Surveying attitudes toward helping wild animals among scientists and students

Animal Ethics

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Contents

Executive summary

Background

While the science of animal welfare has been a well-established field for several decades, it has focused mainly on examining the wellbeing of animals used or directly affected by humans — mainly those kept in captivity. For their part, ecologists and other biologists have studied the lives of animals in the wild and how they relate to their environment, but not the wellbeing of the animals themselves. These animals are threatened by many factors that can cause them suffering, including starvation, thirst, disease, parasites, injuries, aggression, extreme weather conditions, and stress. While providing them aid may in many cases be beyond our capacities, there are many circumstances where doing so is feasible. Acquiring more knowledge can improve the prospects of positively impacting the wellbeing of wild animals.

Objectives

This project aims to assess the perceptions and attitudes held by scholars and students in life sciences toward researching different forms of interventions to reduce the suffering of wild animals. The project is based on and complements a previous study (Animal Ethics 2020) based on qualitative interviews with scientists to gain more knowledge about this question.

This study has examined several questions related to how to best achieve this goal. It has aimed to attain the following:

- Identify which research projects focused on ways of improving the wellbeing and reducing the suffering of wild animals are likely to get more attention from scientists
- Identify the extent to which those projects are likely to be supported in academia

- Identify the extent to which the projects are likely to be interesting to students
- Learn more about what obstacles such research might face, and the most promising ways to overcome them

Methodology

These questions were examined using a semi-structured survey for quantitative and qualitative data collection. We sent 3,905 emails with an invitation to fill out an online questionnaire to scholars at university departments of biological, ecological, veterinary, and related sciences around the world. We received 111 responses from scholars in 19 different countries. We also distributed questionnaires among life science students in different countries, who were recruited through a snowball sampling procedure. We received 226 questionnaires completed by students in 24 countries.

The questionnaires asked participants about three hypothetical research projects: the first one (Vaccination) was about wild animal vaccination aimed at stopping the spread of a disease among animals in the wild; the second (Urban Ecology) about how to reduce the harms that wild animals suffer in urban environments; and the third (Weather Effects) about how to successfully intervene to aid animals suffering in the wild due to harsh weather events. The motivation for these three research projects would be the improvement of the wellbeing of animals. We had previously identified these three projects as especially promising in our former qualitative study, and they have also been mentioned in the literature about the issue. We asked participants about their support for each of these projects, about their opinions concerning the support of other scholars and students for these projects, and about the likelihood that university departments would support such projects. We also asked them about what obstacles they perceived for each of these three research projects to be successfully carried out.

Results

Responses were mostly favorable in all cases. Levels of support and perceived support by others ranged, depending on the question, from over 60% to over 90%.

Students and scholars tended to give similar responses. The level of support was highest in almost all cases for the second project, Urban Ecology. The first project, Vaccination, also received substantial support. It was ranked second except in one very important category — expected support at university departments, in which it was ranked third. The third project, Weather Effects, was ranked first in this category. The results showed no substantial conflict between the perceptions and attitudes among scholars and students.

The perceived obstacles to the development of these projects were mainly external, having to do especially with lack of funding, and, to a lesser extent, with technical issues and bureaucracy. Attitudinal obstacles were less frequently mentioned. Those that were mentioned include the idea that the wellbeing of animals is irrelevant, the fact that the projects would study ways of intervening in nature, that they would study non-anthropogenic harms suffered by non-threatened species, and that they would not benefit humans. These objections were least prevalent in the case of the Urban Ecology project, and were most commonly mentioned for the Weather Effects project. Nevertheless, they were a minority among those that were mentioned for each of the three research projects.

Limitations

We didn't get conflicting responses from scholars and students. But we detected three other ways in which the results of the study may have been distorted to some extent. First, some respondents confused considerations about interventions with considerations about research projects studying those interventions. Second, we consider it likely that there is a self-selection bias resulting from the scholars who responded being more sympathetic toward helping wild animals than average life scientists. To counter its impact on the validity of our results, we included questions about perceived attitudes and support by fellow scholars and university departments. Third, our results may have been affected by some respondents not properly understanding the meaning of the term "animal welfare."

Conclusions

Given the results, it seems that there is much room for growth in the development of research on this topic. Concerns about the tractability of improving the wellbeing of animals in the wild do not appear to be shared throughout academia. In particular, projects aimed at improving the situation of wild animals in urban environments are likely to get support if they are promoted. In addition, research on helping animals suffering as a result of weather events may be successful in challenging the idea that we should not intervene for the sake of wild animals. In the responses about this project, we found an interesting combination of factors: respondents saw it as the most likely of the three projects to be supported in academia, and the subject of the research is also seen as a form of intervention in nature to improve the wellbeing of animals, which is a common objection.

This study shows that there is a lack of familiarity among biologists with the science of animal welfare. The study also suggests that the attitudes of students in natural sciences regarding aiding wild animals are not significantly different from those of scholars. In fact, we found no indication of any recent paradigm change with respect to the consideration of animals' wellbeing in biological sciences. This suggests that in addition to promoting new research projects, raising awareness about the reasons to work on the wellbeing of animals could be fruitful.

Recommendations

In light of the results, we make several specific recommendations for those who want to improve the wellbeing of wild animals. They include

- The promotion of cross-disciplinary academic research on helping animals living outside of direct human control
- Emphasizing projects aiming at
  (i) improving the wellbeing of animals in urban and similar areas and
  (ii) helping animal negatively affected by weather effects
- The promotion of training in animal welfare science to biologists and environmental scientists, and especially to students in these fields

- Carrying out educational work about the feasibility of helping wild animals among natural sciences students in particular, and among other relevant agents in society

Background

Animal welfare science was developed several decades ago with the aim of studying the wellbeing of animals living under direct human control, especially those living in captivity (Broom 1988; 1991; Mellor, Patterson-Kane & Stafford 2009). By animals under "direct human control," we mean animals whose lives and activities are directly determined by human beings, such as domesticated (excluding feral) animals, and captive wild animals. Less attention has been paid to other animals, including those living in the wild and non-domesticated animals located in urban areas (whose lives may be shaped but not directly controlled by humans) (Kirkwood, Sainsbury & Bennett 1994; Jordan 2005; Kirkwood 2013; JWD Wildlife Welfare Supplement Editorial Board 2016). It has focused so far on animals who are harmed in very direct, straightforward ways by human actions (such as by hunting or fishing). With a few exceptions (Boonstra 2013; Cattet 2013), it hasn't been applied to examining the wellbeing of other animals. Many other circumstances related to how those other animals (living in wild, urban, and other ecosystems) behave and relate to their environment, as well as their life histories, have been studied a great deal by ecologists and other natural scientists, but not with a focus on the wellbeing of the animals. However, sentience among wild animals has been well established, meaning they can be positively or negatively impacted by the events of their lives (Price 1985; Gregory 2004; McLaren, Bonacic & Rowan 2007; Linklater & Gedir 2011; Beausoleil 2014; Beausoleil et al. 2018). These animals face many hardships in the ecosystems they live in, caused by factors such as starvation, thirst, disease, parasites, injuries, aggression, extreme weather conditions, and stress (Gould 1982; Dawkins 1994; Faria & Paez 2015; Tomasik 2015; Horta 2017; Animal Ethics 2016a; Ryf 2016; Soryl 2019; Waldhorn 2019).

Research on the welfare of animals living outside of direct human control would allow us to improve their wellbeing when they face such hardships. But this depends on two main factors: (1) a motivational one: the willingness of humans to deliver such help or to act in other ways that ameliorate the situation for the sake of their wellbeing; and (2) a cognitive one: the knowledge necessary to carry out those

courses of action. These two factors can reinforce each other; more concern for animals in nature can encourage more research, leading to a deeper knowledge on these issues, which can in turn increase concern.

The study of animals in nature with regard to their welfare would be based on animal welfare science, and also incorporate approaches from ecological sciences and other related disciplines. The term "welfare biology" has been used to name this cross-disciplinary work (Ng 1995; Faria & Horta 2019).

This study's main goal is to assess attitudes among scholars and students in life sciences toward research about different interventions that could reduce the suffering of wild animals. This knowledge can be instrumental to learning what kind of research would be promising in terms of stimulating further work in this field. This question was examined in an earlier study (Animal Ethics 2020) using qualitative interviews with scientists. The design of the present study was based on the results of that study, so it can test, complement, and expand its findings.

Objectives

- Identify which research topics related to reducing wild animal suffering are more likely to be viewed as important and feasible by established natural science scholars
- Identify which of these topics are more likely to be endorsed and funded in academia
- Identify which of these topics are more interesting to students in life sciences
- Learn more about obstacles to promoting such research and about how best to overcome them

Methodology

Survey design and questionnaire

This study was focused on learning the perceptions and attitudes toward three hypothetical research projects held by (1) scholars in biology, ecology, environmental sciences, and by animal welfare scientists focused on wild animals; and (2) students of biology and related sciences.

We used a semi-structured survey for quantitative and qualitative data collection. The instrument also sought information concerning relevant socio-demographic characteristics of the respondents. We designed two questionnaires: (i) a questionnaire to be filled out online by university professors and researchers, and (ii) a paper-and-pencil questionnaire to be filled out by university students. The survey included closed and open-ended questions; the latter was intended to gather further information and ideas we might not have initially considered.

To create the survey, we began by narrowing down the scope of our questions to focus on practical concerns, such as whether participants believe support exists for research regarding specific scenarios of wild animal suffering, and whether they think such research would produce valuable knowledge.

To choose our scenarios for the survey, we considered the results of our previous qualitative study (Animal Ethics 2020), and looked at the available literature about aiding animals in the wild. In our qualitative study, we asked experts about their views about different ways of helping animals. In addition, experts highlighted other relevant topics to explore beyond our original scenarios and questions. The results of that study indicated that three interventions were particularly promising, namely vaccination programs (Vaccination), aiding wild animals in urban environments (Urban Ecology), and aiding animals harmed by weather events (Weaher Effects). Vaccination and rescues of animals harmed by weather conditions have been mentioned often in the literature about ways to aid animals in the wild (Kirkwood & Sainsbury 1996; Bovenkerk et al. 2003; Palmer

2010; Animal Ethics 2016b). In the case of vaccination, there is an extensive body of literature, as this measure is employed to prevent zoonotic transmissions of diseases from nonhuman animals to humans, although this practice also benefits animals (for instance, Wandeler et al. 1988; Slate et al. 2009; Tompkins et al. 2009; Buddle 2011). For its part, the study of the situation of wild animals in urban environments has been focused primarily on direct anthropogenic harms (Hadidian & Smith 2001; Hadidian & Baird. 2001; Krimowa 2012). However, in our qualitative study it was pointed out to us that the wellbeing of wild animals could be studied in easier ways in urban and suburban environments than in other areas. In addition, we expected this line of research would be more acceptable to those objecting to helping animals in the wild (Horta 2017).

