Fondazione Lombardia per l'Ambiente

A1.2 IDENTIFICATION OF THE MAIN FACTORS THAT AFFECT THE ENVIRONMENTAL VULNERABILITY OF ECOSYSTEMS TO INVASIVE ALIEN SPECIES (IAS)

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1. INTRODUCTION

The INVALIS project aims to improve policies to protect biodiversity from the threat posed by Invasive Alien Species (IAS). One of its main goals is to identify the dimensions and the factors that determine the natural ecosystems' vulnerability affecting the establishment of Invasive Alien Species.

The Managing Authority aims to improve the policy instrument, importing effective ways derived from the interregional cooperation to implement new projects relevant to the protection of biodiversity.

Under investment priority, interventions for the protection of environmentally sensitive (touristic) areas (e.g. protected areas and NATURA 2000 sites) will be supported in terms of a) increasing their resilience to IAS introduction, b) establishing an early warning and information system, and c) performing response actions for high priority species.

Furthermore, management support services will be provided to public authorities' staff as regards the development of a common IAS management protocol that will outline the procedures that relevant staff should follow to administer all actions related to IAS management.

The region expects management of the alien species to be improved based on the INVALIS lessons learnt in the following ways:

- Select funding priorities for projects based on the natural environments' vulnerability to IAS. This includes allocating more funds to interventions contrasting biological invasions in fragile areas.
- Establish collaboration schemes between research institutes, public authorities and the management bodies of protected areas to support the reskilling of their workforce on IAS management.
- Develop indicators for monitoring the effectiveness/efficiency of the IAS related projects that have been implemented.

Four main factors that can affect the ecosystem vulnerability have been identified and reported in Figure 1.

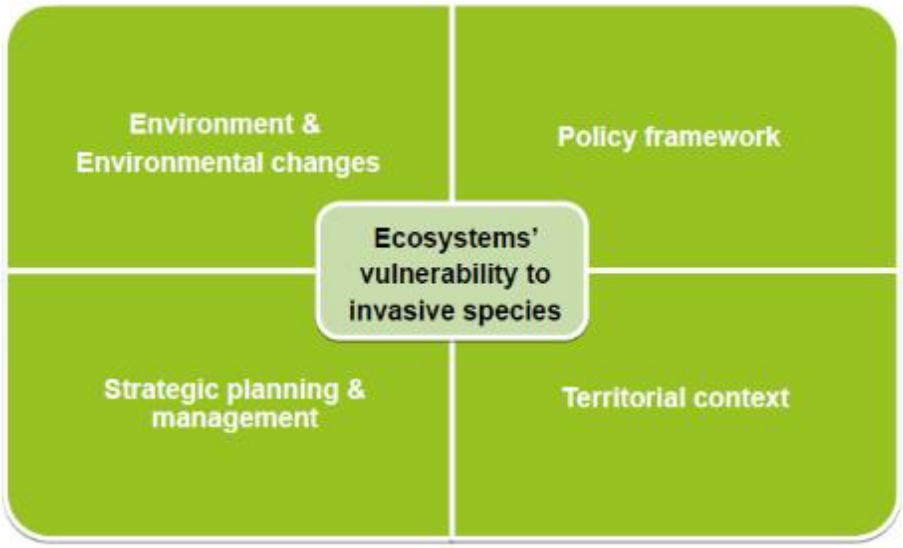

Figure 1. Main factors that can affect the environmental vulnerability of an ecosystem

In this context, the role of the Lombardy Foundation for the Environment (FLA) was to prepare a methodology (common questionnaire) in order to enable partners to collect information from their stakeholders and to identify the factors that determine regional natural ecosystem vulnerability to the introduction and establishment of IAS.

The questionnaire follows the conceptual scheme presented in Figure 1, where the 4 main factors affecting ecosystem vulnerability are considered in the first 3 sections, followed by an additional section regarding the specific experience of the respondents (APPENDIX 1).

2. SURVEY RESULTS

In total, 106 filled in questionnaires were collected from the seven partners, as reported in table 1. FLA (Italy) contributed with the highest number of responses (24) followed by ERDF (Spain (21), and Greece (17). As in the Application Form reported on page 67, all partners must provide the results of a minimum of 8 territories. Thus, when this value was not reached, data were not included in the analysis because they are not representative of the region.

*Table 1: Questionnaire responses by INVALIS partner project. *minimum number of questionnaires not reached*

Partner	Acronym	Country	Number of questionnaire responses	%
National Center for Environment and Sustainable Development	NCEDS	Greece	17	16
Lombardy Foundation for the Environment	FLA	Italy	24	23
Regional Ministry for the environment and rural, agricultural policies and territory	ERDF	Spain	21	20
Corsican Agency of Environment	OEC	Corsica	15	14
Bucharest-Ilfov Regional Development Agency	ADR-BI	Romania	1*	1*
Institute of Science, Technologies and Agroenvironment of the University of Porto	ICETA	Portugal	16	15
Zemgale Planning Region	ZPR	Latvia	12	11
Total		**EU**	**106**	**100**

2.1 Section 1 – General information

The first section of the questionnaire aimed to collect general information on the respondent and which his/her role in the Assessment area (Aa) was. Most of the answers to the questionnaire were provided by managers, technical operators or researchers.

The second question was "Who is the Responsible Body for the management of the Assessment Area?" and results show that 43% of the total Assessment Areas (Aas) are managed by Public Authorities and almost 30% by Parks (Figure 2).

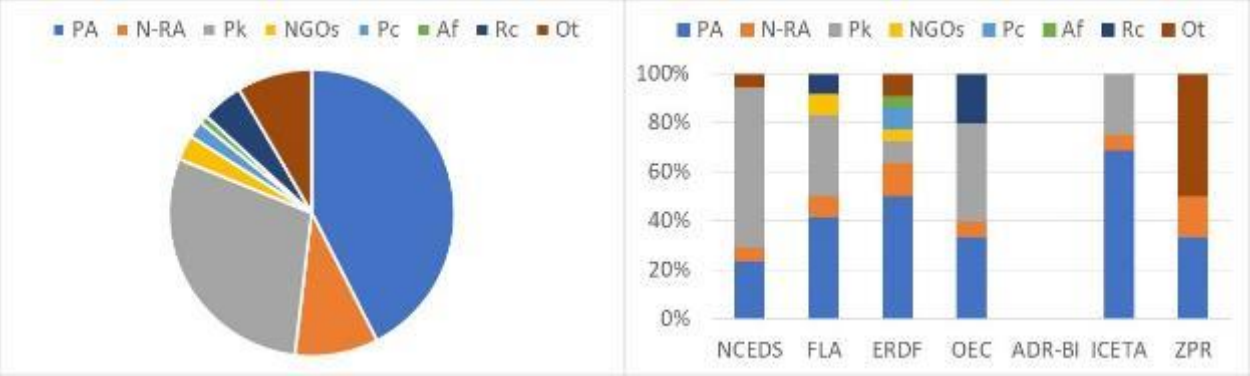

Figure 2. Results of Question #2: "Who is the Responsible Body for the management of the Assessment Area?" PA: Public Authorities; N-RA: National/Regional Agency; PK: Parks/Protected Areas; NGOs: Environmental NGOs; Pc: Private companies; Af: Armed forces; Rc: Research centres/Universities; Ot: Other. For the acronyms of the partners, see Table 1.

2.2 Section 2 – Environment and environmental change

The aim of the second section of the questionnaire was to describe the Assessment area on the basis of its ecological characteristics.

Question #3 was related to the level of biodiversity in the Aas. Biodiversity is often used as a proxy that defines the health status of a given ecosystem. For example, in a pristine environment, biodiversity is generally high and native species occupy all the available ecological niches.

57% of the respondents considered the biodiversity of their Aas at a high level, 35% at a medium level, whereas and only 7% judged the biodiversity at a low level (Figure 3).

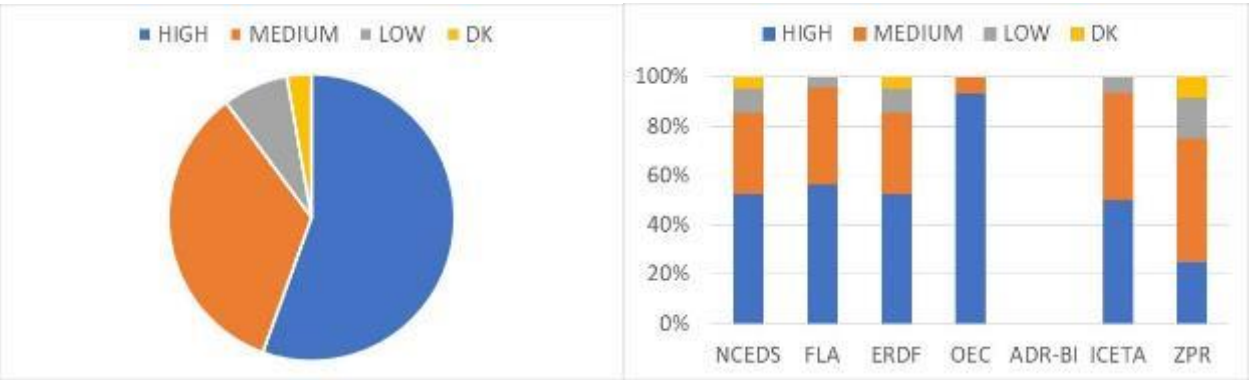

Figure 3. Results of Question #3: "In your opinion, which is the level of biodiversity in the Assessment Area?" HIGH: high level; MEDIUM: medium level; LOW: low level; DK: don't know. For the acronyms of the partners, see Table 1

Question #4 "In the Assessment Area, are there endemic species or protected/threatened species?" underlined the importance of the presence of endemic/endangered species for their natural value. On the other hand, the presence of endangered species could also increase the vulnerability of an ecosystem because usually these species very often require specific habitats conditions that have to be preserved.

The answers indicate that in almost all the Assessment Areas at least one endemic or protected/threatened species is present which is an extra value for the area, thus requiring priority in conservation efforts (Figure 4).

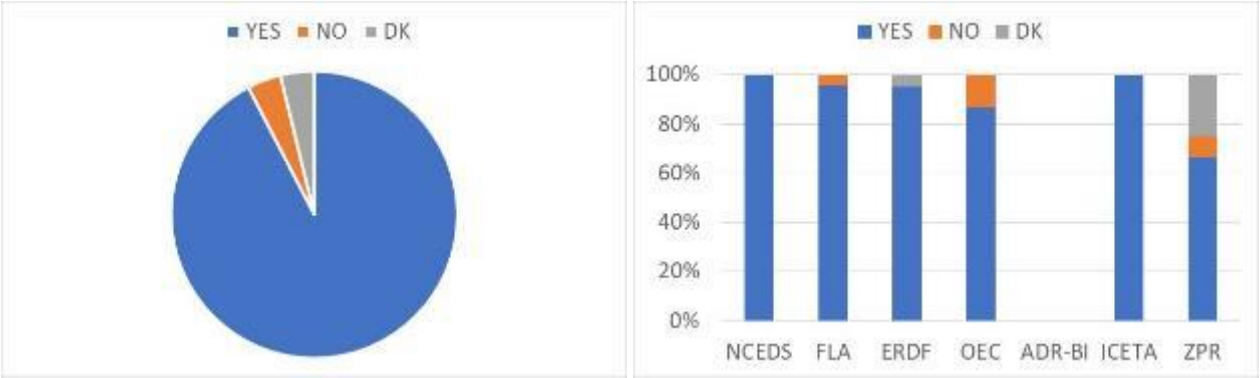

Figure 4. Results of Question #4: "In the Assessment Area, are there endemic species or protected/threatened species?" DK: don't know. For the acronyms of the partners, see Table 1

There are many other causes that can lead to a decrease in biodiversity level such as environmental pollution, habitat fragmentation and the presence of anthropogenic impacts that cause diminished resistance of native populations to other disturbing factors. Questions #5 and #6 take these conditions into consideration: in all the Assessment areas, the level of anthropogenic disturbance is medium (Figure 5), as is habitat degradation (Figure 6).

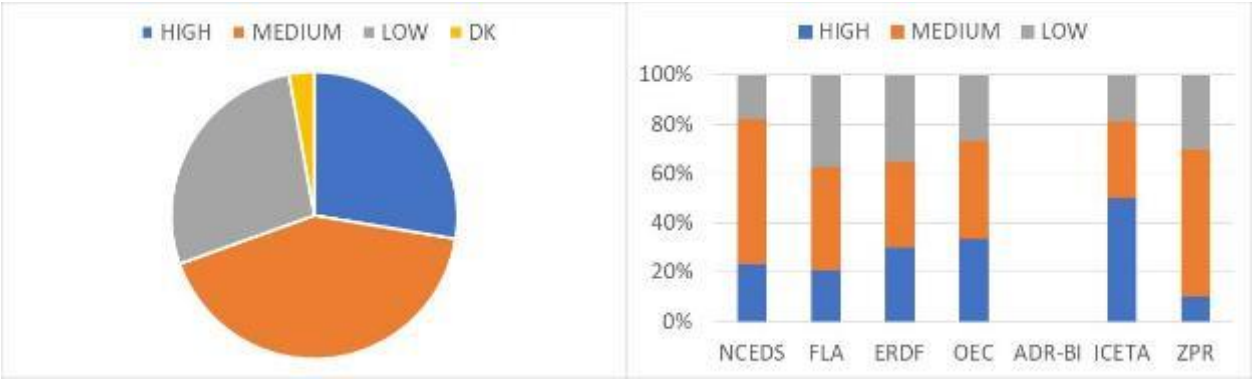

Figure 5. Results of Question #5: "In your opinion, which is the level of anthropogenic disturbance/pollution in the Assessment Area?" HIGH: high level; MEDIUM: medium level; LOW: low level; DK: don't know. For the acronyms of the partners, see Table 1

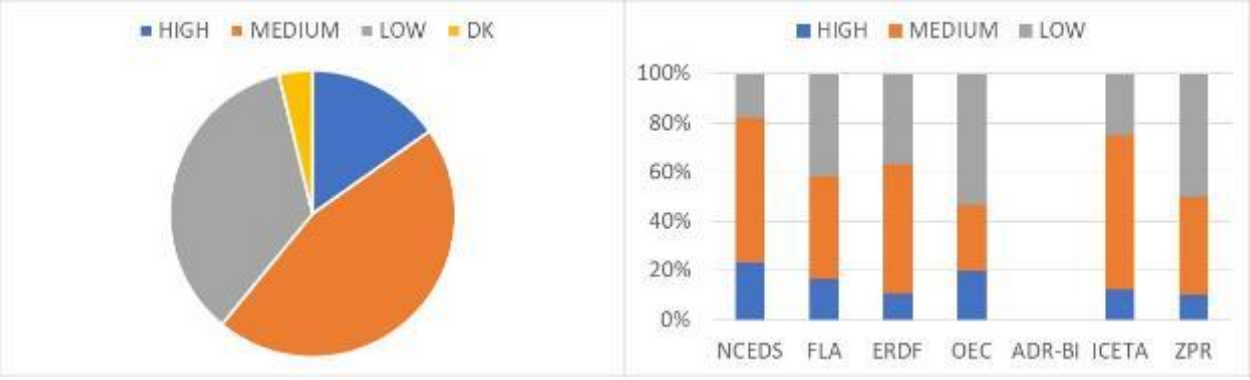

Figure 6. Results of Question #6: "In your opinion, which is the level of habitat degradation/ habitat loss / anthropogenic disturbance/pollution in the Assessment Area?" HIGH: high level; MEDIUM: medium level; LOW: low level; DK: don't know. For the acronyms of the partners, see Table 1

Habitat degradation, presence of anthropogenic impact and proximity to human activities cause simplification of the habitat, leading to vacant niches and impoverishment of biodiversity. These factors favour the establishment of more opportunistic species. The landscape in which the Aa is included is crucial for maintaining its biodiversity. If the Aa is isolated and surrounded by a heavily anthropized territory (e.g. urban or rural), the level of vulnerability is higher compared to other areas surrounded by a more natural context.

Most of the Aas are surrounded by urban/rural areas and this might increase their vulnerability (Q7, figure 7).

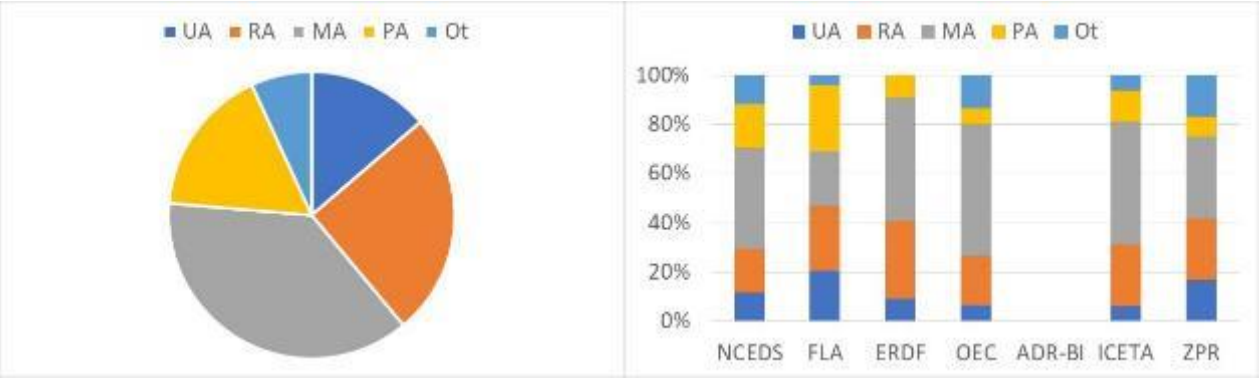

Figure 7 Results of Question #7: "Which types of ecosystem surround the Assessment Area?" UA: Urban Areas; RA: Rural Areas; MA: Mixed urban/rural Areas; PA: Pristine Areas; Ot: Others. For the acronyms of the partners, see Table 1

Moreover, some of the anthropogenic activities that take place around the Assessment Areas (e.g. commercial) are more likely to favour the introduction of IAS and alter the environment (e.g. industrial) thus enhancing IAS establishment. Most of the Assessment Areas analysed are surrounded by agriculture, livestock and industries (Q8, Figure 8).

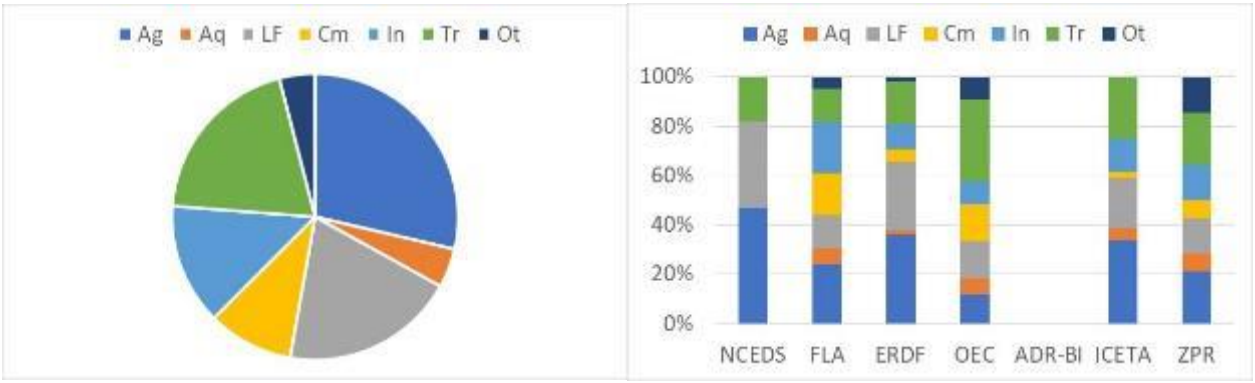

*Figure 8. Results of Question #8: "Which types of anthropogenic activities surround the Assessment Area (within 10 km)?" Ag: Agriculture; Aq: Aquaculture; LF: Livestock / Farm; Cm: Commercial; In: Industries; Tr: Tourism / recreational; Ot: Others. For the acronyms of the par*tners, see Table 1

Another important factor associated to invasion vulnerability refers to the difficulty of access to the Aas (e.g. lack of roads or presence of physical barriers). The more difficult the access is, the more the Aa should be less vulnerable to alien species introduction. Moreover, according to the propagule pressure theory, if an Aa is close to inhabited centres the risk of IAS entry is considered higher. Almost all the answers indicated that more than 90% of the Assessment Areas are easily accessible (Q9, Figure 9) and they are also located very close to inhabited centres (Q10, Figure 10).

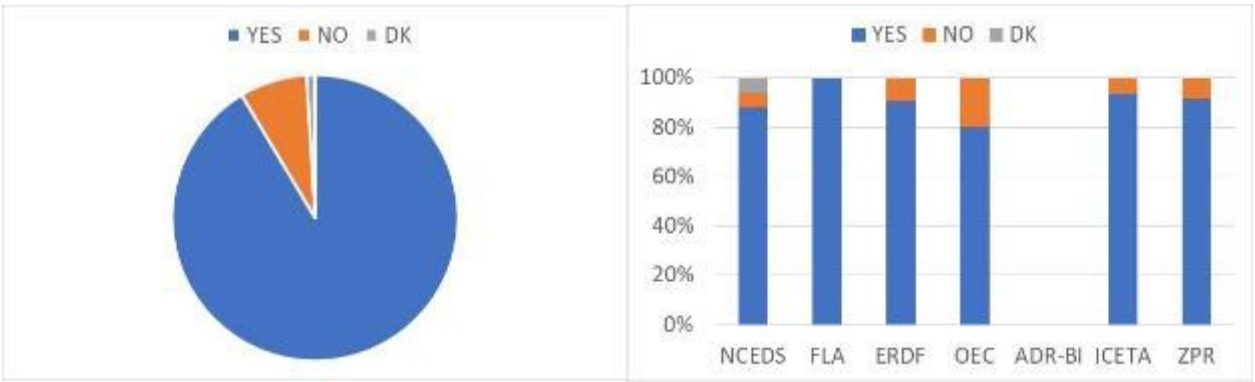

Figure 9. Results of Question #9: "Is the Assessment Area easily accessible?" For the acronyms of the partners, see Table 1

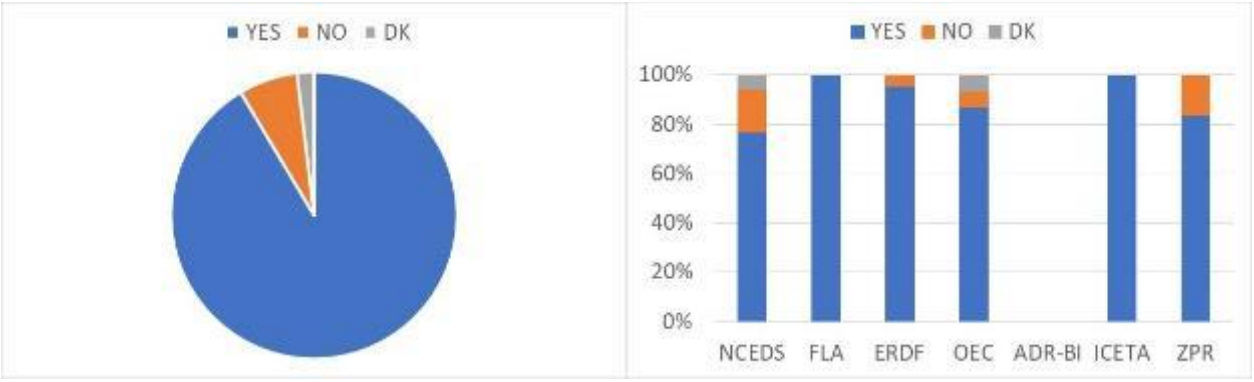

Figure 10. Results of Question #10: "Is the Assessment Area close to inhabited centres (within 10 km)?" For the acronyms of the partners, see Table 1

Climate change is another factor that affects the vulnerability of an ecosystem; it causes an increase in temperature and, as consequence, an increase in the number of extreme meteorological events, determining a major instability of the environment which in turn favours the shift of biomes and the successful introduction of invasive of alien species.

