Deliverable: Socio-economic impact analysis

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The LIFE SAMFIX project is co-funded by the European Union's LIFE Programme under Grant Agreement LIFE17 NAT/IT/000609.

SUMMARY

The LIFE SAMFIX Project aims to develop protocols and tools for prevention and alarm, to collect and evaluate the invasion data about *Xylosandrus* beetles with the ultimate aim of eradicating or containing current infestations and preventing future expansions.

The Project targets three observation areas: Italy (Circeo), France (Côte d'Azur) and Spain (Valencia) and the distribution and data collection is articulated in three temporal phases, the first one was carried out in due time, while the second and third ones were delayed in 2021 and early 2022 due to the Covid-19 pandemic.

Alongside the development of the Project, residents, stakeholders and tourists from the three areas have been interviewed about various issues related to the expected results of the implemented actions, such as:

- Opinion about the importance of the local natural environment and of the actions to safeguard it;
- Evaluation of local environment;
- Willingness to adopt behaviours that aids the protection of local flora and fauna.

Residents and stakeholders have also been asked about:

- Awareness of the Project and willingness to comply within the suggested actions;
- Expectation about the results of the project;
- Disposition to follow the suggested actions in the future and/or in the eventuality of further phases of the Project.

Chapter 1 of this final report presents the dimension of the statistic samples of the interviews among each category (residents, stakeholders, tourists) in the three areas during the three phases, and presents the characteristics of the samples. Here are also gathered the results of the inquiries carried out during the three phases respectively for residents, stakeholders and tourists. The results reflect a broad consensus with the general protection of the environment and also specifically with the actions related to the LIFE SAMFIX project. We gather a large willingness to participate in actions aimed to safeguard local flora and fauna; and these who are aware of the project declared that they expect the actions to be effective if supported by the local population or by more involved people. In the final phase the stakeholders mainly observe that the actions have been effective as prevention and/or elimination of parasites. A comparisons between the results of similar questions submitted to both residents and tourists is also delivered, highlighting how tourists give higher importance to the quality of the environment and how they are more willing to cooperate for its protection.

In chapter 2 data obtained from these surveys have been completed with these obtained by the X-platform concerning citizens' participation in surveillance activities. This comparison highlight that more than 350 users used the SAMFIX Agent app and in 2021 and 2022 more than

150 registered and sent valuable information through about 100 geo-referenced reports on the possible presence of Xylosandrus.

Chapter 3 focuses on an estimation of the economic impacts, i.e. an estimation of the risk and scale of potential economic losses in the project core areas related to the *Xylosandrus* spp. spread, based upon an assessment of actual value of economic activities most at risk and the risk analyses made in Action D1, compared with an estimation of the cost of implementation of the demonstrated prevention, early warning and rapid response protocols, thus providing for an economic trade-off. This estimation interestingly shows that even if the costs of monitoring and managing of the plants represent a high figure, these actions allow to keep the value of the asset constant over the year.

Introduction

The SAMFIX Project consists in a series of actions meant to prevent and/or eradicate exotic xylophage beetles that spread and endanger the woods of the Mediterranean area of the EU. Three protected areas have been involved to collect on site data: the Circeo National Park in Italy; the Côte d'Azur area, France; the Valencia area, Spain.

The analysis of the impact on social perception and behaviour on local communities, tourists and stakeholders is part of this Project. This analysis aims to assess, amongst target groups, changes in awareness and attitudes regarding the threat of alien species, asses changes in their awareness of how their own behaviour can favour or limit the risk of invasions of alien species, assess changes in their effective behaviour and their perception of their own contribution.

To this end, we gather the opinions of different groups of people that somehow interacted with the Parks areas (tourists, residents and stakeholders), initially highlighting the context in which the actions are meant to be implemented and later showing the expectations and feedbacks of both residents and stakeholders in regards to the effectiveness of the measures implemented, direct and indirect benefits, and communication actions.

The inquiry has been divided in three temporal phases; the first one launched right after the start of the project, in 2019; the following ones were delayed because of the Covid-19 pandemic and occurred in spring/summer 2021 (second one) and early 2022 (third one).

The survey submitted to tourists did not change throughout the duration of the project, focusing on the importance of the environment as a deciding factor in choosing a destination. On the contrary, the surveys submitted to residents and stakeholders evolved with the project, reflecting their opinions while the actions were taking place and afterwards.

Interviews have been taken by Parks staff, both in loco and through the Parks' websites.

To fully evaluate the social impact of effectiveness of the measures implemented within the project, data obtained by the X-platform on citizens' participation on surveillance activities have also been collected in order to gather progressive information regarding the use of the IT tools made available to them (SAMFIX Agent app) and their actual contribution to *Xylosandrus* monitoring. This information makes it possible to strengthen the dynamic monitoring of the evolution of *Xylosandrus* presence and damage incidence level in the project core areas, to complement the data acquired from traps, field surveys, and remote sensing/GIS.

Lastly, an economic impact analysis highlighting the risk and scale of potential economic losses in Circeo National Park related to *Xylosandrus* spp. spread have been carried out with the aim to assess the monetary benefits of prevention, early detection and rapid response protocols in natural parks. It demonstrated that despite these costs are high, these action nevertheless allow to keep the value of the asset constant over the years.

1. Surveys on social perception and behaviour

The partners have conducted a total amount of 327 interviews in the first phase (140 in the Circeo area, 179 in the Côte d'Azur area, 8 in the Valencia area); 263 interviews in the second phase (187 in the Circeo area and 76 in the Côte d'Azur area; the Valencia area didn't participate); 219 interviews in the third phase (124 in Circeo, 88 in Côte d'Azur and 7 in Valencia). Figure 1 shows the distribution of the interviews among each category of respondents in the three areas during the three phases. While the dimensions of the samples in Circeo and in Côte d'Azur areas are consistent, in Valencia the numbers are too small to be statistically significant. In fact due to the lack of a venue such as a Visitor Centre, questionnaires in Valencia couldn't be widely disseminated.

Figures 2-4 describe the characteristics of the samples. Man represent the majority of the samples for the Circeo area, while women are the most represented in Côte d'Azur. Most of the interviewees are under-64 years old and highly educated.

The most represented age category is the 45-64 years old. Young people are the largest age group just in the Circeo resident sample, while older people are more represented in the Côte d'Azur area (Figure 3). All the samples are characterized by very high education level (Figure 4).

Figure 1 Dimension of the statistic samples in the three areas

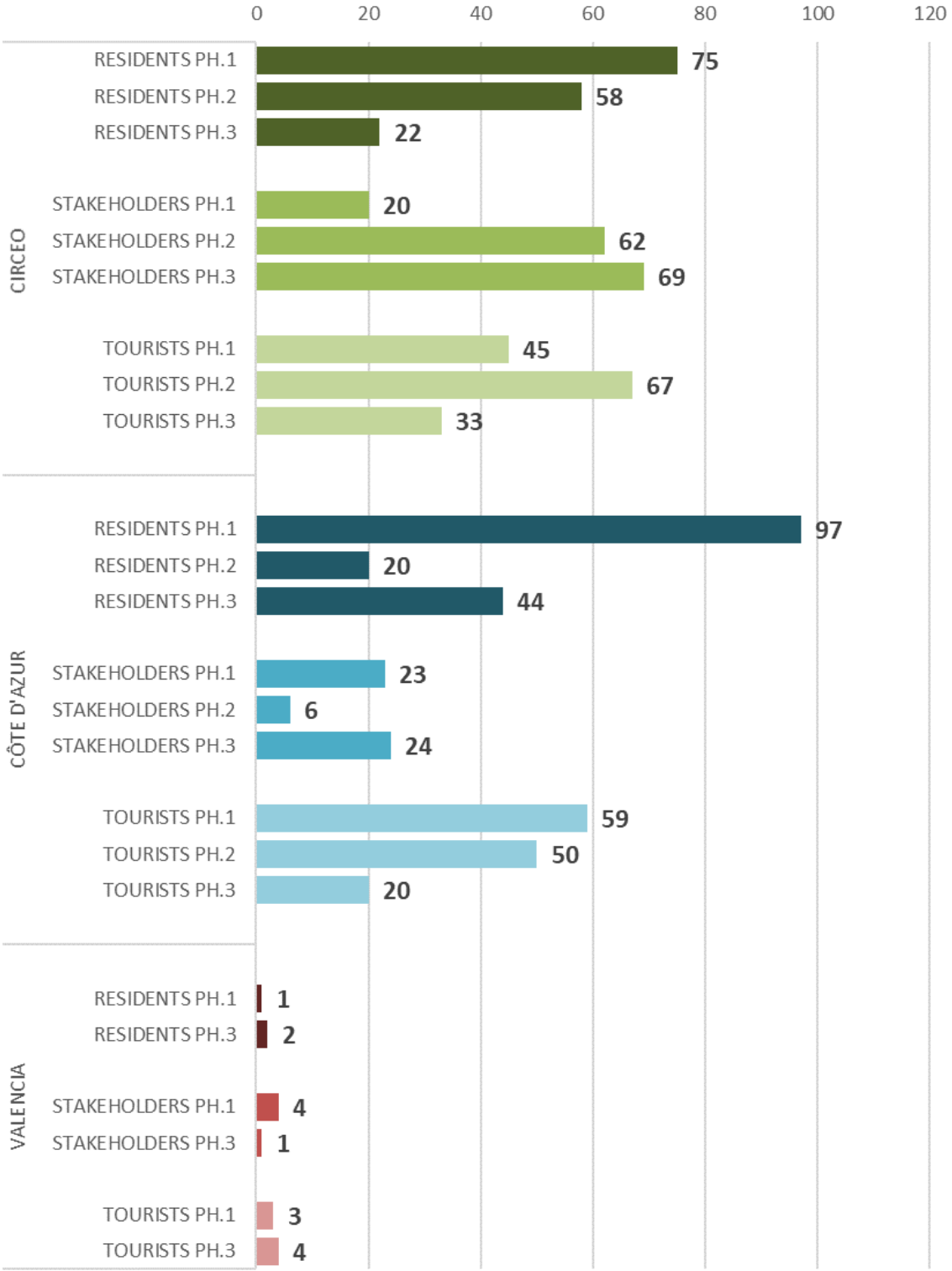
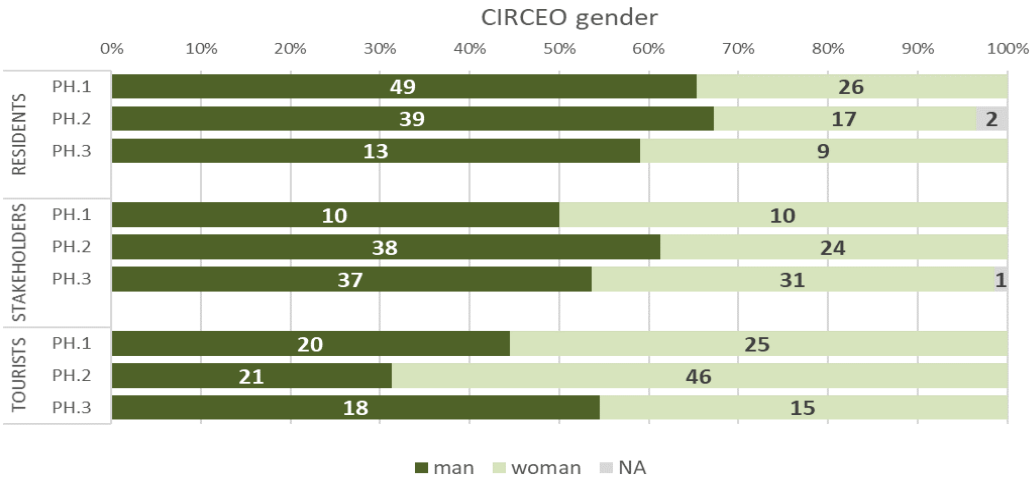
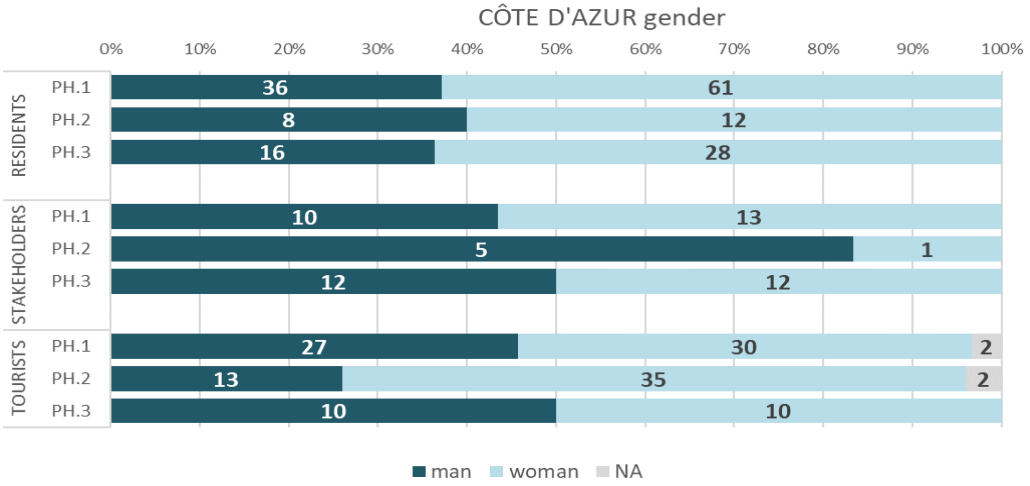