We narrowed the questions about the three scenarios in accordance with the objective of the project (Table 1). We did not include more alternatives because we were concerned that might have led to fewer participants completing the surveys.

Table 1. Descriptions of hypothetical research project scenarios

Scenarios	**Description**
Scenario 1 – Vaccination	*A non-threatened population of wild animals is suffering from a painful illness, and a research project is proposed in order to develop a vaccine that would stop the spread of the disease.*
Scenario 2 – Urban Ecology	*Various species of wild animals live in urban habitats. A research project is proposed to study how animal welfare considerations could be incorporated into urban planning and development, and to study what other ways there may be to reduce the harms they typically suffer.*
Scenario 3 – Weather Effects	*Extreme weather events are affecting a non-threatened population of wild animals by rapidly increasing their mortality rate. A research project is proposed to study how to help these animals survive extreme weather conditions with the main motivation being animal welfare.*

We asked respondents a primer question about their own views about the three research projects, and then two other questions that were directed at learning more about which of these topics has a greater chance of being researched in the near future. These were all closed questions. Scholars were asked to rate the acceptability of the following three statements on a 5-point Likert scale (from "Strongly Disagree" to "Strongly Agree"):

1. *This research project would produce important and useful knowledge*
2. *Fellow scholars are likely to support this research project*
3. *Your department or other departments at your university are likely to support this research project*

For their part, students were asked to rate on the same scale the following three statements:

1. *This research project would produce important and useful knowledge*
2. *Fellow students are likely to support this research project*
3. *Professors in your field are likely to support this research project*

Then, at the end of the questionnaires, we also asked both scholars and students about the obstacles that they would expect each research project to face, for which we included an open question. The questions we asked were:

4. *Do you foresee any obstacles for this research project? (please circle) Yes No*
5. *If yes, briefly name one or two potential obstacles:* _____

Procedure and sample

Recruitment process

An invitation to fill out the questionnaire online was sent by email to scholars at university departments of biological, ecological, veterinary, and related sciences across 23 countries in Europe, North and Latin America, Australasia, and Africa. A total of 3,905 emails were sent from October 2018 to June 2019. The survey was sent in English, except in the case of scholars from Spanish, French, and Portuguese speaking countries, to whom the survey was sent in their native languages. We

expected that the scholars more likely to be interested in animals in the wild would be more likely to reply.

Questionnaires were also filled out by students who were recruited through a snowball sampling procedure by leveraging students and university scholars who volunteered to distribute the survey at their universities. At the request of certain volunteers who were unable to print and distribute the physical questionnaire, an online version of the survey addressed to students was also designed and sent out via email.

Responses by research field

We obtained a total of 337 completed surveys: 111 by scholars and 226 by students. The average response rate by scholars was 2.8% (111 completed surveys out of 3905 emails sent).

We collected complete surveys from scholars (Figure 1) in a wide range of fields in biological sciences (71%), animal sciences (26%), and environmental sciences (3%); and from students (Figure 2) of biological sciences (65%), environmental sciences (31%), and animal sciences (4%).

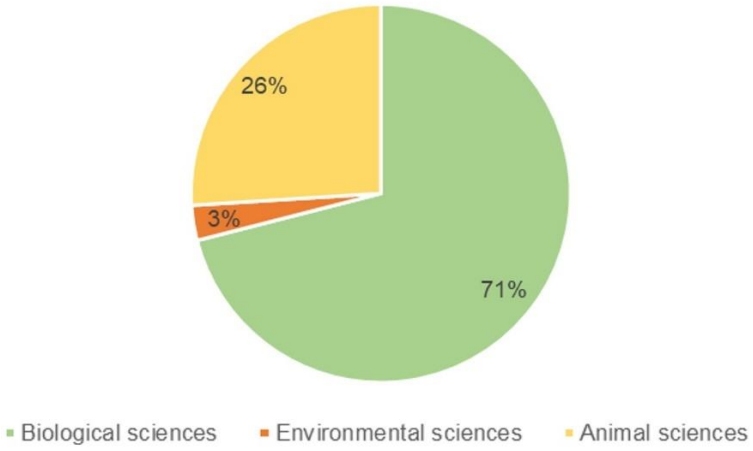

Figure 1. Breakdown of responses from scholars by field of research

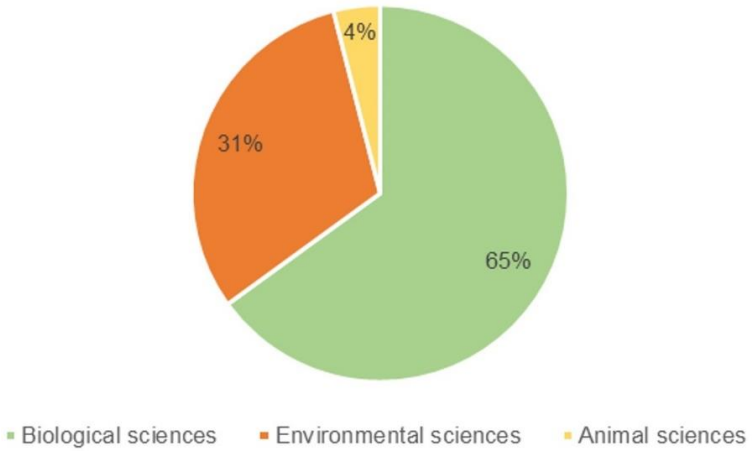

Figure 2. Breakdown of responses from students by field of study

Responses by country

We received responses from scholars in 19 different countries (Table 2), and from students in 24 different countries (Table 3).

Table 2. Scholars' response rate by country

Country	Emails sent	Responses	Response rate
Canada	755	10	1.3%
USA	620	10	1.6%
Mexico	366	13	3.6%
UK	362	6	1.7%
Colombia	317	27	8.5%
Australia	201	3	1.5%
France	186	2	1.1%
Chile	162	8	4.9%
Spain	162	3	1.9%
New Zealand	158	3	1.9%
Peru	107	4	3.7%
Brazil	91	4	4.4%
Ecuador	84	7	8.3%
Venezuela	64	0	0.0%
Argentina	49	2	4.1%
Uruguay	48	3	6.3%
Sweden	40	2	5.0%
Costa Rica	37	1	2.7%

South Africa	35	0	0.0%
Portugal	23	2	8.7%
Germany	19	0	0.0%
Denmark	10	0	0.0%
Netherlands	9	0	0.0%
Ghana*	0	1	N/A
Total	**3905**	**111**	**2.8%**

Table 3. Student response rate by country

Country	**Responses (n=226)**
Netherlands	50
Spain	41
UK	20
Mexico	18
Finland	17
Austria	15
Brazil	15
Greece	13
USA	11
Colombia	6
Germany	5
China	2
Zambia	2
Belgium	1
Ireland	1
Kenya	1
Korea	1
Norway	1
Slovenia	1
South Africa	1
Suriname	1
Sweden	1
Uganda	1
Vietnam	1
Total	226

* Although we did not send any surveys to scholars from universities in Ghana, one professor responded that their country of residence was Ghana.

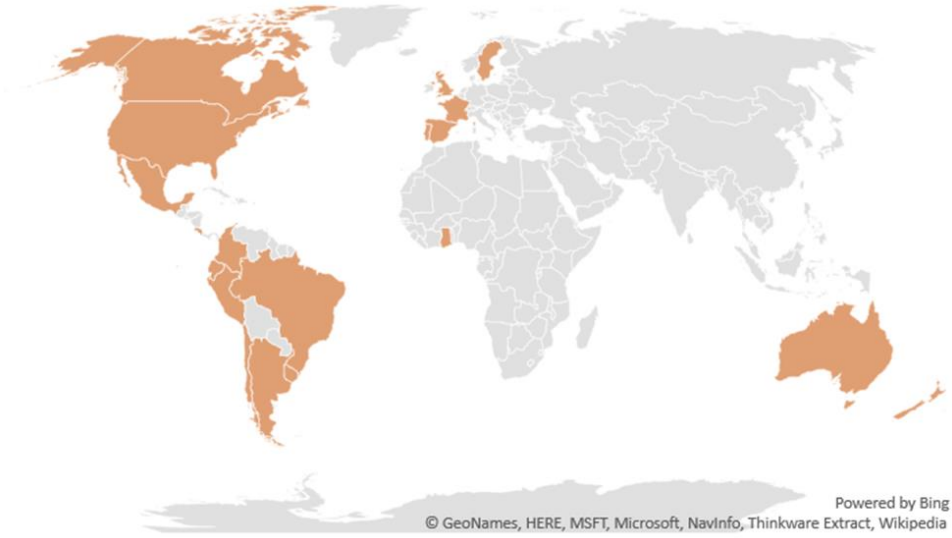

Figure 3. Countries of residence of responding scholars

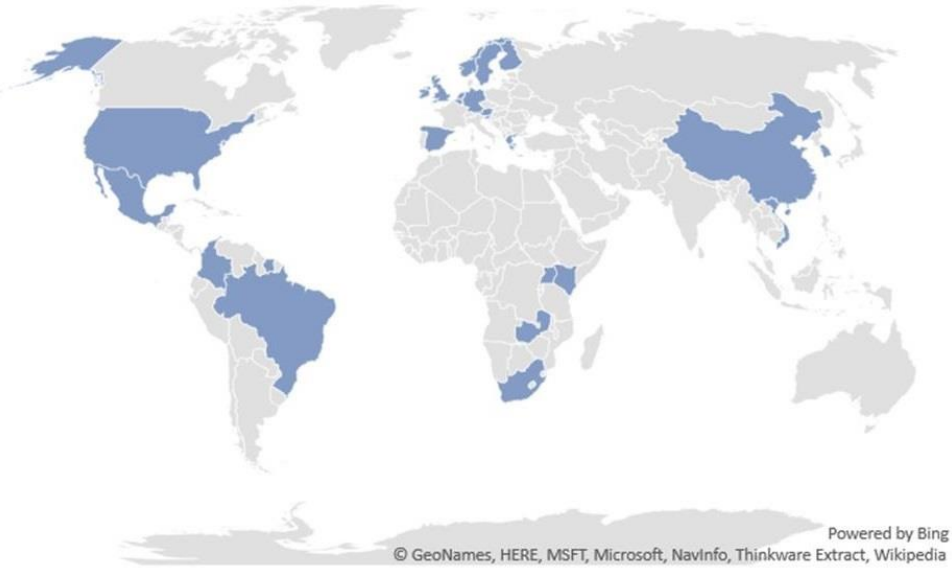

Figure 4. Countries of residence of responding students

Age of participants

The average age of the scholars who completed the survey was 47 years, ranging from 23 to 71 years (Figure 5). For students, it was on average 22 years, ranging from 18 to 40 years (Figure 6).