Most of the respondents indicated that the risk of IAS entry related to climate change into the Assessment Areas is considered high or medium (Q11, Figure 11).

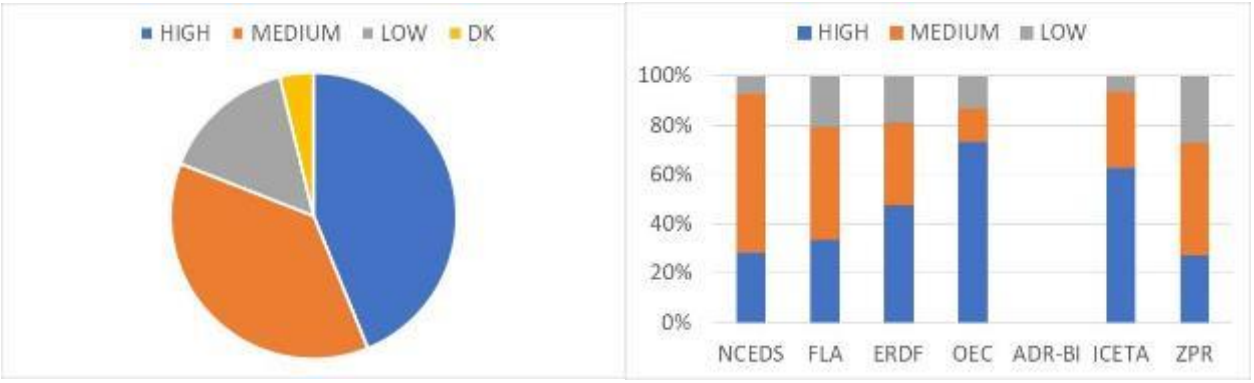

Figure 11. Results of Question #11: "Under the predicted future climate conditions, how do you evaluate the risk of IAS entry into the Assessment Area?" For the acronyms of the partners, see Table 1

Presence/new introduction of Invasive Alien Species have strong direct/indirect impacts on native species, competing with them for habitat, or food resources and predating natives or acting as disease vectors. To contrast the introduction/reintroduction of IAS it is important to understand what the possible pathways and vectors of introduction in the Assessment areas are. Usually, if an area has more than one pathway of introduction, this area is more vulnerable to future IAS entry.

From our analysis three main pathways emerge, almost 43% of the respondents considered the "Unaided introduction" (a secondary, natural dispersal of IAS that have been introduced by other pathways across political borders) as the most relevant pathway of introduction; about 30% indicated the "Intentional release" of live organisms for the purpose of human use in the natural environment and the same percentage of respondents indicated the "Unintentional release" (intentional introduction of organisms as commodity in containment facilities and unintentionally escape in nature) (Q12, Figure 12).

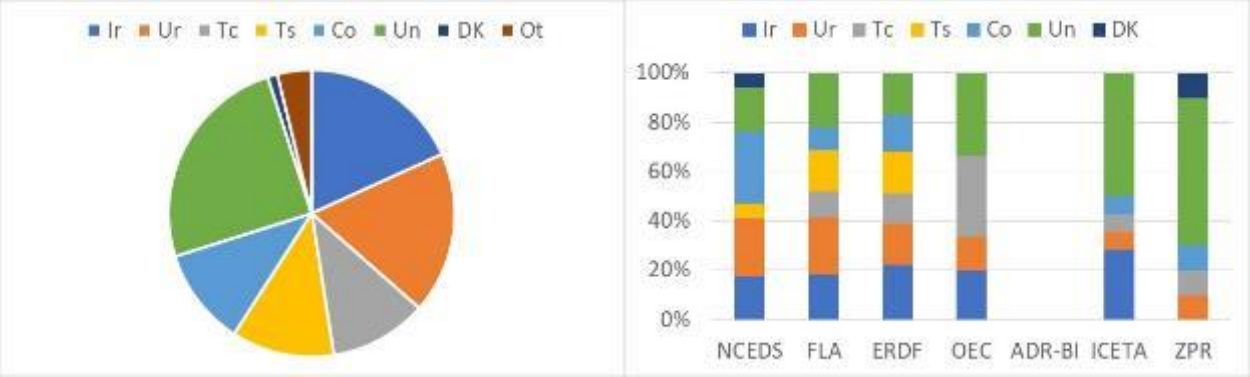

Figure 12. Results of Question #12: "In your opinion, which is the pathways of future introduction/reintroduction of IAS may be present in the Assessment Area?" Ir: Intentional release; Ur: Unintentional release; Tc: Transport- contaminant; Ts: Transport – stowaway; Co: Corridors; Un: Unaided; DK: Don't Know; Ot: Others. For the acronyms of the partners, see Table 1

Another source of IAS introduction can be the occurrence of occasional events such as hunting / fishing competitions, local fairs, sport events. As an example, the introduction in Italy of the bivalve mollusc *Dresseina polymorpha* was due to an international boat exhibition in a lake of Northern Italy. 46% of the respondents indicated that the occurrence of a such type of events is very likely, instead 33% indicated NO as the answer, whereas the remaining ones are not aware about this type of event (Q13, Figure 13).

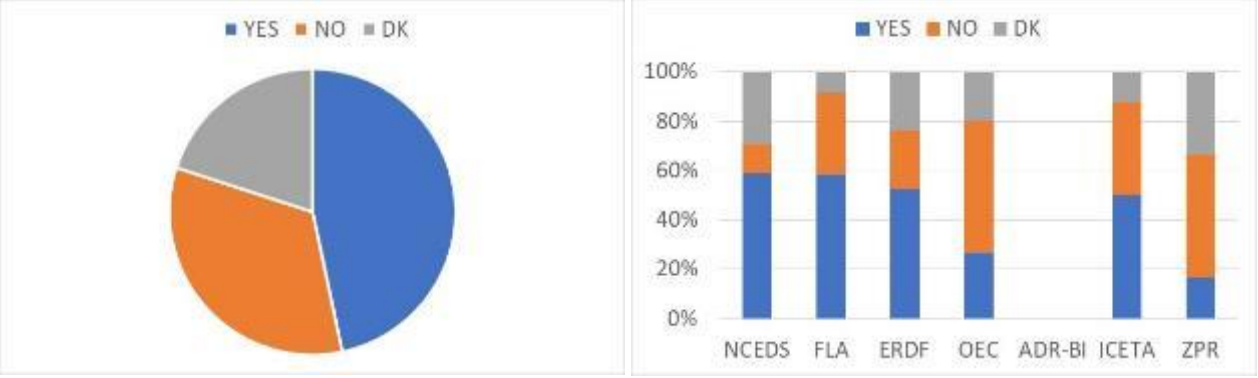

Figure 13. Results of Question #13: "In the Assessment Area or nearby, are you aware of the occurrence of occasional events which are likely to introduce or re-introduce IAS?" For the acronyms of the partners, see Table 1

2.3 Section 3 – Policy framework, strategic planning and management awareness

The presence of a specific legislation against the introduction of IAS and an active IAS management can reduce the environmental vulnerability of an ecosystem. Furthermore, the presence of a strategic planning management of the Assessment Area might increase its resistance to IAS. A strong monitoring activity with efficient surveillance of the main pathways and vectors of introduction and an early monitoring system are the best practices to control the invasion of IAS. These tools, associated with a synergic policy strategy shared among public organisations, Regions and Countries represent the perfect combination for IAS management. Moreover, the creation of protected areas favours an increase in ecosystem health reducing the vulnerability of protected areas, as described above.

Question #14 had the aim of investigating which management actions were performed in the Assessment Areas. The most common action performed by the respondents was awareness raising (49% of the total), followed by experience in control actions (29%) (Q14, figure 14).

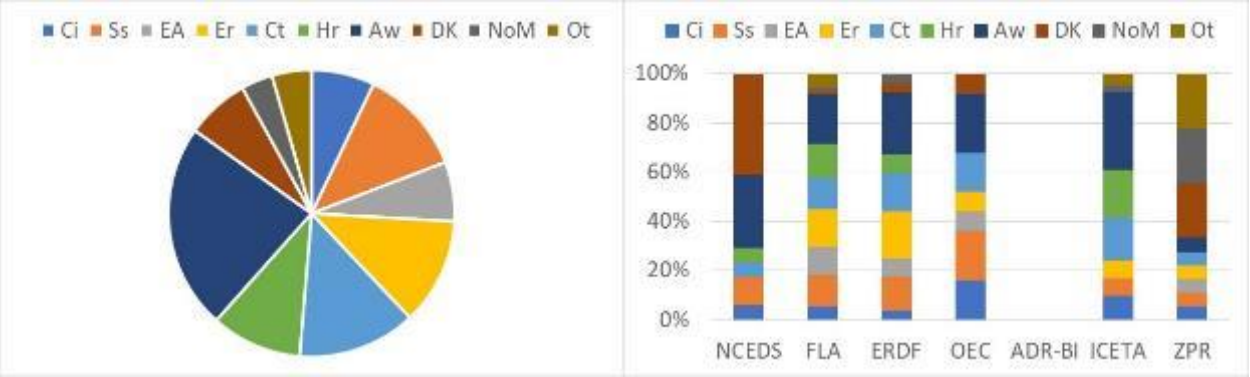

Figure 14. Results of Question #14: "In the last 5 years, which kind of strategic planning and management actions have been done or are ongoing in the Assessment Area with focus on IAS?" Ci: Centralized information system data base; Ss: Surveillance system; Er: Early alert system; Er: Experience in eradication actions; Ct: Experience in prevention / eradication / control actions; Hr: Habitat restoration; Aw: Awareness raising; DK: don't know; NoM: no strategic planning; Ot: Other. For the acronyms of the partners, see Table 1

Question #15 was strictly related to the activity of awareness raising, because the lack of awareness on the Invasive Alien Species is one of the main problems in their management. School projects of environmental education (40% of the total) and the organisation of public events for the citizens (23% of the total) were the main activity of awareness raising (Q15, figure 15).

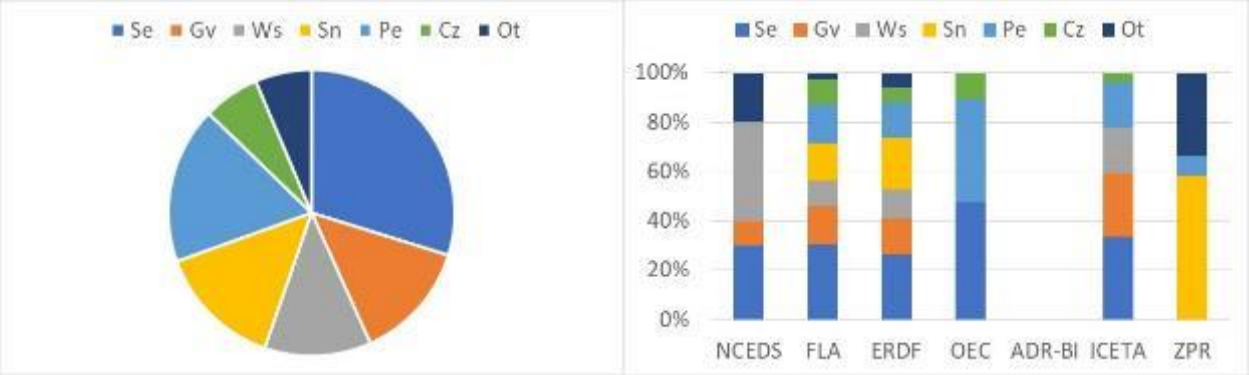

Figure 15. Results of Question #15: "if your previous answer was awareness raising, which kind of activity is present in the Assessment area?" Se: School education; Gv: Guided Visits; Ws: official website; Sn: Social Network; Pe: Public events; Cz: Citizen science events; Ot: Other. For the acronyms of the partners, see Table 1

2.4 Section 4 – Territorial context and observed problems

The aim of this section was to highlight all socio-economical aspects related to the vulnerability of an environment to IAS that can be relevant for vulnerability assessment, from a possible conflict of interests between environmental protection and economic interests, to awareness of the value of the environmental and technology development. Conflicts of interest (e.g. when an IAS has a socio-economic value) can influence the vulnerability of an ecosystem, because in these cases, the implementation of control actions is more difficult.

As a general comment, it is possible to say that none of the three kinds of conflicts (economic, cultural and social proposed in Question #16), prevails over the others. Moreover, most of the respondents indicated that conflicts of interests did not represent a main problem in the management of IAS. For example, only ERDF considered the level of economic conflict of interests to be high, while cultural conflict was considered to be at a medium level only by FLA and partially by ERDF. Social conflicts were almost always at a low level or not present.

On the contrary, about Question #17, 34% of the respondents indicated the lack of economics resources as the main problem faced, followed by the lack of specific policies (29% of the total), of awareness (26% of the total) and of dedicated staff (25%) (Figure 17).

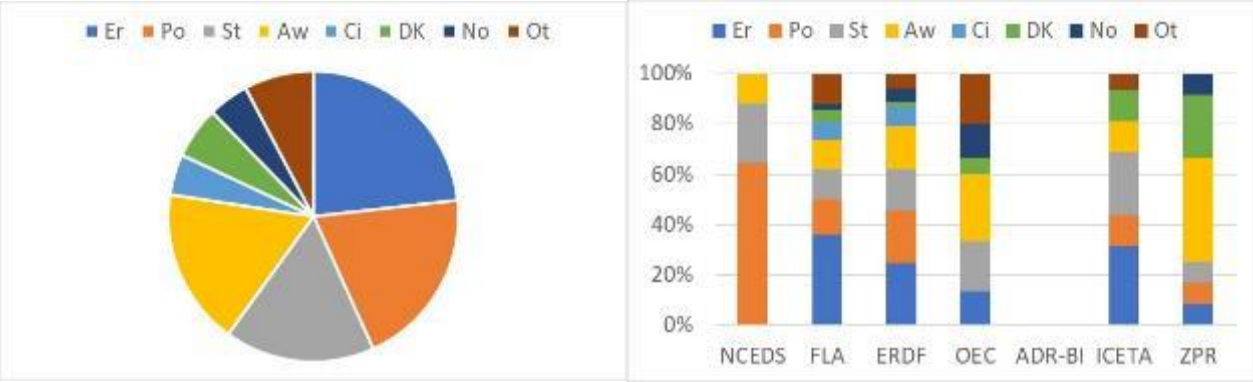

Figure 17. Results of Question #17: "Which are the main problems that have occurred during the projects/actions against IAS?" Er: lack of economic resources; Po: lack of policies; St: lack of staff; Ci: conflict of interests; DK: don't know; No: no problems; Ot: Other. For the acronyms of the partners, see Table 1

2.5 Section 5 – Type of projects/actions against IAS and exchange of experience

The first question of this section (Question #18) is related to the level of presence of IAS in the Assessment Areas. If an area is already colonised by IAS, it is more vulnerable to further invasions due to the direct/indirect effects of IAS on native species.

Most of the Assessment areas present a medium / low level of IAS (77 %) and only a small percentage (15%) a high level of IAS (Figure 18).

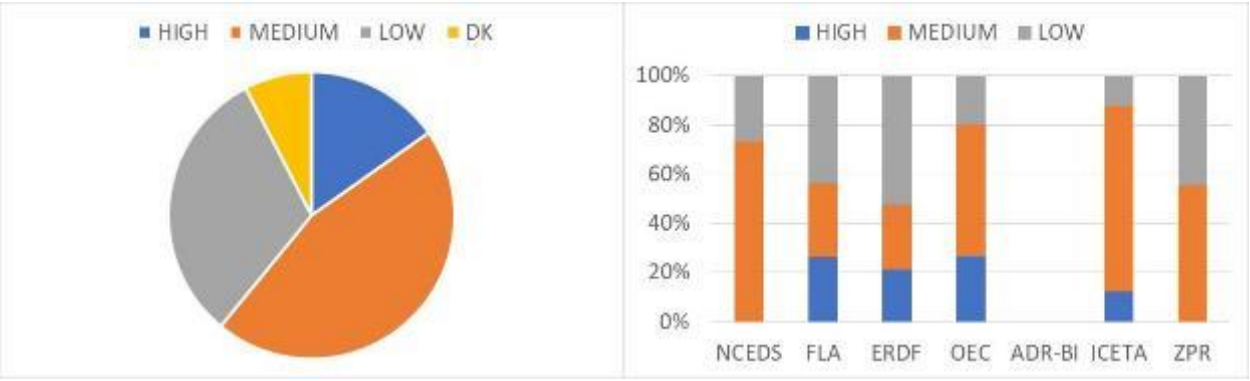

Figure 18. Results of Question #18: "How do you evaluate the level of presence of IAS in the Assessment Area?" For the acronyms of the partners, see Table 1

The most common type of IAS in the Assessment areas are plants (considered as the sum of sub-areal and aquatic plants), followed by fishes and birds (Q19, Figure 19).

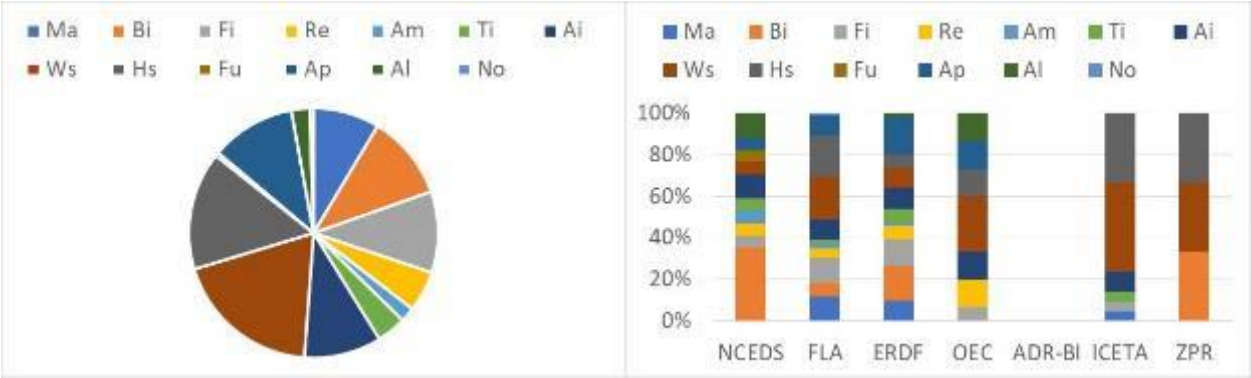

Figure 19. Results of Question #19: "Which type of IAS are present in the Assessment Area?" Ma: Mammals; Bi: Birds; Re: Reptiles; Am: Amphibians; Ti: Terrestrial invertebrates; Ai: Aquatic invertebrates; Ws: Woody species; Hs: Herbaceous species; Fu: Fungi; Ap: Aquatic plants; Al: Algae; No: None. For the acronyms of the partners, see Table 1

To the question about the type of project/ actions done in Aas, respondents indicated field research projects and risk assessment evaluation as the most common actions performed (Q20, figure 20). Moreover, they were requested to say whether they were informed about the budget and the scale of the projects. These two characteristics are important for project effectiveness because they can give some information about project size and relevance and thus about the possible positive results. Half of the respondents declared that they were not informed about the budget of the projects (Q21, figure 21), had local or regional scale (Q22, figure 22), they did not achieve a particularly high level of success and that results are still under evaluation (Q23, figure 23).