Figure 2 Statistic samples in the three areas: gender





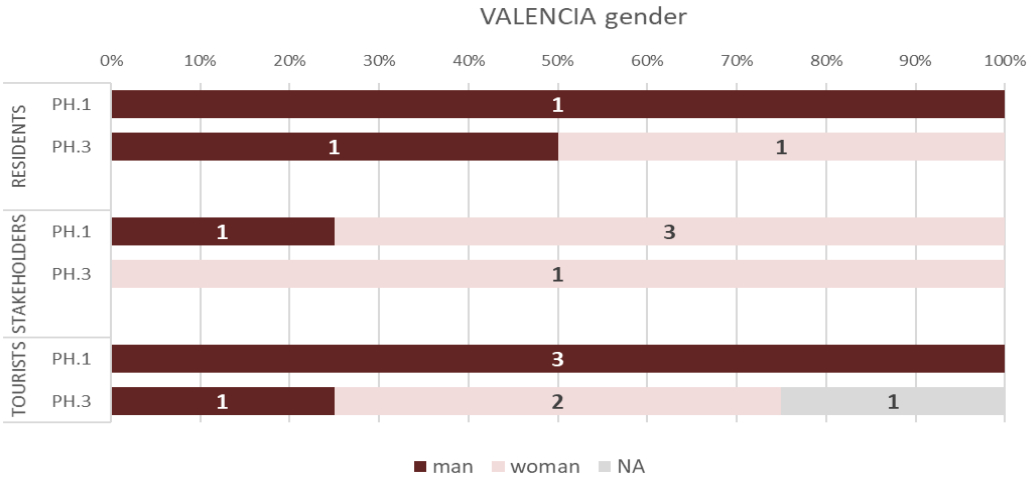


Figure 3 Statistic samples in the three areas: age

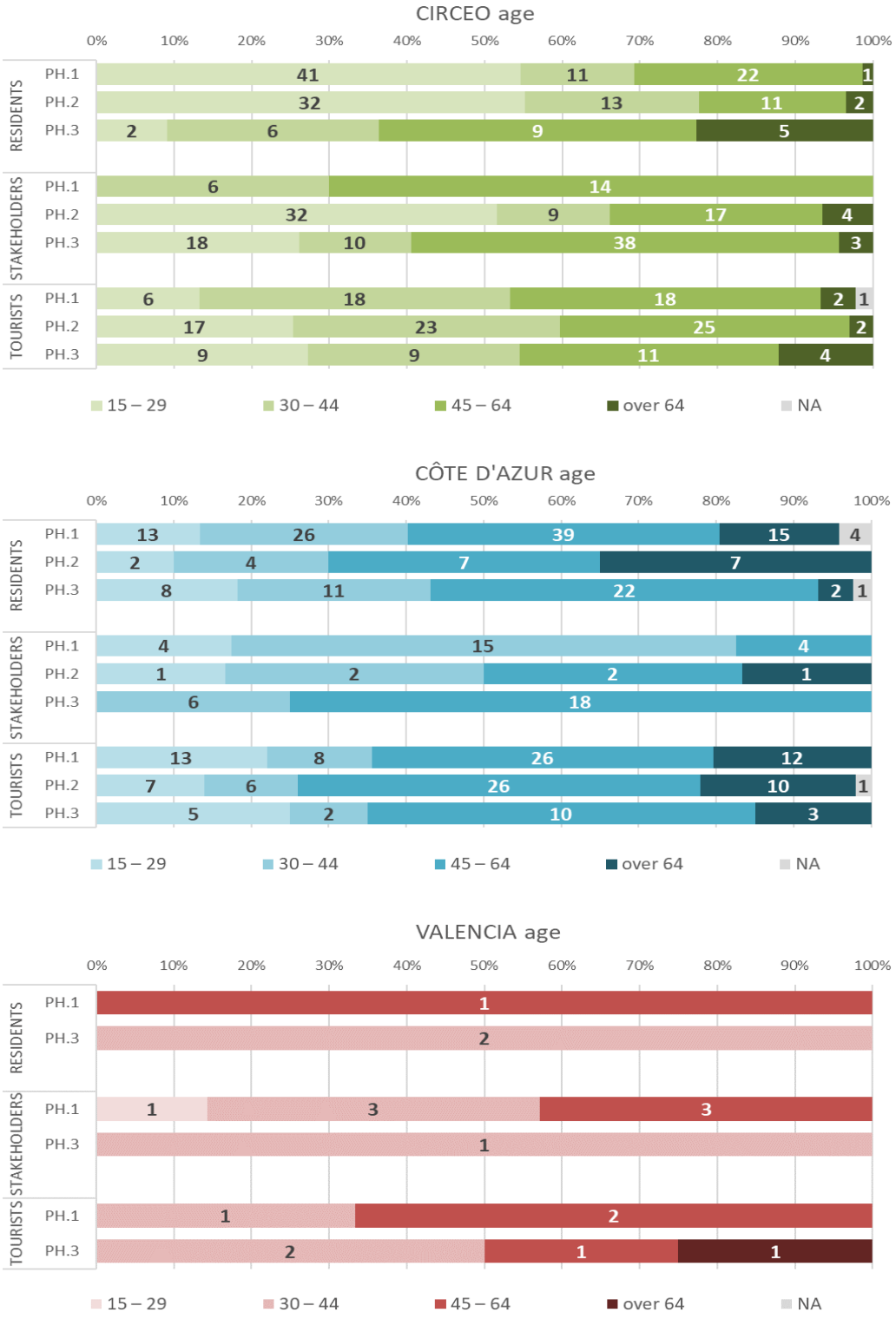
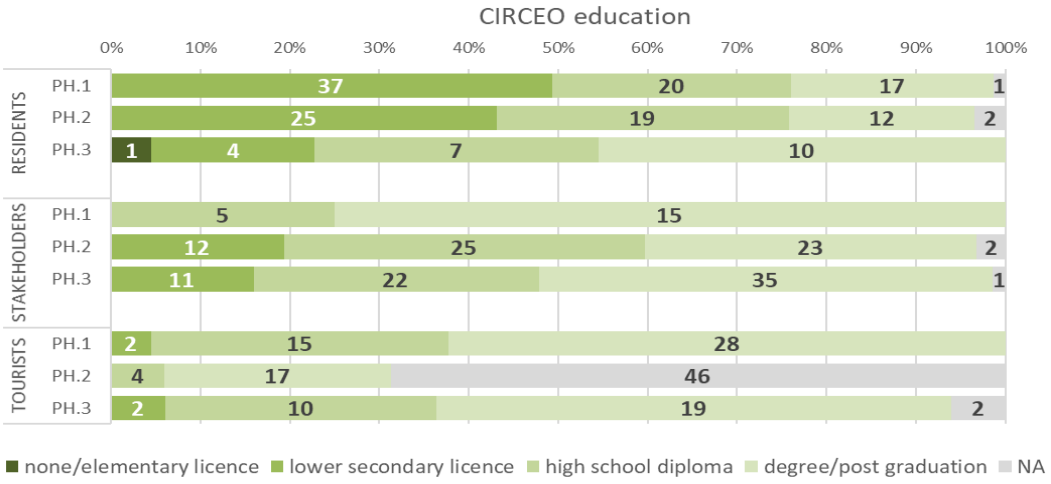
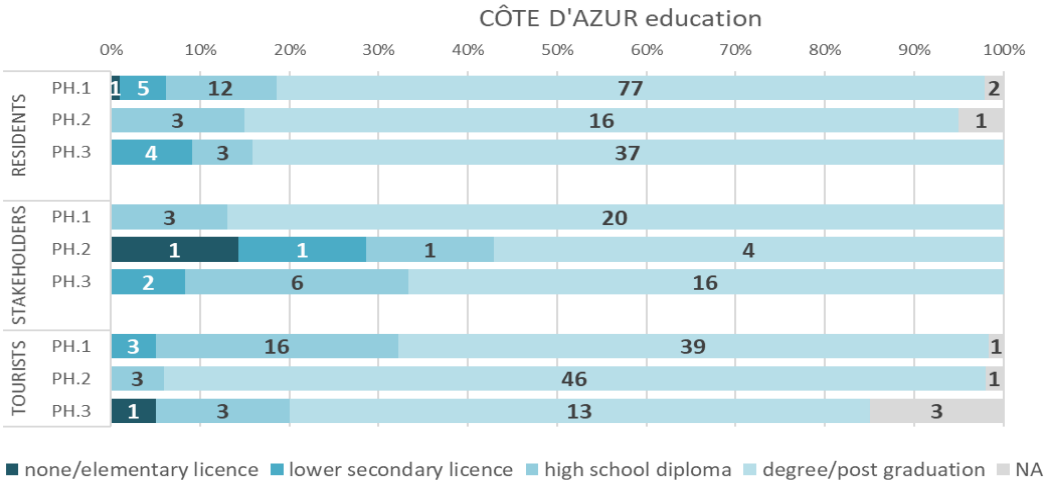
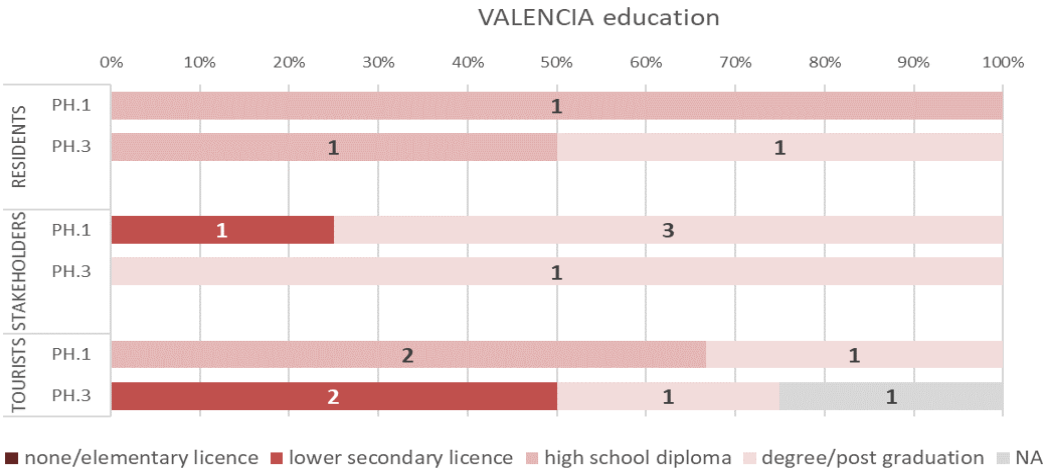


Figure 4 Statistic samples in the three areas: education







1.1. Perception and behaviour of the residents in the three areas

Figure 5 shows the differences in sample numbers paired with the progression of the Project.

We can see how the numbers steadily diminishes for the Circeo area, while in the Côte d'Azur area it's the lowest during the second phase. As previously stated, the numbers are very low in Valencia.

Figure 6 shows the residents' fields of profession or interest.

In the Circeo area we can see how in the first phase interviewees are mostly part of the agricultural field; in the second one they are mostly students and in the third one mostly in the education/training field.

Regarding the Côte d'Azur area, the most numerous fields are consistently the forestry and agricultural fields.

Figure 5 Residents : samples from the three areas in the three phases of the survey

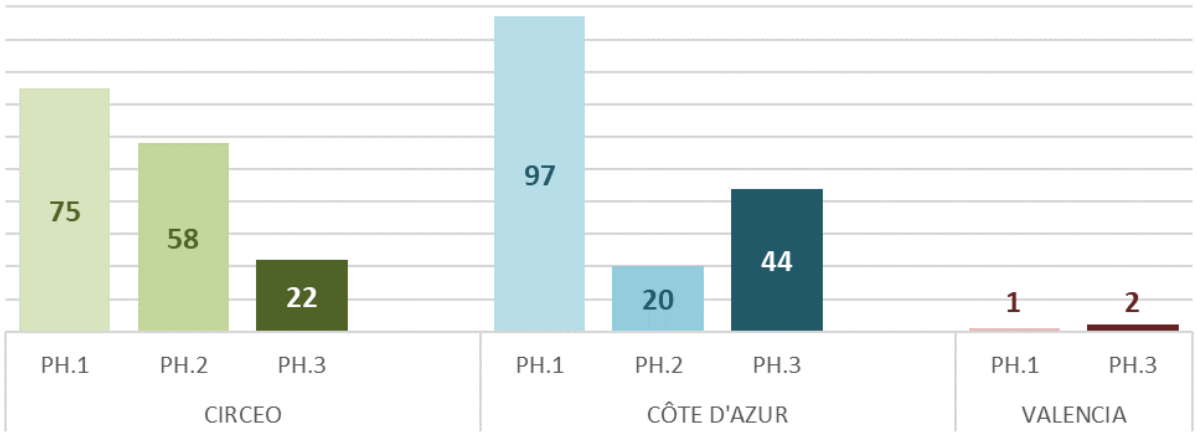
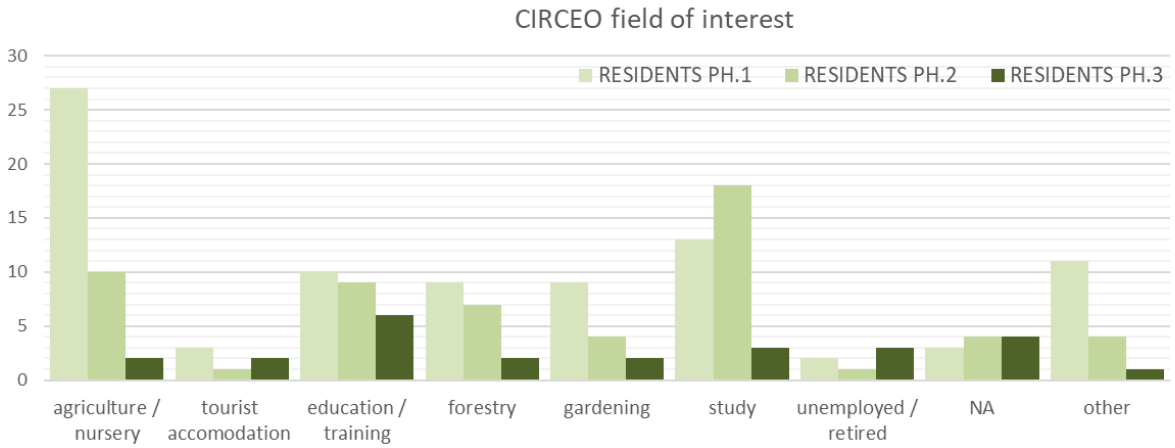
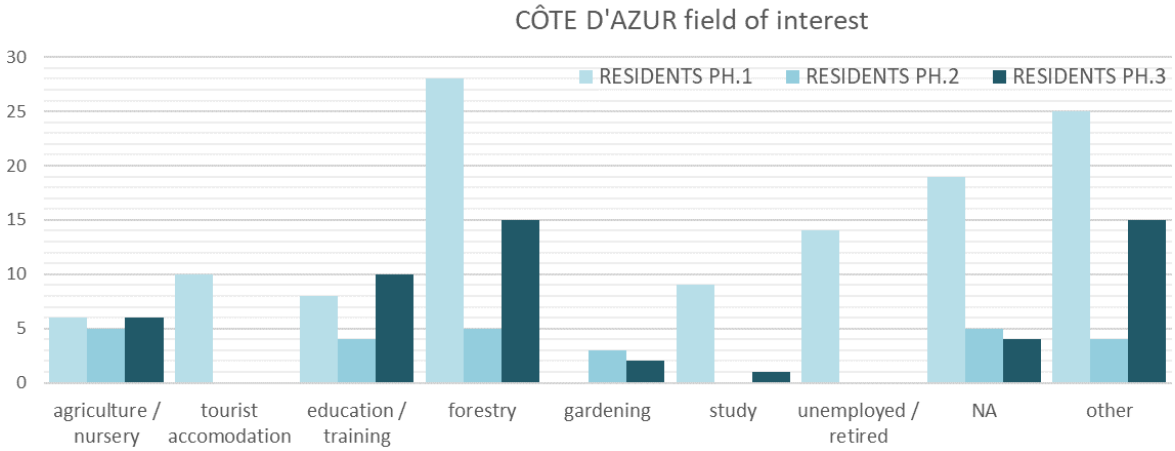


Figure 6 Residents of the three areas: professional/amateur activities and interests





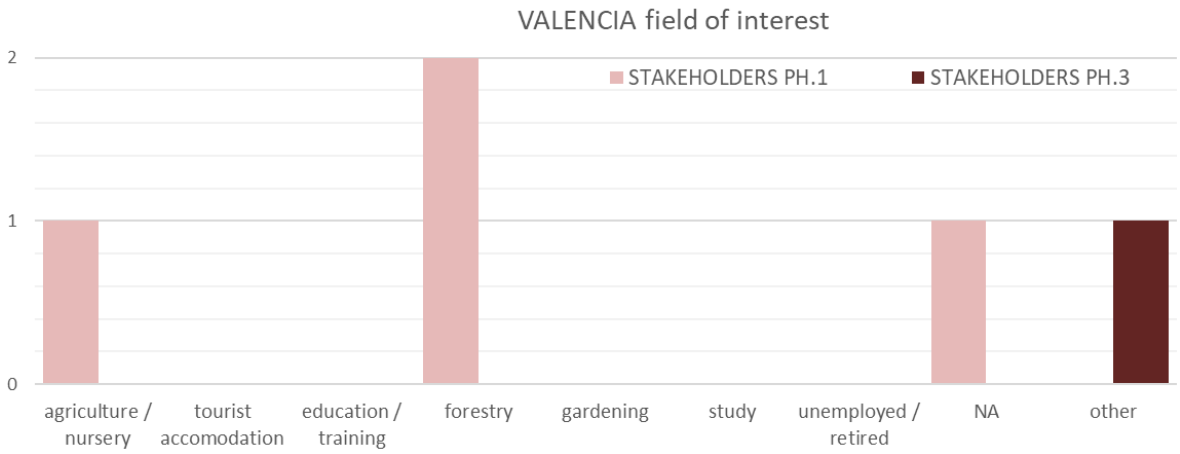


Figure 7 Have you ever been involved or are currently involved in environmental protection ?