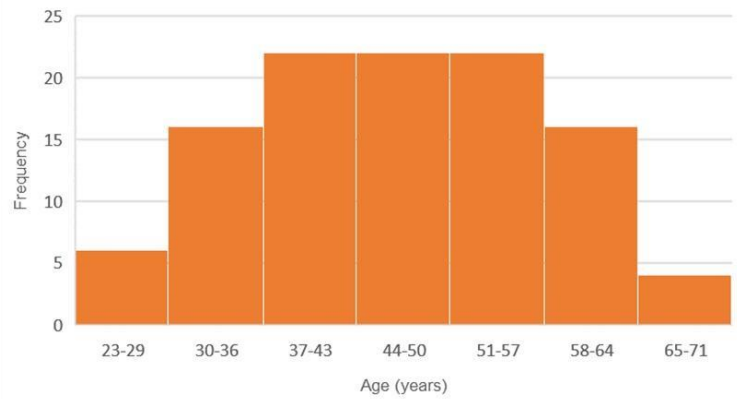

Figure 5. Breakdown of responding scholars by age

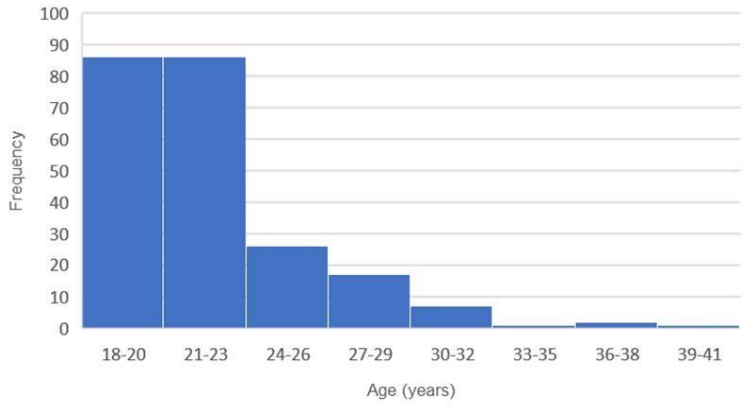

Figure 6. Breakdown of responding students by age

Data analysis

Quantitative data regarding perceptions and attitudes toward different research projects were analyzed using descriptive and association statistics. For certain questions, we performed chi-square analysis with a 95% confidence level to examine the differences between students and scholars.

To analyze the information concerning perceived obstacles to the research projects, we classified the responses into different categories and specified and compared the frequencies in each category to quantify their relative importance. In some cases, what appears to be a single obstacle actually encompasses more than one. In such cases, we categorized the response as if the respondent were mentioning each of those obstacles. Also, some responses were too abstract or

general to confidently assess what considerations they refer to, so they were grouped under the tag “Unspecified”.

We also decided to group together responses reporting the participant’s own views about the obstacles and their views about the positions that other scholars or students may have. We did this for the sake of simplicity, as the distinction between the two kinds of responses would not have been relevant for the purposes of this research, since our objective was to gain knowledge about the social perceptions in the groups they are part of.

Results

We obtained two types of results. Responses to the first three questions in the questionnaires provided us with quantitative data concerning support for the different research projects, while the response to the last question provided us with qualitative information about the perceived obstacles those research projects would face. We present them separately below.

Quantitative results: support for research projects

Respondents' favorability toward research projects

The responses were favorable for all three hypothetical research projects. In many cases, the responses of scholars and students coincided.

A large majority of participants agree that all research projects would produce important and useful knowledge. When asked about their opinion on whether research projects "would produce important and useful knowledge", the most common response by scholars was "strongly agree" for all three scenarios (Figure 7). The Urban Ecology project was the most favored (92% of scholars agreed), followed by Vaccination (89% of scholars agreed) and Weather Effects (85% of scholars agreed).

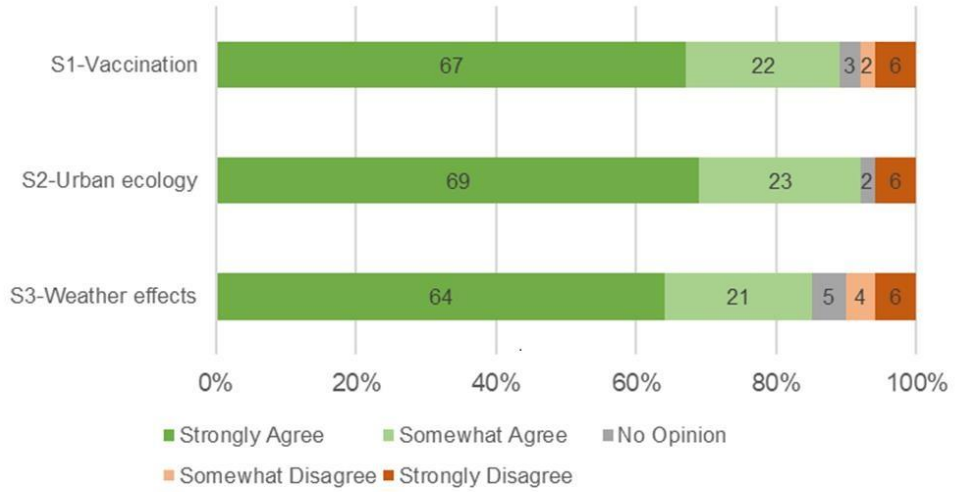

Figure 7. Breakdown of scholars' responses to questions about whether hypothetical scenarios 1-3 would provide useful knowledge

For students, results were very similar (Figure 8). The Urban Ecology project was also the most favored (93% of students agreed), followed by Vaccination (89% of students agreed) and Weather Effects (81% of students agreed).

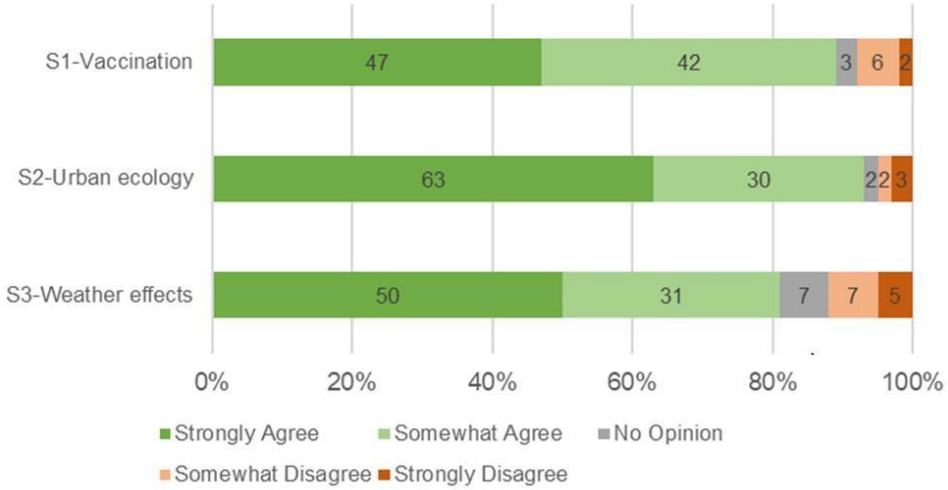

Figure 8. Breakdown of students' responses to questions about whether hypothetical scenarios 1-3 would provide important and useful knowledge

Perceived potential endorsement of research projects

Scholars and students widely perceive potential support for all projects among their fellows. Scholars' most common response on whether fellow scholars in their field or other fields would support these research projects was "somewhat agree" for

Vaccination, and "strongly agree" for Urban Ecology and Weather Effects (Figure 9). Urban Ecology was the most favored (85% of scholars agreed), followed by Vaccination (80% of scholars agreed) and Weather Effects (74% of scholars agreed).

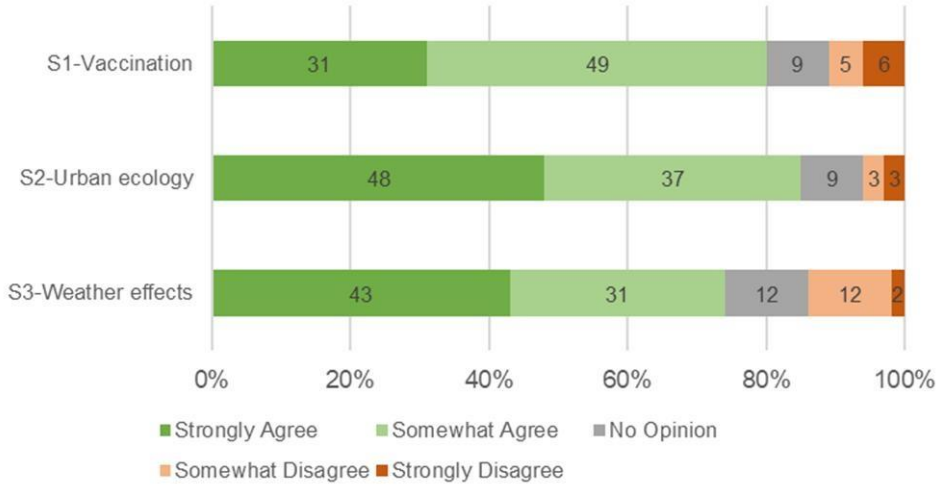

Figure 9. Breakdown of scholars' responses to questions about whether they feel the scenarios would receive support from fellow scholars

Students' opinions on whether their professors would support these projects also followed the same trend (Figure 10). Urban Ecology was the most favored (81% of students agreed), followed by Vaccination (72% of students agreed) and Weather Effects (71% of students agreed).