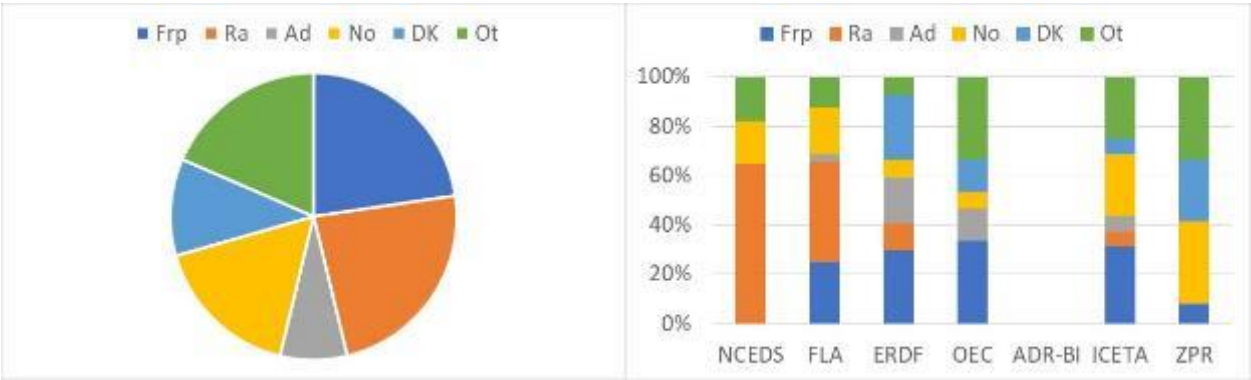

Figure 20. Results of Question #20: "Which type of projects / actions has been done in the Assessment Areas?" Frp: Field research project; Ra: Risk assessment evaluation; Ad: Administrative /legislative actions; No: No actions; DK: don't know; Ot: Other. For the acronyms of the partners, see Table 1

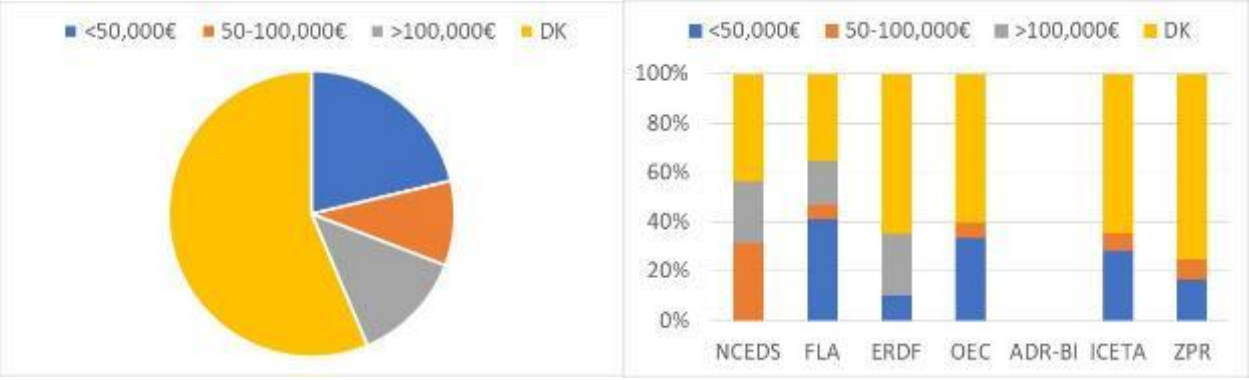

Figure 21. Results of Question #21: "Which is / was the project budget?" For the acronyms of the partners, see Table 1

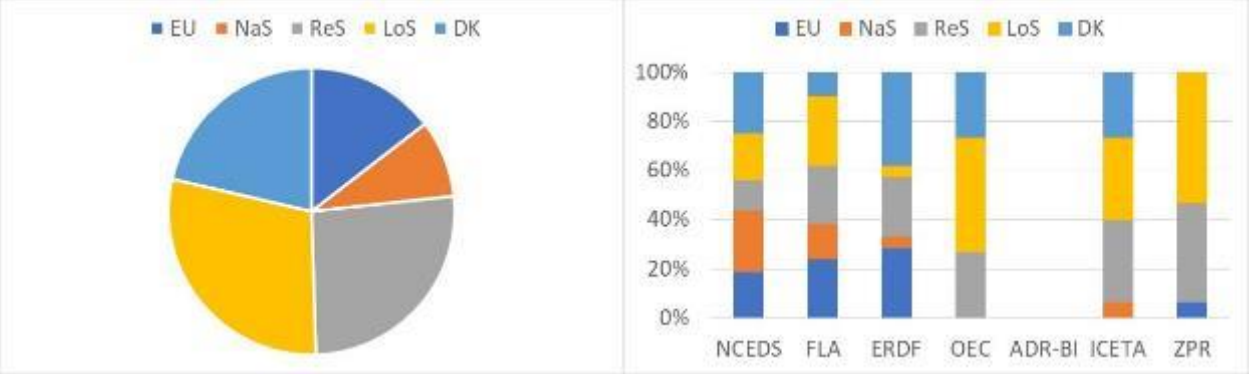

Figure 22. Results of Question #22: "Which is / was the scale of the project?" EU: European scale; NaS: National Scale; ReS: Regional Scale; LoS: Local Scale; DK: don't know. For the acronyms of the partners, see Table 1

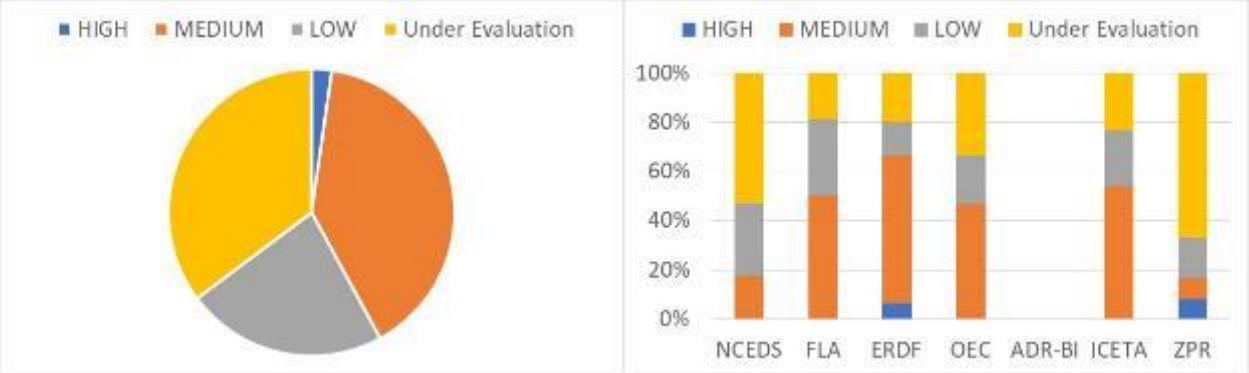

Figure 23. Results of Question #23: "Which level of success did the project achieved / has the project achieved so far?" High: almost all IAS specimens eradicated; Medium: IAs specimens still present; Low: no effect on IAS; Under evaluation: the project is not finish yet. For the acronyms of the partners, see Table 1

The last two questions of the questionnaire concerned practical information on the project, such as the type of control methods (Question #24) and the type of techniques (Question #25) used. Respondents indicated that the control method most commonly used was of a physical type (Figure 24); as the most common IAS in the assessment areas were plants, the most suitable control technique was hand removal; in many cases (38%) the technique used was unknown (Figure 25).

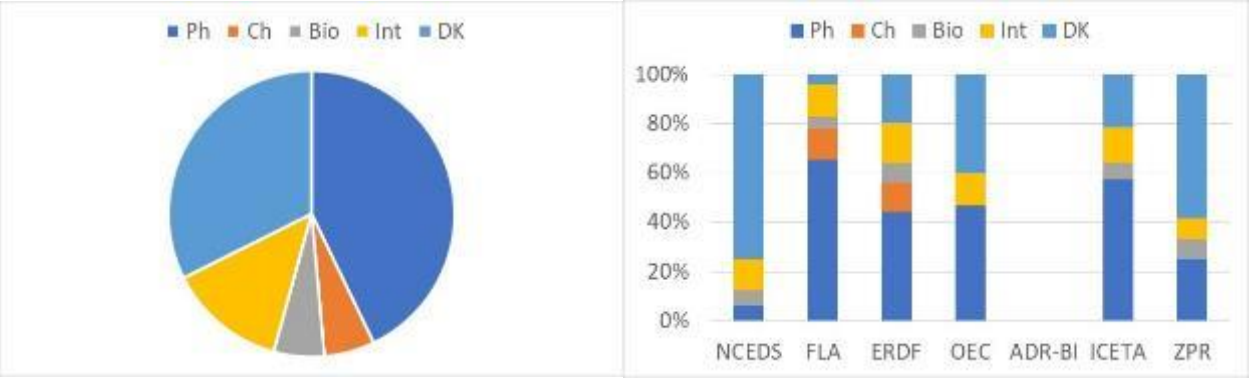

Figure 24. Results of Question #24: "Which type of control methods of IAS did you use / has been used?" Ph: physical; Ch: Chemical; Bio: Biological; Int: Integrated methods; DK: don't know. For the acronyms of the partners, see Table 1

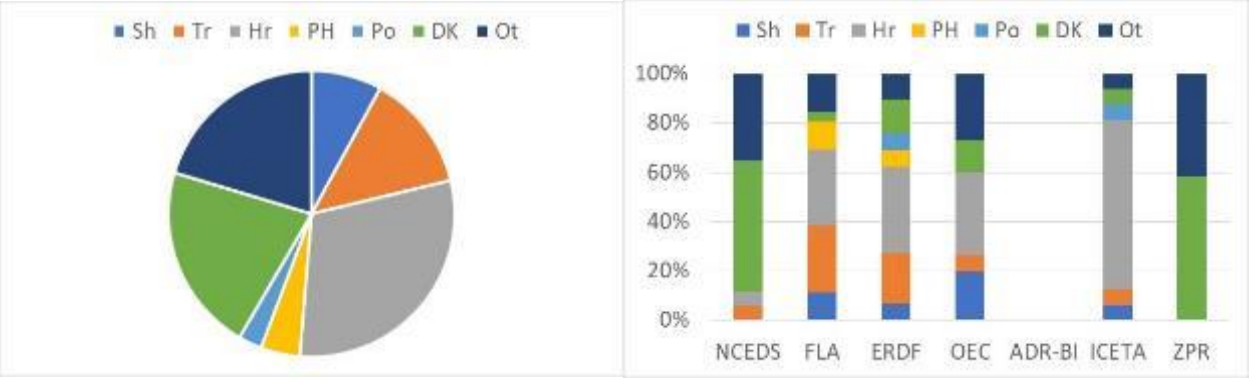

Figure 25. Results of Question #25: "In case of eradication / control, which type of techniques did you use / has been used?" Sh: Shooting; Tr: Trapping; Hr: Hand removal; PH: pesticides / Herbicides; Po: Poisoning; DK: don't know; Ot: Other. For the acronyms of the partners, see Table 1

3. PARTNERS' RESULTS

3.1 National Center for Environment and Sustainable Development (NCEDS) – Greece-

The National Center for Environment and Sustainable Development (NCEDS) collected a total of 17 responses (Table 1): most of the questionnaires (47.1%) were filled in by technical operators of Parks or Protected Areas (Question #1) which represent 64.7% of the Assessment Areas investigated (Question #2) (Figure 26a).

According to the respondents, the level of biodiversity of the Aas was high (Question #3) and they also reported the presence of endemic or protected species (Question #4), despite the fact that the level of anthropogenic disturbance and habitat alteration were considered as medium level (Questions #5, #6).

The anthropogenic pressure on the Greek Aas was mainly due to the uses of the surrounding territory, mainly characterised by mixed urban/rural areas (Question #7) where the main activities are agriculture and livestock (Question #8). Considering the fact that Aas are very close to inhabited centres and that they are also easily accessible (Questions #9, #10), the general anthropogenic disturbance is considerably high (Figure 26a-b).

Moreover, the respondents underlined that the Aas could be easily interested in new processes of colonisation of IAS due to climate change (Question #11) and they also pointed out the presence of several possible pathways of introduction of IAS, such as corridors or unintentional release (Question #12).

Related to the presence of different pathways of introduction, the respondents also reported the possibility of the occurrence of occasional events in the Aas or in nearby areas: this could represent another way of IAS introduction in the Aas (Question #13) (Figure 26b).

After a general characterisation of the Aas, the Greek respondents were asked to describe the policy framework and the strategic planning present in their region, how they managed the awareness on the problem caused by IAS and which kind of problems they have faced during their management actions against IAS.

At the first question of this section, most of the respondents highlighted a general lack of management actions against IAS (Question #14) and the main good practice performed against IAS was related to increased citizens' awareness through official websites and school projects of environmental education (Question #15) (Figure 26b).

The answers to Question #16 on the conflict of interests were not particularly relevant for our analyses because out of 17 respondents, only two reported the presence of a medium level of economic conflict of interest, eight of them answered that there weren't any conflicts, while two chose the answer "don't know" and five of them did not answer the question at all.

The absence of management actions in Greece was mainly due to the lack of economic resources but also due to the lack of specific policies against IAS (Question #17) (Figure 26b).

The last section of the questionnaire was related to the projects developed against IAS in the Aas. The respondents evaluated the level of presence of IAS as medium (Question #18), which were mainly represented by birds (Question #19). Against the existing IAS, they mainly performed risk assessment evaluation projects (Question #20) with a variable budget (but most replies to this question were "don't know") (Question #21), on a national scale (Question #22) and the results are still under evaluation (Question #23). Unfortunately, the majority of the respondents declared that they did not know which control method was used (Questions # 24, 25) (Figure 26c).

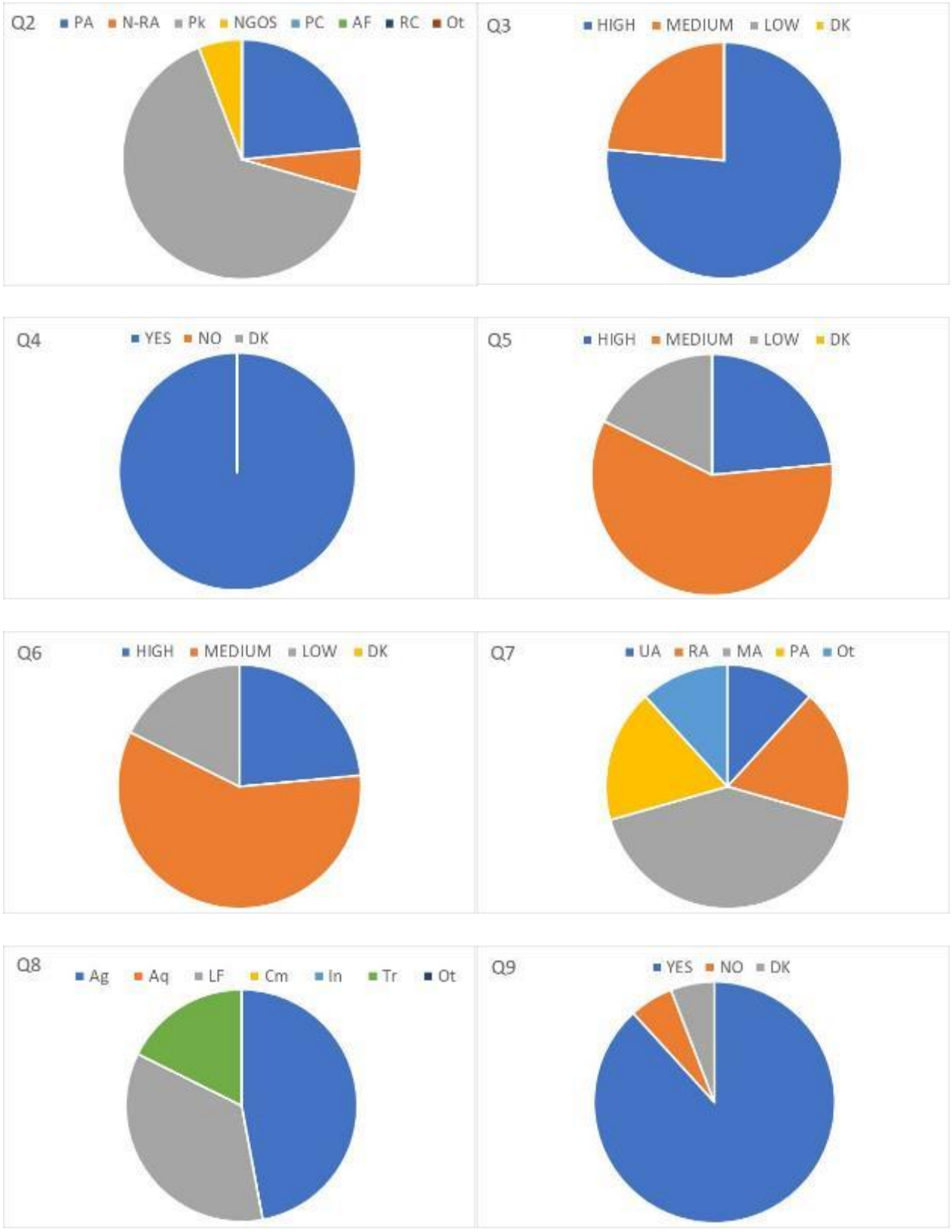

Figure 26a. Graphical answers to the questions from #2 (Q2) to #9 (Q9) collected by NCEDS. For label acronyms, see appendix 1.

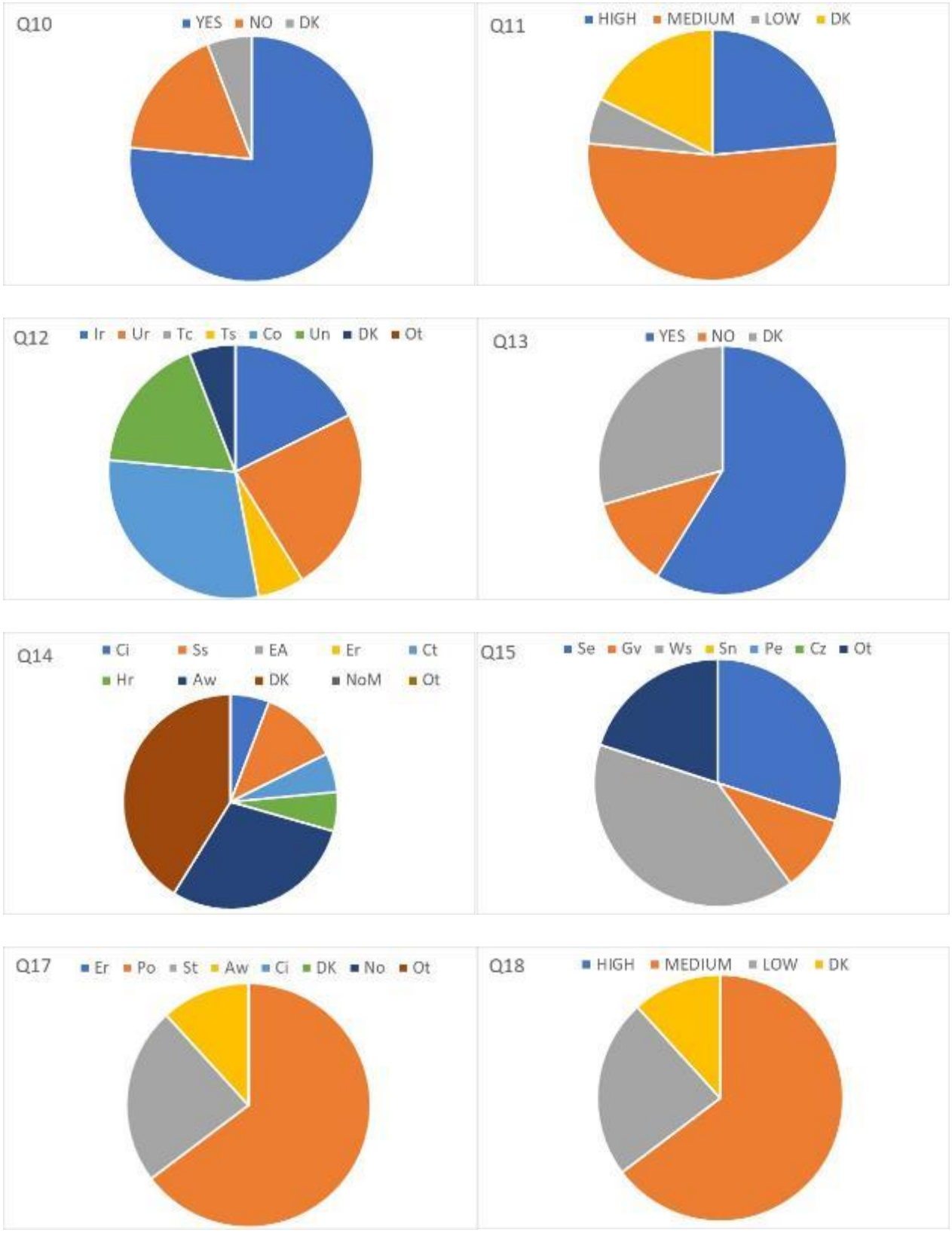

Figure 26b. Graphical answers to the questions from #10 (Q10) to #18 (Q18) collected by NCEDS. For label acronyms, see appendix 1.

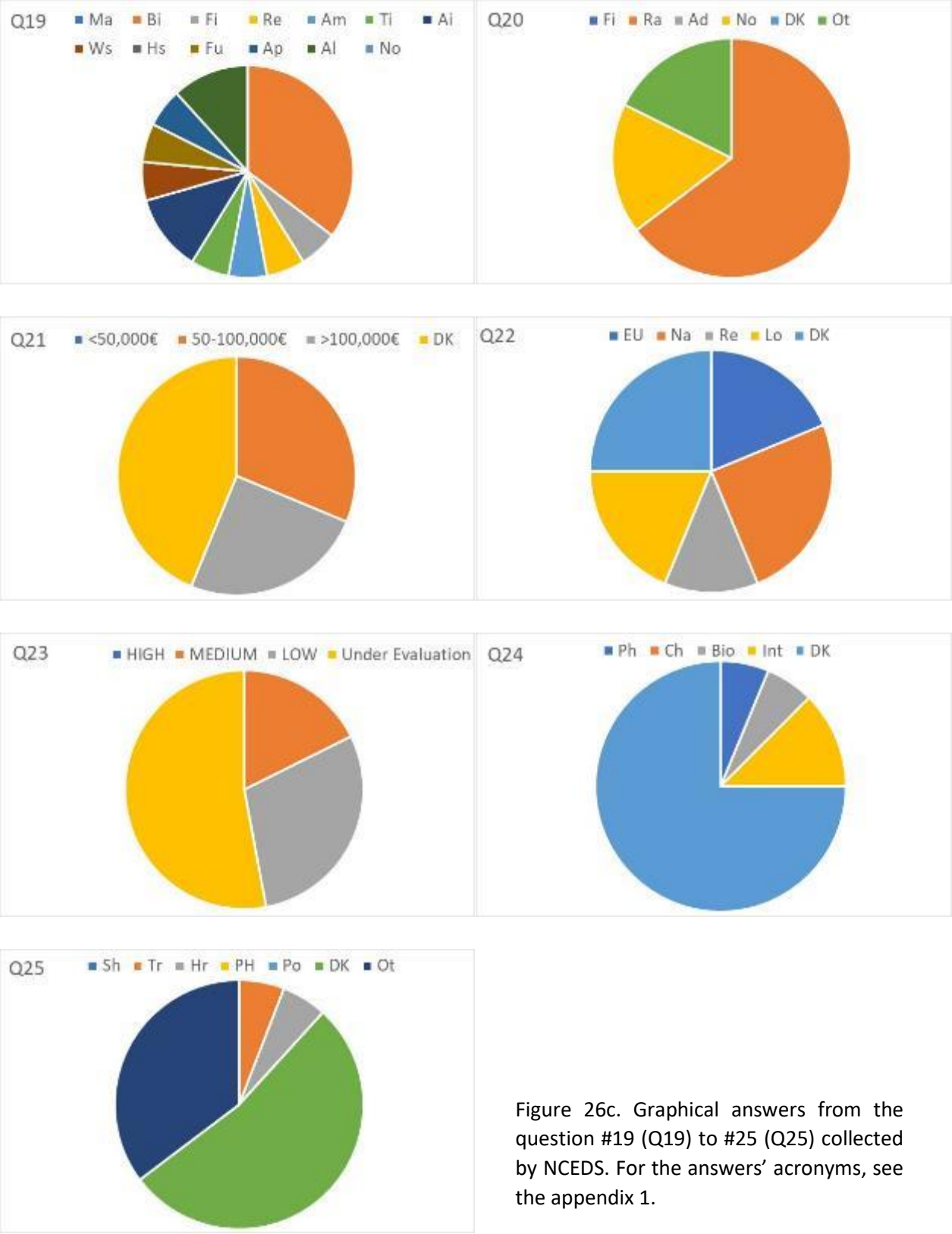

Figure 26c. Graphical answers from the question #19 (Q19) to #25 (Q25) collected by NCEDS. For the answers' acronyms, see the appendix 1.

3.2 Lombardy Foundation for the Environment (FLA) – Italy –

In total FLA collected responses from 24 Lombardy areas. The answers were mainly provided by researchers (26%), technical operators (26%) and managers (22%) (Question #1).

