WORKPACKAGE 1 – BIODIVERSITY AND PERCEPTION

DELIVERABLE 2 – REPORT ON CITIZEN SCIENCE'S PROGRAMS

CONTEXT

GENERAL CONTEXT

Citizen science is a wonderful tool for scientists. It allows to gather more data, from more different places and more frequently than a research team could do it. This powerful tool is especially important in a period of declining biodiversity, where changes have to be measured for a great variety of species and in various place.

The most popular example of how scientists can use data from citizen science to obtain of global overview of a biological phenomenon is probably the case of decline of insects' population in Germany (Hallmann et al. 2017). The paper has some biases, that have already been discussed in the scientific community, but two points need to be acknowledged. First, the paper is still congruent with others, more recent papers that have address properly the biases found in the German paper (Sánchez-Bayo et Wyckhuys 2019), we can conclude that the methodology, if not perfect, produced no aberrant result. Second, the biases are mostly due to the way citizen science works. Once known, they can be easily taken into account in order to weight data and results accordingly.

INSIDE THE PROJECT

As the project aims mapping interactions between humans and liminals through the case of corvids, citizen science is a good starting point. It tells us a lot about how humans acknowledge species, which ones and when. It can also, as said in the General context section, provide us some information we could not gather on a traditional academic manner, due to the lack of time, materials or availability of specialist.

RESEARCH QUESTION AND HYPOTHESIS

QUESTION AND SUBQUESTION

This deliverable is part of the Case study 1, aiming to study the relationship between biodiversity and perception of such biodiversity on different semiotic levels. The main question of this Case study is: What are the roles of liminal species in a human city?

This report on citizen science's programs aims to answer more specifically to the question: What can we learn of the voluntary interaction of humans toward corvids?

HYPOTHESIS OF THIS STEP

The general hypothesis of the Case study is that cities are perceived as an exclusively human environment. It is true that biodiversity in cities is expectedly still lower than in most natural ecosystems, yet it is present, complex and changing. So, humans and animals are parts of this ecosystems, interacting permanently with each other and strongly semiotically linked.

The hypothesis of this precise step is that citizen science is a way humans chose to interact, in a voluntary manner, with liminal species. It can give scientists a lot of information about biodiversity in cities, but also a lot

of information about how humans perceive the species living with them. In such a perspective, the biases found in previous papers using citizen science, like said in the General context section, are not just biases: they are semiotic information about a different topic.

METHODOLOGY

METHODOLOGICAL CHOICES

On advice of Veljo Runnel (University of Tartu Natural History Museum and Botanical Garden) two different sources of data were used.

The first one is the public collaborative data base eElurikkus, that allows anyone to report the observation of any species (bird, mammal, insect, plant etc.) at anytime and anywhere. The data base was restricted to Tartu area (see Figure 1 in Documents section).

The second one is the annual citizen science program Suvine aialinnupäevik (coordinated by the Estonian Ornithological Society), that takes place every year from 1st March to 3rd October (the data used were from the 2020 report). All links are available in the Annexes.

Both sources were analysed in order to understand several aspects of human voluntary interaction with corvids:

- Where are the corvids observed? What does it tell us about the triangular relationship between humans, corvids and city?
- When did the observations take place? What does it tell us about how this relationship is evolving through the year?
- Who did the observations? What does it tell us about the human involvement?
- Who was observed? What does it tell us about the way different species are having different semiotic power on human minds?

ISSUES AND PROBLEM SOLVING

The first issue was that the citizen science program Suvine aialinnupäevik is only in Estonian, and the report itself is only in Estonian. As only few data of the report were necessary for this part of the project, this issue was solved by querying the eElurikkus data base with scientific names of the studied species. The data base gave the corresponding names in Estonian, and these names were searched through the report. As most of the data are presented in data tables, it was possible to exploit them without mastering Estonian (see Table 1 and Table 2 in Documents section).

The second issue was that both sources suffered from some biases, as it was expected in the General context section. But it appeared that, rather than biases, they could be considered as inputs: they are also data, just not answering the same question. In order to avoid a biased result, all potential biases are detailed one by one in the Points of vigilance section. All their interpretations are detailed in the Raw results and Interpretation sections.