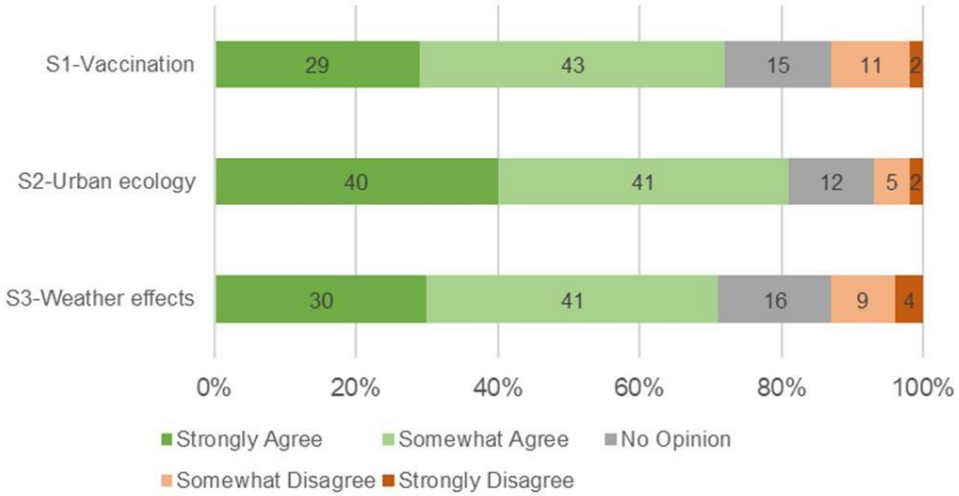

Figure 10. Breakdown of students' responses to questions about whether they feel the scenarios would receive support from their professors

When asked whether fellow students would support each research project, students' most common response was "somewhat agree" for Vaccination and Weather Effects, and "strongly agree" for Urban Ecology (Figure 11). Again, Urban Ecology was the most favored (86% of students agreed), followed by Vaccination (82% of students agreed), and Weather Effects (77% of students agreed).

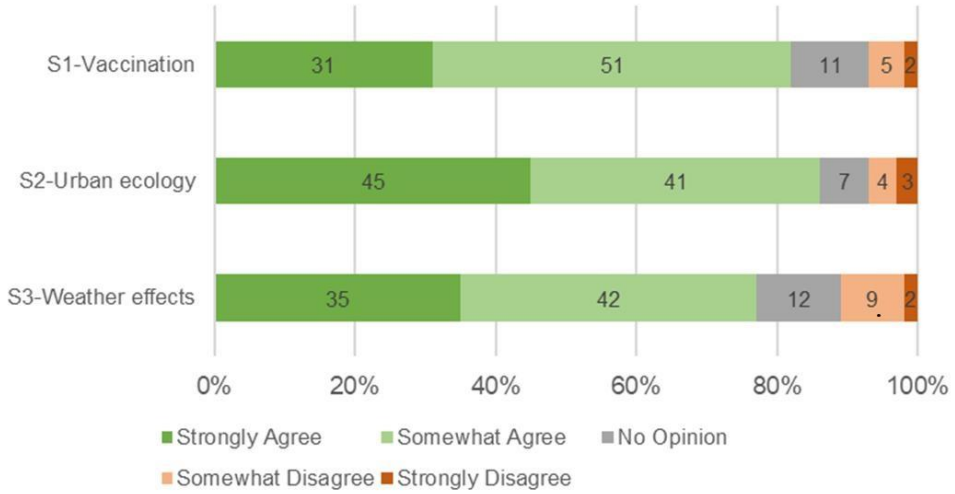

Figure 11. Breakdown of students' responses to questions about whether scenarios 1-3 would receive support from fellow students

Most scholars agreed that university departments would support all three research projects with resources (Figure 12). There was substantial support for the three projects. A large majority of scholars agreed that their departments or other departments at their university would support research on Weather Effects (73%). A majority also agreed about Urban Ecology (62%) and Vaccination (56%).

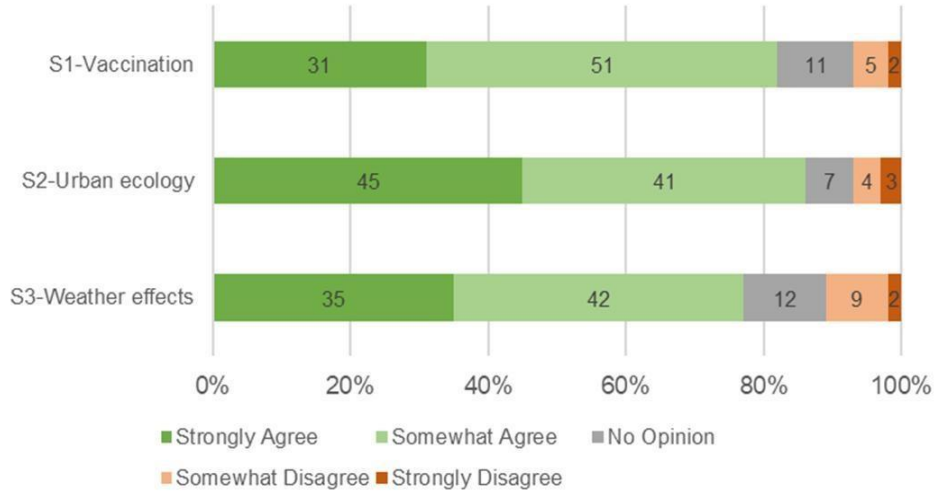

Figure 12. Breakdown of scholars' responses about whether scenarios 1-3 would receive support from university departments

Qualitative results: perceived obstacles for research projects

Most participants mentioned obstacles to all scenarios, especially for Vaccination (68% of scholars and 81% of students). A statistically significant difference was found between scholars (Figure 13) and students (Figure 14) in terms of the obstacles regarding this scenario indicated ($p=0.009$) with a confidence level of 95%, suggesting that students are more likely than scholars to see obstacles for Vaccination.

Fewer obstacles were mentioned for Weather Effects, with 52% of scholars and 58% of students perceiving obstacles. The difference between the two samples was not significant ($p=0.35$). Finally, for Urban Ecology, where 51% of scholars and 55% of students mentioned obstacles, the difference was not also significant either ($p=0.35$).

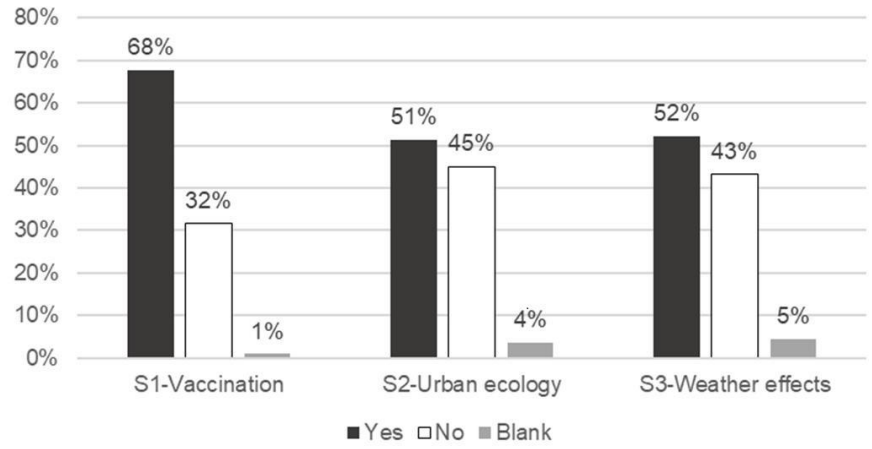

Figure 13. Obstacles perceived by scholars

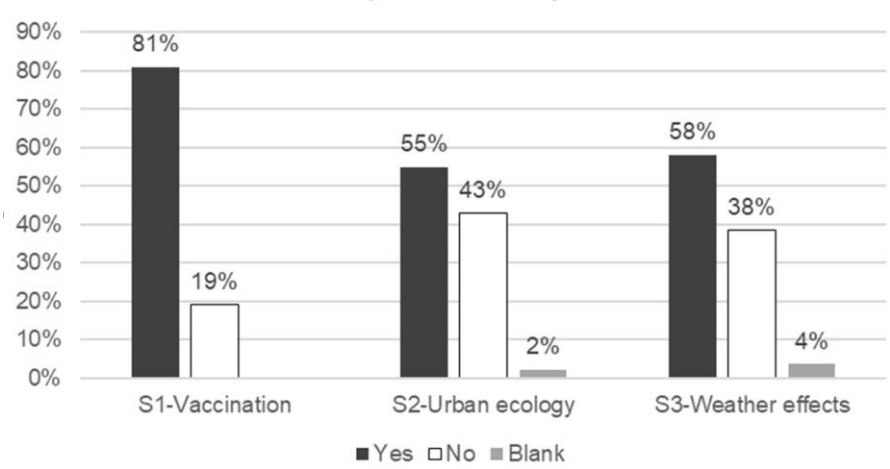

Figure 14. Obstacles perceived by students

Scenario 1 – Vaccination

A total of 351 obstacles were mentioned by participants (103 by scholars, Figure 15; and 249 by students, Figure 16) for this scenario. Named obstacles were classified into 13 categories (all of which were mentioned by students, and 12 of which were mentioned by scholars). We will see them now, followed in some cases by examples of each type of response.

1. *Funding*: scholars 35%; students 43%

2. *Technical difficulties for vaccine development*: scholars 21%; students 14%. This category comprises concerns about unintended consequences, vaccine effectiveness, time, facilities, and expertise.

   Scholars:
   - "How to reach the population, how to deliver the vaccine"
   - "How complete would the vaccination program be? Will it include all the individuals in the population? Will it include all populations? For how many generations of the species will the vaccination program be applied?"
   - "Scientists would have to demonstrate that it is feasible i.e. that a sufficient proportion of the population could be vaccinated in order to stop the disease from spreading"
   - "Number of individuals to be used in the study, study temporality, adaptations / facilities"
   - "Insufficient technical staff"

   Students:
   - "Maybe the vaccine will not be able to stop the illness"
   - "Emergence of resistance"
   - "Giving the vaccination to wild animals, meaning finding and capturing the animals"
   - "Vaccine development takes time"
   - "That professors or assistants do not have enough knowledge to provide useful information"

3. *Bureaucracy*: scholars 12%; students 2%. This category comprises obstacles related to permits, patents, procedures, and regulations.

   Scholars:
   - "Bureaucratic procedures associated with permits for research, access and management of wild animals"
   - "Conflicts with patents and access to genetic resources"
   - "Permits to work with wild species"

   Students:
   - "Practical application may be hindered by regulations"
   - "Patents by private sector parties"

4. *The targeted animal populations would not be threatened ones*: scholars 9%; students 13%.