Most of the Aas are managed by Public Authorities (43%) and Parks (30%) (Question #2) and they have a medium/high level of biodiversity (Question #3), with the presence of endemic/protected species in almost all the Aas (Question #4) (Figure 28a).

In general, the level of anthropogenic disturbance was considered medium/low (Question #5) as well as habitat modification (Question #6). The Aas are surrounded by rural and urban areas, but also by pristine areas (Question #7); the main anthropogenic activities surrounding the Aas are agriculture, industry and commerce (Question #8) (Figure 28b).

Moreover, due to the closeness to inhabit centres, the easy accessibility, the effect of climate change, the presence of various pathways of introduction of IAS and the possibility of occurrence of occasional events, all the Aas showed a relative vulnerability to new invasions (Questions #9, #10, #11, #12 and #13) (Figure 28b).

The most important management actions performed in recent years have been related to awareness raising, attempts of eradications and habitat restoration activities (Question #14). In particular, awareness raising was conducted through school projects of environmental education, site visits with a specialised guide and social networks (Question #15) (Figure 28c).

Often, the management actions of IAS were in conflict with economic, cultural or social interests. In Lombardy, the respondents pointed out a low level of economic conflict but, on the contrary, they highlighted a certain presence of cultural and social conflicts (Question #16, figure 27).

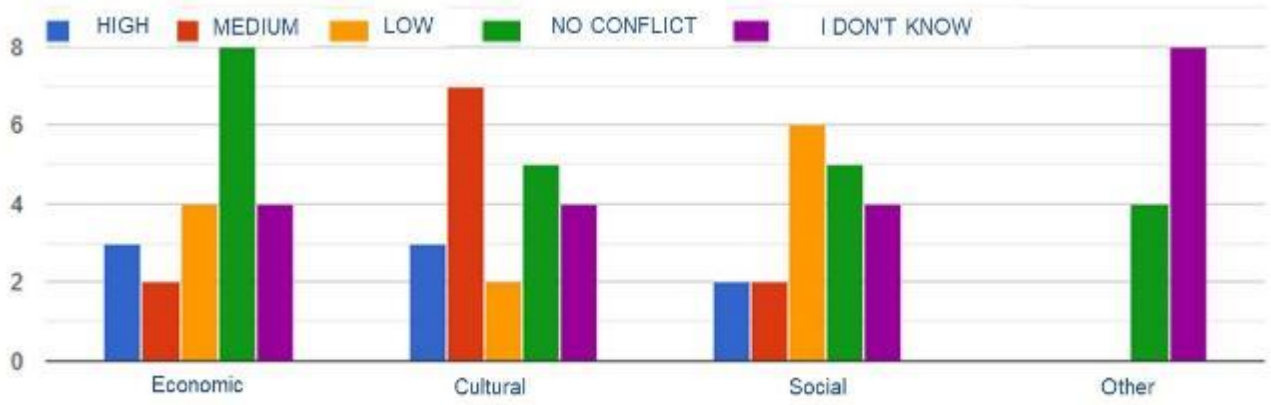

Figure 27. FLA answers to Question #16: "In the assessment area, is/was there any conflict of interest in the management action aiming to control IAS?"

In general, the main problems that occurred during the projects performed against IAS were related to the lack of economic resources (Question #17) that determined a medium-low level presence of IAS in the Aas (Question #18) (Figure 28c).

According to the respondents, the main animal IAS present in Lombardy belong to the classes of mammals and fishes, whereas for plants, there is a substantial equilibrium between woody and herbaceous IAS (Question #19).

In order to contrast these IAS, several different types of actions were performed, mainly based on risk assessment analysis or field research projects (Question #20).

However, all of the projects had a relatively small budget (Question #21), on a regional or local scale (Question #22) and thus reached a medium level of success, meaning that IAS are still present in the Aas, despite the actions proposed (Question #23).

The methodologies used for the control action were mainly physical (Question #24) like shooting, trapping or hand removal (Question #25) (Figure 28d).

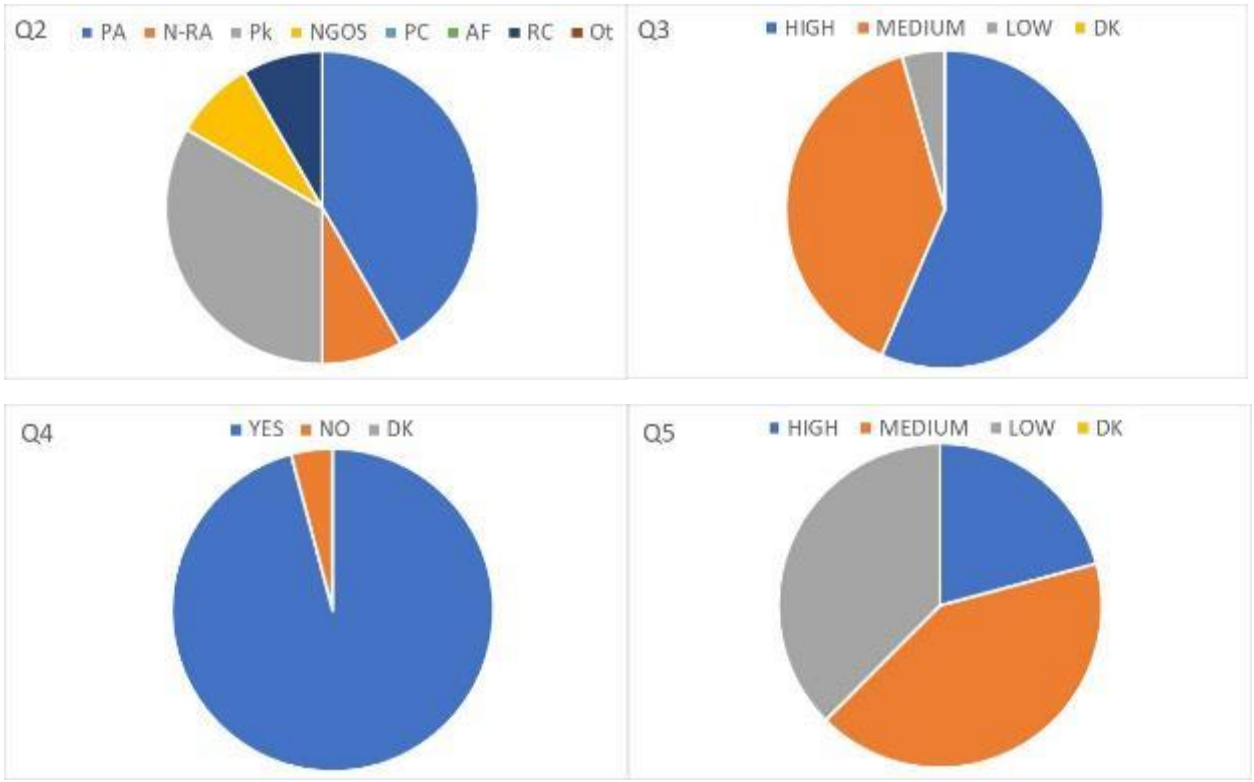

Figure 28a. Graphical answers to the questions from #2 (Q2) to #5 (Q5) collected by FLA. For label acronyms, see appendix 1

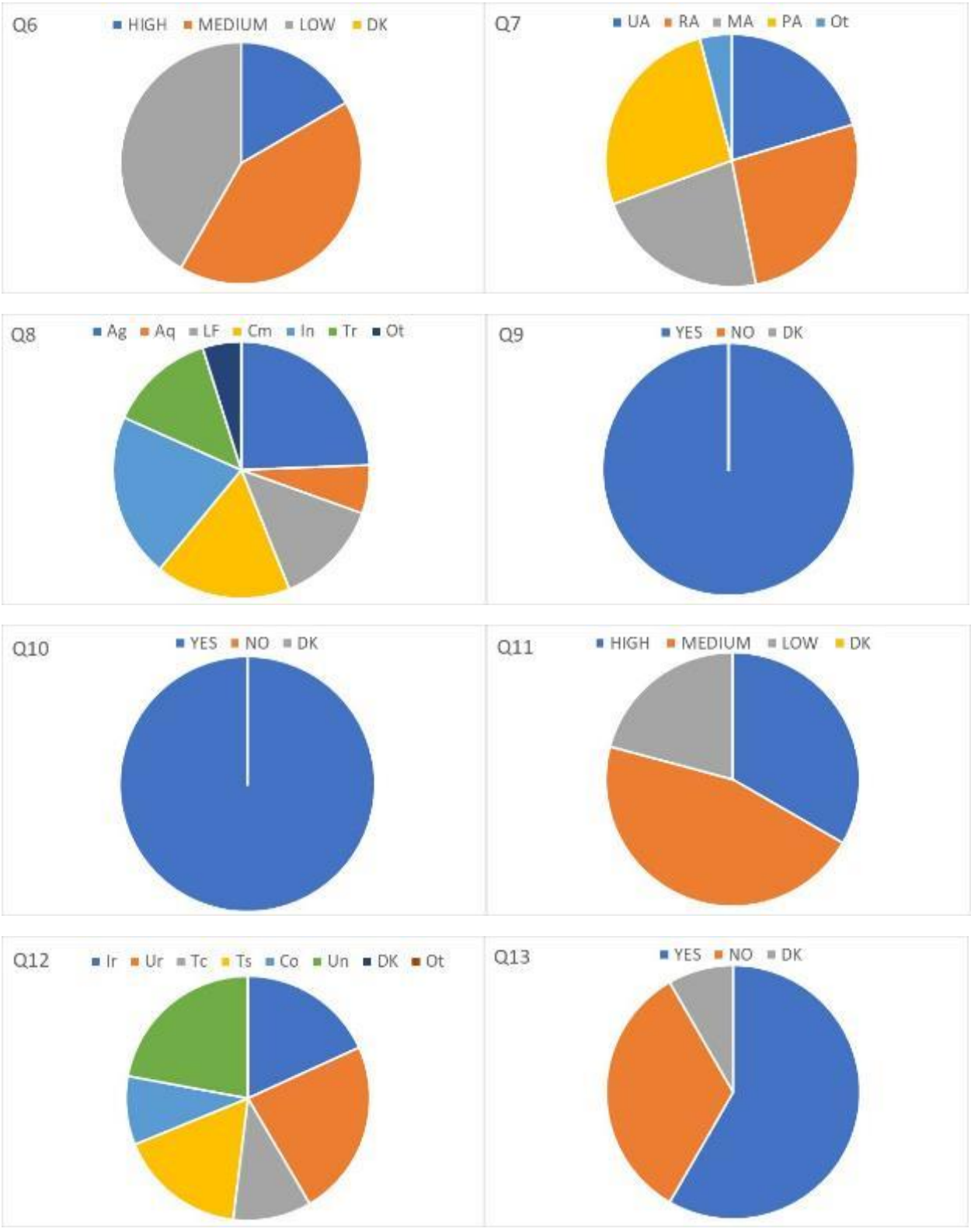

Figure 28b. Graphical answers to the questions from #6 (Q2) to #13 (Q13) collected by FLA. For label acronyms, see appendix 1

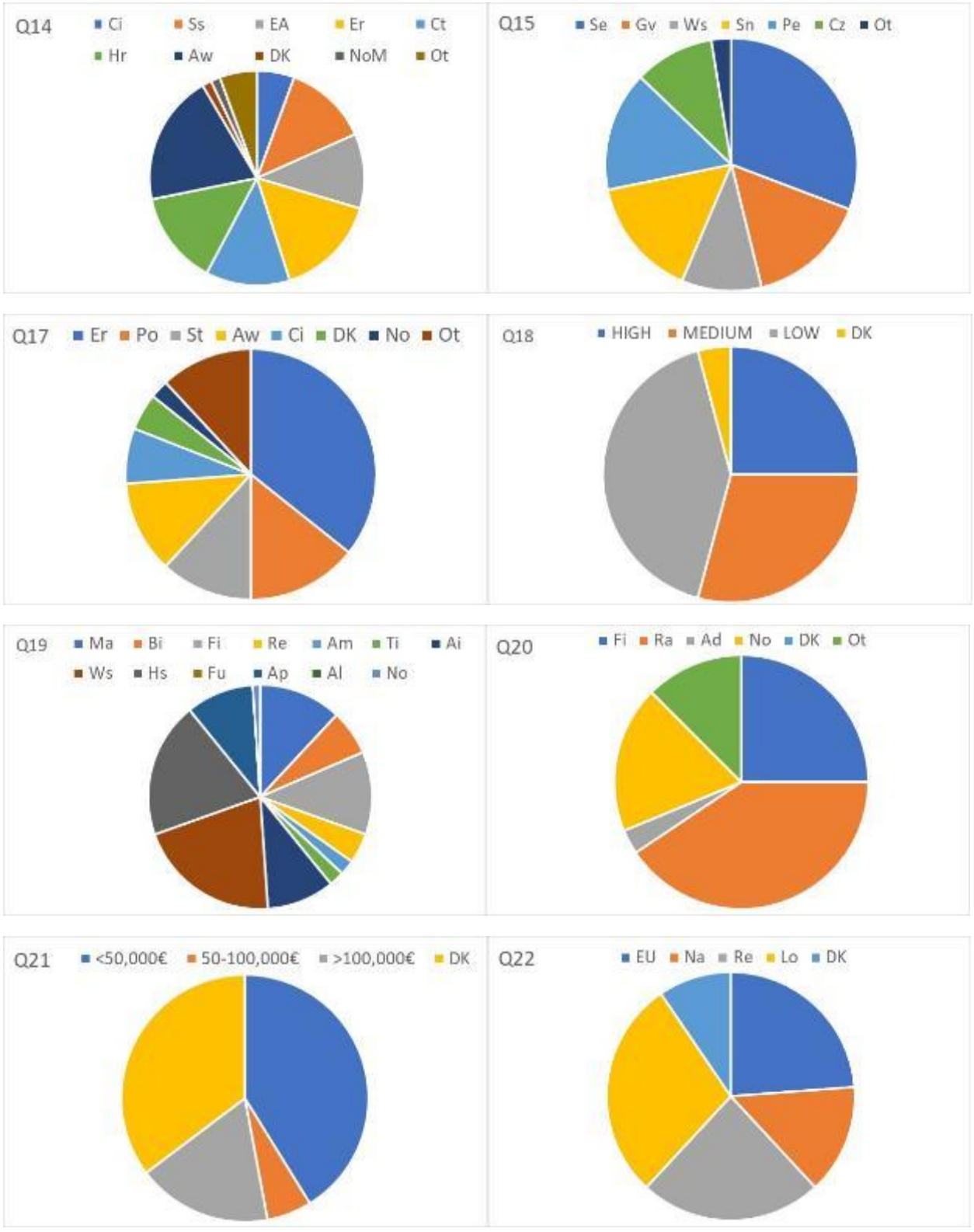

Figure 28c. Graphical answers to the questions from #14 (Q14) to #22 (Q22) collected by FLA. For label acronyms, see appendix 1

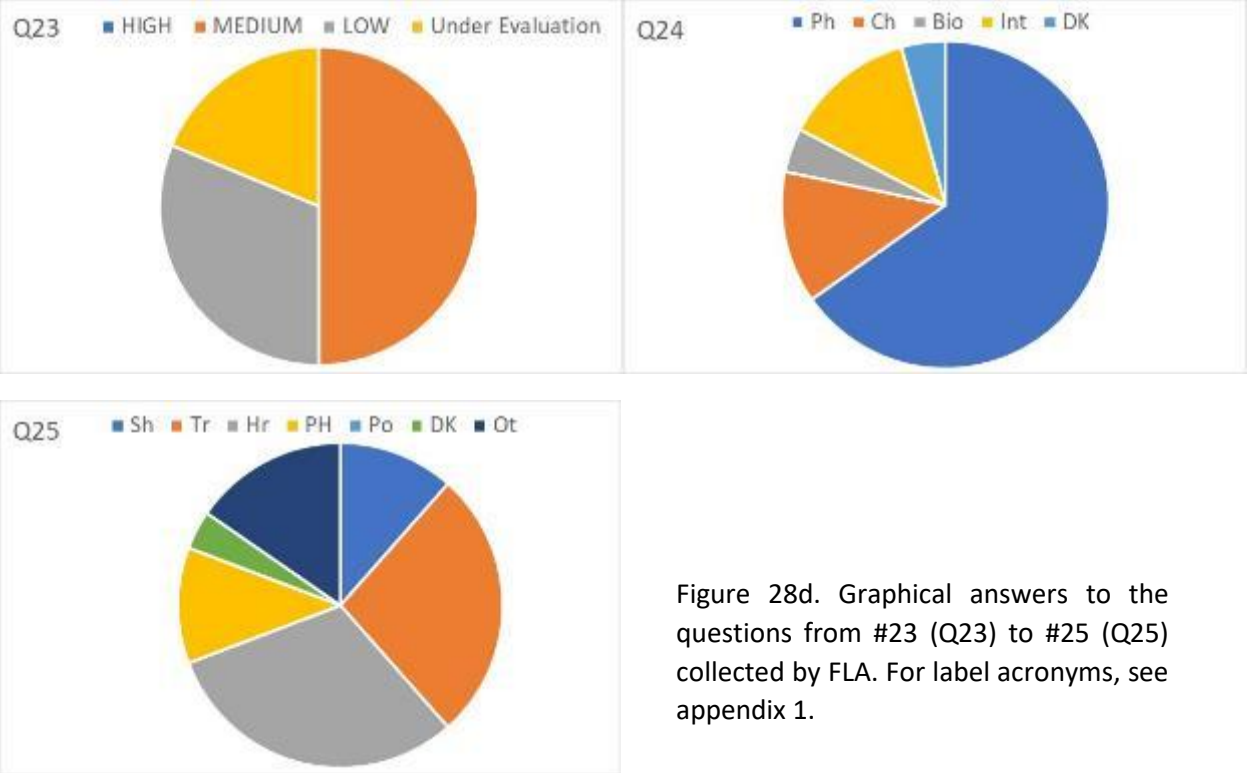

Figure 28d. Graphical answers to the questions from #23 (Q23) to #25 (Q25) collected by FLA. For label acronyms, see appendix 1.

3.3 The Regional Ministry for the environment and rural, agricultural policies and territory – Regional Government of Extremadura (ERDF) -Spain-

ERDF contributed to this report with 21 questionnaires, mainly filled in by technical operators (28.6%), director (19%) and researchers (14.3%) of Assessment Areas managed by Public Authorities or National/Regional Agency (Questions #1, #2).

In the Aas of this Region, the level of biodiversity is considered medium/high and in almost all of them there are endemic/threatened species (Questions #3, #4). Despite those answers, which theoretically indicate that anthropogenic disturbance should be moderate, the three options of Question #5 (high, medium and low) were equally considered (Question #5). Instead, the answer to question #6 is in line with the medium/high level of biodiversity: the results indicate a medium/low level of habitat modification (Question #6) (Figure 30a).

According to the respondents, the Aas of the Extremadura Region are surrounded by mixed urban/rural areas (Question #7) and the most important anthropogenic activities are agriculture and livestock (Question #8). Moreover, these Aas are easily accessible and close to inhabited centres (Questions #9, #10).

Considering all the possible characteristics that could influence the colonisation of IAS (e.g. climate change, presence of pathways of introduction and occurrence of occasional events), the respondents evaluated the risk of IAS entry into the Aas due to climate change as medium/high (Question #11) and they underlined the presence of more than one pathway of introduction (Question #12). They also pointed out the occurrence of occasional events in the Aas or in nearby areas as highly possible (Question #13).

In the last 5 years many activities have been performed in Extremadura, among which the experience of eradication and the increase of awareness were considered the two best practices (Question #14). In order to raise awareness, school environmental activities, the use of social networks and guided visits with expert staff were proposed (Question #15) (Figure 30b).

Taking into account the possible presence of conflict of interests, the respondents indicated the presence of a high level of economic conflicts and medium/low level of cultural and social conflicts (Question #16, Figure 29).

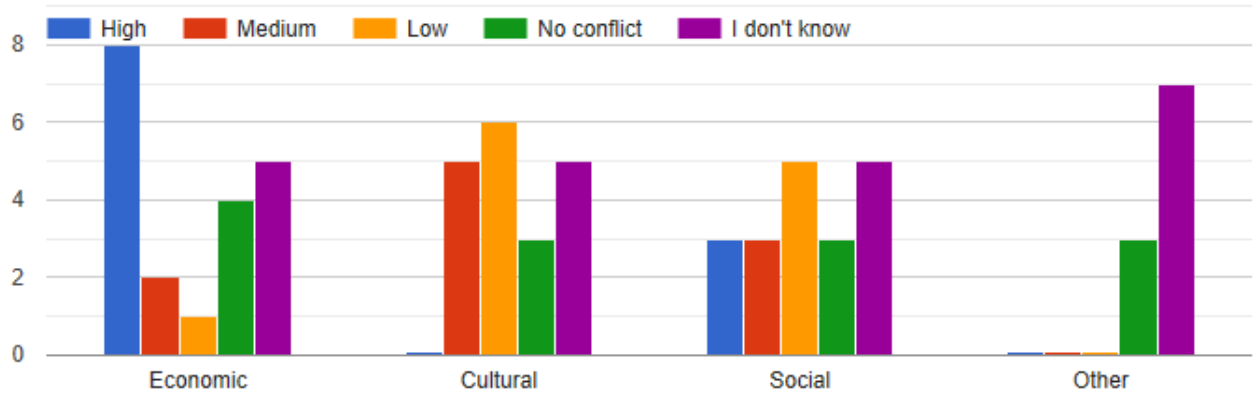

Figure 29. ERDF answers to Question #16: "In the assessment area, is/was there any conflict of interest in the management action aiming to control IAS?"

The lack of economic resources, of clear policies, specialised staff and citizens' awareness (Question #17) were the main problems that were faced.

The actions against IAS were performed even though the level of presence of IAS was considered low (Question #18) and the most relevant type of IAS present in the Aas belonged to the group of aquatic plants, birds and fishes (Question #19). Against these IAS, the most common actions were field research projects (Question #20), even though most of the respondents did not know the budget of the projects (Question #21) or their scale (Question #22). These projects are still on going so the results are not definitive yet (Question #23) and, considering the type of IAS in the Aas, they

mainly used physical methods (Question #24), such as hand removal for plants and trapping for animals (Question #25) (Figure 30c).