POINTS OF VIGILANCE

The following points of vigilance need to be underlined:

- **Naming errors**: both data bases include observations of "vares" or "*Corvus corone*". This is clearly not possible, at least not with such prevalence. Corvus corone is not observed in Estonia, there should be only observations of "hallvares", "*Corvus cornix*" or "*Corvus corone cornix*". The confusion is probably

due to the fact that both species were considered as once for a very long time, hooded crows being only a subspecies of crow. Birds enthusiasts were probably used to certain way of naming and did not bother to precise the subspecies, creating errors in the database. This point of vigilance is easy to address, even more with pictures added in the eElurikkus data base by observers, which clearly show hooded crow registered as *Corvus corone* (see Figure 2 in Documents section). This common confusion was confirmed by ornithologist Marko Mägi (Institute of Ecology and Earth Sciences of Tartu) during an interview.

- **Geographical bias**: the eElurikkus data base revealed a geographical bias of observation (this bias is addressed by restricting observation area in the Suvine aialinnupäevik program). Some areas considered of interest for the observation of corvids in general and *Corvus cornix* in particular (see document D12) were absolutely empty of any observation. It is important to note that, geographically speaking, observations are telling us more about humans observing birds that about the observed birds.
- **"Remarkable" bias**: the eElurikkus data base revealed a bias in the kind of species observed. A very good example of this bias is the duck, which is completely under-registered (see Figure 3), probably because it is not "spectacular". Therefore, it is important to note that these data base do not reveal observations, but rather the way some species are making or not enough meaning in human minds in order to be "remarked" when observed, and then registered. The Suvine aialinnupäevik program should be a bit less biased on this aspect, as the methodology insists very clearly on how it is important to register every bird every time it is seen. But it is not possible to exclude the fact that the bias still influences human behaviour, without awareness.

RESULTS

RAW RESULTS

ABOUT WHERE THE OBSERVATIONS TAKE PLACE

For the Suvine aialinnupäevik program, people are observing their gardens (and sometimes the one of their neighbours). This choice is limited, but it is methodological choice, and it is well-followed by the participants.

For the eElurikkus data base, some places seem strangely empty of observations, even if the species are indeed very present here (see document D12 about the choice of observation spots for this project). Other places are "overcrowded" by reports, on the contrary. Lona Päll (Semiotics Department, University of Tartu) explained that some places, especially dumpsters in the south-east of the city, are very well-known places for birds' enthusiasts that tend to gather here especially for observing birds and spotting rare specimens.

ABOUT WHEN THE OBSERVATIONS TAKE PLACE

For the Suvine aialinnupäevik program, observations are clearly limited in time (see guidelines on their website, in the References section) as the aim of the program is the reporting of migrations returns and nesting.

For the eElurikkus data base, observations take place all the year. This is interesting in the case of corvids, especially *Corvus cornix*, that can be or be not a migrating bird, depending on the area. Estonia is registered as one the northern area where migrations tend not to happen, but the border is not far, and it is interesting to see if crows are also registered in winter. As the reports show (see Figure 4 in the Documents section), they are indeed observed in winter.

ABOUT WHO DID THE OBSERVATIONS

Both programs are very popular, and inhabitants of Tartu seem involved. The eElurikkus data base gathers 41.156 for Tartu during the last 5 years. The Suvine aialinnupäevik program of 2020 involved 1.193 persons in Estonia, and 91 of 675 observation points were in Tartu County, with 44 in Tartu Intramuros.

ABOUT WHO IS OBSERVED

Corvids represent an important part of observations. In the Suvine aialinnupäevik program 2020 report, they gather 11.4% of birds' observations. In eElurikkus data base, 3.368 of the 31.844 birds' records are corvids (we are including observations of *Coloeus monaledus*).

Both programs present naming errors. In the Suvine aialinnupäevik program, the word "vares" is used instead of proper "hallvares". Marko Mägi confirmed that people usually use "vares" indistinctly for *Corvus cornix* (hallvares), *Corvus corax* (kaaren), *Corvus frugilegus* (künnivares) and sometimes *Coloeus monaledus* (hakk) by just calling them "väike (small) vares". These naming errors are also presents in the eElurikkus data base, as explained in the Points of vigilance section.

If the Suvine aialinnupäevik program seem to avoid the major part of the "remarkable" bias by giving very strict and precise observations guidelines (they can be read on the website, see References section), the eElurikkus data base show clear signs of these bias. As explained in the Points of vigilance section, ducks for example (see Figure 3 in the Documents section) are three times less reported than woodpeckers.