   Scholars:
   - "Resources for wildlife are scarce and should be directed to threatened species"
   - "Currently I would say the consensus is that vaccination should only be used as a last option with critically endangered species threatened by vaccinable disease"
   - "The population is not threatened, which would be the main justification for most researchers"

   Students:
   - "Difficult to find support for a non-threatened species"
   - "People might not support saving a species that is not threatened"
   - "Some people may believe the focus should be on threatened species rather than non-threatened species"

5. *Concerns related to intervening in natural processes*: scholars 6%; students 8%

   Scholars:
   - "It shouldn't be done; we are intervening with natural selection"
   - "In an ideal situation it is better not to intervene with natural processes"
   - "Perturbation of normal evolutionary process of populations"

   Students
   - "Disturbing the ecological cycle"
   - "You're altering natural selection"
   - "If natural animals suffer from diseases, it's against nature to want to protect them from it"

6. *Ethical obstacles to using animals*: scholars 3%; students 6%

   Scholars
   - "Welfare implications of taking wild animals into captivity to study the disease"
   - "The development of vaccines requires using animals in the early stages to prove effectiveness"

Students

- “Test vaccines on wild animals? No way”
- “Ethical issue on treating animals during research”
- “Moral restrictions related to well-being of the researched animals”

7. *Lack of importance of animal welfare*: scholars 3%; students 2%

- “This is not evolutionarily/ecologically relevant to the wider picture” (scholar)
- “People don't think it's useful enough” (student)

8. *Protests and disagreements by actors outside academia*: scholars 3%; students 2%

- “The anti-vaccine movement could go against intervening in animals, even for increasing their welfare” (scholar)
- “Protests from locals” (student)

9. *The research project tackles non-anthropogenic suffering*: scholars 3%; students 1%

- “If it's not an anthropogenic condition, why intervene?” (scholar)
- “I don't support the cure of non-anthropogenic diseases” (student)

10. *Lack of benefits for humans*: scholars 2%; students 3%

- “Excessive focus on what can be profitable” (scholar)
- “Diseases that have no human relevance are rarely considered important enough for research” (student)

11. *Unspecified ethical issues*: scholars 2%; students 1%. We grouped here responses whose point was unclear. They might refer to some of the points mentioned above, such as the use of animals, to concerns regarding interventions, or to other considerations.

- “Ethics approval” (scholar)
- “Bioethical problem” (student)

12. *Other actors' disregard for animal welfare*: students 3%; not mentioned by scholars

    - "Lack of awareness towards nonhuman animals"
    - "Not all people are concerned about animal welfare, but maybe enough to justify this study"

13. *The rest of the responses were categorized as unspecified*: scholars 1%; students 2%, including "various", "I don't know", and "depends on the species".

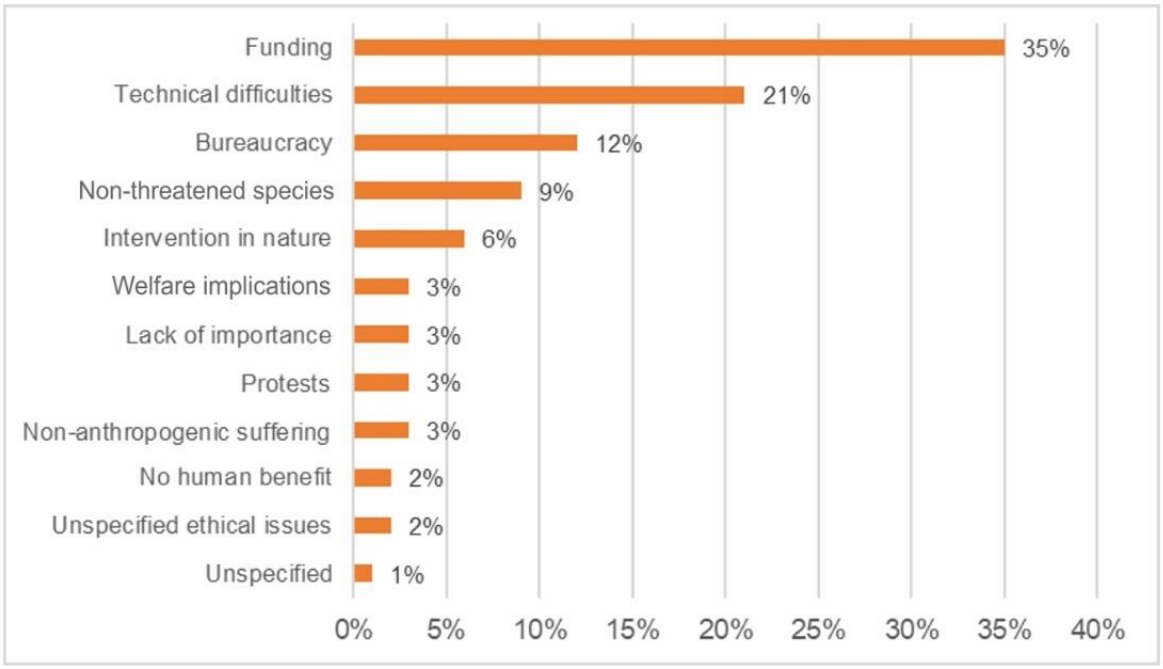

Figure 15. Obstacles to Vaccination named by scholars

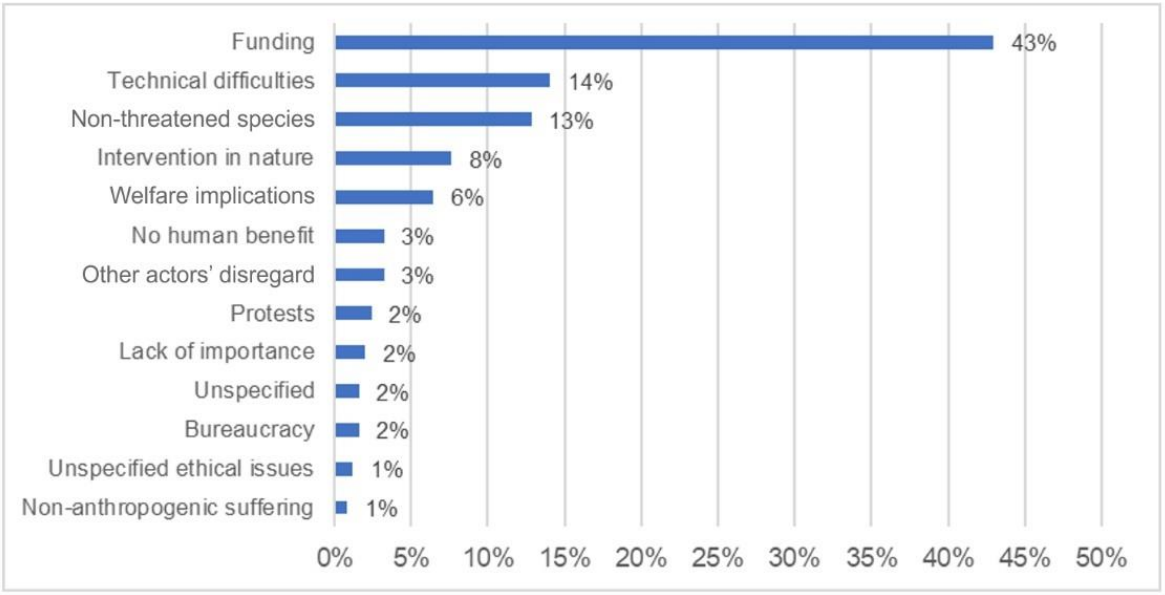

Figure 16. Obstacles to Vaccination named by students

Scenario 2 – Urban Ecology

A total of 235 obstacles were mentioned by participants (81 by scholars, Figure 17; and 154 by students, Figure 18) for this scenario. Defined obstacles were classified into 14 categories (13 of which were mentioned by scholars and 13 of which were mentioned by students).

1. *Funding*: scholars 35%; students 34%. This was the obstacle most frequently named by both scholars and students.

2. *Technical difficulties for the development of the project*: scholars 15%; students 10%. This was the second most frequently named by scholars and the third most mentioned by students. This category comprises concerns about data, methods, space, expertise, facilities, and impact. While some of the responses pointed at issues with logistics, others indicated a lack of knowledge of animal welfare science and its methods.

   Scholars
   - "How to measure animal welfare"
   - "I'm not sure whether there are experts in this topic"
   - "Research facilities (mainly laboratories) are scarce"
   - "Logistical problems in carrying out the research"

Students

- "How to study these harms and suffering"
- "It might be hard to record data on these animals"
- "The space where the experiment could take place"
- "Animal welfare and urban planning is difficult to research because of the different scales at which it could be implemented"

3. *Public attitudes toward animals living in urban areas*: scholars 13%; students 4%

Scholars

- "Strong public opinion about urban species ('pest species') may impact the ability to perform research on that topic"
- "Perception of general public regarding 'good animals vs. bad animals' "
- "Surely there will be someone who thinks that it is better to exterminate those annoying animals"

Students

- "Some people in urban areas may just simply not want the animals there"
- "Not all species are equally valued in urban environments; for example, some are seen as pests"

4. *Bureaucratic matters*: scholars 9%; students 1%

- "Bureaucracy" (scholar)
- "Permits to work with the species" (scholar)
- "People might complain that… their plans need to be checked by so many people" (student)

5. *Political issues*: scholars 6%; students 13%. This was the second most commonly named obstacle by students, but it was mentioned only a few times by scholars.

Scholars

- "Ignorance and lack of sensitivity of the ruling class"
- "Political will"

Students

- "Lack of support by local politicians"
- "I don't think many governments would support this; it's not good for getting votes"

- "Political opposition" (urban study is polemic)

6. *Protests and disagreements by other actors*: scholars 5%; students 5%

- "Conflicts with animal rights organizations" (scholar)
- "Conflicts with entrepreneurs and local people where these animals are found" (scholar)
- "Protest from locals or animal lovers" (student)

7. *Private interests of other actors*: scholars 4%; students 3%

- "Construction and urban development companies disrespecting regulations by using bribery and corruption practices" (scholar)
- "Opposition from large corporations" (student)

8. *Lack of importance of animal welfare*: scholars 3%; students 4%

- "What are the animals and why should they be studied? That they exist is not sufficient, if we are talking science as opposed to management or engineering" (scholar)
- "The research project would not be creating new and valuable information, only how to manage a problem already happening" (student)

9. *Citizen participation*: scholars 3%; students 6%

- "Approval by the inhabitants of the community" (scholar)
- "Passivity from society to necessary measures" (student)

10. *Human-wild animal conflicts*: scholars 1%; students 5%

- "There is no clear awareness of the environmental impact generated between wild animals in human habitats and the transmission of diseases in both ways" (scholar)
- "Increased likelihood of accidents through increased wildlife in cities" (student)

11. *Intervention in nature*: scholars 1%; students 3%

- "This point requires different points of view, since urban habitats are not wild habitats for many species, but possibly if they are habitats for those that have adapted to them. Therefore, it is a matter of adaptation to changes on the planet, and from that point of view, nothing should be done in particular to favor these species" (scholar)