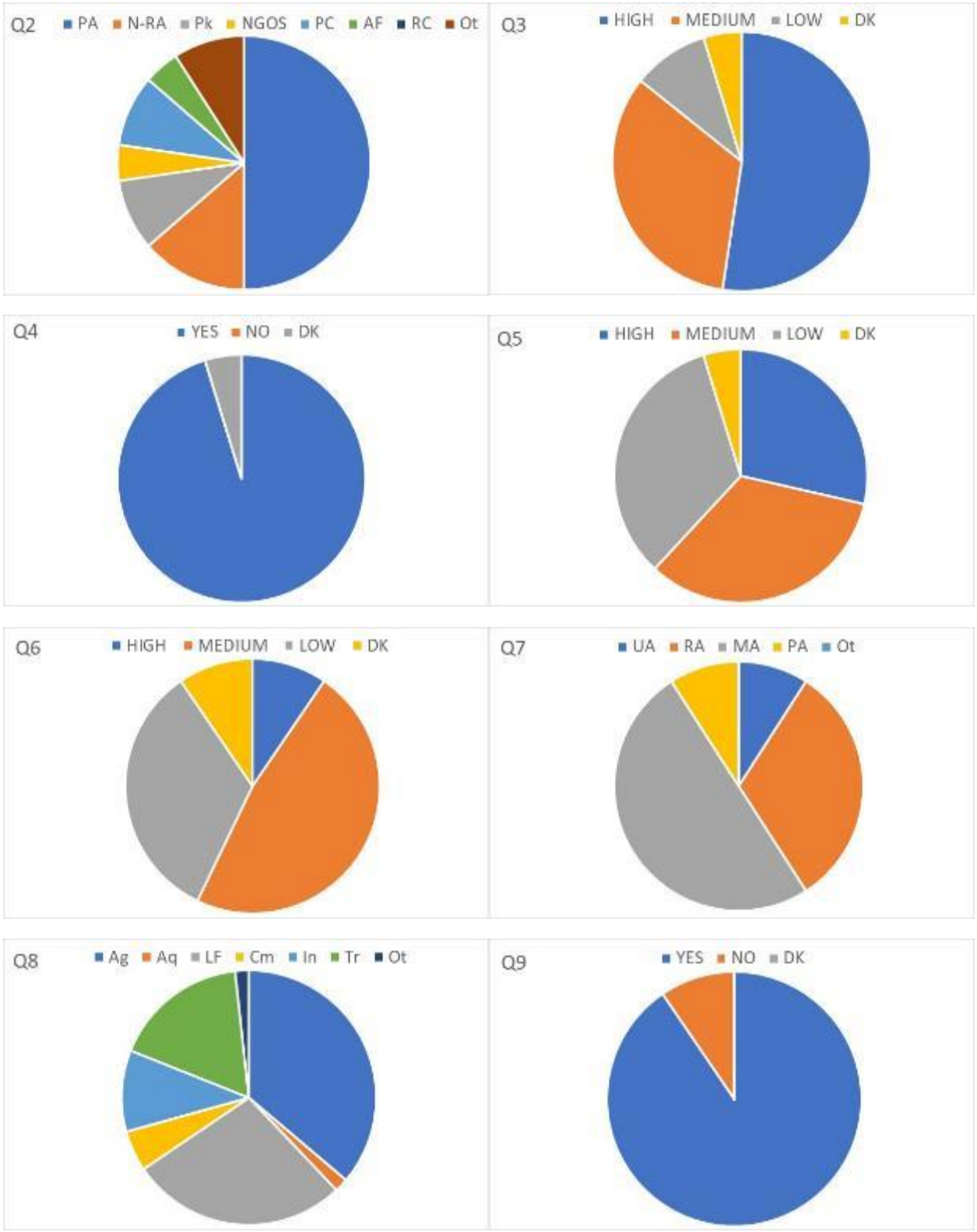

Figure 30a. Graphical answers to the questions from #2 (Q2) to #9 (Q9) collected by ERDF. For the label acronyms, see appendix 1.

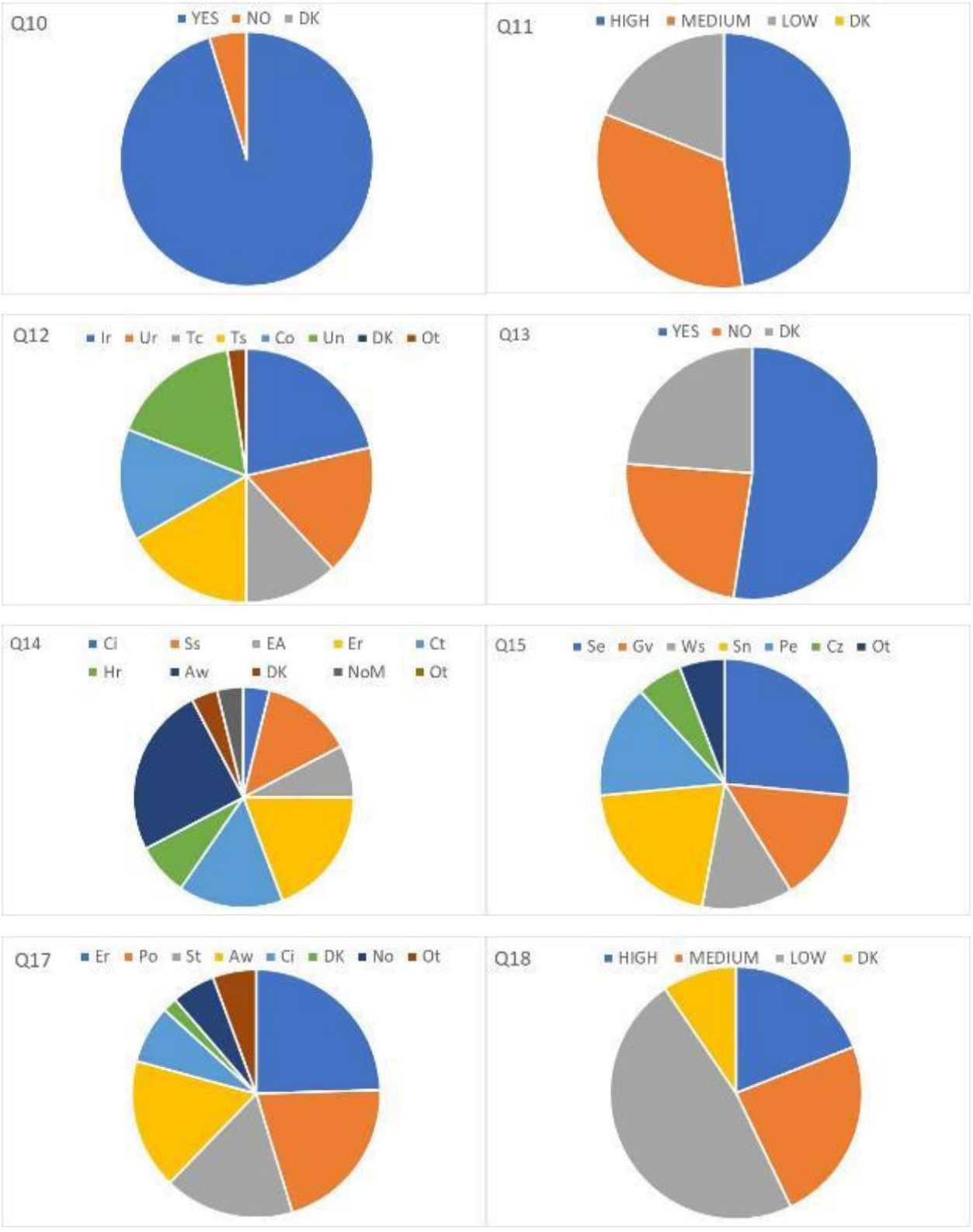

Figure 30b. Graphical answers to the questions from #10 (Q10) to #18 (Q18) collected by ERDF. For the label acronyms, see appendix 1.

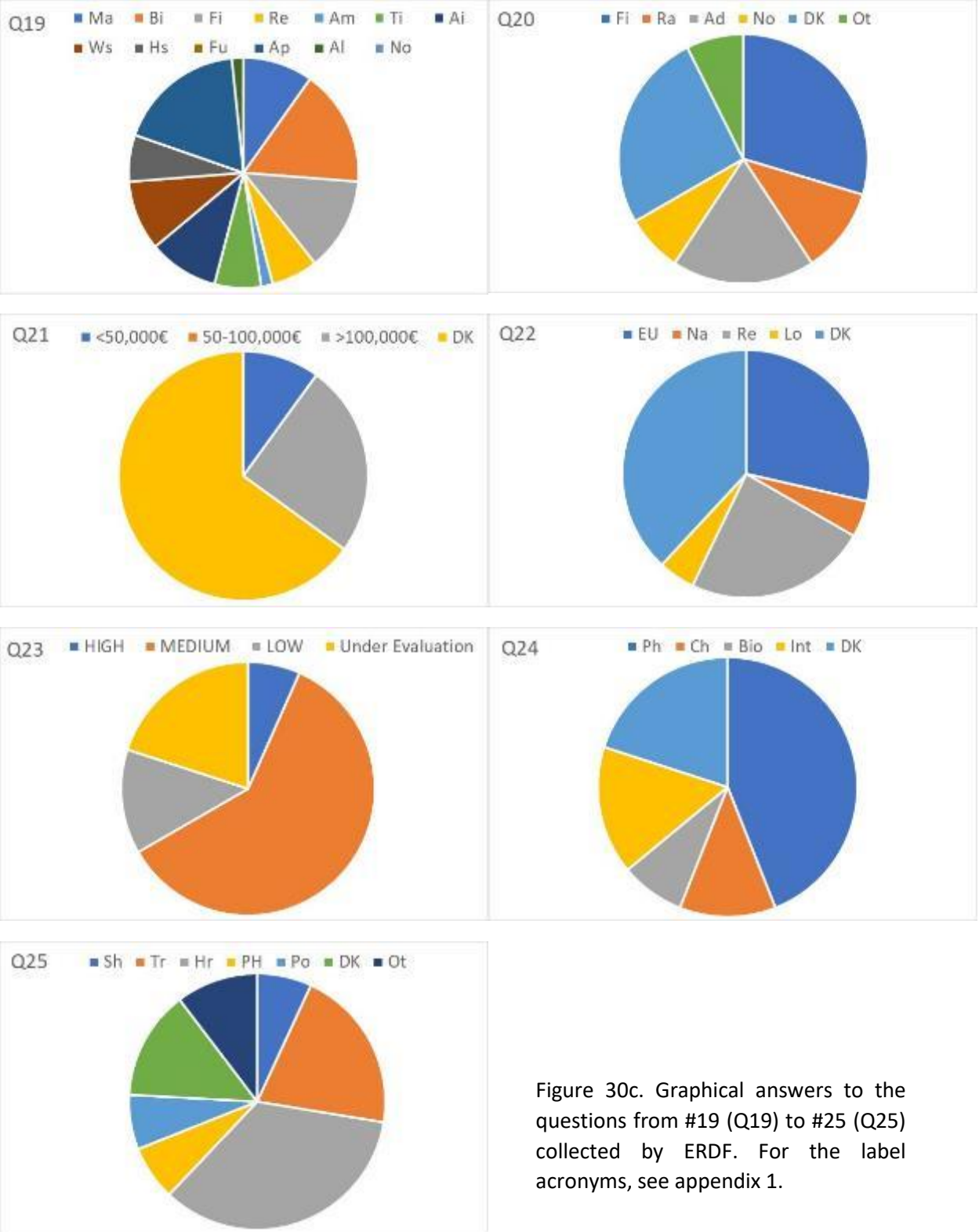

Figure 30c. Graphical answers to the questions from #19 (Q19) to #25 (Q25) collected by ERDF. For the label acronyms, see appendix 1.

3.4 Corsican Agency of Environment (OEC) -France-

The Corsican Agency of Environment contributed to this report with 15 answers. Their answers were mainly provided by Officials of the naturalistic or forestry or marine services and technical operators of Assessment areas managed by Parks and Public Authorities (Questions #1, #2).

The level of biodiversity in the Aas was considered high by almost all the respondents (Question #3) as well as the presence of endemic species (Question #4). The level of anthropogenic disturbance was medium/high (Question #5), despite the fact that the general level of habitat modification was considered quite low (Question #6) (Figure 32a). The Aas are mainly surrounded by urban/rural areas (Question #7) and the main anthropogenic activity is represented by tourism or recreational activities (Question #8) meaning that most of the Aas are easily accessible (Question #9) and close to inhabited centres (Question #10).

Furthermore, the Corsican Aas are considered vulnerable to new invasions due to climate change (Question #11) and the probability of new invasions is favoured by the presence of various pathways of introduction. The most relevant pathways of introduction are the unintentional introduction of live organisms and the secondary, natural dispersal of IAS (Question #12). Over 50% of the respondents declared no possibility of introduction of IAS due to the occurrence of occasional events, thus decreasing the level of vulnerability of the investigated Aas (Question #13) (Figure 32b).

In the last 5 years, in these Aas, the most common actions against IAS have been focused on increasing awareness and surveillance systems (Question #14). In particular, the increase of awareness was conducted through school projects of environmental education and public events, such as seminars and exhibitions (Question #15) (Figure 32b).

In the management of IAS, the respondents did not underline the presence of any particular conflicts of interests (Question #16, figure 31).

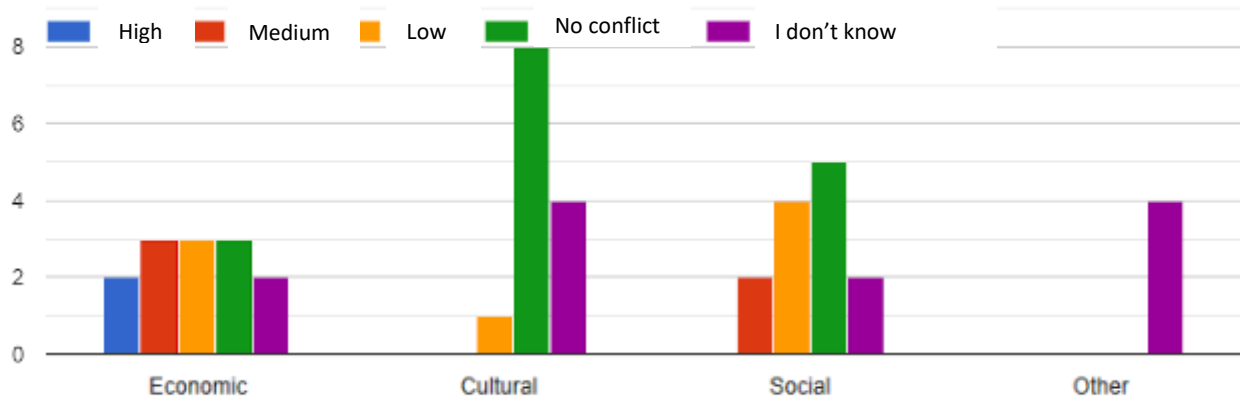

Figure 31. OEC answers to Question #16: "In the assessment area, is/was there any conflict of interest in the management action aiming to control IAS?"

The main other problems observed during the project against IAS were related to a general lack of awareness of the citizens and lack of specialised staff (Question #17) (Figure 32c).

The presence of IAS in the Corsican Aas is considered at medium level especially due to plant species (66% of the total answers) (Question #19). Against those species, they performed field research projects (Question #20), with a budget of <50,000€ (Question #21) and on a local scale (Question #22). The level of success of these projects was mainly medium or still under evaluation (Question #23). The control methods applied were mainly physical (Question #24) such as hand removal (Question #25) (Figure 32d).

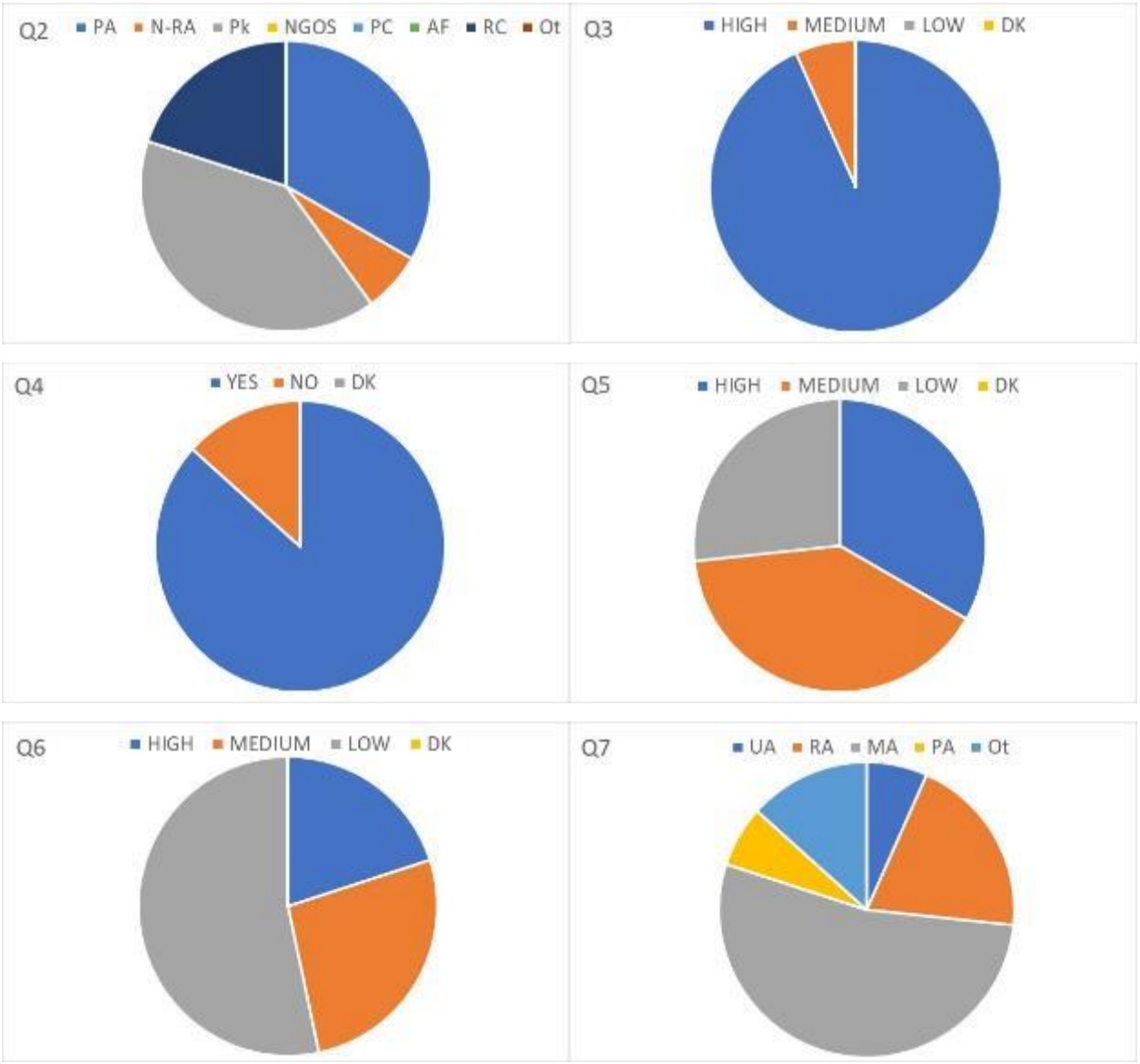

Figure 32a. Graphical answers to the questions from #2 (Q2) to #7 (Q7) collected by OEC. For label acronyms, see appendix 1.

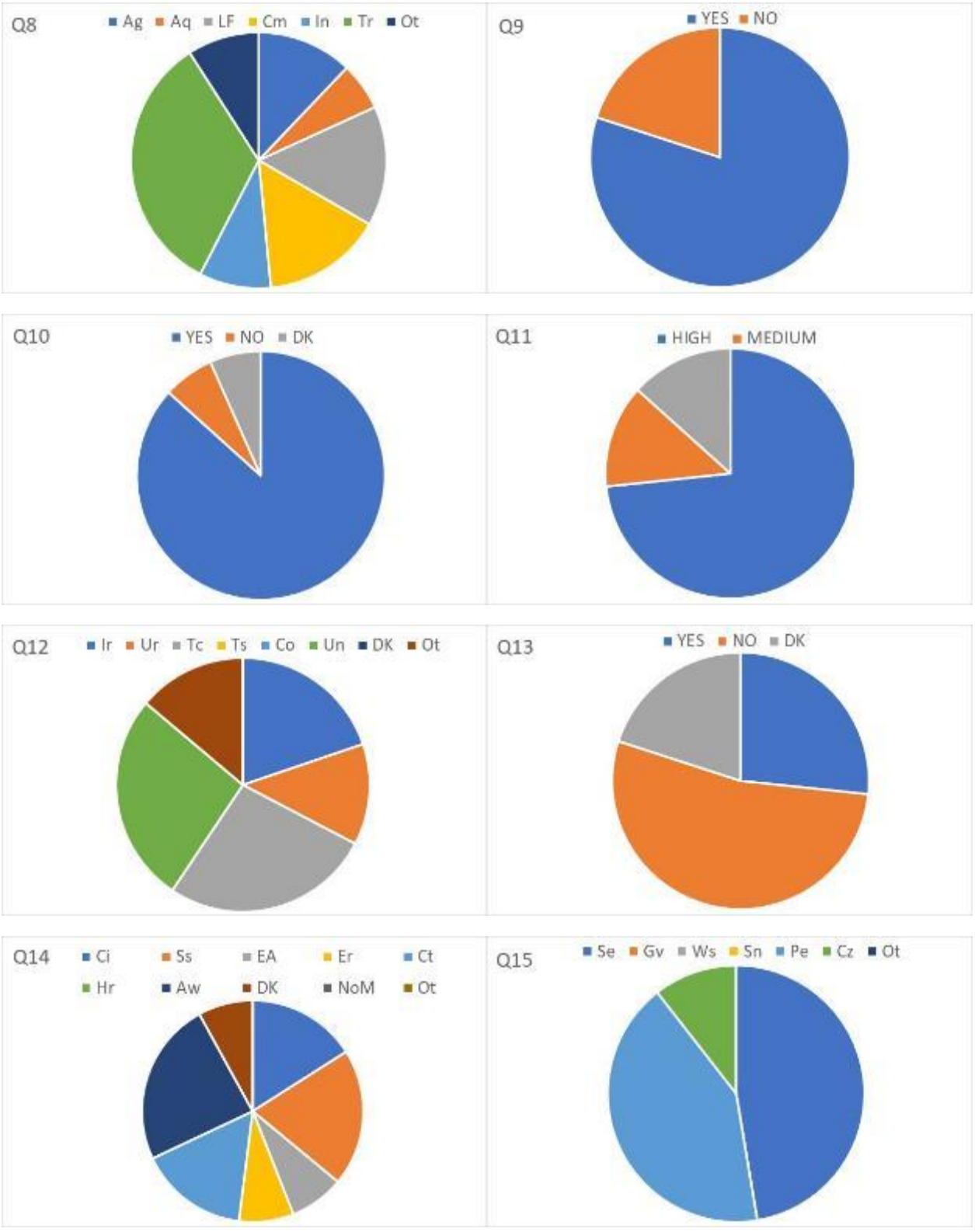

Figure 32b. Graphical answers to the questions from #8 (Q8) to #15 (Q15) collected by OEC. For label acronyms, see appendix 1.