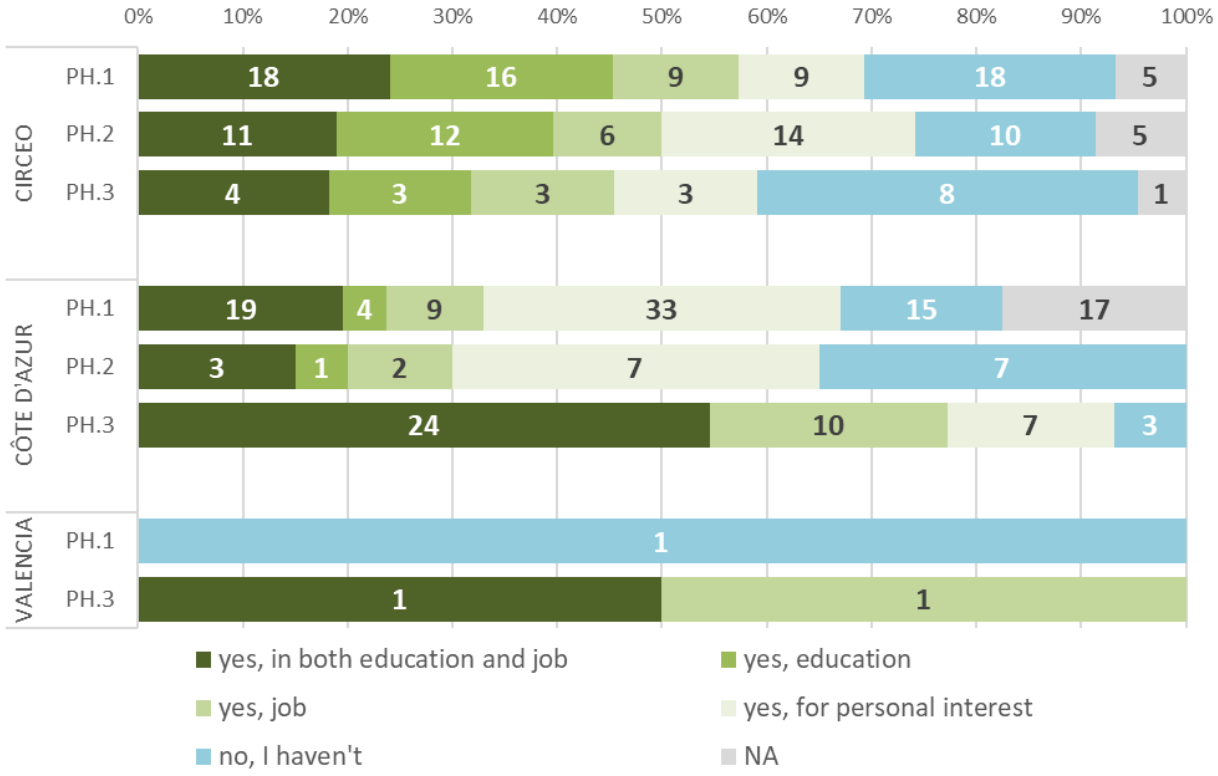
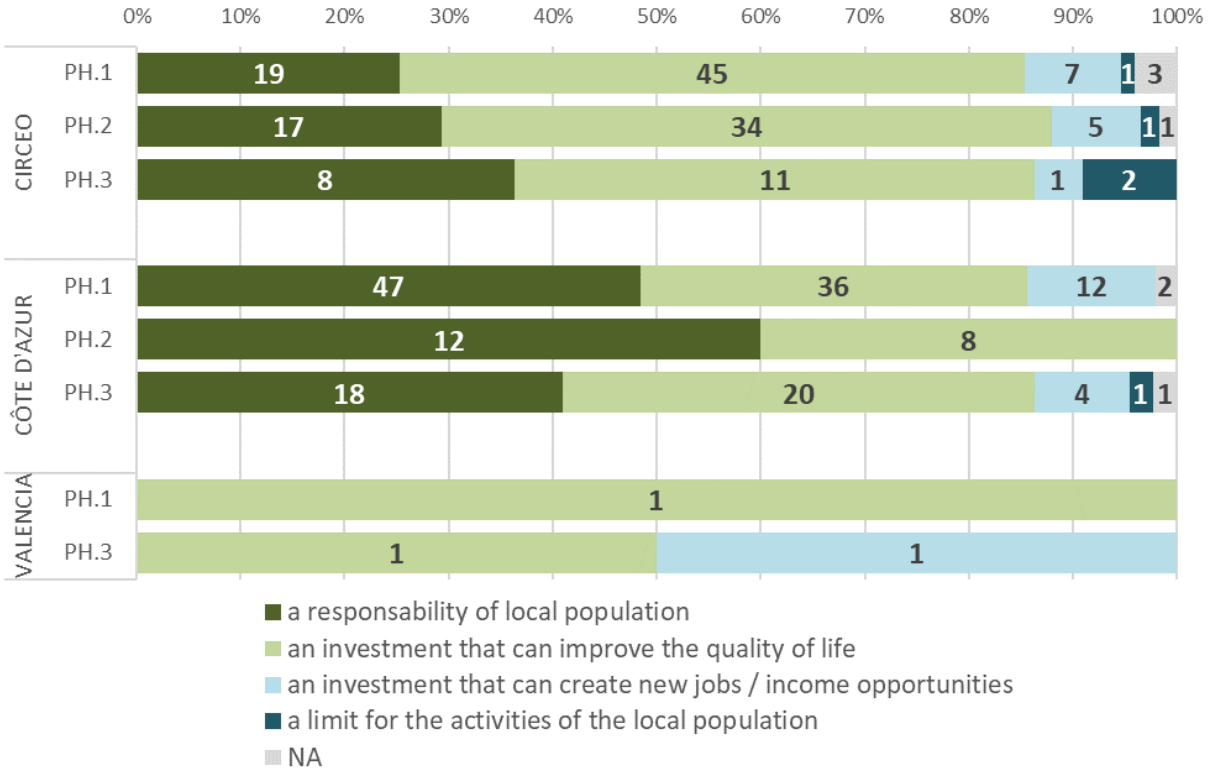


Figure 7 highlights how most of the interviewed residents of Circeo and Côte d'Azur areas have some sort of education or experience in environmental safeguarding.

In the first two phases, the share of residents that declares to be somehow involved with it is nearly 70% in both the most represented areas; in the final phase, it lowers to 60% in Circeo, while it is over 90% in Côte d'Azur.

Figure 8 According to you, the management and protection of landscape and natural environment mainly represents:

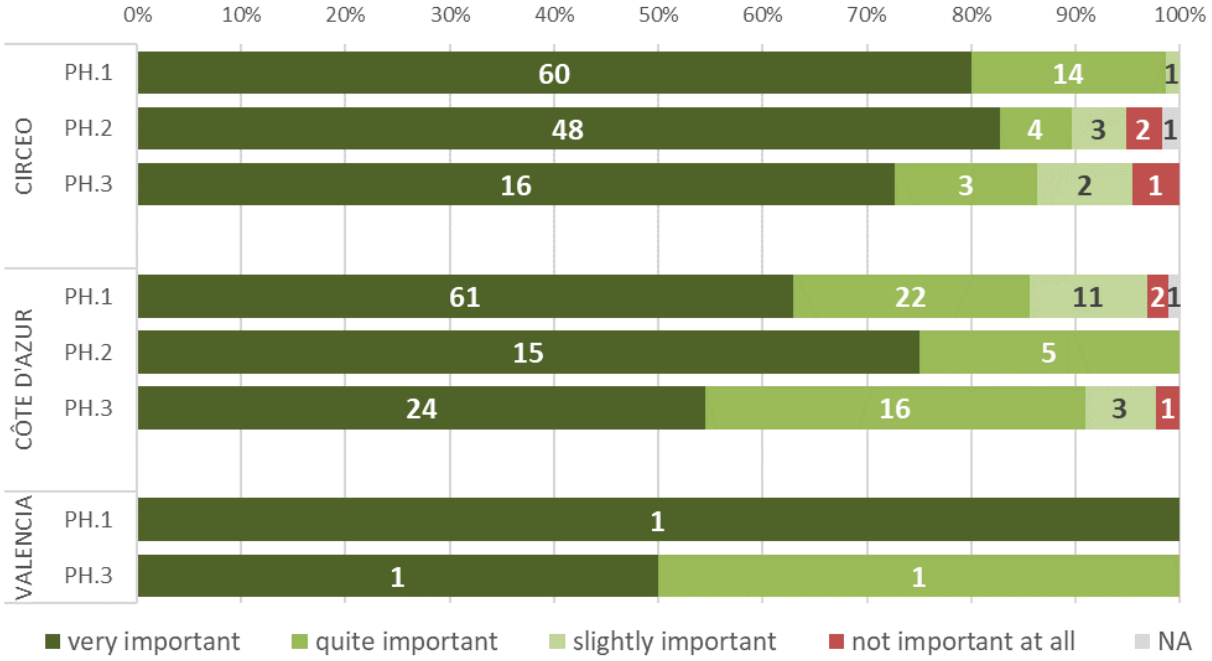


The residents mostly consider the environmental safeguard as a collective responsibility and an investment that improves the quality of life (Figure 8).

Only a small number of people considers it under an economic point of view, seeing it as an investment that can lead to job/income opportunities. It's interesting to note that the economic considerations didn't increase after the beginning of the pandemic crisis.

People who suffer the safeguard of the environment as a limit to human activity are extremely few, to the point of being non-existent in survey results of phase 1 and 2 of the Côte d'Azur area.

Figure 9 How much do you think the protection and conservation of the environment is important for this area ?



Consequently, residents give very high importance to the conservation of the environment (Figure 9).

The percentage that consider it very important remains a large majority during the three phases of all the areas.

Figure 10 In your opinion, how important is the quality of the environment for tourists in this area ?

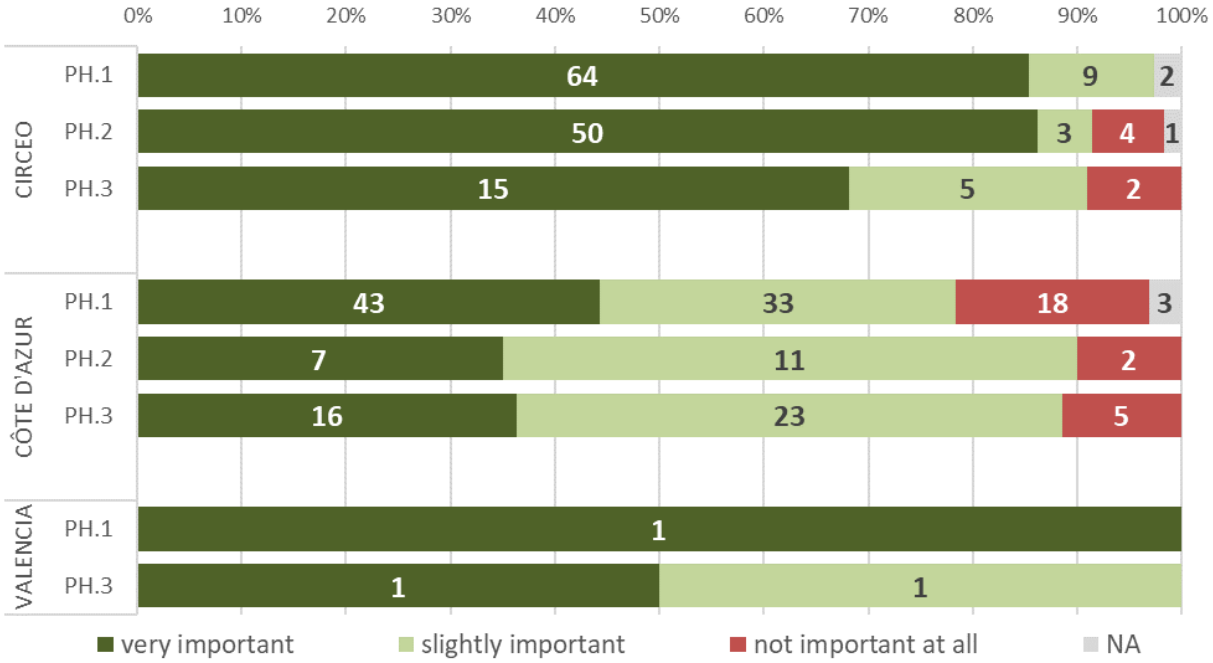
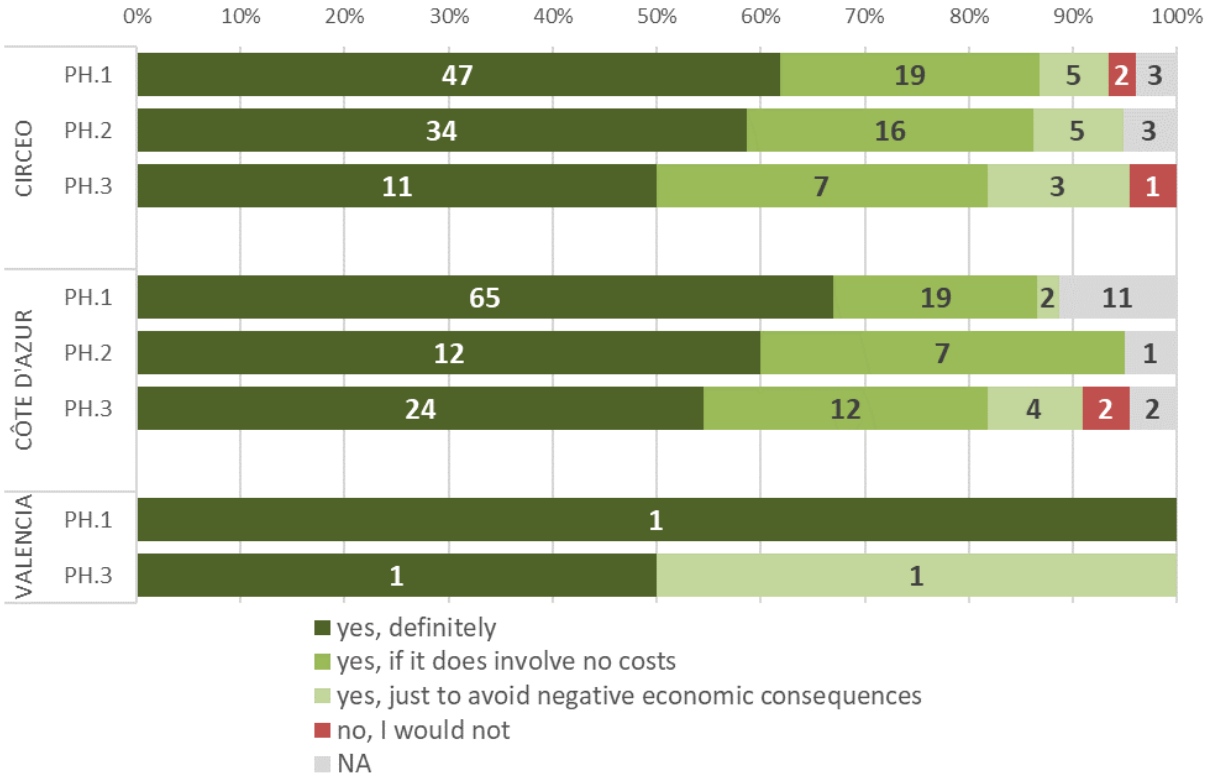


Figure 10 illustrates how the preservation of the quality of local environment is reputed important as a main factor of tourism attraction.

It is extremely relevant for a large majority of Circeo's residents, while in Côte d'Azur the amount of people that consider it very important is comparable to those that think it is only slightly important, with a higher number of people that don't consider it important at all compared to those in the Circeo area.

This last share of residents from both Côte d'Azur and Circeo areas is in fact surprisingly high considering that they live in locations of great naturalistic value.

Figure 11 If one or more plant/animal species typical of the area would be endangered, would you be willing to collaborate to safeguard them ?

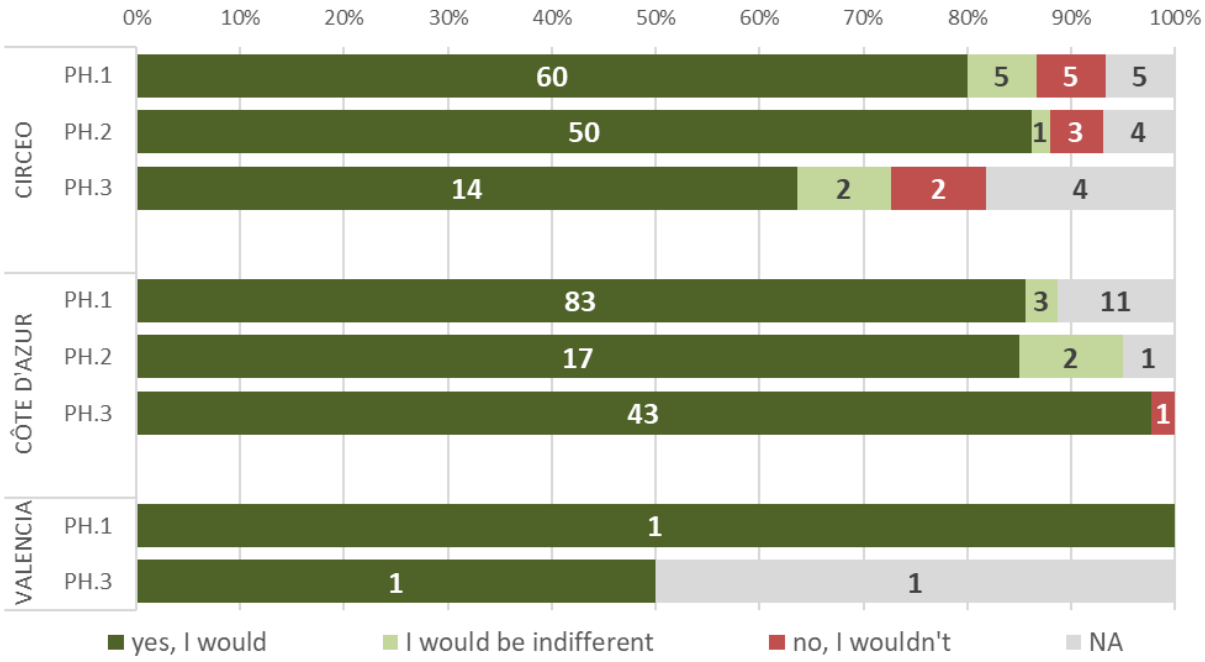


From Figure 11 we can observe the willingness to cooperate in actions meant to protect local fauna and flora.