12. *The targeted animal populations would not be threatened ones*: scholars 4%; not mentioned by students.
    - "Hard to justify such a project: urban habitats are usually not habitats of endangered species or vulnerable populations. Resources would be much better spent in counteracting the loss of natural habitat and creating [refuges] for species who are threatened by habitat loss and not those who adapt and co-exist in urban habitats"
    - "The project is not justified as it is a non-threatened species"

13. *Other actors' disregard for animal welfare*: students 6%; not mentioned by scholars
    - "Low interest from the public"
    - "Lack of awareness and concern"

14. *Unspecified*: scholars 1%; students 4%
    - "The description is too vague" (scholar)
    - "How do you define animal welfare?" (student)

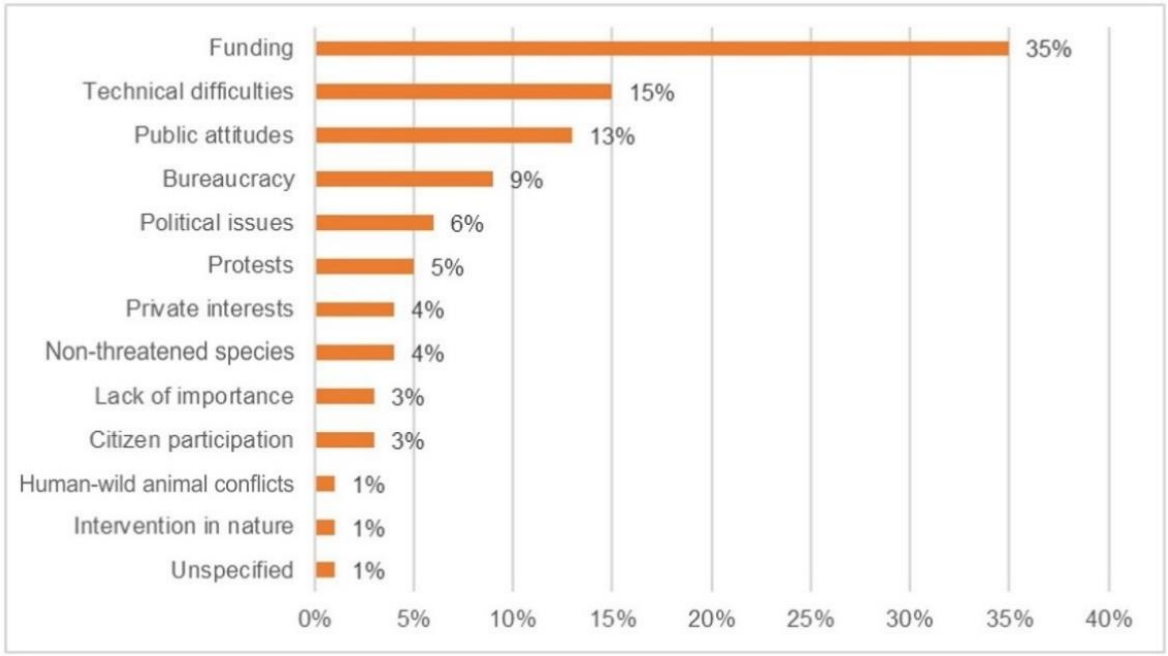

Figure 17. Obstacles to Urban Ecology named by scholars

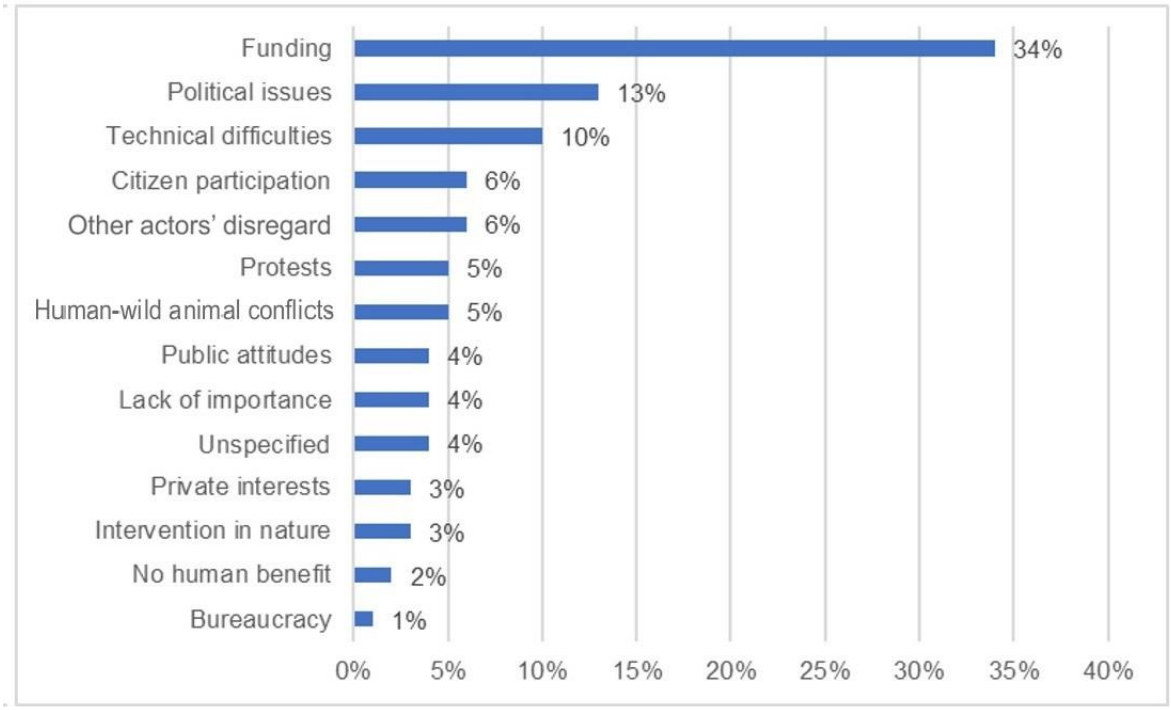

Figure 18. Obstacles to Urban Ecology named by students

Scenario 3 – Weather Effects

A total of 221 obstacles were mentioned by participants (72 by scholars, Figure 19; and 149 by students, Figure 20) for this scenario. The named obstacles were classified into 12 categories (10 of which were mentioned by scholars and 9 of which were mentioned by students).

1. *Funding*: scholars 39%; students 36%. This was, as with the other projects, the obstacle most frequently mentioned by both groups

2. *Technical difficulties*: scholars 39%; students 36%. This was the second most frequently named obstacle in both groups. This category comprises concerns about data, methods, expertise, and facilities.

   Scholars:
   - "Transportation to the disaster site, and finding suitable and trained personnel in disaster areas"
   - "Sample size of wild populations"
   - "Technology, staff expertise, laboratories"
   - "Difficult to access the areas where the problem is being observed"

   Students:
   - "Extreme weather events include so many variables that properly (credibly) analyzing such data sounds like a nightmare"
   - "Unpredictability of weather/climate and feasibility (maybe this population/species isn't made to survive anyway)"
   - "Animal welfare with weather will be very hard to quantify or qualitatively define in an unbiased way"
   - "There are no studies on animals not threatened with extinction"

3. *Intervention in natural processes*: scholars 10%; students 13%. The two groups again coincide, as this was the third most frequently named obstacle by both.

   Scholars:
   - "It depends on what type of event is involved, since many events can be overcome by many species, which possibly lower their population size due to the event, but precisely, those who survive, are those with a gene pool

more adaptive for these events, and favor the maintenance of the species in the long term. Even this view indicates that helping animals that do not live without help to survive can be harmful to the population or species, by maintaining potentially maladaptive or deleterious genes in the population"

- "It could be argued against this project that natural selection should act without help"

Students:

- "It's nature, let it be"
- "People may hold the opinion that you would be interfering with nature"
- "The debate about whether or not we should intervene"

4. *The assumption that animal welfare lacks importance*: scholars 10%; students 9%. The groups concur again, as this is the fourth most frequently named obstacle by both.

Scholars:

- "The animal welfare focus — it would be more relevant to the department if the focus was on selection pressures from climate change"
- " 'Animal welfare' would not be an appropriate justification for a study housed in a biology department - BUT it would also be shortsighted for a biologist to only see the animal welfare application of a more general conceptual problem posed by the scenario: there could/should be evolutionary effects of climate change if large numbers of animals are dying, and there may be important effects on population dynamics that allow strong tests of ecological theory. An animal welfare motivation falls into "applied research", while I work in a "basic research" field. If such work was framed in terms of ecology and evolution of the animals, it would be strongly supported all around"

Students

- "The motivation can be an obstacle… if the motivation is for instance to sustain the number of animals within a population, the research would be more justified"
- "If the system is not changed, climate change will continue to advance, extreme conditions will increase, and more animals will be in danger. Helping animals is just a patch"

5. *The animal population is not threatened*: scholars 3%; students 8%

- "It is difficult to get funding if the population is not endangered now or will be in the future" (scholar)
- "This project has the ability to draw people's attention but the question people might have is why focus on a non-threatened species' welfare but not others if they all suffer from the same extreme weather event?" (student)

6. *Other actors' disregard for animal welfare*: scholars 3%; students 2%

- "Lack of institutional interest" (student)

7. *Bureaucratic matters*: scholars 10%; not mentioned by students. These include "permits and procedures" and "bureaucracy"

8. *Public attitudes*: scholars 3%; not mentioned by students. These include "erroneous interpretations from society"

9. *Non-anthropogenic suffering*: scholars 1%; not mentioned by students

10. *The project would not bring any benefits to humans*: students 4%; not mentioned by scholars