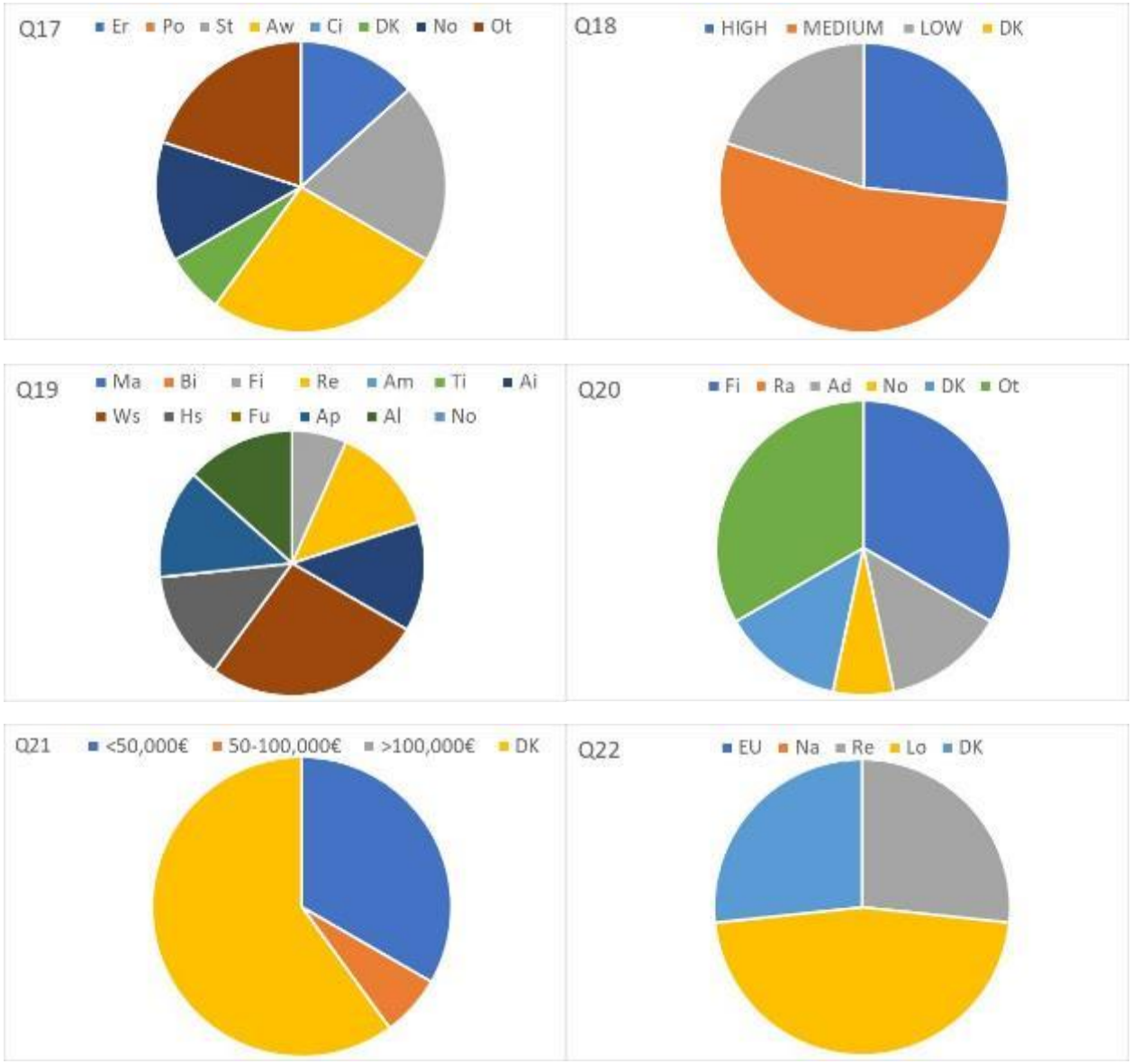

Figure 32c. Graphical answers to the questions from #17 (Q17) to #22 (Q22) collected by OEC. For label acronyms, see appendix 1.

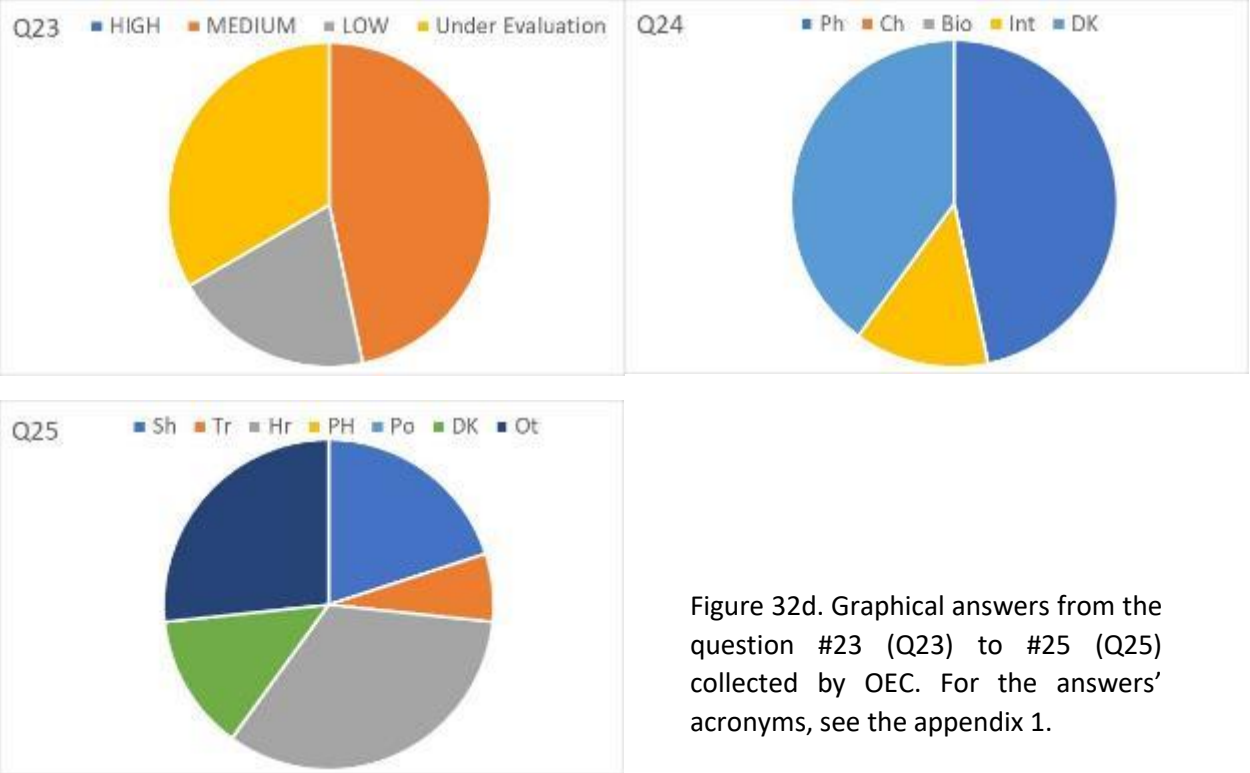

Figure 32d. Graphical answers from the question #23 (Q23) to #25 (Q25) collected by OEC. For the answers' acronyms, see the appendix 1.

3.5 Zemgale Planning Region (ZPR) – Latvia-

ZPR collected in total 12 questionnaires. 33% of the 12 Assessment areas is managed by Public Authorities and almost 17% by National/Regional Agencies. According to the respondents, the remaining 50% of the Aas is managed by other categories of responsible bodies not included in the list of possible answers (Question #2).

The Aas are characterised by a medium/high level of biodiversity (Question #3) and most of them hosted endemic/threatened species (Question #4). The level of anthropogenic disturbance is considered medium (Question #5) as well as the level of habitat degradation (Question #6). Outside the Aas, the surrounding environment is mainly urban/rural areas (Question #7) and the main anthropogenic activities are agriculture and tourism (Question #8); all the Aas are easily accessible and close to inhabited centres (Questions #8, #9) (Figure 34a).

In terms of climate change, the risk of IAS entry into the Aas is considered of medium level (Question #11) and the main pathway of introduction is classified in the "unaided" category (secondary natural dispersal of alien species that have been introduced by means of any pathways) (Question #12). Moreover, the occasional events are not very common in the Aas, thus reducing the possibility of introduction of IAS (Question #13) (Figure 34b).

In this region, most of the respondents indicated that no project was performed against IAS and only 8% answered "awareness raising" as the management action performed (Question #14); in particular, the most common awareness activity was the use of social network to inform citizens (Question #15).

In the management actions against IAS (Question #16, figure 33), conflicts of interests are not particularly relevant, instead the lack of awareness is considered one of the main problems in this region (Question #17).

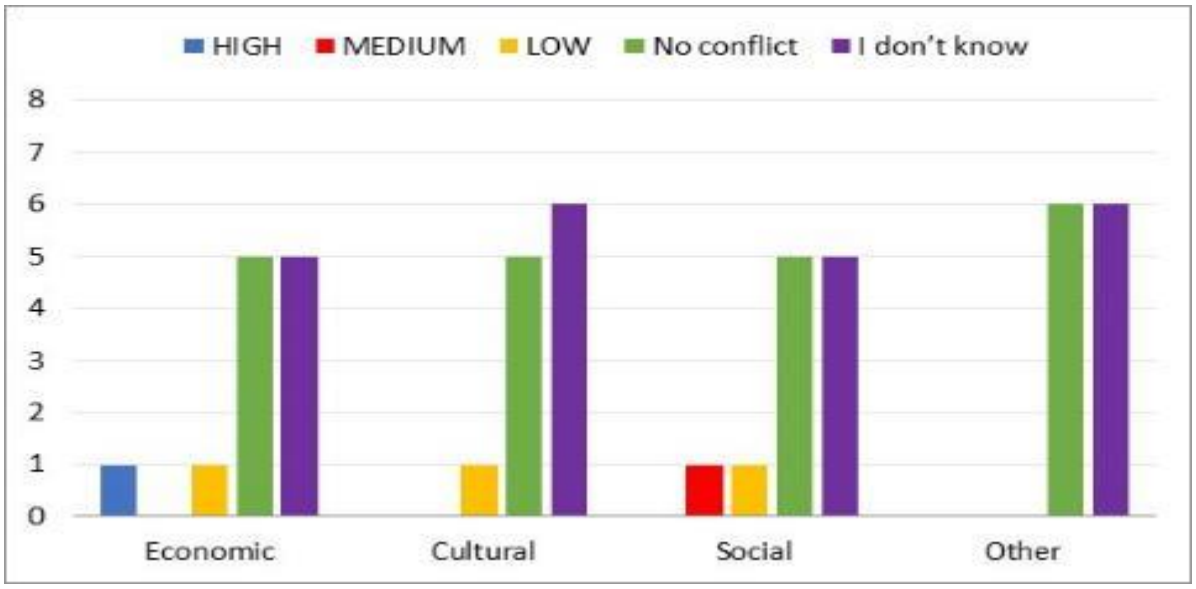

Figure 33. ZPR answers to Question #16: "In the assessment area, is/was there any conflict of interest in the management action aiming to control IAS?"

The presence of IAS in the Aas is considered medium/low (Question #18) and the most common IAS belong to herbaceous species (Question #19). Against them, only a few projects have been done or the respondents were not aware of them (Question #20), with a low budget (Question #21), mainly on a local or regional scale (Question #22), whose results are still under evaluation (Question #23). Considering that the respondents were not informed on the type of project against IAS in their Aas, they couldn't properly answer the last two questions of the questionnaire (Questions #24, #25) (Figure 34c).

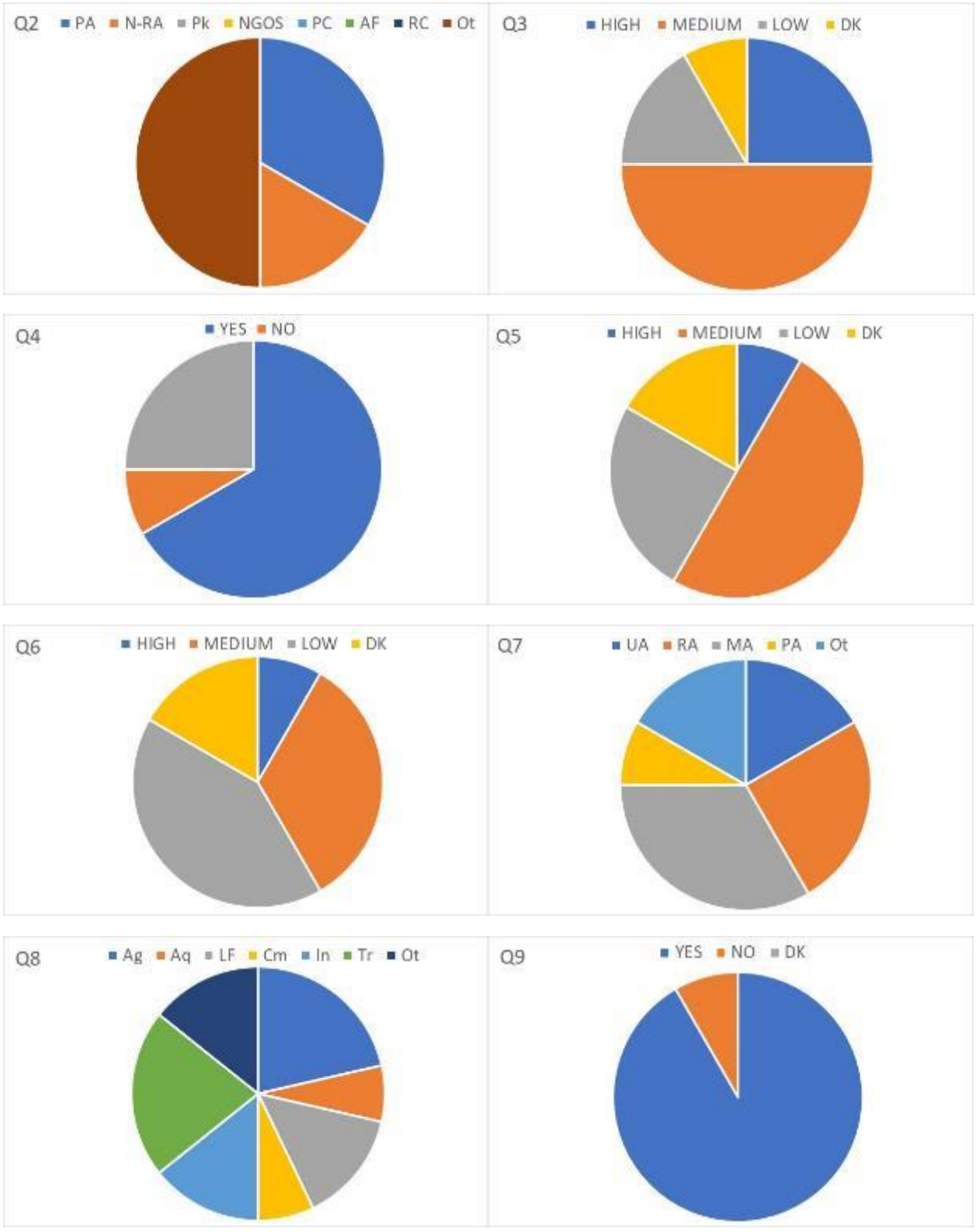

Figure 34a. Graphical answers to the questions from #2 (Q2) to #9 (Q9) collected by ZPR. For label acronyms, see appendix 1.

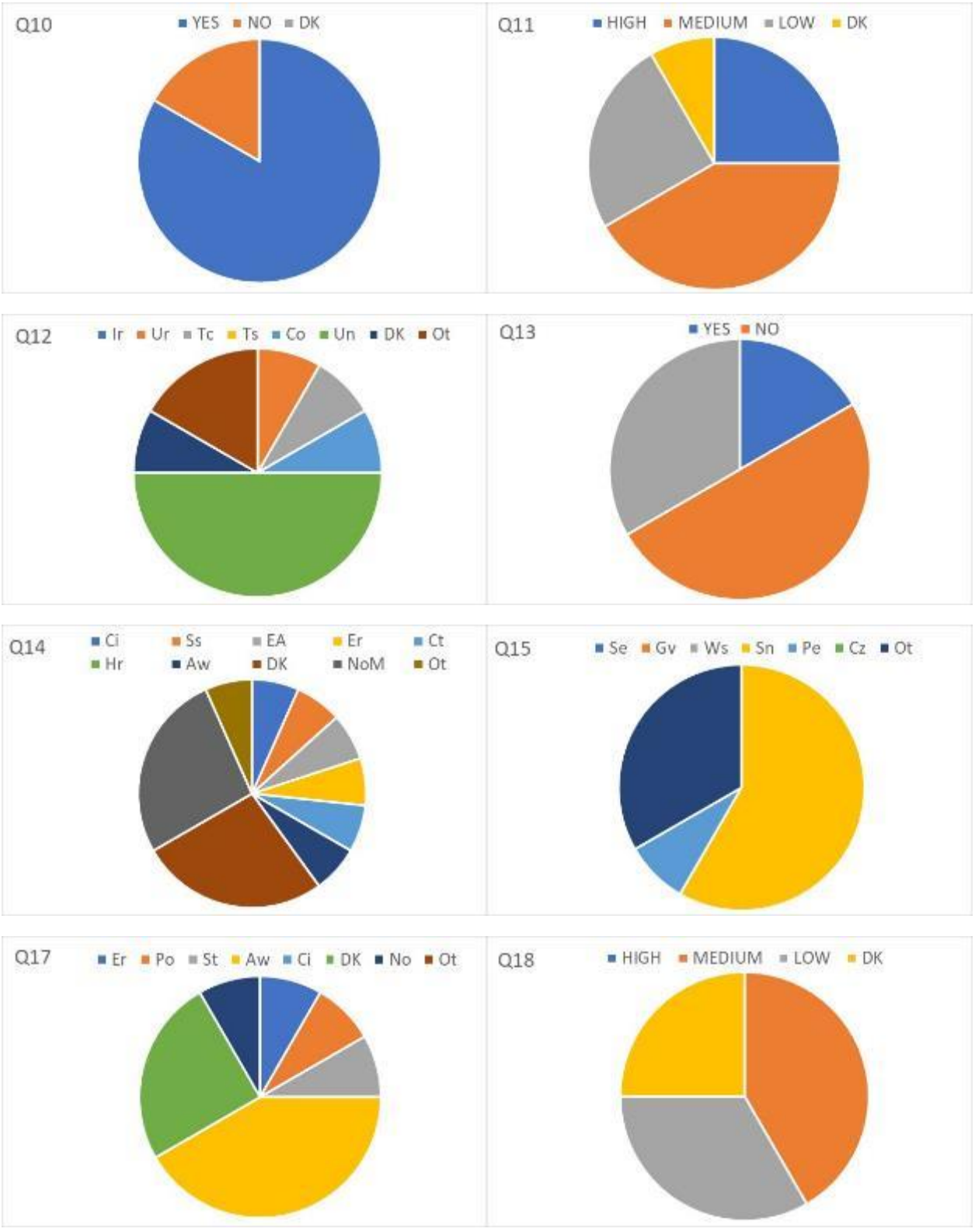

Figure 34b. Graphical answers to the questions from #10 (Q10) to #18 (Q18) collected by ZPR. For label acronyms, see appendix 1.

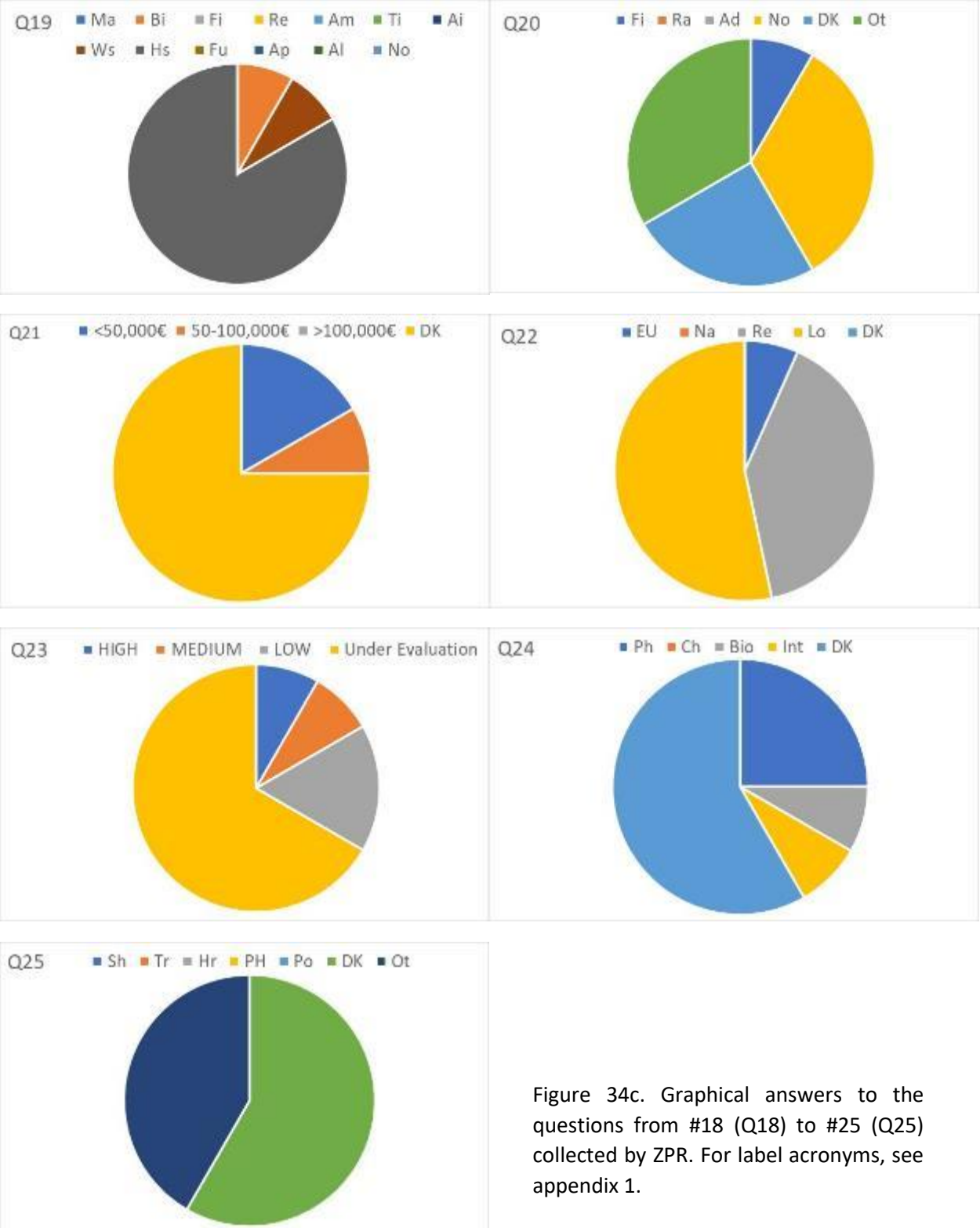

Figure 34c. Graphical answers to the questions from #18 (Q18) to #25 (Q25) collected by ZPR. For label acronyms, see appendix 1.