Despite a general positive response, the people that would unconditionally cooperate with the project gradually decreases over time, in favour of the people that would only collaborate if it meant not spending.

Still, the percentage that is unwilling to collaborate at all and that doesn't answer never significantly surpasses the 10% of the sample.

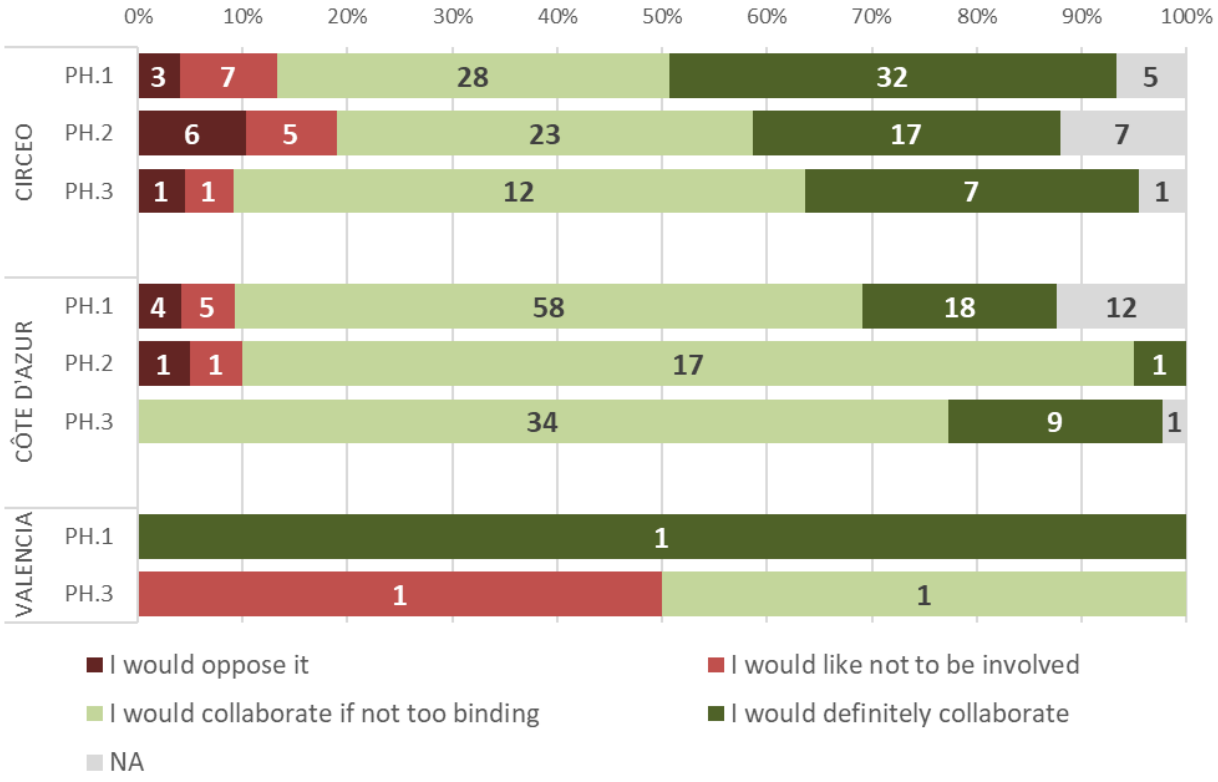
Figure 12 Would you support an action to avoid the spread of exotic xylophage (wood-eating) beetles, which threaten the local plant species of the Mediterranean scrub and fruit trees ?



More specifically, facing the issue of the countermeasures to avoid the spread of the exotic xylophage beetles through the Mediterranean coastline (Figure 12), the explicit favour, though remaining the majority, is less unanimous compared to what's showed in Figure 11, while shares of indifferent and unwilling to participate people grow.

In regards to the progress of the Project, the willing to support the actions diminishes in the Circeo area and increases in the Côte d'Azur one.

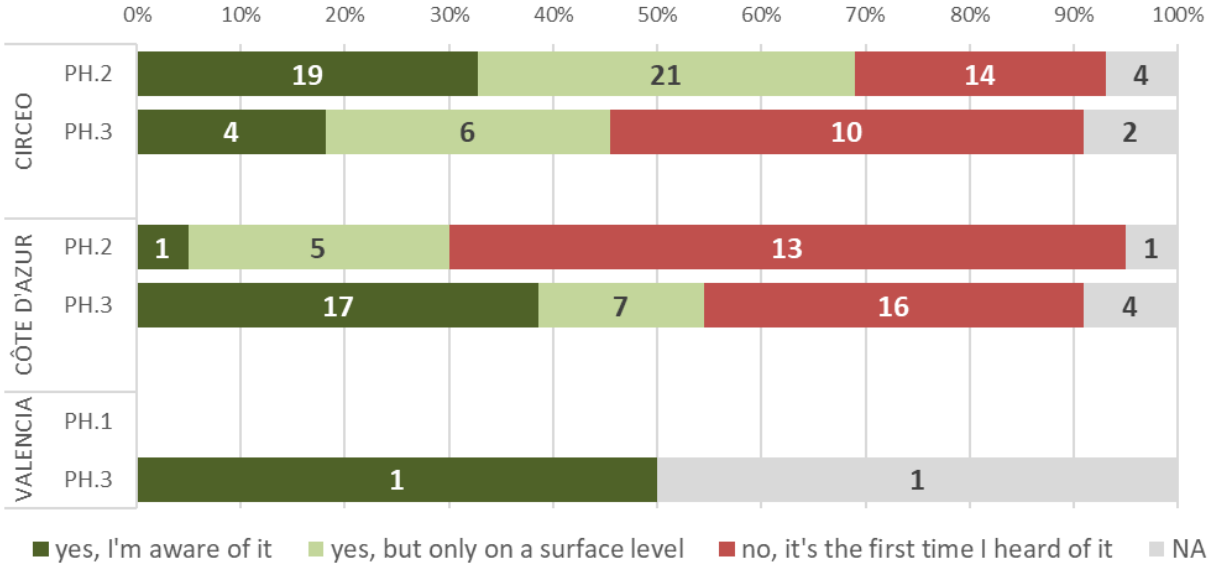
Figure 13 How willing would you be to collaborate for the success of this intervention ?



When it comes to actually collaborate for the success of the intervention (Figure 13), the most common answer is positive if the actions required were not too binding; this position becomes more diffused over time.

The unconditioned adhesion, as well as indifference and open opposition, decreases in the Circeo area; in the Côte d'Azur area, in the end there are no more opponents or indifferent people.

Figure 14 Are you aware of the LIFE SAMFIX project and the related targets to protect the local ecosystem ?

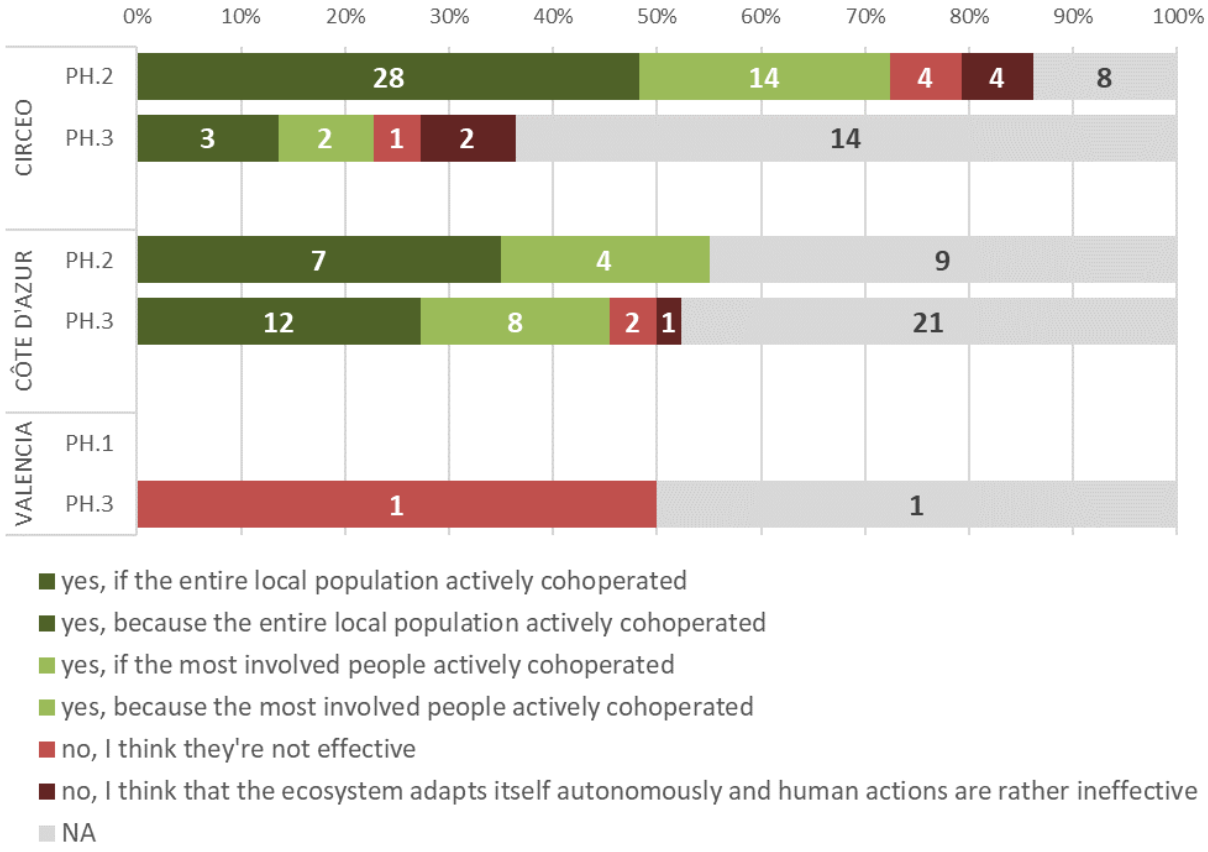


In phases 2 and 3, the residents have been asked about their awareness of the Project (Figure 14).

The percentage of unawares remains a minority, despite its growing among the Circeo residents (from 25% to 45%); among the Côte d'Azur ones, this percentage is the majority in the second phase (65%), but falls to 35% in the end.

Even the interviewees that declare to be aware mostly only have a surface level knowledge of the project.

Figure 15 Taking into account your knowledge of the project, do you believe that the suggested actions can be/have been effective ?

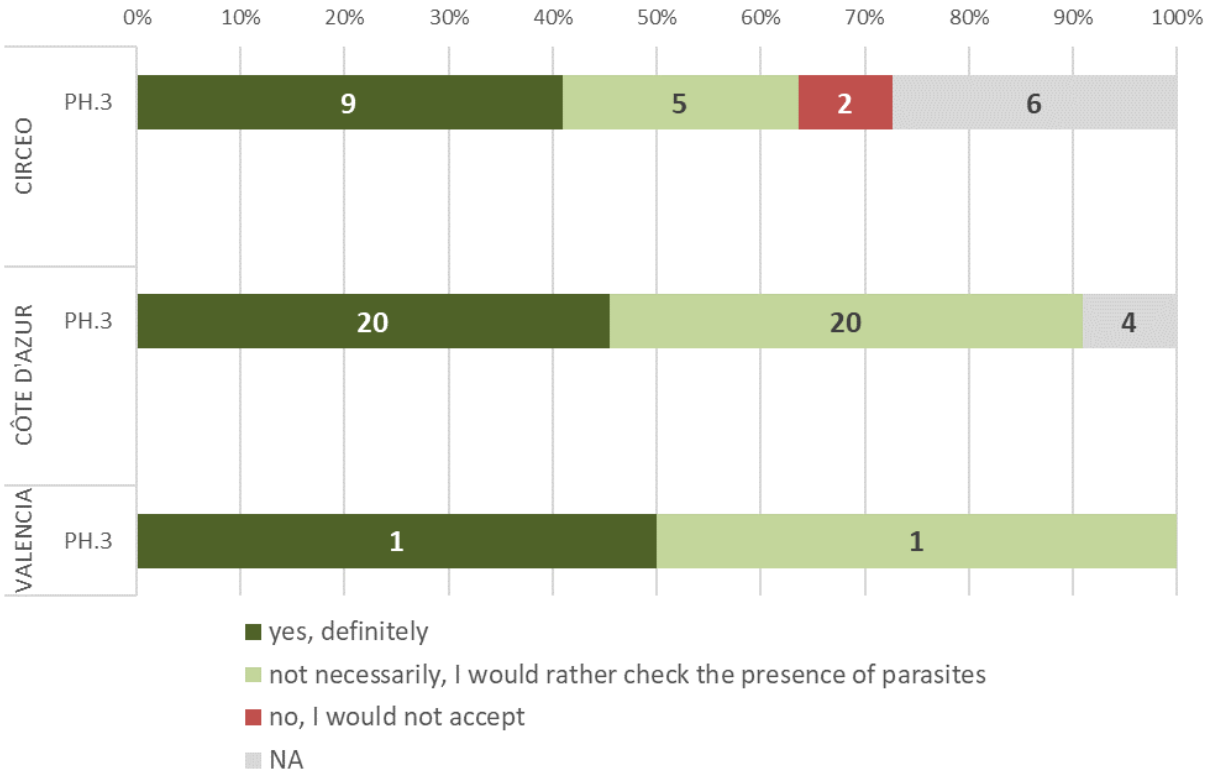


Regarding the effectiveness of the Project (Figure 15), in the second phase the question asked the residents about their expectations, while in the final phase what is inquired is the opinion about the actual effectiveness of the actions.

In the Côte d'Azur area and in the third phase of the inquiry in the Circeo area, there is a very high amount of people that do not answer.

Whenever they answer, the residents are mostly convinced of the effectiveness of the related actions, the majority reputing necessary the active participation of the whole local population, but a percentage confides that the cooperation of the most involved people is sufficient to achieve a good result.

Figure 16 Would you accept to acquire only local plants for your balcony/garden/green areas to avoid the spread of alien parasites which threaten the local ecosystem ?

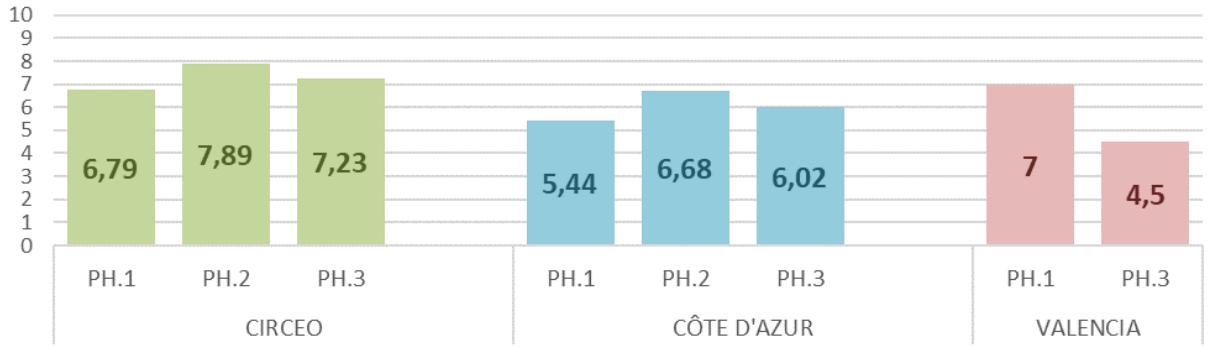


In the final phase, the residents have been asked if they would be willing to avoid acquiring exotic plants to prevent the spread of alien parasites (Figure 16).

In the Circeo area, we can observe that slightly more than 40% is willing to comply, while more than 20% would not, but would check for parasites and around a 10% would not accept.

In the Côte d'Azur area, the respondents that would comply are equal to those who would simply check for parasites, but no one opposes to the request.

Figure 17 From 1 to 10, what number would you give to the quality of the natural environment in this area ?



In conclusion, we can compare the evaluation out of 10 that the residents in the three areas give to the quality of the environment (Figure 17).

The Circeo area emerges as the most appreciated by its residents, with an evaluation around 7 and more (averaging 7,3).

The evaluation in Côte d'Azur area is a bit lower, reaching an average of 6, a number surpassed only in the later stages of the Project.

In Valencia's case we only have one evaluation in the first phase (7) and two in the third one, of which one is 7 and the other is 2, but the numbers are too few to calculate a significant average.

1.2. Perception and behaviour of the stakeholders in the three areas

From the first phase emerges the fact that the interviewed stakeholders are mainly involved in environmental protection both in their education and work. They repute the environment protection mainly as an investment that improves the quality of life; in the Côte d'Azur area many stakeholders highlight the aspect of the responsibility that falls on the local population.