11. *Various ethical issues*: students 3%; not mentioned by scholars

12. *Unspecified*: scholars 4%; students 5%

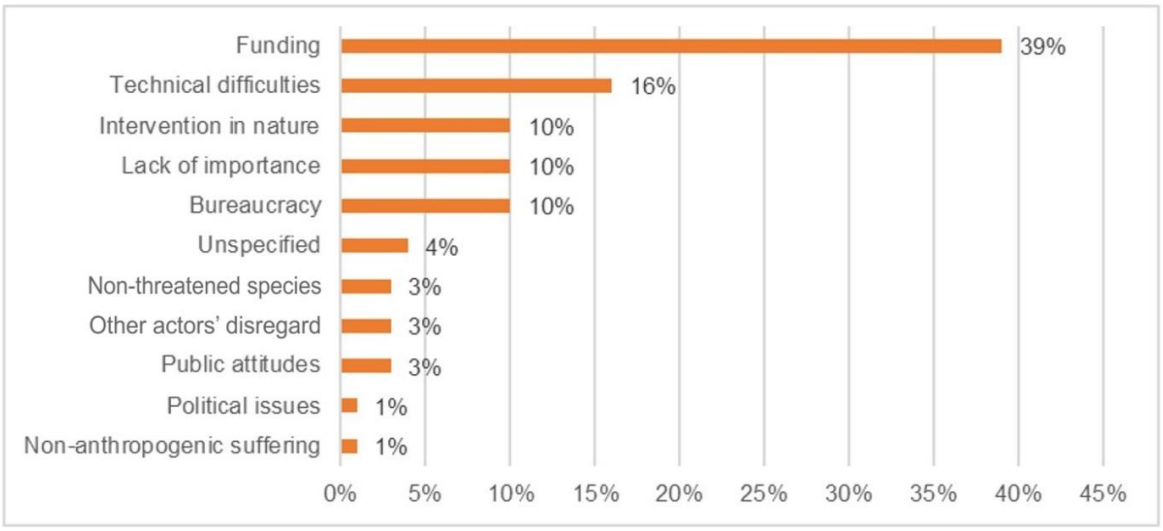

Figure 19. Obstacles to Weather Effects named by scholars

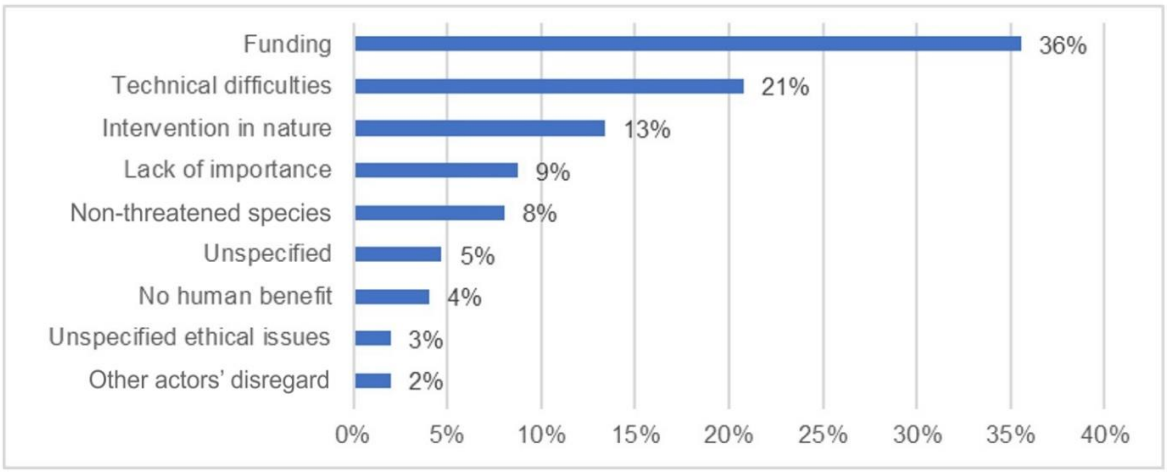

Figure 20. Obstacles to Weather Effects named by students

The categories mentioned above can be clustered in two main groups, *external obstacles*, and *attitudinal obstacles. External obstacles* are those unrelated to the attitudes of scholars and students, and that are a result of factors outside their control; these are constraints that many research projects face. A*ttitudinal obstacles* include those related to the attitudes that scholars and students hold, and will be considered separately.

External obstacles were mentioned much more frequently than attitudinal ones. The frequencies of the three most commonly mentioned external obstacles and of attitudinal obstacles are shown in Table 4 and Table 5:

Table 4. Frequencies of the most commonly mentioned external obstacles (in percentages of total responses)

		Funding	**Technical difficulties**	**Bureaucracy**
Scenario 1 Vaccination	Scholars	35	21	12
	Students	43	14	2
Scenario 1 Urban ecology	Scholars	35	15	9
	Students	34	10	1
Scenario 1 Weather effects	Scholars	40	16	10
	Students	36	21	-

Table 5. Frequencies of mentions of attitudinal obstacles (in percentages of total responses)

		Intervention in nature	**Non-anthropogenic suffering**	**Non threatened species**	**Lack of relevance of animal welfare**	**No human benefit**
Scenario 1 Vaccination	Scholars	6	3	8	3	2
	Students	8	1	13	2	3
Scenario 2 Urban ecology	Scholars	1	-	4	3	-
	Students	3	-	-	4	2
Scenario 3 Weather effects	Scholars	10	3	1	10	-
	Students	13	8	-	9	4

Discussion

General support for the research projects

The average response rate among scholars (2.8%) was very low, which is itself an indicator of the weight this group gives to the topic. We mentioned above that we expected the results to be representative of the opinions of those scholars who are more interested in the wellbeing of animals in the wild, as they are more likely to respond. This low rate of response may indicate that the topic is not considered very interesting by a majority of scholars.

Among the people who did respond, the majority favored all three research projects in terms of providing useful and important knowledge, support from fellows, and support by university departments.

Comparison of support expressed for each research project

The Urban Ecology project was the most favored among all participants. Most scholars and students agreed (92% and 93%, respectively) and strongly agreed (69% and 63%) that it would provide important and useful information. It also ranked first in scholars' agreement (85%) and strong agreement (48%) about support by fellow scholars; in students' agreement (85%) and strong agreement (48%) about their fellow students support; and in students' agreement and strong agreement about their professors' support for it. It was also the one about which the fewest participants perceived obstacles (51% and 55%); however, in terms of support by university departments, professors favored the Weather Effects project over the Urban Ecology project (83% vs. 62% agreed; 45 vs. 33% strongly agreed). One reason for this may be the general awareness and greater availability of resources that universities have for topics related to climate change.

Results were less clear when comparing attitudes toward the Vaccination and the Weather Effects projects. More scholars agreed (89% vs. 85%) and strongly agreed (67% vs. 64%) that Vaccination would provide important and useful information than agreed for Weather Effects. More of them also agreed that Vaccination would be supported by fellow scholars than Weather Effects (80% vs. 74%), although fewer scholars strongly agreed with this (31% vs. 43%). For their part, more students agreed that Vaccination would provide important and useful information than Weather Effects (89% vs. 81%), although fewer of them strongly agreed with this (47% vs. 50%). The same was true of their opinions concerning support for these two scenarios by their fellow students (82% vs. 77% agreed; 31% vs. 35% strongly agreed) and professors (72% vs. 71% agreed; 29% vs. 30% strongly agreed), although the differences here were minimal.

Obstacles faced by the research projects

External obstacles

As in the results of our previous qualitative study, funding is considered a major external obstacle. In fact, in this study it was by far the most mentioned (by both scholars and students) obstacle for all scenarios. In four out of six cases (see Table 4), it was mentioned more than twice as many times as the second most commonly mentioned obstacle.

The second most frequently mentioned obstacle (technical difficulties) was also present in most cases (five out of six, see Table 4) and is also an external obstacle. It is worth mentioning here that obstacles of this type may be very diverse. Some participants may have in mind feasibility issues; others may think of impediments that could be solved with appropriate funding. Finally, there are cases where it is unclear whether the technical issues that the respondent has in mind can be solved with further funding, for instance, when lack of competent staff is mentioned.

Bureaucratic problems were the third most mentioned by professors, but were brought up significantly less by students. The fact that scholars are much more familiar than students with the context in which research takes place suggests that scholars may be more aware of the importance of this factor than students. In fact, this may suggest that the opinions of scholars concerning external obstacles more generally may be more reliable, because they have more experience in dealing with

them. This consideration may also apply to other differences of perception regarding external obstacles between scholars and students.

Other perceived obstacles are related to the attitudes of non-academic agents such as politicians or members of civil society. We can group these concerns under labels such as "political will", "protests and disagreements", and "lack of interest from the public or politicians". They were far from being as prevalent as the previously mentioned obstacles, although they were mentioned by some scholars and students. These responses indicate that participants from both groups perceived that the public and politicians may not be aligned with the promotion of animals' wellbeing when it conflicts with other values or interests they hold.

Attitudinal obstacles

Scholars appear to consider it more feasible to carry out these research projects, which is important because we can expect them to be more competent to make evaluations of this kind. More importantly, they raise fewer objections to the value of the research.

In addition, we should bear in mind that attitudinal obstacles correspond with different positions that would be unfavorable to the interventions that the research projects would study. These positions can be divided into three main groups:

Disregard for the aims of intervention. Some of the responses make different points leading to the conclusion that we *don't have good reasons* to carry out such interventions. They aren't necessarily related to *reasons against* carrying them out (though the participants may reach this conclusion if there's a comparatively better use of the resources an intervention would require). Within this group are responses that these interventions don't benefit humans, that the welfare of animals is not relevant, or that the targeted animals don't belong to threatened species.

Opposition to intervention. Other responses make different points leading to the conclusion that they have specific *reasons opposing* the interventions or their execution. The responses that are clearly within this group are those that say these are forms of intervention in nature.

Unspecified. Finally, there are responses that may fall within either or both groups depending on the attitudes of those holding them. They are the ones that mention— that these forms of intervention would be tackling non-anthropogenic suffering. Some views hold that we have no reason to try to reduce such suffering, even if it is acceptable to do so. Some others hold that we should not try to reduce such suffering.

The most serious objections to the different forms of intervention are in responses showing direct and specific opposition to intervention, followed by those classified as unspecified. The consider the least important to be those that show disregard for the aims of the intervention. This is because disregard may indicate no interest in being personally engaged in a certain kind of research without actual opposition.

The frequency with which different attitudinal obstacles were mentioned varied substantially depending on the intervention being examined (see Table 5). The most commonly mentioned one was that the research projects related to forms of intervention in nature. The second most common attitudinal obstacle identified in our survey was the belief that animal welfare lacks relevance. The third most commonly mentioned was that the animals helped by the interventions were not members of threatened species. The fourth most common attitudinal objection is that the interventions would tackle non-anthropogenic harms, instead of harms caused by humans. Finally, the fifth is that the intervention would not further human interests.

Attitudes toward the three research projects compared

The external obstacles that were mentioned more often — funding, technical difficulties, and bureaucracy — were mentioned in relatively similar percentages for all three research projects (see Table 4, which summarizes the results from Figures 15-20). Variations are only substantial in perceptions of obstacles regarding the interests of other actors (like corporations, local people, and politicians), which were given much more importance in the case of Urban Ecology (scholars 15%, Figure 17; students 24%, Figure 18).