3.6 Institute of Science, Technologies and Agroenvironment of the University of Porto (ICETA) -Portugal-

ICETA collected 16 questionnaires, mainly filled in by managers or technical operators (Question #1) of Assessment areas, managed by Public Authorities or parks (Question #2). Despite a high/medium level of biodiversity (Question #3) and the presence of endemic or threatened species (Question #4), 50% of the Aas has a high level of anthropogenic disturbance (Question #5) and a medium level of habitat degradation (Question #6). Most of the Aas are surrounded by mixed urban/rural areas (Question #7) and the main anthropogenic activities are agriculture/livestock, and a good percentage of respondents indicated the presence of tourism (Question #8).

The presence of tourism is favoured by the easy access (Question #9) and the closeness of the Aas to inhabit centres (Question #10).

Most of the Aas are evaluated at high risk of IAS entry due to expected climate change (Question #11) and the main pathway of introduction is the secondary dispersal of IAS previously introduced in other nearby areas (Question #12) as, for example, the introduction of IAs due to the occurrence of occasional events (Question #13). The respondents indicated that three main strategic planned actions performed in the last 5 years against IAS have been: increase of awareness, experience in habitat restoration and experience in management (prevention, eradication or control actions) (Question #14). The awareness raising was done throughout school environmental education, guided visits and the use of official website to spread information on the problems caused by IAS (Question #15). On some occasions, these management actions encountered medium/low level of economic and social conflicts but, on the other hand, no cultural conflicts were underlined (Question #16, figure 35).

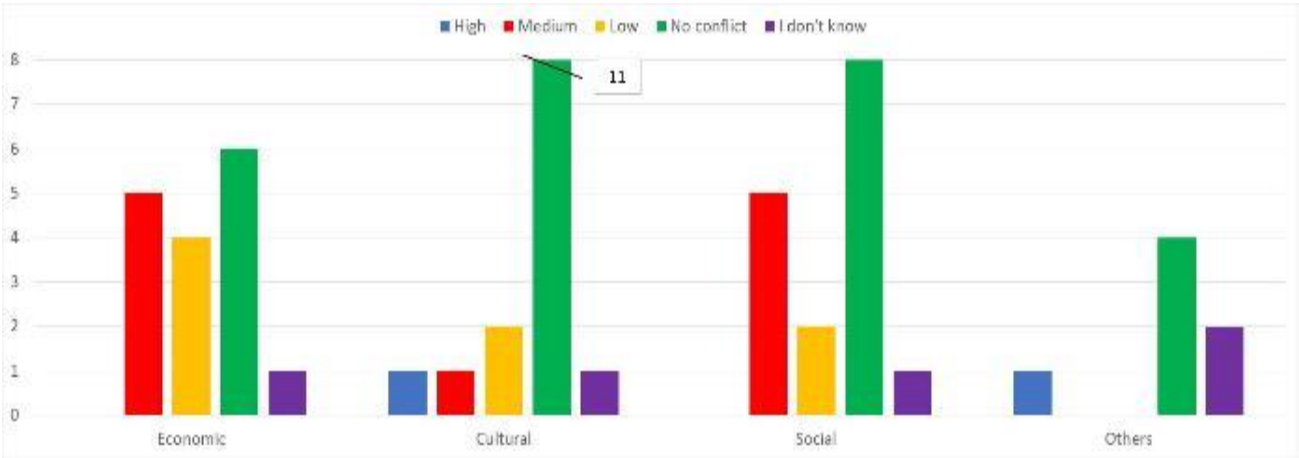

Figure 35. ICETA answers to Question #16: "In the assessment area, is/was there any conflict of interest in the management action aiming to control IAS?"

On the contrary, the real problems indicated by the respondents were lack of economics resources and staff (Question #17). The level of IAS in the Aas is considered medium (Question #18) and the most abundant IAS are woody and herbaceous plants (Question #19). The main actions against IAS were field research activities (Question #20) but the respondents did not know the available budget for the projects (Question #21). These projects are on a regional/local scale (Question #22) and most of them had medium success.

Finally, considering that the most abundant type of IAS are plants, the most used control methods were mainly physical such as hand removal (Questions #24, #25).

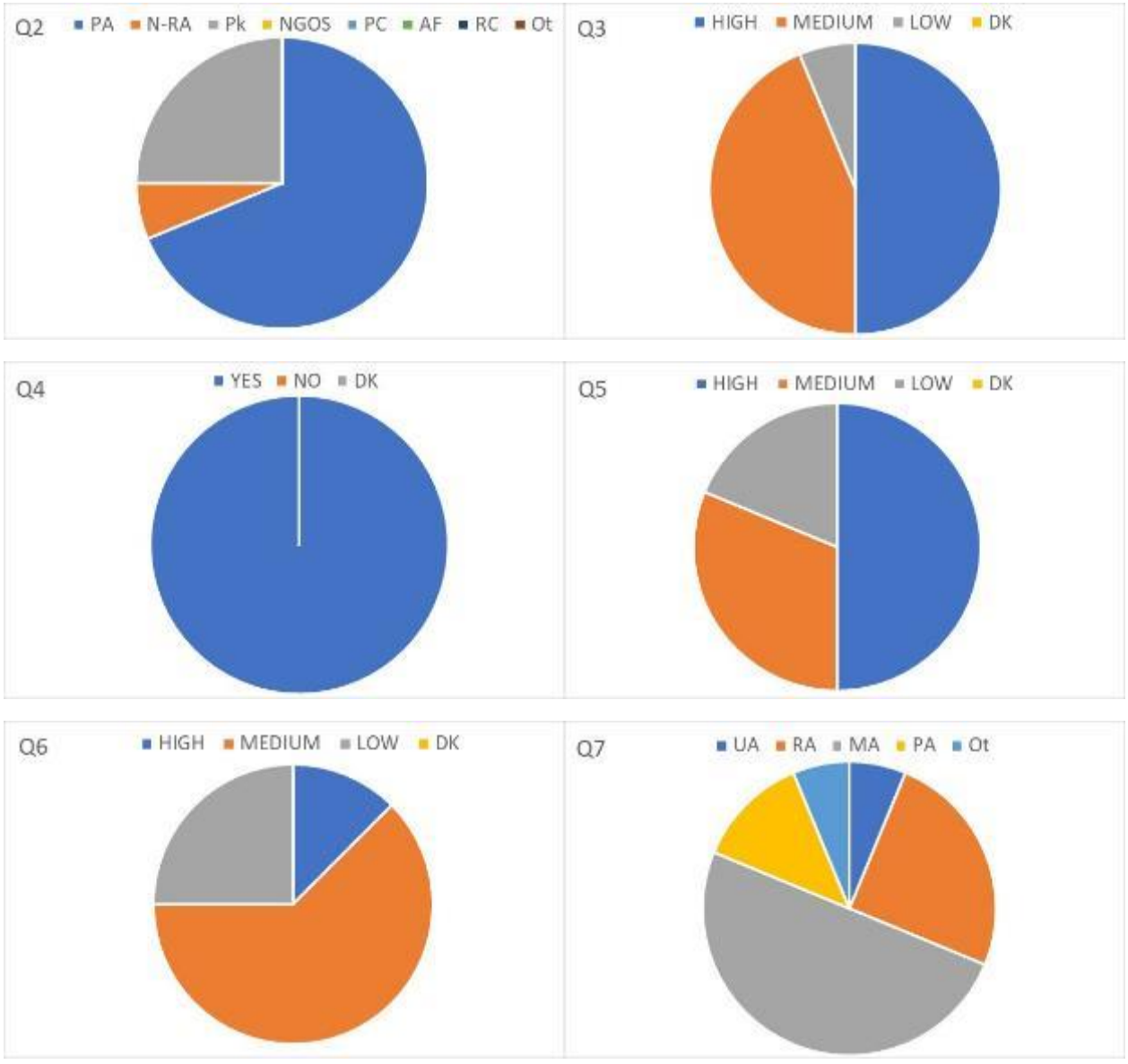

Figure 36a. Graphical answers to the questions from #2 (Q2) to #7 (Q7) collected by ICETA. For label acronyms, see appendix 1.

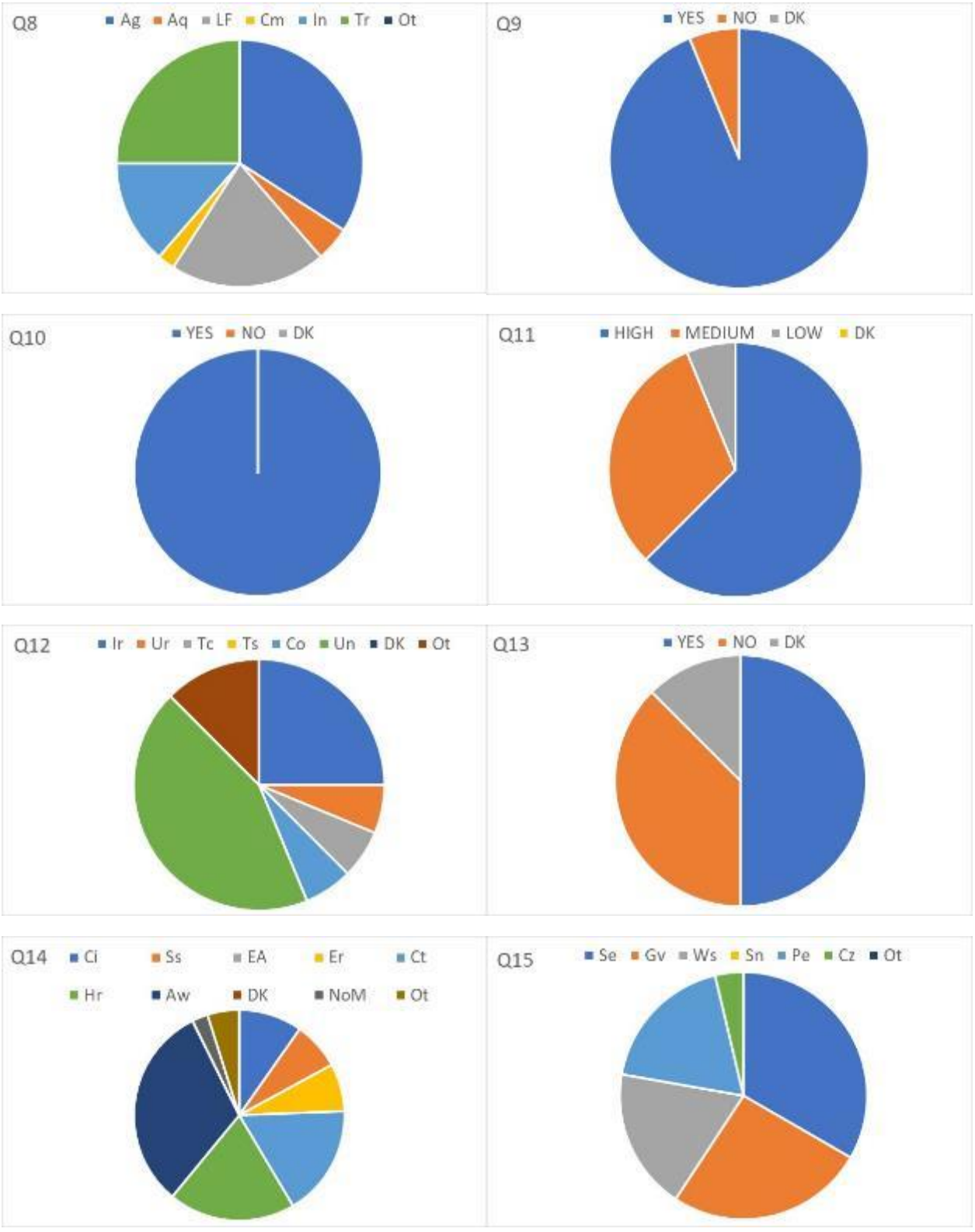

Figure 36b. Graphical answers to the questions from #8 (Q8) to #15 (Q15) collected by ICETA. For label acronyms, see appendix 1.

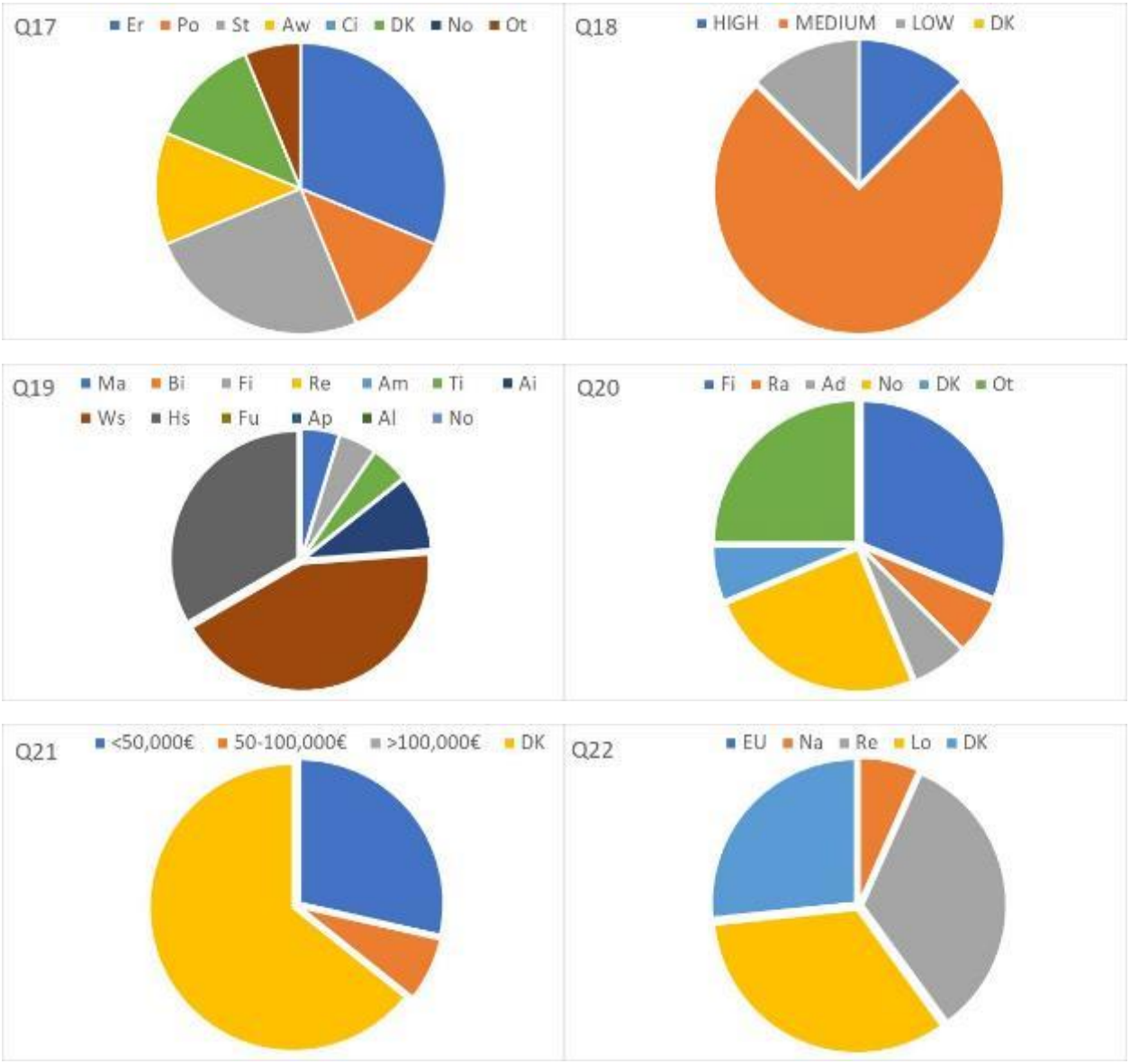

Figure 36c. Graphical answers to the questions from #17 (Q17) to #22 (Q22) collected by ICETA. For label acronyms, see appendix 1.

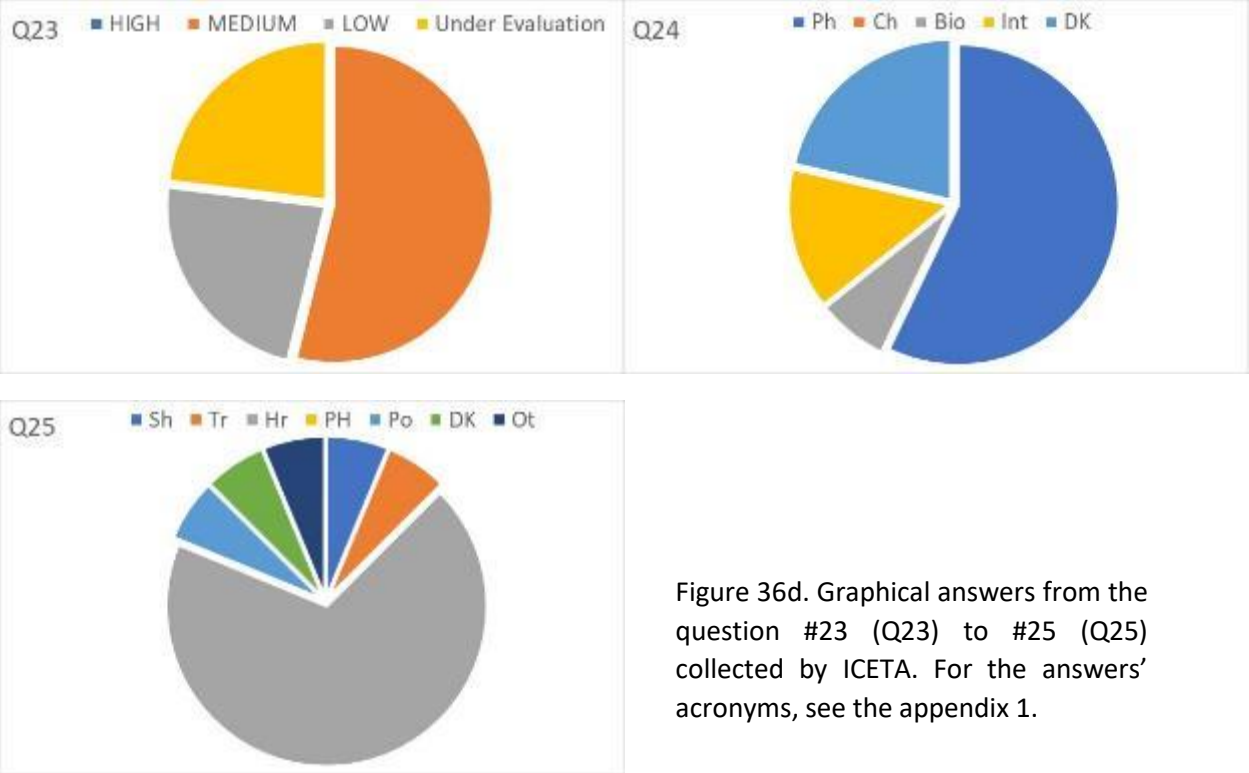

Figure 36d. Graphical answers from the question #23 (Q23) to #25 (Q25) collected by ICETA. For the answers' acronyms, see the appendix 1.

4. MULTIVARIATE ANALYSES

For the multivariate analysis, we selected 18 out of 25 questions that were strictly related to environmental vulnerability (Table 2). Multivariate analyses were performed using the software PRIMER 6 (PRIMER-E Ltd, 2007).

Table 2. Selected questions for the multivariate analysis (MA)

Number	Question	Considered in MA	Not considered in MA
Q1	Which is your role in the Assessment Area?		*X*
Q2	Who is the Responsible Body for the management of the Assessment Area?		*X*
Q3	In your opinion, which is the level of biodiversity in the Assessment Area?	*X*	
Q4	In the Assessment Area, are there endemic species or protected/threatened species?	*X*	
Q5	In your opinion, which is the level of anthropogenic disturbance/pollution in the Assessment Area?	*X*	
Q6	In your opinion, which is the level of the habitat degradation / habitat loss/ landscape modification (anthropogenic barriers e.g. dams, motorways) in the Assessment Area?	*X*	
Q7	Which types of ecosystem surround the Assessment Area?	*X*	
Q8	Which types of anthropogenic activities surround the Assessment Area (within 10 km)?	*X*	
Q9	Is the Assessment Area easily accessible?	*X*	
Q10	Is the Assessment Area close to inhabited centres (within 10 km)?	*X*	
Q11	Under the predicted future climate conditions, how do you evaluate the risk of IAS entry into the Assessment Area?	*X*	

Q12	In your opinion, which pathways of future introduction/reintroductions of IAS may be present in the Assessment Area?	*X*	
Q13	In the Assessment Area or in nearby areas, are you aware of the occurrence of occasional events (i.e. hunting/fishing competitions, local fairs, sport events) which are likely to introduce or re-introduce IAS?	*X*	
Q14	In the last 5 years, which kind of strategic planning and management actions have been done or are ongoing in the Assessment Area with focus on IAS?	*X*	
Q15	If your previous answer was G - "Awareness raising", which kind of activity is present in the Assessment Area?		*X*
Q16	In the Assessment Area, is/was there any conflict of interest in the management action aiming to control IAS?	*X*	
Q17	Which are the main problems that have occurred during the projects/actions against IAS?	*X*	
Q18	How do you evaluate the level of presence of IAS in the Assessment Area?	*X*	
Q19	Which type of IAS are present in the Assessment Area?		*X*
Q20	Which type of projects/actions has been done in the Assessment Area?	*X*	
Q21	Which is/was the project budget?		*X*
Q22	Which is/was the scale of the project?	*X*	
Q23	Which level of success did the project achieved/has the project achieved so far?	*X*	
Q24	Which type of control methods of IAS did you use / has been used?		*X*
Q25	In the case of eradication/control, which type of techniques did you use / have been used?		*X*
	TOTAL	***18***	***7***

Data were analysed by means of the Bray-Curtis similarity matrix and results showed that there was a strong relation between FLA and ERDF (76.07%), OEC and ICETA (72.52%), while ZPR and NCEDS shared less similarity compared to the other Partners (Table 3).

Table 3. Results of the Bray-Curtis similarity matrix. For the acronyms see table 1.

Similarity (0 to 100)

	NCEDS	FLA	ERDF	OEC	ZPR	ICETA
NCEDS						
FLA	51.201					
ERDF	56.137	76.07				
OEC	59.737	56.432	61.201			
ZPR	55.772	39.748	47.49	58.647		
ICETA	60	63.904	69.518	72.525	54.266	

From this matrix, a cluster analysis was performed in order to better highlight the similarity between partners. The graph showed two main groups: one composed of FLA and ERDF (hereinafter referred to as GR1) and another one composed of OEC and ICETA (hereinafter referred to as GR2) (Figure 37). ZPR and NCEDS showed less similarity compared to the others, therefore they were not included in further analysis.

