory by getting access to both raw and harmonized data. It can facilitate advanced knowledge exchange on climate smart forestry measures and support research on forest-related topics.
- **Forest industry** can benefit from the Observatory's services, such as better projections of timber supply, locating certified trees, predicting pests and diseases, and dynamic maps of vulnerability to specific disturbances. This information can assist in planning and decision-making processes within the industry.

For each stakeholder group a large variety of potential services have been identified.

Stakeholders	RELEVANCE	Potential services / functions provided by the ForestWard Observatory										Func 6	Func 7
		Vulnerability assessment: Risks and disturbances	Testimonials from trusted experts	Decision support	Trends, time-series	Comparisons across regions leaving from other countries	Spatial prioritization	Watchdog function	Predictions (climate, pests...)	Ecosystem services	Cost-effectiveness		
Forest managers	3	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Get the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.		
EU-level policy actors	2			Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.		
National®ional level policy actors	3	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.		
Conservation actors	4	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.		
NGOs and citizen groups	5	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.		
Academics & researchers	5	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.		
Forest industry	5	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.	Use the Observatory to assess the vulnerability of forest ecosystems to different disturbances and to identify the most vulnerable areas.		

The visioning suggests that the Observatory can provide cost-effectiveness analysis, predictions related to climate and pests, assessment of ecosystem services, vulnerability assessment, and decision support. It can also offer trends and time-series data, comparisons across regions, spatial prioritization, and a watchdog function. During the exercise the project team assumed that users appreciate the observatory for its ability to compare their own data/experience with the contents, build confidence in trusting the outputs, and provide information that they cannot figure out from their own experience alone.

The following types of information and data were mentioned as potentially relevant outputs provided by the Observatory:

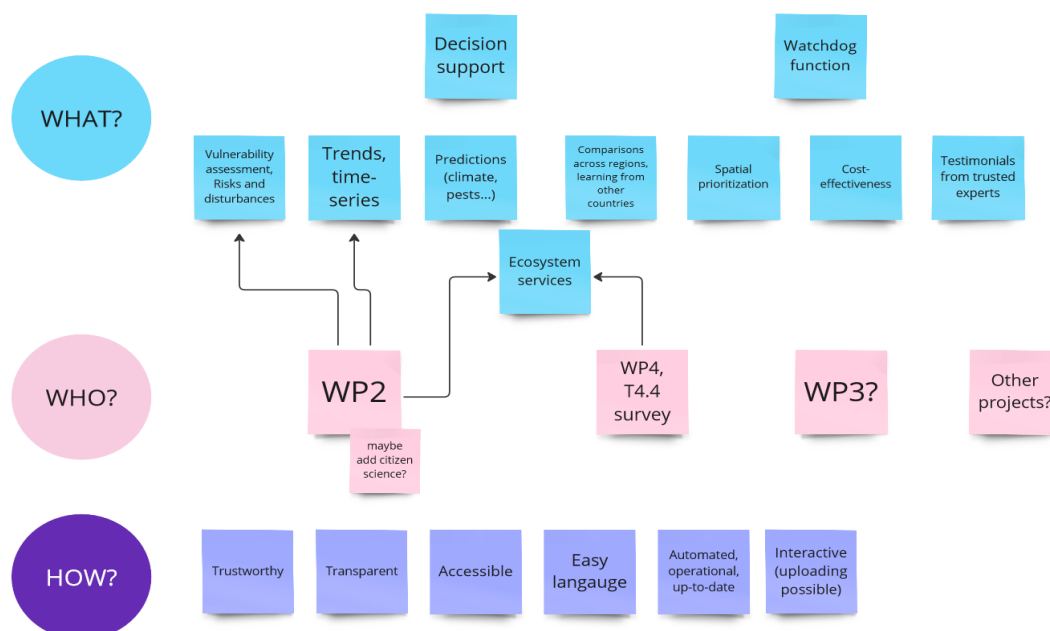
- temporal dynamics of forest ecosystems,
- time series of biodiversity and forest cover,
- soil type indicators,
- forest-related risks,
- disturbance areas,

- transparent information on forest management practices (incl. publicly accessible forest management plans),
- maps with wildlife indicators/seedling stands,
- maps with public access information and recreational trails,
- maps with protected status of forests.

The above listed data and information can help the users to:

- compare their own performance (status/trends of forests) with other member states,
- harmonize national or regional indicators with those of the EC,
- identify effective forest management practices,
- understand the effects of changing climate,
- justify resources for implementation work,
- analyse costs and assess risks associated with different management approaches and measures,
- make better investment decisions.

The follow-up discussion helped prioritize the most relevant services / functions of the Observatory. It also provided some initial ideas of which FORWARDS work packages and tasks can contribute to the different functions of the Observatory. Based on these takeaways, the ForestWard Observatory should focus on providing trustworthy, transparent, and accessible information in an easy language. It should have an automated and operational system that allows users to upload their own datasets and algorithms. Interactive features would enhance user experience. Additionally, collaboration with other projects and incorporating citizen science could further enrich the observatory's offerings.



Further discussion is necessary to identify all the interlinkages within the project as well as the relationships and potential collaborations with other projects.