Despite this, Urban Ecology was the most favored research project, the one with the fewest participants mentioning obstacles overall, and also the one with the fewest participants mentioning attitudinal obstacles identified. This scenario

implies no direct intervention in the wild. Accordingly, the claim that this research project would study a form of intervention in nature was rarely mentioned as an obstacle (1% of scholars and 3% of students, Table 5). There were no mentions that it would address a form of non-anthropogenic suffering or that it would not be focused on a threatened species, and the response that it is not addressing a human interest was only mentioned by a few students (2%), and not at all by scholars. Some responses were that the welfare of the affected animals was not a relevant issue (3% of obstacles mentioned by scholars and 4% by students), slightly more than for Vaccination, but less than for Weather Effects.

As for the other two scenarios, Vaccination and Weather Effects, the attitudinal obstacles mentioned were different (see Table 5, which summarizes the results from Figures 15-20). Overall, fewer respondents mentioned obstacles for Vaccination. Moreover, the only obstacle that clearly received more mentions for Vaccination (8% by scholars and 13% by students) was that the animals targeted by the intervention this research project would study are not members of a threatened species. In comparison, this was 4% of the obstacles identified by scholars for Urban Ecology and 1% for Weather Effects. This obstacle was not mentioned by students in any of the three scenarios.

A possible explanation for this may be that wild animal vaccination projects have been carried out for conservationist reasons in other cases, so the objection here might have to do with the idea that such intervention can be legitimately carried out, but only in those cases. This interpretation is backed, for instance, by a response from a scholar who said that "[r]esources for wildlife are scarce and should be directed to threatened species," and by a student who mentioned that "[s]ome people may believe the focus should be on threatened species rather than non-threatened species."

Other than this, only a few scholars (2%) mentioned that Vaccination would not provide benefits for humans, while none of them mentioned this for Weather Effects. These obstacles correspond to objections that fall within the group that entails disregard for the aims of intervention, not necessarily opposition to it.

All the other obstacles were mentioned many more times for Weather Effects than for Vaccination. This was particularly the case with the moral objection to the research on the basis that it would study a form of intervention in nature (scholars 6%, students 8% for Vaccination; versus scholars 10%, students 13% for Weather Effects), even though, in contrast the claim that the targeted species would not be

threatened ones (in conservationist terms) was mentioned much more often in the case of Vaccination (scholars 8%, students 13%) and virtually never for Weather Effects (only 1% of scholars). Finally, identifying animal welfare as not a relevant concern was mentioned much more for Weather Effects (scholars 10%, students 9%) than for Vaccination (scholars 3%, students 2%), even though such a concern seems equally relevant in both cases.

One explanation for this may be that this kind of response is influenced by the idea that helping animals harmed by weather events is a stronger form of intervention in nature. Another explanation could be that scholars wanted to stress that research on Weather Effects could gain more support if framed in terms of conservation rather than animal welfare, while they did not think this was the case for the Vaccination project. We saw that one scholar mentioned as an obstacle to the Weather Effects project its "animal welfare focus — it would be more relevant to the department if the focus was on selection pressures from climate change." Another participant said that "'Animal welfare' would not be an appropriate justification for a study housed in a biology department… If such work was framed in terms of ecology and evolution of the animals, it would be strongly supported all around." Similarly, a student said that the project's "motivation [i.e. the promotion of animals' wellbeing] can be an obstacle" and that "if the motivation is for instance to sustain the number of animals within a population, the research would be more justified."

Limitations of this study

There are four epistemic limitations of this research project that we anticipated, and that were apparent in the responses given by the participants. Two of them we deemed to be not relevant. The other two, while not crucially relevant, may have had some impact on the results of the study.

Differences between the perceptions and attitudes among scholars and students

We have seen that when asked the same question, responses from scholars and students differed; however, these differences were not significant. As we indicated above, we used chi-square analysis with a 95% confidence level to consider the differences between the responses given by scholars and students for certain questions.

We have seen some examples of scholars having different perceptions than students do about the feasibility of certain research and about the kind of external obstacles it might face; we have suggested that professors are more likely to have greater insight due to their expertise in the field. Thus, it is especially revealing that scholars seem to regard all three research projects as more feasible than students do. One consideration external to the participants' perceptions and attitudes that could explain why fewer scholars identified obstacles than students may be that students are willing to spend more time completing questionnaires than professors; however, this doesn't seem to be the case because scholars typically wrote longer responses than students did.

There are smaller differences between scholars and students about whether they favor the research projects than there is about the projects' feasibility or obstacles to them. A large difference in the attitudes of scholars and students would suggest a conflict between short- and long-term strategies. A long-term strategy for establishing certain lines of research in academia would have to give greater weight

to the attitudes of younger people. That is, it would imply promoting lines of research that are more likely to be supported by future scholars (who are currently students), even if they are not the ones supported by present scholars. On the other hand, short-term progress needs support from present scholars. The results of this study indicate that there may not be any such conflict, given that the attitudes of scholars and students do not diverge greatly.

Responses focused on interventions, rather than research projects about them

In the survey, we asked exclusively about the participants' views about the research projects themselves; however, the obstacles that were mentioned often had to do with the interventions those research projects aimed to study. That is, some responses expressed objections against vaccinating wild animals, helping wild animals in urban environments or rescuing animals in harmful weather events. However, these are not objections to researching how these interventions could be carried out.

Attitudes toward interventions and toward research about those interventions do not always exactly coincide. Some people may oppose an intervention itself, for instance, due to our current lack of knowledge of the indirect effects the intervention may have. Those holding this view may still support doing *research about* such an intervention. This view was held by some participants in our previous qualitative research about this issue (Animal Ethics 2020). Moreover, respondents in that study often mentioned that gaining more knowledge is always good, even if it's not for the purpose of directly applying it. Due to this, the results of this study would have been more accurate if responses were all clearly focused on the research projects themselves, though we do not think this factor has made a key difference.

Participants biased toward favoring the study of animal welfare

Volunteers distributed questionnaires to students, while scholars were contacted via email. We expected that scholars who filled out the questionnaire are likely to be interested in, or sympathetic toward, the study of animals. In order to compensate for this bias, we included survey questions concerning support by fellow scholars,

as well as potential support by university departments. Responses showed that scholars agree and strongly agree much more often when they were asked about whether they support the research projects than when they are asked about whether their colleagues would support them (this happened for all three projects). However, the responses concerning the attitudes of their colleagues show results that are still widely favorable toward the research projects. This was also observed in the case of the third question, about the likelihood that those projects could be supported at their universities. These responses lead us to believe that self-selection bias of participants may not undermine the validity of their responses.

Poor understanding of the term "animal welfare"

Finally, what may have been the most important epistemic limitation in this study is that some participants may have failed to understand the meaning of the term "animal welfare." We found many responses that show a proper understanding of what animal welfare is. However, as indicated above, we did have some responses that suggest this misunderstanding. We have not been able to determine the extent to which this confusion may have been present.

Conclusions

The main results of this study can be summarized in the following points:

Room for future progress. Research projects focused on the individual wellbeing of animals have the potential to be supported by students and professors of biology and related sciences. This indicates support for helping wild animals as a cause area, by showing that experts do regard it as tractable and think that more knowledge can be gained.

In the previous section, we saw that we should not assume that support for research about certain forms of intervention will coincide with support for the interventions themselves. This means that even if some forms of intervention to help animals (such as those considered in this study) are still regarded as controversial to some extent, research on them can nevertheless be promoted successfully.

Work on the welfare of animals in urban areas is promising. Studies about helping urban wild animals may be more likely than the other projects to advance cross-disciplinary work (combining research in ecology and animal welfare science), because they are likely to get more support and to meet with less opposition.

Work on weather effects on the welfare of animals has substantial potential. Of the three projects, work on aiding animals affected by weather effects appears to have the greatest potential to challenge the idea that we should not help animals in the wild. This was the project that was most often identified as a form of intervening in nature, which was perceived as an obstacle. If our aim is not gaining the knowledge needed to intervene as soon as possible in the short term, but rather fostering further research on the wellbeing of animals in the wild, then a project like Weather Effects may be more effective than the others, precisely because it is more challenging to the idea that it is wrong to aid animals in the wild. Its successful development would help to counteract this idea.

We have also seen that although professors and students seem more reluctant to support this intervention, they believe that it is more likely to be carried out in their universities. A major reason for this may be current worries about the impact of climate change (Palmer 2010; McCumber & King 2020).

There is a lack of training in animal welfare science among natural sciences scholars and students. We have seen that one of the main limitations of this project is a possible failure to understand what animal welfare is. We have also seen confusion concerning what may be best for the wellbeing of animals and a lack of scientific knowledge about this topic. These issues seriously impede the incorporation of the promotion of animal welfare as one of the aims of their work.

No signs of any change in approach yet. When we considered the possible epistemic limitations to this study, we noted similar attitudes of scholars and students toward the study of possible actions to improve the wellbeing of animals. This indicates that there has not been a noticeable paradigm shift concerning the values informing scientific practice in the fields the surveyed students are studying. This is instructive: unless educational efforts are directed toward them or there is a change in societal attitudes, we can assume that natural science students will continue to have similar attitudes to their professors.

All the previous points have important implications for organizations and individuals who want to fund scientific work as a way to effect change for animals. There is a final consideration that can be added to this that falls outside of the main focus of this study; however, it is suggested by the previously mentioned point about how perceptions and attitudes can continue through time in academia:

Funding new research projects may be insufficient. Unfortunately, the funding needed for academic research is very high. It remains to be seen the extent to which people concerned with the situation of animals may be able to provide such funding. Some efforts can be made to shift some resources in this direction; however, there is another, potentially more effective way to promote work on this topic: raising concern about it among scholars and students in natural sciences and society in general. This may also be an effective way of educating new generations of students and young scholars about concern for the wellbeing of animals.

Specific recommendations

In light of the results of this study, we can make several specific recommendations about promising ways to increase understanding of how to (1) improve the wellbeing of animals in the wild, and (2) advance the creation of a cross-disciplinary field of research studying this question:

- Promote research projects studying interventions aimed at improving the situation of wild animals
- Emphasize research aimed at improving the wellbeing of animals in urban and suburban areas. We regard this as one of the fastest ways to make progress in the development of cross-disciplinary work in ecology and animal welfare science
- Emphasize research aimed at improving the wellbeing of animals affected by weather events. This may lead to progress in the development of cross-disciplinary work in ecology and animal welfare science and can challenge biases against the idea of aiding animals living outside of human control
- Promote training in animal welfare science for biologists and environmental scientists, and especially for students in these fields
- Promote educational work among natural sciences students about research aimed at helping wild animals, and, especially, about its feasibility
- Educate other relevant agents in society, from public policy makers to people and associations with an interest in the wellbeing of animals, about the reasons for and the feasibility of scientific work aimed at developing initiatives for the benefit of wild animals

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