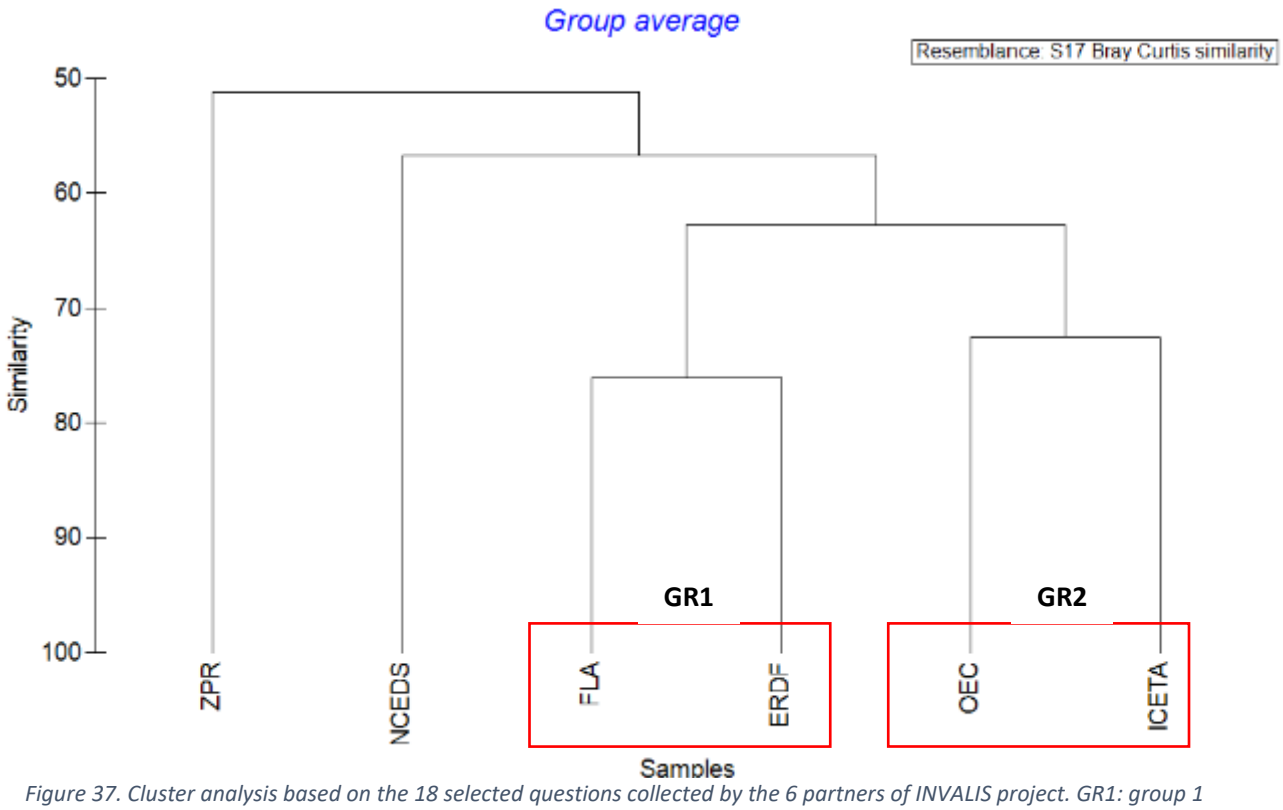

Figure 37. Cluster analysis based on the 18 selected questions collected by the 6 partners of INVALIS project. GR1: group 1 composed by FLA and ERDF; GR2: group 2 composed by OEC and ICETA. For the acronym of the partners' name see table 1

The two emerged groups were investigated in detail by means of a SIMPER analysis, which quantifies the contribution of each variable (in this case, the answers) to the total similarity and/or dissimilarity.

In Group 1 (FLA and ERDF), the Aas are characterised by the presence of endemic / protected species, a high biodiversity level, despite mixed urban / rural areas that surround the Assessment areas, and the intense agricultural or livestock activities. Moreover, the Assessment areas are close to inhabited centres and easily accessible, their level of habitat modification is medium, and the occurrence of occasional events is highly possible.

The main management actions against IAS are awareness raising and the attempt to eradicate or control the IAS, while the main problem that occurred is the lack of economic resources. These actions were performed despite a low level of IAS. The IAS were mainly introduced intentionally and the probability that climate change would influence new invasions is high.

Although field research projects were performed in these areas, IAS are still present (medium results).

The Aas of Group 2 (OEC and ICETA) share similar characteristics with Group 1, such as the presence of endemic / protected species or the closeness to inhabited centres and easy access.

However, some differences characterise this group. For example, presence of tourism or recreational activities, a medium level of IAS in the Assessment areas, less opportunity of the occurrence of occasional events and a high-medium level of anthropogenic disturbance.

Finally, the fact that both NCEDS and ZPR have more than 50% similarity with Group 1 and Group 2 means that they have some common characteristics to both groups, but also a few peculiarities, such as the presence of IAS classified at a medium level and in general scanty information on the few local projects performed against IAS, the majority of which are still under evaluation.

5. FINAL CONSIDERATIONS

According to the INVALIS workplan, Lombardy Foundation for the Environment, through an agreement with the University of Pavia, was in charge of developing a methodology in order to gather inputs in each partner region about the most important factors that are responsible for the vulnerability of the local environments to alien species introduction and establishment (Action A1.2).

A lot of literature is devoted to scanning the possible determinants of the success of alien species in a given region. Most of the papers deal with biological traits of introduced species and with propagule pressure (i.e. the quantity of individuals, or their parts, that can establish in a new ecosystem).

Comparatively, less research has been devoted to the capacity or susceptibility of the receiving environment to host and nurture new entrant species: that is the ecosystem vulnerability.

These considerations led us to design a conceptual scheme made of 4 parts encompassing the factors described as capable of influencing ecosystem vulnerability to the arrival of invasive species (Figure 1).

The interaction of «aggressive» alien species with weakly resistant ecosystems is leading to the maximum probability of biological invasions occurring.

An ecosystem is less vulnerable to IAS invasion if it has a high/medium level of biodiversity, a low level of presence of IAS, a medium/low level of anthropogenic disturbance and habitat degradation, and it is surrounded by pristine areas. Furthermore, the absence of any type of conflicts of interest

(economic, cultural or social) is an important factor that favours the promotion of actions/projects against IAS, from awareness raising to habitat restoration activities.

On the contrary, there are other factors that increase the ecosystems' vulnerability. An area that is close to inhabited centres, is easily accessible, and it is surrounded by rural or urban areas with anthropogenic activities such as agriculture, industries and commercial activities, is more vulnerable to IAS invasions. Moreover, the occurrence of occasional events in the area or nearby and the presence of more than one vector of introduction represent another two factors that increase its vulnerability.

Finally, the ecosystems' vulnerability also increases if areas do not have specific legislation against IAS and if they have low economic resources or a lack of specialized staff to perform projects against IAS (Figure 38).

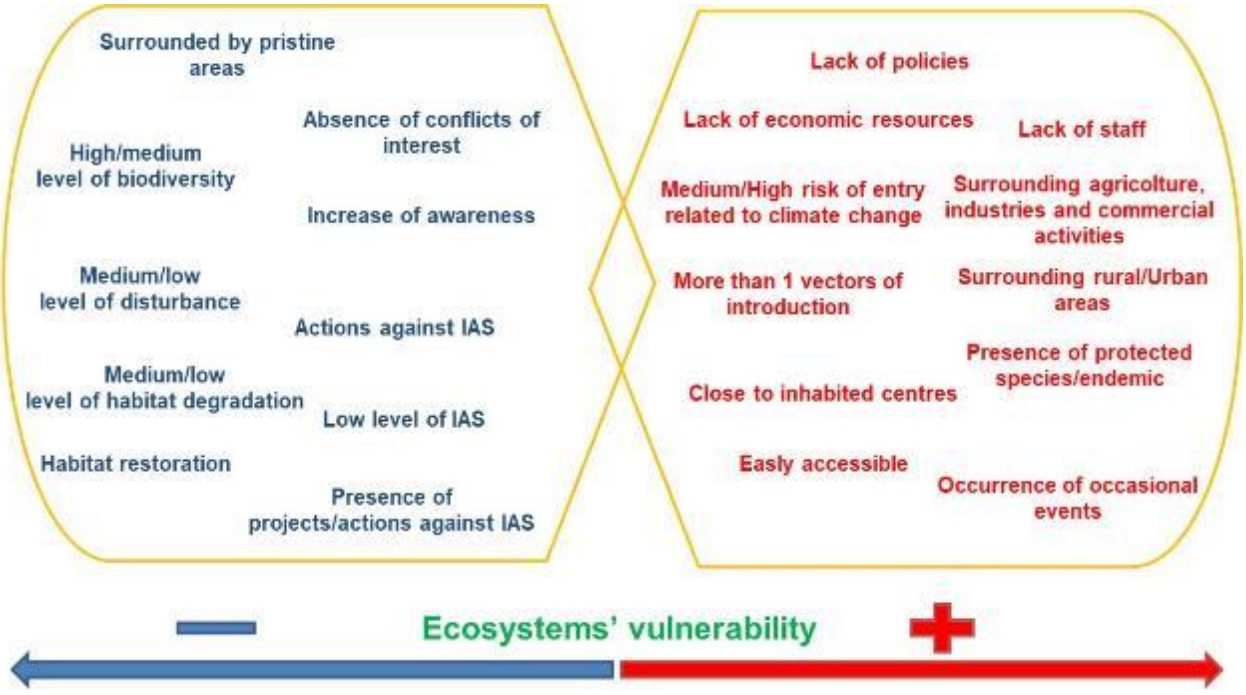

Figure 38. Conceptual scheme of the main factors that can affect the ecosystem vulnerability

By combining the information reported in the conceptual scheme of figure 38 with the results of the questionnaire an indication on the vulnerability of the ecosystems analysed within the INVALIS project can be outlined.

Most of the INVALIS Assessment areas share characteristics that favour the process of invasion, such as a medium level of habitat degradation and of anthropogenic disturbance, a landscape mainly composed of rural or urban areas with intense agriculture or livestock activities. Moreover, the

majority of the Assessment areas are easily accessible and close to inhabited centres; due to these latter characteristics, in many of them also a relevant impact of the tourism, as well as other recreational activities, are recognised as possible sources of introduction of IAS. Also, the effect of climate change, which is part of the anthropogenic impact, contributes to increasing ecosystem vulnerability.

The management of IAS is not always easy to address. A series of problems, such as the lack of clear policies, of economic resources, of specialised staff and a low level of awareness of the problems caused by IAS often interfere with the level of success of the actions negatively affecting the vulnerability.

On the other hand, the Assessment Areas of the INVALIS project have other characteristics that decrease their vulnerability. In most of the Aas, the medium / high level of biodiversity protects them from IAS invasion. Moreover, there are projects or management actions against IAS that do not cause a high level of conflicts of interest and this represents a core advantage in the control of IAS.

The combination of ecological characteristics of the areas associated with the management actions against IAS and the surrounding anthropogenic activities are the main factors that contribute to environmental vulnerability to invasive species.

Considering that the ecological characteristics are intrinsic to an environment and constitute a non-modifiable factor, the only way to decrease ecosystem vulnerability is to make relevant changes to the management of the area and to the surrounding anthropogenic activities that might be controlled through specific regulations.

First of all, it would be beneficial to increase citizen awareness on the ecological and economic problems caused by IAS. There are different ways to involve citizens in environmental projects, from citizen sciences in projects on monitoring alien species, to dedicated events with the aim of increasing citizen knowledge on the impacts of IAS on the environment.

Another useful action could be to finance projects against IAS that can guarantee a constant monitoring activity of the environment by specialised staff and reduce the impacts of IAS.

Last but not least, it would be better to have a more detailed legislation that is shared between Regions and Countries to regulate those anthropogenic activities responsible for the introduction of IAS. For example, the duty to "check, clean and dry" all the possible vectors that can favour the diffusion of IAS or the ban on commercialising some species (e.g. *Trachemys scripta*).

In conclusion, the ecosystems' vulnerability is a multifaced problem depending on intrinsic environmental factors which characterise each ecosystem, but it is also highly influenced by anthropogenic activities.

Appendix 1: the questionnaire on the ecosystems' vulnerability to IAS invasions

In bold, the acronyms of each answers reported in the previous graphs. The questionnaire is available at https://forms.gle/HiQYGva3dM2xsf7dA

Section 1 - General information

Name and Surname:

Email:

Name of the Assessment Area:

Brief description of the Assessment Area:

---

1. Which is your role in the Assessment Area?

   A Director/Manager

   B Regional ecological guards

   C Technical operator

   D Official of the naturalistic or forestry or marine services

   E Environmental educator or "green journalist"

   F Researcher

   G Other (please specify)

2. Who is the Responsible Body for the management of the Assessment Area?

   A Public Authorities **(PA)**

   B National / Regional Agency **(N-RA)**

   C Parks / Protected areas **(PK)**

   D Environmental NGOs **(NGOs)**

   E Private companies **(PC)**

   F Armed forces **(AF)**

   G Universities / Research centres **(RC)**

   H Other (please specify) **(Ot)**

Section 2 - Environment and environmental change

3. In your opinion, which is the level of biodiversity in the Assessment Area?

A	High	**(HIGH)**
B	Medium	**(MEDIUM)**
C	Low	**(LOW)**
D	I don't know	**(DK)**

Rationale: Biodiversity is considered a proxy of ecosystem health: in a pristine area, biodiversity is generally high and native species occupy all the available ecological niches, hence IAS are expected to have less available resources and niches.

4. In the Assessment Area, are there endemic species or protected/threatened species?

A	Yes	**(YES)**
B	No	**(NO)**
C	I don't know	**(DK)**

Rationale: The presence of endangered species represents an extra value for an area, thus requiring priority in conservation efforts

5. In your opinion, which is the level of anthropogenic disturbance/pollution in the Assessment Area?

A	High	**(HIGH)**
B	Medium	**(MEDIUM)**
C	Low	**(LOW)**
D	I don't know	**(DK)**

Rationale: One of the most relevant causes leading to a decrease in biodiversity is environmental pollution that causes diminished resistance of native populations to other disturbing factors such as the invasion of new species.

6. In your opinion, which is the level of the habitat degradation / habitat loss/ landscape modification (anthropogenic barriers e.g. dams, motorways) in the Assessment Area?

A	High	**(HIGH)**
B	Medium	**(MEDIUM)**
C	Low	**(LOW)**
D	I don't know	**(DK)**

If possible, please provide an example

_____

_____

<u>Rationale:</u> Habitat degradation, presence of anthropogenic impact and proximity to human activities cause simplification of the habitat, leading to vacant niches and impoverishment of biodiversity. These factors favour the establishment of more opportunistic species

7. Which types of ecosystem surround the Assessment Area?

A	Urban areas	**(UA)**
B	Rural areas	**(RA)**
C	Mixed urban/rural areas	**(MA)**
D	Pristine areas	**(PA)**
E	Other (please specify)	**(Ot)**

_____

<u>Rationale:</u> The landscape in which the Assessment Area is included is crucial for maintaining its biodiversity. If the AA is isolated and surrounded by a heavily anthropized territory (e.g. urban or rural), the level of vulnerability is higher compared to other areas surrounded by a more naturalised context.

8. Which types of anthropogenic activities surround the Assessment Area (within 10 km)? (Please select more than one option if necessary)

A	Agriculture	**(Ag)**
B	Aquaculture	**(Aq)**
C	Livestock/farm	**(LF)**
D	Commercial (airports, ports, logistic centres)	**(Cm)**
E	Industries	**(In)**
F	Tourism/recreational	**(Tr)**
G	Other (please specify)	**(Ot)**

_____

Rationale: Some anthropogenic activities are more likely to introduce IAS (e.g. commercial), or to favour IAS establishment (e.g. industrial) compared to others.

9. Is the Assessment Area easily accessible?

A	Yes	**(YES)**
B	No	**(NO)**
C	I don't know	**(DK)**

Rationale: If the Assessment Area is difficult to access (e.g. lack of roads or presence of physical barriers), it should be less vulnerable to alien species introduction.

10. Is the Assessment Area close to inhabited centres (within 10 km)?

A	Yes	**(YES)**
B	No	**(NO)**
C	I don't know	**(DK)**

Rationale: According to the propagule pressure theory, inhabited centres are considered one of the main sources of IAS diffusion.

11. Under the predicted future climate conditions, how do you evaluate the risk of IAS entry into the Assessment Area?

A	High	**(HIGH)**
B	Medium	**(MEDIUM)**
C	Low	**(LOW)**
D	I don't know	**(DK)**

<u>Rationale:</u> Climate change is another factor that affects the vulnerability of an ecosystem because it leads to a higher instability, favouring the invasion of alien species.

12. In your opinion, which pathways of future introduction/reintroductions of IAS may be present in the Assessment Area?

A	Intentional release (Intentional introduction of live aliens organisms, for the purpose of human use, in the natural environment)	**(In)**
B	Unintentional release / escape (Intentional introduction as a commodity in containment facilities but escapes unintentionally in nature)	**(Ur)**
C	Transport - Contaminant (Unintentional introduction of live organisms as contaminants of a commodity that is intentionally transferred through)	**(Tc)**
D	Transport - stowaway (Unintentional introduction of live organisms attached to transporting vessels and associated equipment)	**(TS)**
E	Corridors (Unintentional introduction via human infrastructures linking previously unconnected regions)	**(Co)**
F	Unaided (Secondary, natural, dispersal of alien species, that have been introduced by means of any of the foregoing pathways, across political border)	**(Un)**
G	I don't know	**(DK)**
H	Other (please specify)	**(Ot)**

_____

13. In the Assessment Area or in nearby areas, are you aware of the occurrence of occasional events (i.e. hunting/fishing competitions, local fairs, sport events) which are likely to introduce or re-introduce IAS?

A	Yes	**(YES)**
B	No	**(NO)**
C	I don't know	**(DK)**

Rationale: *Occasional events could be the source of accidental IAS introduction in the Assessment Area. For example, the introduction in Italy of the bivalve mollusc* Dreissena polymorpha *was due to an international boat exhibition in a lake of Northern Italy.*

Section 3 - Policy framework, strategic planning and management awareness

14. In the last 5 years, which kind of strategic planning and management actions have been done or are ongoing in the Assessment Area with focus on IAS? Please select more than one option if necessary

A	Centralized information system data base	**(Ci)**
B	Surveillance system	**(Ss)**
C	Early alert system	**(Ea)**
D	Experience in eradication actions	**(Er)**
E	Experience in prevention/eradication/control actions	**(Ct)**
F	Habitat restoration	**(Hr)**
G	Awareness raising	**(Aw)**
H	I don't know	**(DK)**
I	No strategic planning and management actions	**(NoM)**
L	Other (please specify)	**(Ot)**

Rationale: *The presence of a strategic planning management of the Assessment Area could increase its resistance to IAS.*

15. If your previous answer was G - "Awareness raising", which kind of activity is present in the Assessment Area? Please select more than one option if necessary

A	School environmental education	**(Se)**
B	Guided visits	**(Gv)**
D	Available information on official web site	**(Ws)**
E	Social networks	**(Sn)**
F	Public events (seminars, exhibitions)	**(Pe)**
G	Citizen science events	**(Cz)**
H	Other (please specify)	**(Ot)**

Rationale: Lack of awareness on the Invasive Alien Species is one of the main problems for their management.

Section 4 - Territorial context and observed problems

16. In the Assessment Area, is/was there any conflict of interest in the management action aiming to control IAS? Please specify which kind of conflict of interest you think is present and also indicate its importance

	Type/Level	HIGH	MEDIUM	LOW	No conflict	I don't know
A	Economic					
B	Cultural					
C	Social					
D	Other					

Rationale: Conflicts of interest (e.g. happening when an IAS has socio-economic value) can influence the vulnerability of an ecosystem, because it is more difficult to implement control actions.

17. Which are the main problems that have occurred during the projects/actions against IAS?

A	Lack of economic resources	**(Er)**
B	Lack of policies	**(Po)**
C	Lack of staff	**(St)**
D	Lack of awareness	**(Aw)**
E	Conflict of interests	**(Ci)**
F	I don't know	**(DK)**
G	No problems	**(No)**
H	Other (please specify)	**(Ot)**

Section 5 - Type of projects/action against IAS and exchange of experience

18. How do you evaluate the level of presence of IAS in the Assessment Area?

A	High	**(HIGH)**
B	Medium	**(MEDIUM)**
C	Low	**(LOW)**
D	I don't know	**(DK)**

Rationale: An Assessment Area already colonised by IAS is more vulnerable to further invasions due to the direct/indirect effects of IAS on native species

19. Which type of IAS are present in the Assessment Area?

A	Mammals	**(Ma)**
B	Birds	**(Bi)**
C	Fishes	**(Fi)**
D	Reptiles	**(Re)**
E	Amphibians	**(Am)**
F	Terrestrial Invertebrates	**(Ti)**
G	Aquatic Invertebrates	**(Ai)**
H	Woody species	**(Ws)**

I	Herbaceous species	**(Hs)**
L	Fungi	**(Fu)**
M	Aquatic plants	**(Ap)**
N	Algae	**(Al)**
O	None	**(No)**

20. Which type of projects/actions has been done in the Assessment Area?

A	Field research project	**(Fi)**
B	Risk assessment evaluation	**(Ra)**
C	Administrative/legislative actions	**(Ad)**
D	No projects	**(No)**
E	I don't know	**(DK)**
F	Other (please specify)	**(Ot)**

21. Which is/was the project budget?

A	<50,000 €
B	50,000-100,000 €
C	>100,000 €
D	I don't know

<u>Rationale:</u> the budget of the project could give some information on project size and relevance and thus on the possible positive effects.

22. Which is/was the scale of the project?

A	EU scale	**(Eu)**
B	National scale	**(Na)**
C	Regional scale	**(Re)**
D	Local scale	**(Lo)**
E	I don't know	**(DK)**

<u>Rationale</u>: the scale of the project provides information on its possible effectiveness at larger scale

23. Which level of success did the project achieved/has the project achieved so far?

A	High (almost all IAS specimens eradicated)	**(HIGH)**
B	Medium (IAS specimens still present)	**(MEDIUM)**
C	Low (No effect on IAS)	**(LOW)**
D	Still under evaluation	**(UNDER EVALUATION)**

24. Which type of control methods of IAS did you use / has been used?

A	Physical	**(Ph)**
B	Chemical	**(Ch)**
C	Biological	**(Bio)**
D	Integrated methods	**(Int)**
E	I don't know	**(DK)**

25. In the case of eradication/control, which type of techniques did you use / have been used?

A	Shooting	**(Sh)**
B	Trapping	**(Tr)**
C	Hand removal	**(Hr)**
D	Pesticides/herbicides	**(PE)**
E	Poisoning	**(Po)**
F	I don't know	**(DK)**
G	Other (please specify)	**(Ot)**

26. Could you give us a brief description on your project/action against IAS, providing useful information (e.g. website if available)