They unanimously consider the protection and quality of the local environment very important for the areas themselves and as touristic attraction. The evaluation out of 10 of local natural resources is fairly high for the Circeo area (7,25), but barely sufficient for the other two areas (6 in both cases).

The stakeholders declare to be ready to cooperate to safeguard local fauna and flora if endangered and to be supportive of actions to prevent the spread of xylophages beetles. While in the Circeo and in the Valencia areas they are mostly willing to unconditionally collaborate, in the Côte d'Azur area a slight majority will collaborate if not too binding.

During the second and third phase the stakeholders have been asked about their participation to the Project, their expectations and opinions on the effectiveness of the related actions and their willingness to keep cooperating.

Figure 18 shows the numbers of stakeholders interviewed during the final phases. They are highly represented in the Circeo area, less in the Côte d'Azur area, while only one interview has been concluded in Valencia.

Figure 19 highlights the field of interest declared by the stakeholders interviewed during the whole Project. Though many natural fields are represented, in the Circeo area prevail the activities related to forestry and education; in the Côte d'Azur area the main field is forestry. In Valencia, during the first phase the two interviewed stakeholders are involved in forestry, while in the third phase the only one declares other fields of interest.

Figure 18 Stakeholders : samples from the three areas in the second and third phase of the survey

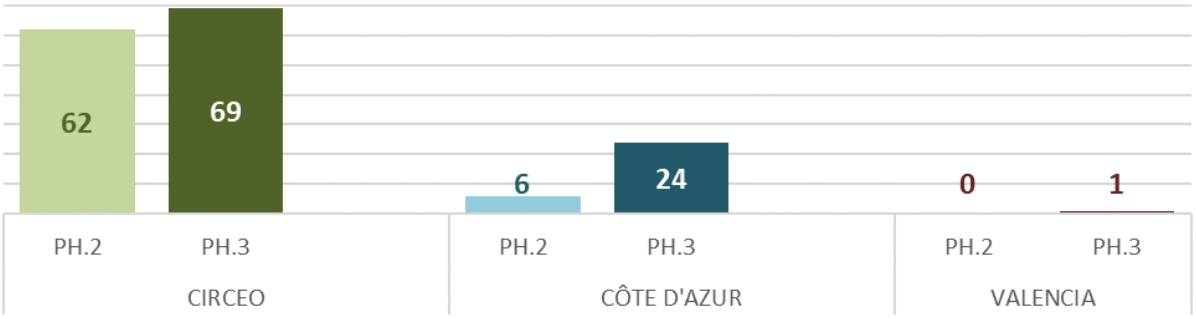
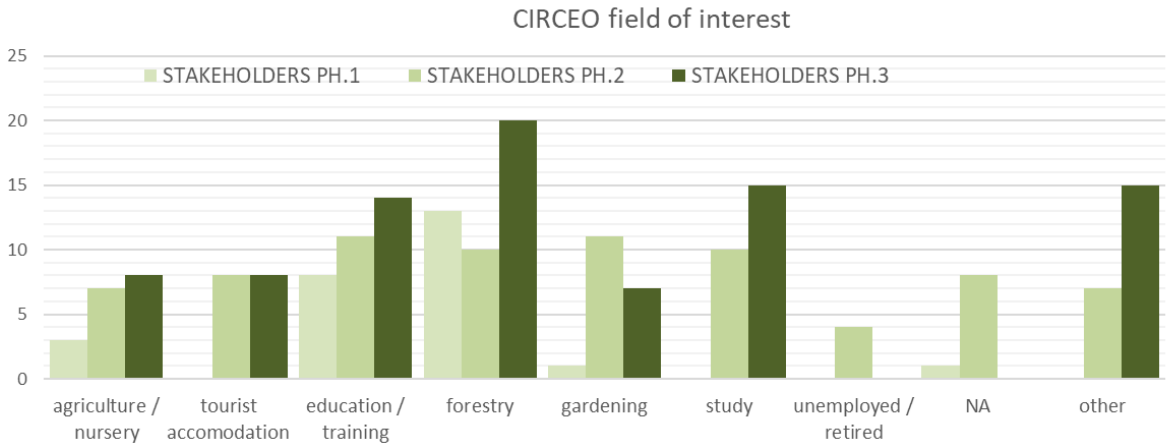
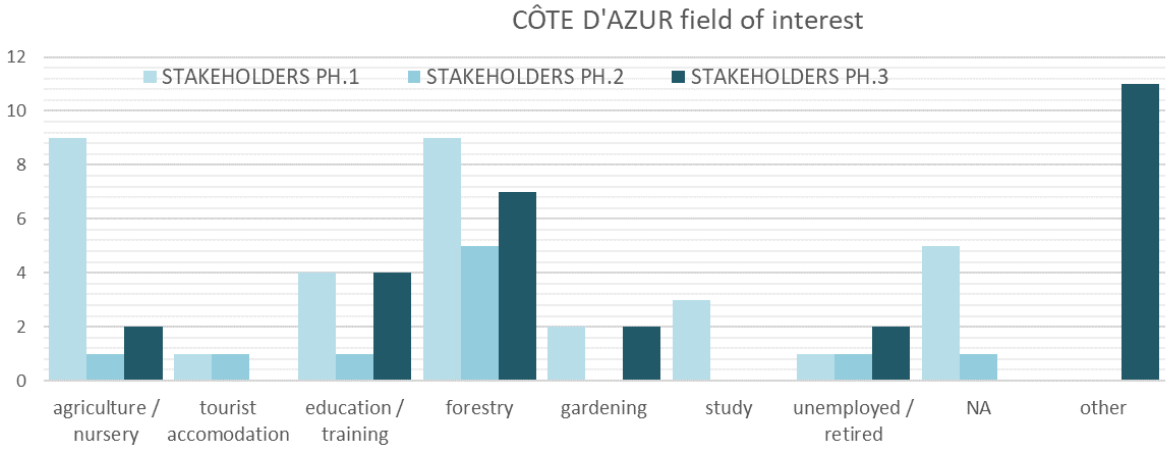


Figure 19 Stakeholders of the three areas : professional/amateur activities and interest





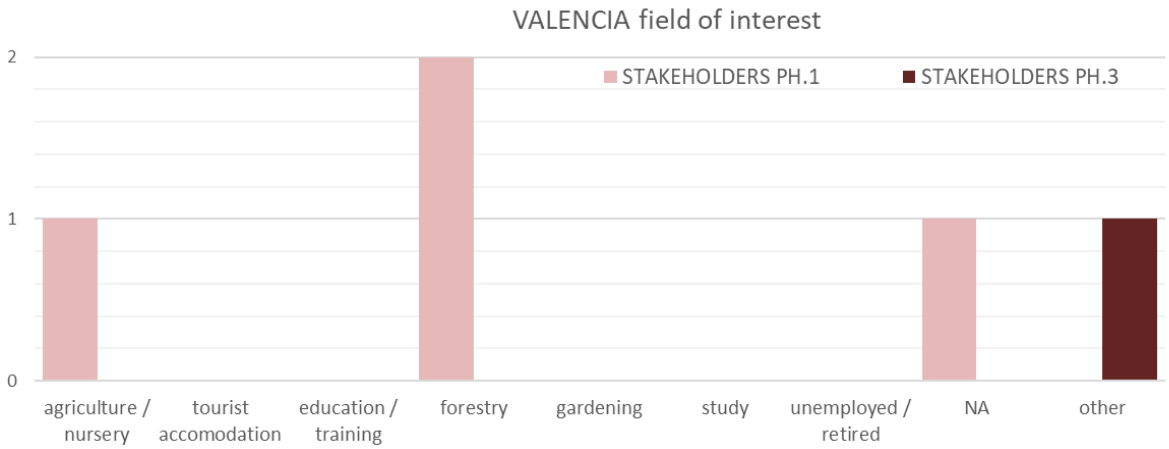
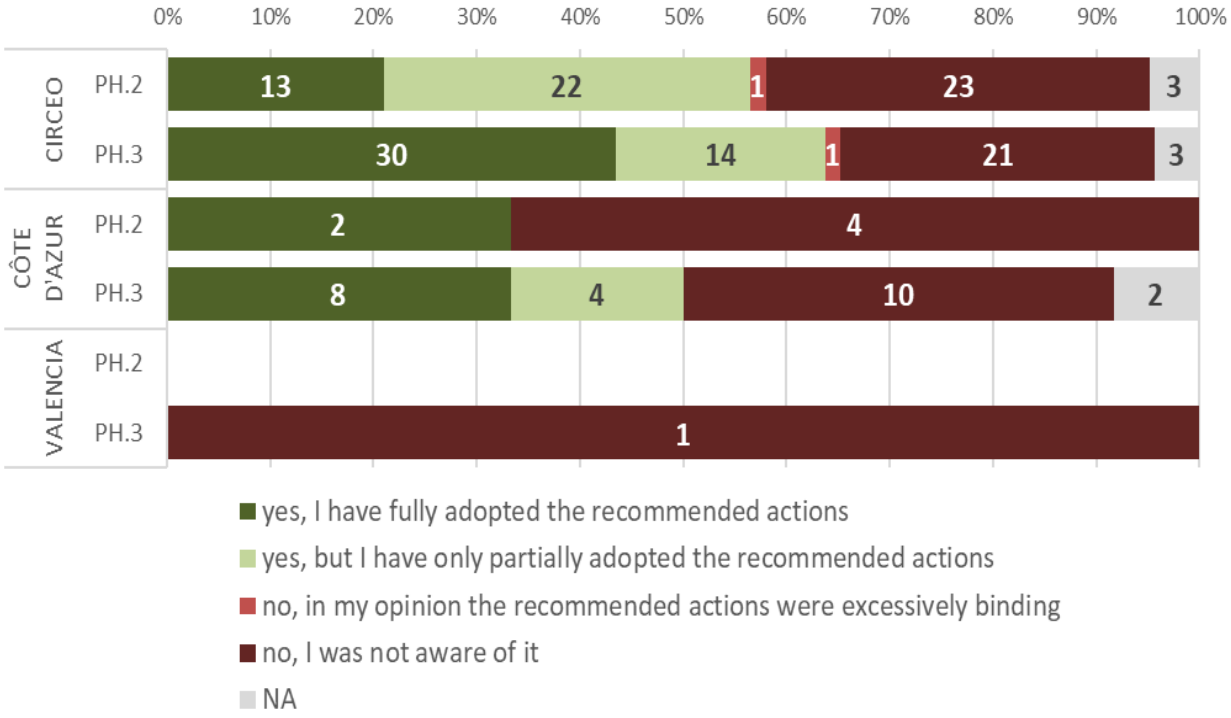


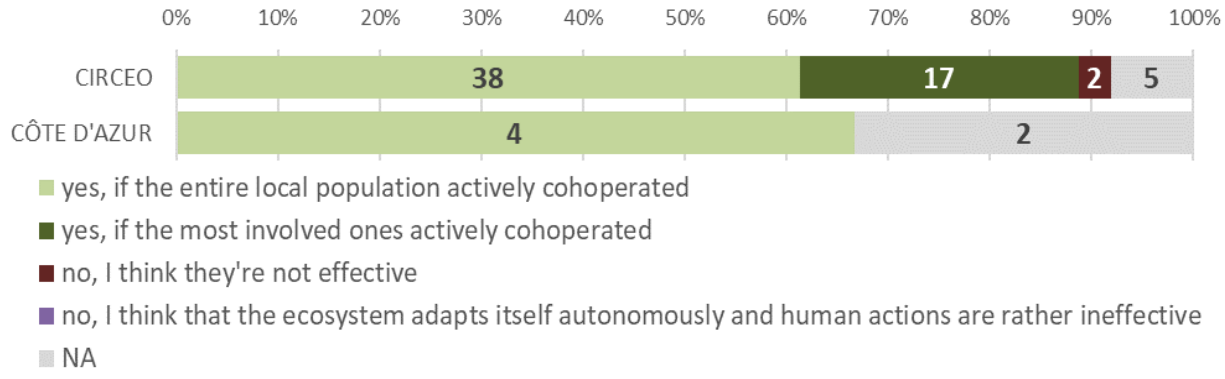
Figure 20 Have you actively collaborated in the LIFE SAMFIX Project, following the guidelines for a shared strategy ?



In response to a question about the active collaboration to the Project (Figure 20), a good deal of the stakeholders in both phase two and three declare not to be aware of it. Whenever they were aware, they followed the requested action, at least partially.

Only one respondent in the Circeo area, though aware, did not comply, thinking that the proposed actions were too binding.

Figure 21 Phase 2 : taking into account your knowledge about the project and your experience with it, do you think that the shared actions are effective ?



In the second phase, the stakeholders are mainly convinced of the effectiveness of the actions, but the majority thinks that a good result can be achieved only if the whole local population actively cooperates (Figure 21).

Asked on the intension of keeping on cooperating in the third phase, near a 30% doesn't answer or declare not to be willing to keep on, while a large majority declares to comply (Figure 22).

Figure 22 Phase 2 : will you keep on cooperating to the project in its final phase ?

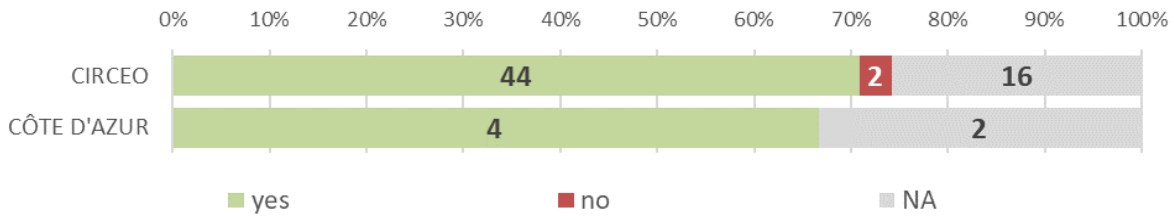
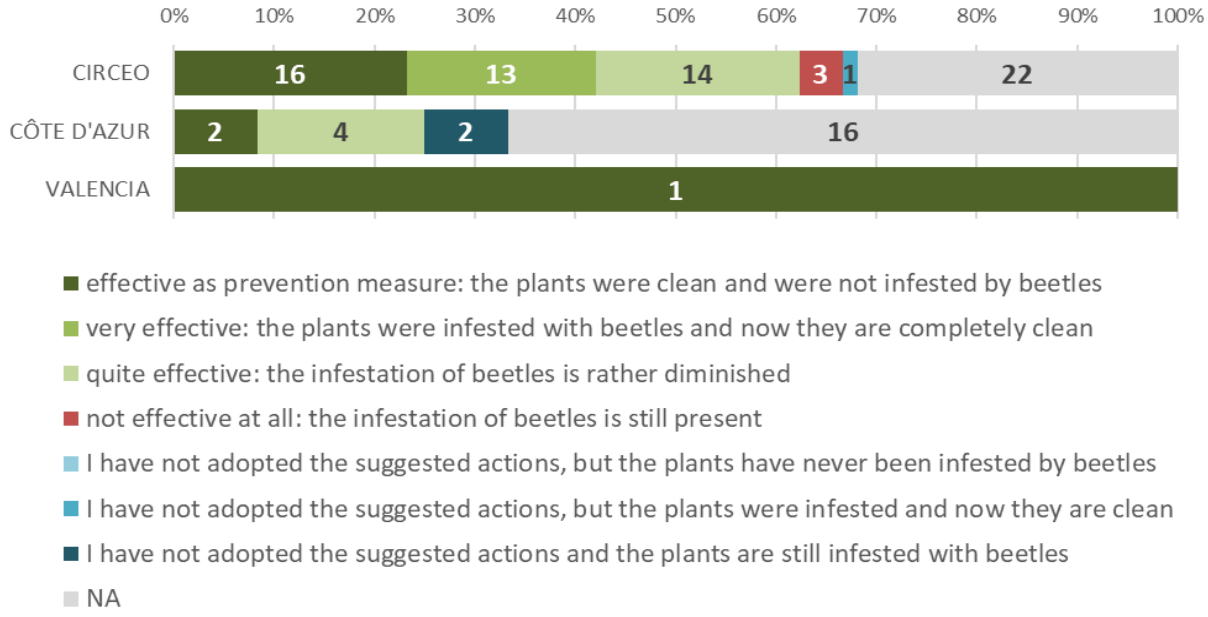


Figure 23 Phase 3 : taking into account your personal experience with the project, do you consider that the actions suggested and that you have adopted have been effective ?

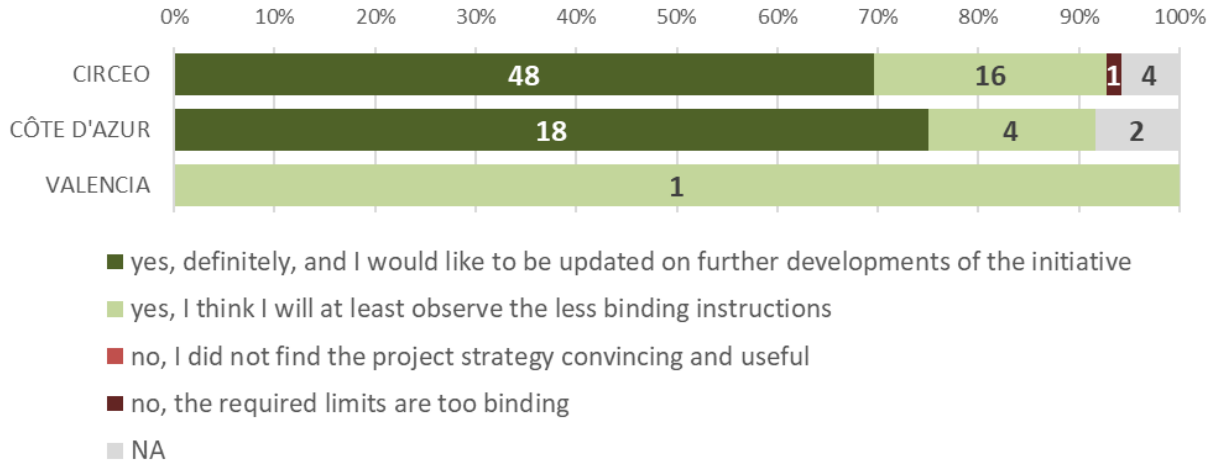


In the final phase (Figure 23), the stakeholders that do not answer about the effectiveness of the actions adopted are a large majority in the Côte d'Azur area (almost 70%), while they are slightly more than 30% in the Circeo one. Among the respondents, many think the actions to be effective, at least partially.

In the Circeo area we find comparable amounts of people between those who repute the actions effective as prevention and those who find them very effective (plants previously infested have become clean after the interventions) or quite effective (the infestation remains but rather diminished).

Half of the respondents in the Côte d'Azur area thinks the actions to be quite effective; two repute them useful as prevention, while another two declares that they have not adopted the suggested measures and thus their plants are still infested.

Figure 24 Phase 3 : in order to prevent the spread of alien species in your area, do you think that you will continue to behave according to the suggestions of LIFE SAMFIX Project ?



Taking into account the experience of the stakeholders with the Project, there is a quite unanimous will to keep on applying the suggestions to prevent the spread of alien species of parasites that endanger local flora and fauna (Figure 24).

The majority is interested in being updated of any further development of the Project and around the 20% declares that will continue to adopt at least the less binding actions.

Only one respondent in the Circeo area, finds the instructions too binding to be followed.

1.3. Perception and behaviour of the tourists in the three areas

As said before, the survey for the tourists is the same throughout all the project. In the following pages, the figures will compare the results of the three phases in the three areas. The samples are quite consistent in the Circeo and Côte d'Azur areas, very low in Valencia (Figure 25)

While the majority of the tourists visits the areas for the first time or occasionally, in Circeo grows the percentage of regular visitors; in Valencia, on the contrary, the few tourists interviewed visit the area on a regular basis (Figure 26).

Figure 25 Tourists : samples from the three areas in the three phases of the survey

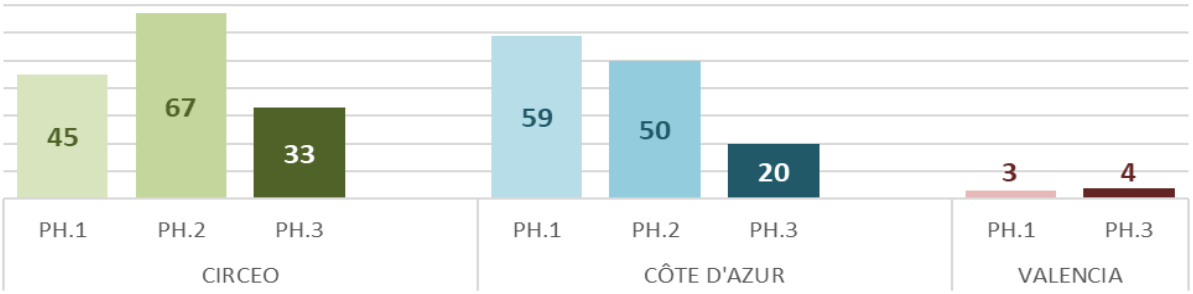


Figure 26 How often do you visit this area ?

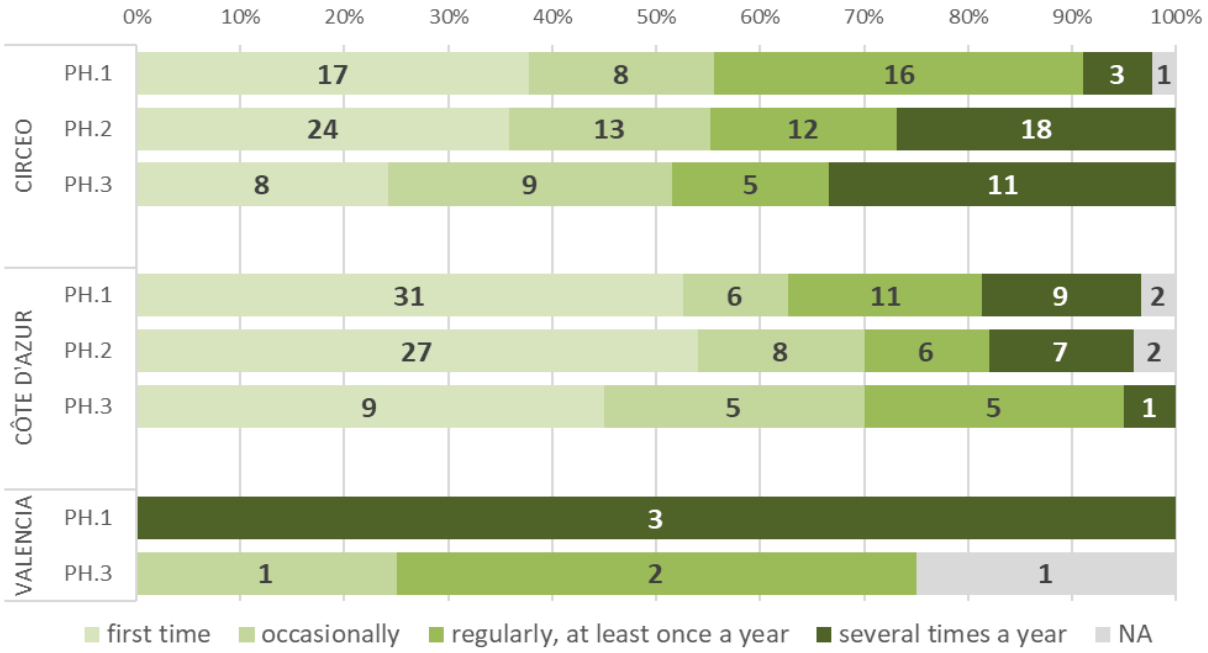
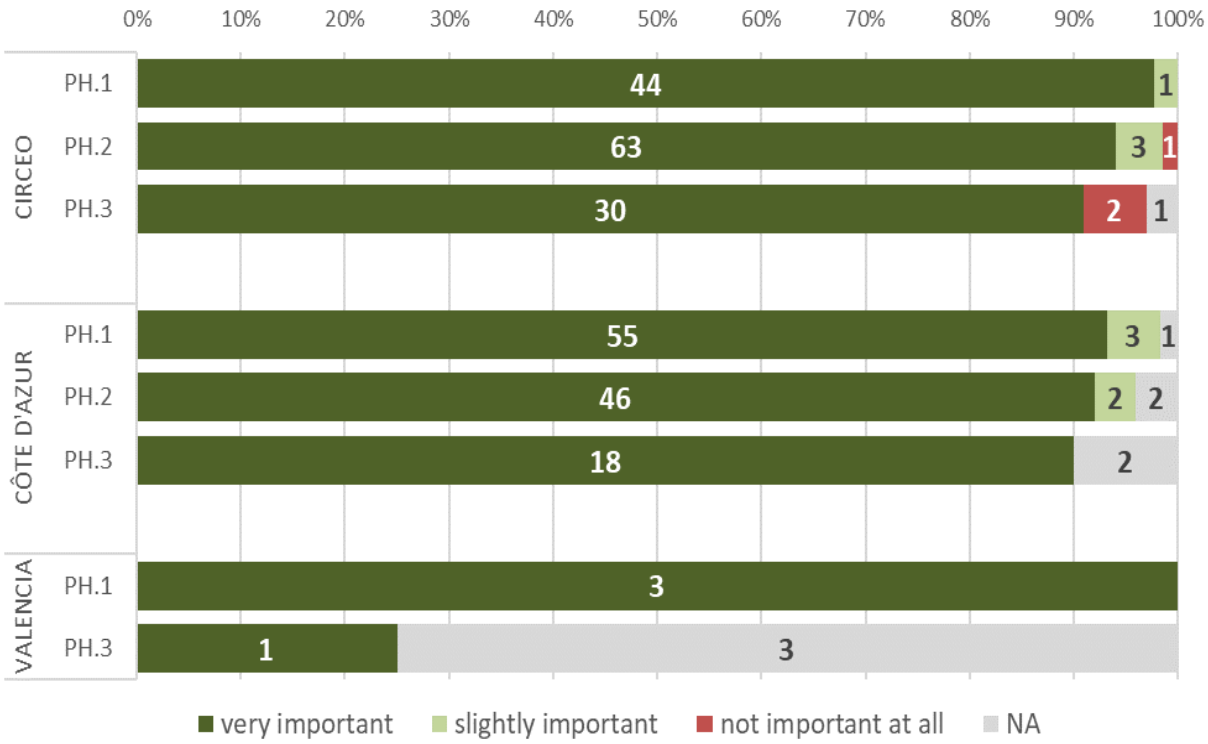
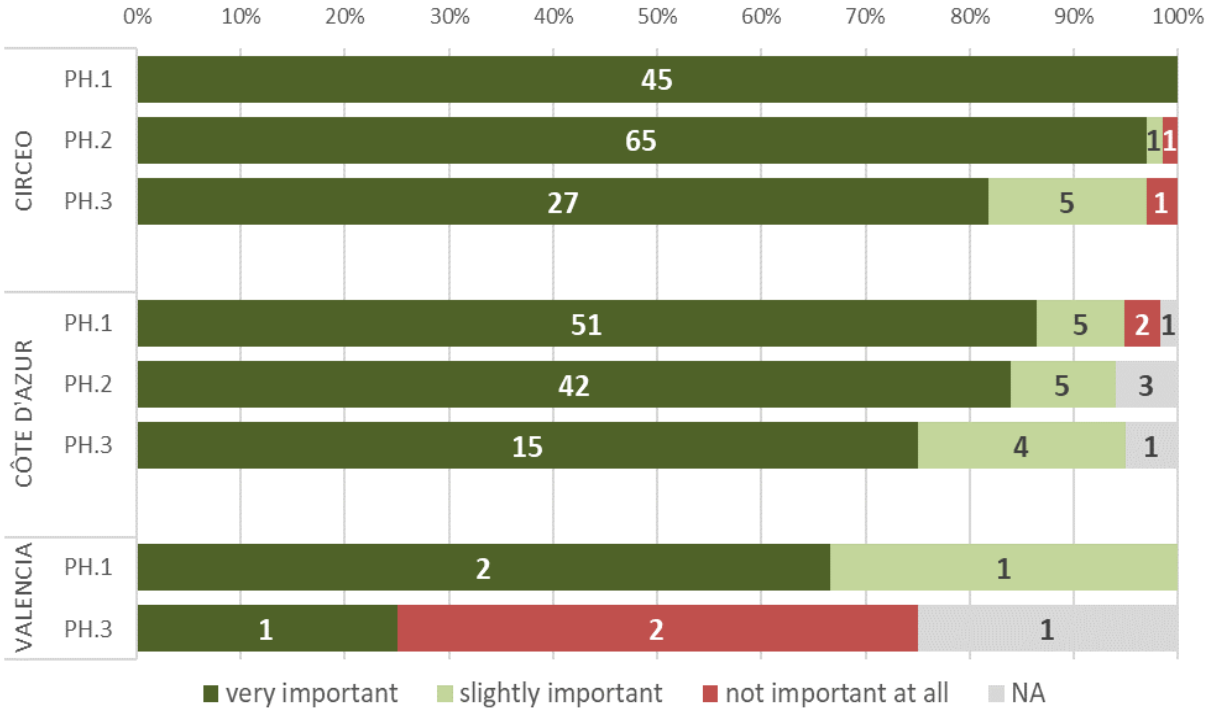


Figure 27 How important is the quality of the environment (local fauna and flora, sea, seabed, air quality) when assessing this tourist destination ?



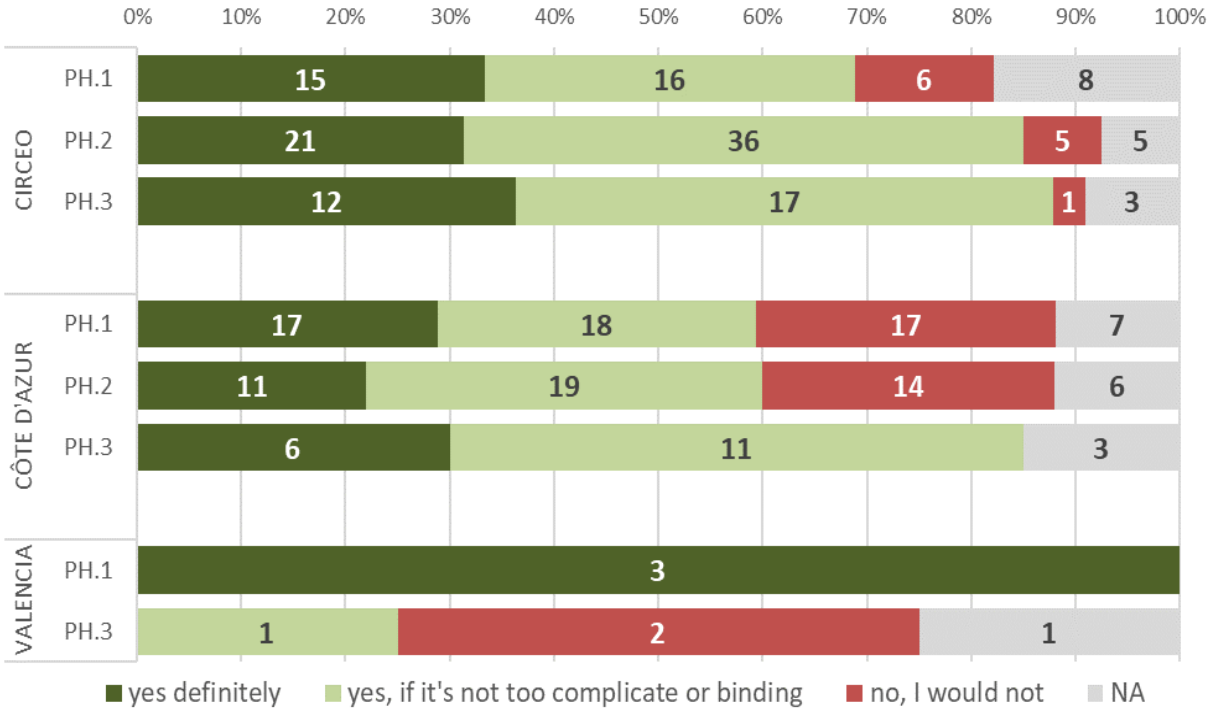
When asked about the importance of the good quality of the environment in deciding to visit the area, over 90% of the samples reputes it very important (Figure 27).

Figure 28 In your opinion, how important is it to protect the local plant and animal species of the area against the invasion of alien species and parasites that could compromise their presence ?



When it comes specifically to the protection of local flora and fauna against parasites, again the majority of tourists reputes it very important, but the percentage of people that consider it only slightly important grows over time and in a couple of occasions people answered that they don't find it important at all (Figure 28).

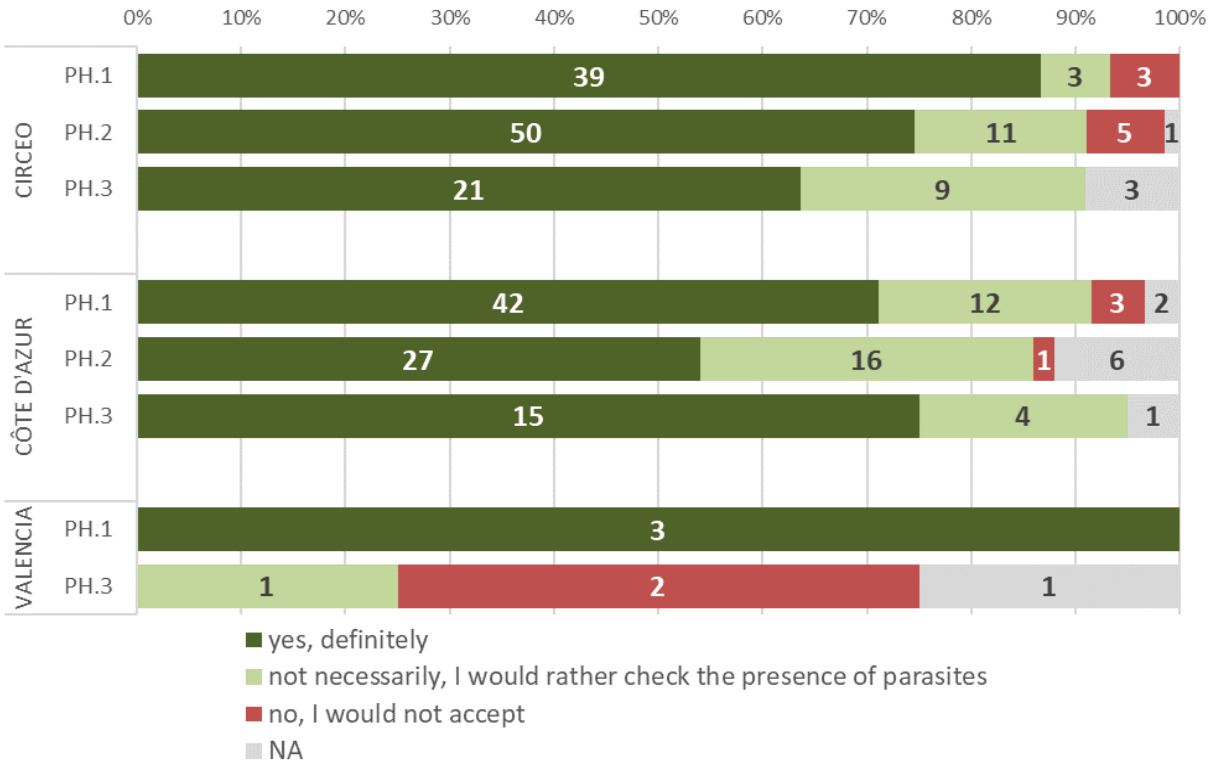
Figure 29 During your permanence in this area, would you be willing to collaborate in a project to monitor the vegetation of the Mediterranean scrub, by informing the Park Authority of potential parasites on the trees ?



Regarding an active participation on their part, by informing about the presence of parasites on the trees, most of the tourists would help, but a large part would only if the task was not too complicated (Figure 29).

Nonetheless, a substantial percentage would not participate at all. Still, in both Circeo and Côte d'Azur areas, this amount diminishes over time.

Figure 30 Would you accept to acquire only indigenous plants for your balcony/garden/green areas to avoid the spread of alien parasites which threaten the local ecosystem ?



Lastly, tourists were asked whether they would accept to avoid buying alien plants so not to spread more parasites (Figure 30). The majority would agree unconditionally, while a percentage between 20% and 40% would rather only check that the plants were clean of parasites.

1.4. Comparisons

As a final observation we compared the results of some of the questions submitted to the residents and to the tourists. Figure 31 shows how despite the already generally high value given to the quality of the environment by the residents of the three areas, tourists always gave it an even higher importance.

Figure 31 Importance of the quality of the environment for tourists and in the opinion of residents and stakeholders of the three areas

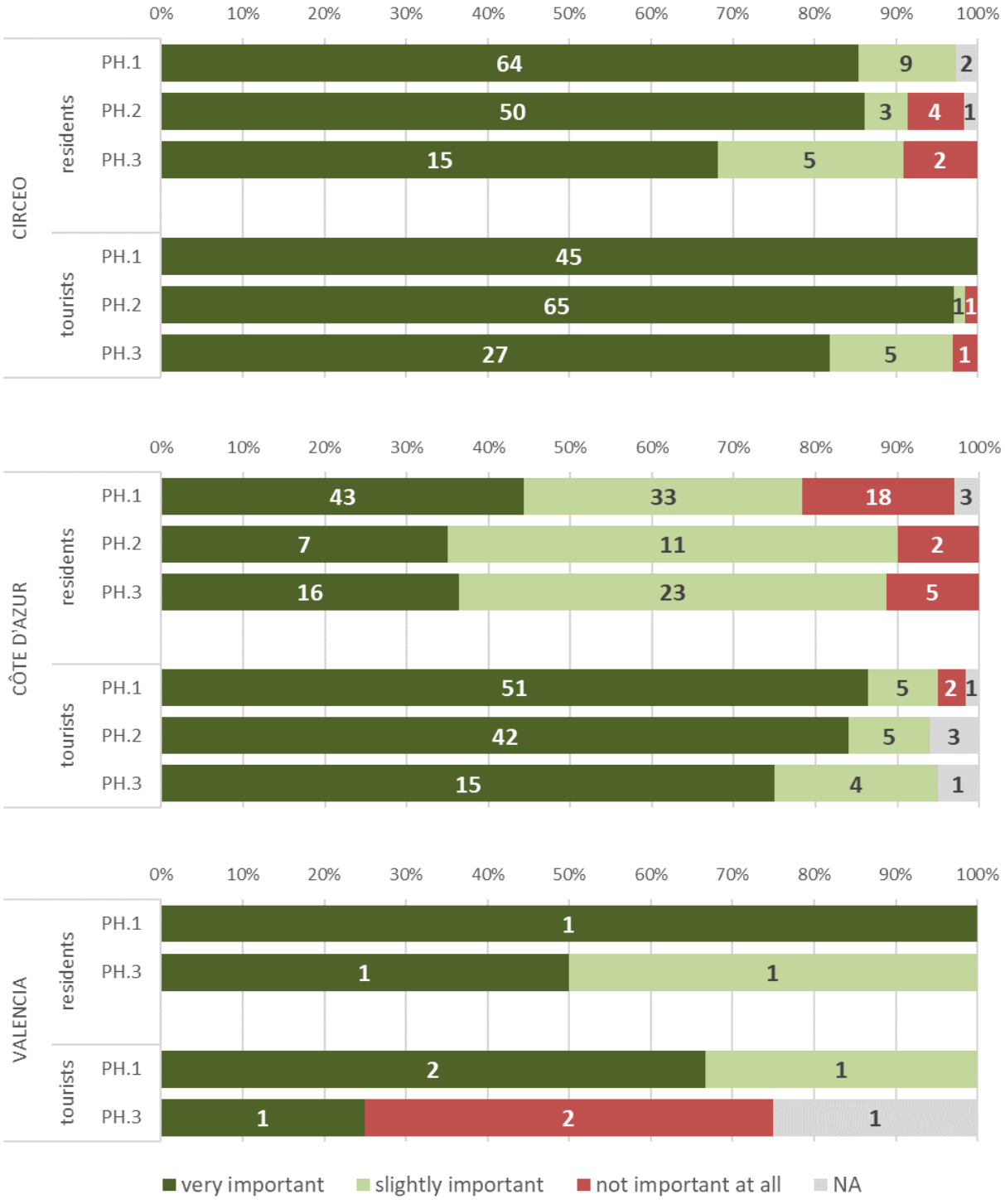
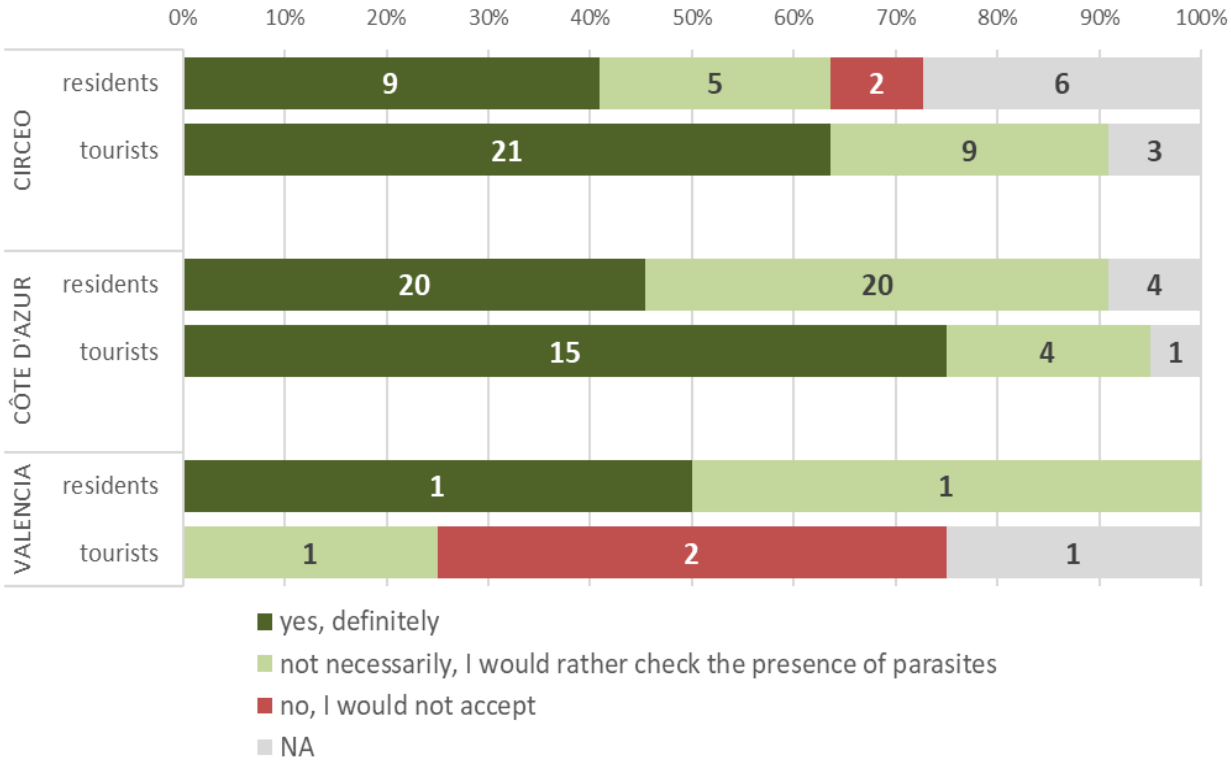
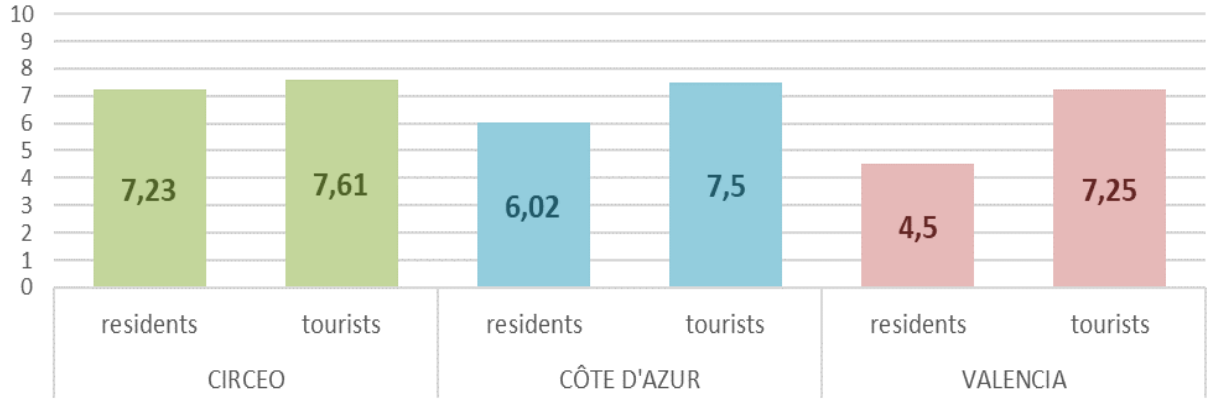


Figure 32 Would you accept to acquire only indigenous plants for your balcony/garden/green areas to avoid the spread of alien parasites which threaten the local ecosystem ?



Similarly, Figure 32 shows that tourists were more willing to directly avoid buying non indigenous plants to avoid the spread of parasites, compared to residents where there is a higher percentage that were against the request, preferring to only check for the presence of parasites or completely refusing.

Figure 33 Phase 3 : from 1 to 10, what number would you give to the quality of the natural environment in this area ?



As a last comparison, Figure 33 illustrates how even in the rating out of 10 of the quality of the environment, in all the three areas tourists gave a significantly higher rate than residents, except for the Circeo area, where the rating only differs slightly (0.38 of difference).

2. Citizens' participation in surveillance activities

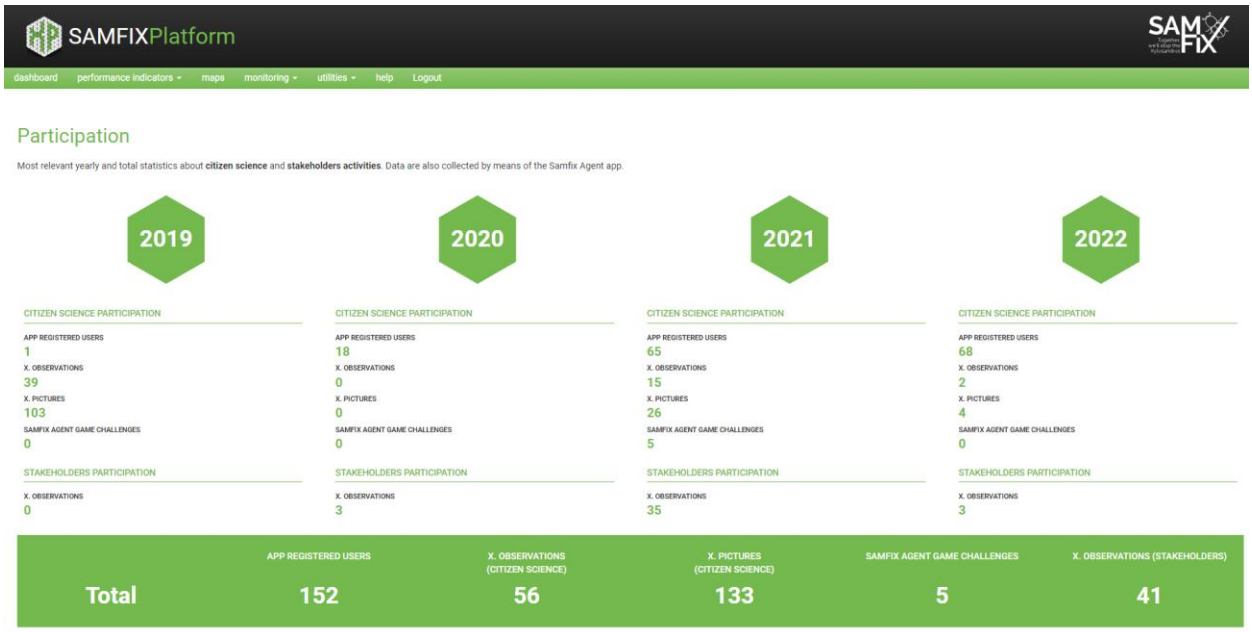
As part of the project, various citizen science activities aiming to the involvement and participation of Citizens and Stakeholders in active surveillance missions had to be implemented. Several citizen science activities were carried out as part of special events organised by parks authorities and other partners involving the use of the SAMFIX Agent app by individual citizens, thus supporting the collection of data on the presence of *Xylosandrus* and possible damage caused by it.

The data summarising the extent of these activities throughout the duration of the project can be found in the X-platform: a central IT platform (accessible from the project website) for data storage, integration, validation, analysis, and output information. The X-platform is a communication and decision support system embedding spatially explicit information, such as those coming from Geographic Information Systems, Remote Sensing and Citizen Science activities.

Figure 34 shows the performance indicators section of the X-platform which summarises, by year, the app's usage data over the four years of the project. To date, there are 152 registered users (37.5% Italian; 35.7% French; 26.24% Spanish), while more than 350 have downloaded the app on their smartphones. In total, 97 reports of possible presence of *Xylosandrus* have been submitted (56 by citizens and 41 by stakeholders), with 133 photographs being sent within the submission.

The surveillance information recorded and sent via the app by users mainly concerned: host plant, entry and exit holes of the insect, health status / type of damage evident on the plant. This information is then evaluated by the project's entomologists in the X-platform who may or may not consider it reliable and possibly proceed with a direct field survey if of interest.

Figure 34 Agent SAMFIX App participation data in performance indicators section of the X-platform



In the *Xylosandrus* Reporting Map section of the X-platform there is a map of the georeferenced points of the reports submitted by users, as shown in Figure 35. Although the observations sent mainly concern the project parks in France, it is worth underlining that in Italy and Spain some reports were sent from outside the project areas, providing valuable information on areas of possible expansion.

Figure 35 Xylosandrus Reporting Map section in the X-platform

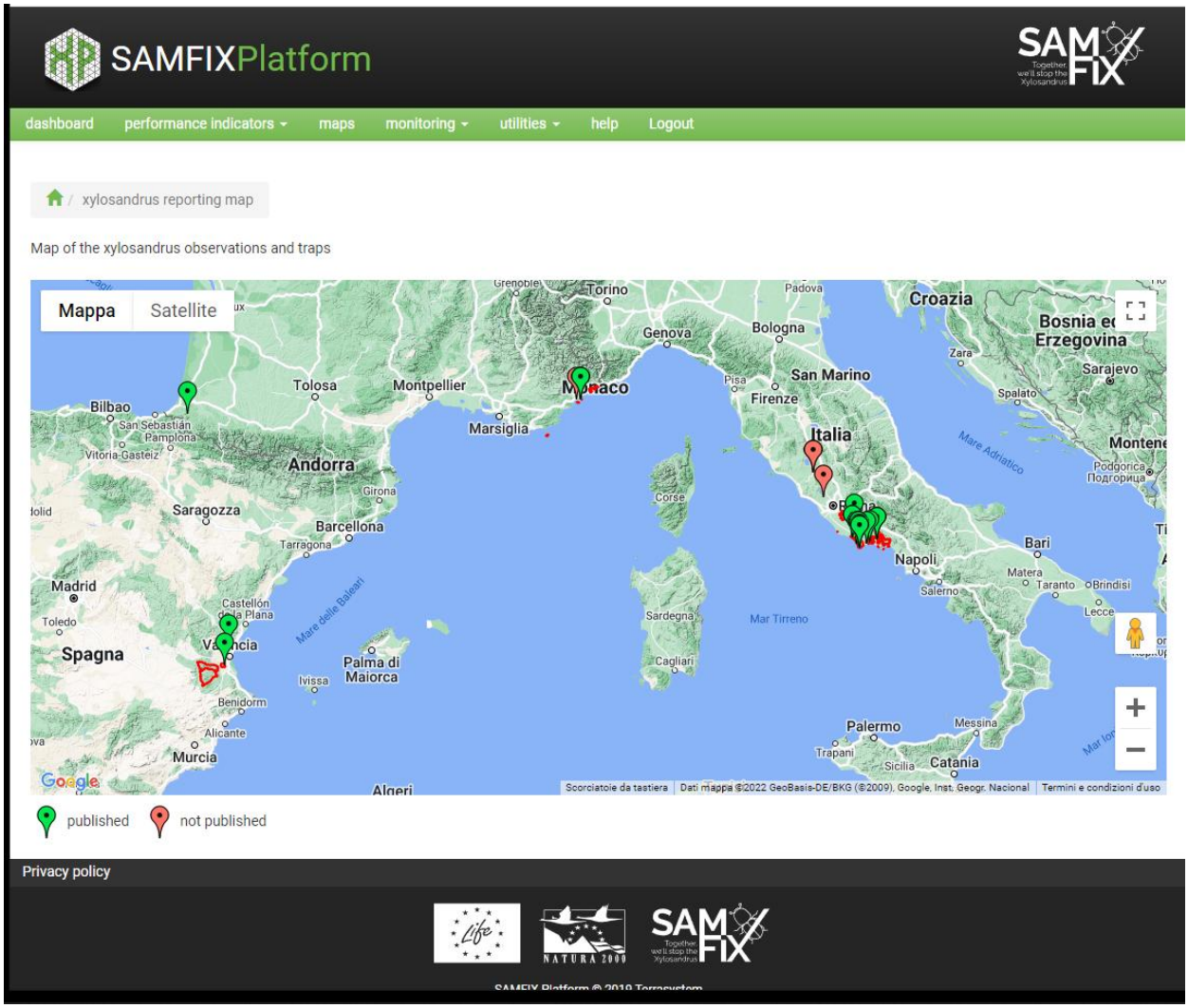
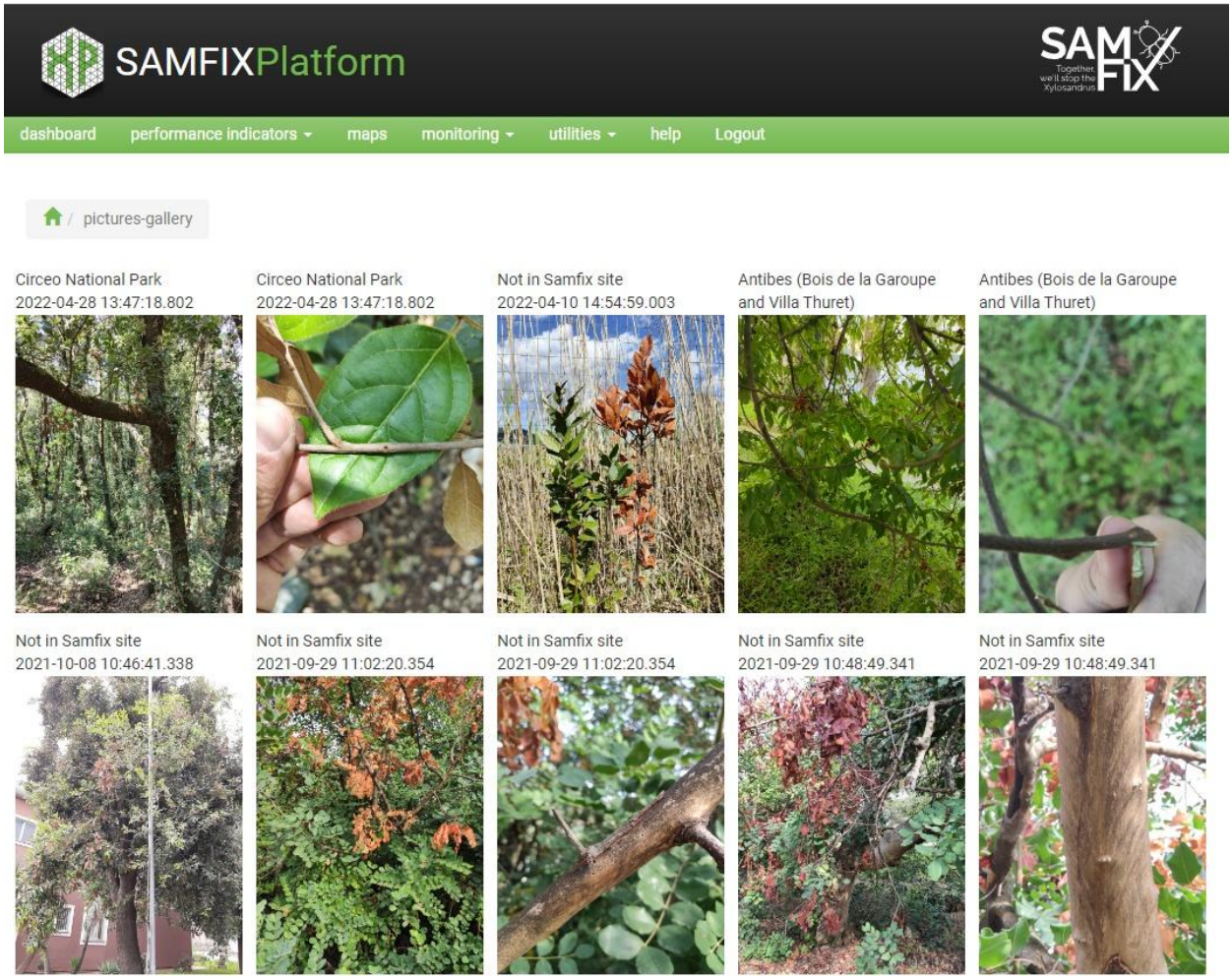


Figure 36 Pictures gallery section in the X-platform



Considering that the app was published at the end of 2019, we can assume that the main limitation of its promotion and use may depend on the pandemic situation and the restrictions that followed.

Another reason is related to the fact that the app was only developed for android systems in order to favour the use of open source systems (as strongly recommended by the European union), which in fact impeded the use of the app to iOS users, particularly numerous in the younger age brackets.

3. Economic impacts

The action foresaw an estimation of the risks and scale of potential economic losses in the project core areas related to *Xylosandrus* spp. spread, based upon an assessment of actual value of economic activities most at risk and the risk analyses made in Action D1. It was compared with an estimation of the costs of implementation of the demonstrated prevention, early warning and rapid response protocols, providing for an economic trade-off.

The expected results was an assessment of the monetary benefits of prevention, early detection and rapid response protocols in natural parks.

An economic evaluation was performed on 3 monumental plants in Circeo National Park Visitor Centre during an instrumental stability evaluation performed by agronomists using the Analitycal Green Estimation Method (A.G.E.M.). This method allows to estimate the economic, landscape and environmental value of a green infrastructure. The evaluation method bases its algorithms on classic estimation criteria: a series of data must be entered taking into account the typical characteristics of each individual, such as the transparency of the crown, the size of the stem and foliage, species and shape.

As in other techniques and procedures for evaluating plants, the calculation of the carbon dioxide absorbed or stored, the oxygen produced and the filtration of PMxx, allows to verify the main ecosystem services of the tree.

The method allows to obtain many results using various calculation possibilities of the software. In a few minutes it is possible to calculate:

- the economic and environmental value of the green infrastructure;
- The economic-environmental value, at a later date, of the green infrastructure;
- the marginal increase in the value of the green infrastructure at a later date;
- The cost of running the green infrastructure in a given lifetime;
- The convenience of management during the monitoring period of the green infrastructure;
- The value of the damage caused to a green infrastructure due to inadequate maintenance;
- the emotional value attributable to a green infrastructure.

These parameters are indispensable to the evaluator and to the manager (or owner) of the green infrastructure, both in terms of management choices and in the awareness of the property assets.

Comparing the parameters used in the classical methods (C.T.L.A., C.A.V.A.T., German, Swiss, for example), it can be seen that the initial economic value is expressed without an evaluation

logic and justified with fractions of market prices or averages that are not particularly specific and none of the methods has an economic quantification of the environmental value.

The AGEM method bases the evaluation logic on mechanisms of classical estimation, well proven for decades; in the aspects that are more difficult to estimate analytically, it uses multiplier coefficients that base their weight on legislation and on criteria already used in other fields and for other sectors.

The method tries to adopt, as far as possible, the economic values according to mathematical calculations that follow a logic of analytical evaluation, in order to reduce the subjective error of the evaluator as much as possible.

Although no clue exists to date to appreciate landscape-related values in the assessment – such as the aesthetic and socio-cultural value, the method applies a matrix of multipliers that takes into account the fundamental aspects that can bring about the change in the value of the green infrastructure.

The 3 plants evaluated are in a wooded area inside Circeo Visitor Centre. The area is subjected to landscape restrictions pursuant to art. 38 of the Regional Territorial Landscape Plan (PTPR). In Circeo National Park Visitor Centre were installed 3 traps (2020-2021) and the trap n. CV02 was installed on plant 1 in 2020 and in 2021.

Classification from Google maps and identification of trees

In the table n.1 below are the dendrometric data of the three trees on which the analysis was based, while tables n.2 and n.3 show the results of the analysis of the A.G.E.M.

N	Scientific name	Common name	Height [m]	Stem diameter [cm]	Crown diameter [m]	Crown depth [m]
01	Quercus ilex	holm oak	22	87.5	10-12	16
02	Quercus ilex	holm oak	23	115	18-22	15
03	Quercus ilex	holm oak	23	98	25	18

Table n.1: dendrometric data

Total CO_2 currently stored (kg)	Estimated O_2 produced (kg)	Expected abatement of pollutants (kg)	Current estimated value of CO_2 absorption/year (kg)	Estimated expected value of CO_2 absorption/year (kg)
34.946,51	25415,65	873,68	329,43	360,14

Table n.2: A.G.E.M. results on O2 and Co2

Present value of the asset	Expected value of the asset	Marginal increase in the value of the asset (in 15 years)	Cost of extraordinary management	Convenience of management
300.223,53 €	331.172,41 €	30.948,88 €	13.812,5 €	17.136,38 €

Table n.3: A.G.E.M. results on the economic value of the asset

In addition to having an impact on natural ecosystems, *Xylosandrus* spp also have an economic value. The monitoring costs, distributed between the purchase of attractors, personnel costs, fuel for the vehicles, had a significant impact on the project budget.

In the Circeo National Park territory between 2020 and 2021 there were two monitoring seasons. The traps were active between March and November, were checked every 3 weeks and the attractors were changed every 6 weeks. In the area where the 3 holm oak trees are present, two multi funnel traps have been installed. The monitoring costs were:

- Traps and Lures (2020): 12.647,70 €;
- Traps and Lures (2021): 13.087,26 €;
- Shipment costs, customs duties, taxes, etc (2020): 2.563,62 €;
- Shipment costs, customs duties, taxes, etc (2021): 3.656,58 €;
- Other direct costs: 258,36 €;

A total of 32.213,52 € were spent in materials for trapping protocols in Circeo National Park in 2020 and 2021. The table 4 quantifies the effort necessary to sample following the protocols drawn up by the SAMFIX project in relation to the cost of personnel in 2021.

Activity	**n. of traps**	**Period**	**Days in field**	**Hours in field**	**Cost [€]*** *cost of labor 21.60 €/h
Push and pull	30	from 01/03/2021 to 31/10/2021	66	165	3.564,00
Transects	45	from 01/03/2021 to 31/10/2021	98	147	3.175,20
Ninfa	12	from 01/03/2021 to 31/10/2021	11	33	712,80
X-Traps	8	from 01/03/2021 to 31/10/2021	11	22	475,20
TOT	95	8 months	186	367	7.927,20

Table n. 4: effort employed by CIRCEO staff to sample

In conclusion we hypothesized a monitoring campaign of the three plants object of study through a transect composed of 5 traps, so as to safeguard the plants themselves and the economic value they have.

- Linear transect protocol: 376,67 € (traps and lures, 8 months) + 352,78 € (field activities). Total cost for a linear transect protocol in the selected area: 729,44 €/year (10.941,60 € in 15 years);
- Cost of extraordinary safety management € 9.562,50 (in 15 years);

- Total cost for management of plants (both for safety and for Xylosandrus spp presence): 21.700,80 € (in 15 years);
- Marginal expected increase in the value of the asset: 21.997,79 € (in 15 years);
- Value of the asset € 300.223,53.

In conclusion, even if the costs of monitoring and managing the plants represent a high figure, these actions allow to keep the value of the asset constant over the years.

4. Conclusions

Taking into account the results of the inquiries on perception and behaviour, we observe a broad consensus on the general protection of the environment and also specifically appreciation of the actions performed within the LIFE SAMFIX Project.

Despite a certain unawareness of the Project among both residents and stakeholders, we gathered a large willingness to participate in actions aimed to safeguard local flora and fauna, in some cases even unconditionally.

The people that declare to be aware of the Project are mainly favourable to it; they expect the actions to be effective if supported by the local population or at least by the more involved people. In the final phase, most stakeholders considered the adopted actions effective in terms of prevention and containment. Considering the importance of the collaboration of locals and the shares of unaware people, it was concluded that communication activities and the spreading of information regarding the Project would probably have been more effective if the outbreak of the Covid-19 pandemic and the following restrictions had not taken place.

In the end we can also observe that tourists are more generous than residents and stakeholders in the evaluation of the quality of the local environment. Tourists interviewed in the three areas seem in fact to be very interested in the quality of the environment and largely willing to cooperate in monitoring eventual parasites on the trees, if not too complicated. This participation and the feeling of being part of the protection of the natural resources could perhaps become a further reason of interest to visit the areas, especially for groups led by educational purposes.

The SAMFIX Agent app counted 152 registered users by project end, among them as many as the 63,8% have demonstrated willingness to take action, sending reports and pictures. Considering that the app was published at the end of 2019, we can assume that the limitation of its dissemination and use may depend on the pandemic situation and the restrictions that followed. Another reason is related to the fact that the app was only developed for the Android system in order to favour the use of open source systems (as strongly recommended by the European union), which in fact limited the use to iOS users, particularly numerous in the younger age brackets

From an economic point of view, the expenses necessary to purchase traps and to supervise the woods should be considered an investment rather than a cost because the damage caused to the natural heritage would be more expensive. In fact it would lead eventually to an economic loss in proportion to the decrease found in the quality of the environment which would negatively impact the tourists' response. Moreover, there would be a further loss of both economic resources and natural heritage in the eventuality of having to substitute century-old trees with younger ones.