INTERPRETATION

ABOUT THE TRIANGULAR RELATIONSHIP BETWEEN HUMANS, CORVIDS AND CITY

Corvids are clearly part of the environment of the humans: frequently observed, sometimes reported. But the places of reported observations are not always matching the real places of living of these birds, meaning that their existence, in data bases, are directly linked to how humans see (or don't see) them. A point that is starting to be investigated, but with no solid results yet is that corvids are almost completely absent of the data base at some precise places where there were complains about their numbers and noises. It is possible that a liminal identified as nuisance becomes invisible as a real animal for humans complaining of it.

ABOUT THE TRIANGULAR RELATIONSHIP EVOLUTION THROUGH THE YEAR

Observations are following seasons. If a augmentation of observations is noted at spring, during nesting season, they are also many observations in winter, even when the weather is particularly bad. No "virtual" disappearing of records is noted.

ABOUT THE HUMAN INVOLVEMENT

Citizen science programs are popular in Estonia, and is seems that inhabitants of Tartu are even more enthusiastic. This is an important point for dissemination and sensitization (see the Popularization aspects section): it is possible to count on a solid interest from the inhabitants about nature, animal species in cities and citizen participation to science.

ABOUT THE WAY DIFFERENT SPECIES ARE HAVING DIFFERENT SEMIOTIC POWER ON HUMAN MINDS

This is maybe the more interesting aspect, from an academic point of view. Some species, especially liminals, are not as powerful at creating meaning in human mind. The fact that some of the most common species (corvids, ducks) are wildly underrepresented in data base shows that they are perceived as "weak semiotic input". Seen more as objects components of the city than as real animals, with sensitivity and agency, they are

more easily accused of nuisances and less prone to create immediate and easy empathy or willing of protection.

MILESTONE 1 – PROGRESS REPORT

IMPACT OF RESULTS

These results are important for two different aspects:

- Scientific aspect: they show that it is possible to extract different data than the ones for which the data base was originally created. These data are still scientifically useful, and bias in citizen science data base should be seen as other kind of information, gathered not about animal or plant species, but about how these species make sense for human observer.
- Popularization aspect: these results also suggest possible improvements of methodology and tools in citizen science programs, in particular in order to avoid naming errors or species confusion when registering an observation.

The impact of these results will be included in the first set of recommendations and propositions for exploitation (see document EX1).

ISSUES, PROBLEMS OR LACKING

The results must be considered as incomplete without a cross-analyse of the real biodiversity data. Deliverable 1 was created to focus on the aspect, the cross-analyse will be done for Deliverable 4.

The results are still fragile. It should be possible to give them more accuracy and robustness by including in the Case study 2 survey (Deliverable 8) some items aiming to clarify or verify the results. Congruence between these results and answers of Tartu's habitants would be a good sign of robustness of the methodology, and therefore of the results.

NEXT STEPS

Results of this deliverable will be analysed jointly with results of Deliverable 1 (Biodiversity's report) and compared. The aim will be to find gaps, paradoxes or overlaps between them, and to create a more precise map of the perceived biodiversity compared to the factual one.

If relevant, they will also be compared to results of Deliverable 3 (Nature perception's report) to see in the perception described in textual materials is consistent with the perception emerging from the comparation of biodiversity's data and citizen involvement in biodiversity science.

GENERAL PROJECT – CURRENT STATE OF PLAY

IMPACT OF RESULTS

These results are not exploitable on their own. But they can be used as starting points in two major aspects of the project. They can help to focus more efficiently on some key-aspects in the communication and dissemination plans. They can also be used as example for developing more relevant methodological tools in the exploitation of data from citizen science's programs.

PROPOSITIONS FOR OTHER ASPECTS OF THE PROJECT

ACADEMIC ASPECTS

These results can be exploited in the academic field in two aspects: learning how to spot biases in exploitation of data from citizen science's programs, and showing how what we perceive as methodological biases can be used to learn something else from our data.

These two aspects can be included, if relevant, in the proposition of first paper of the project (see document P1), but it will more probably interest international partners and could be a good feature to use in the international aspect of the project (see document I1).

POPULARIZATION ASPECTS

These results will be at the very beginning of both dissemination and communications aspects of the project. They must be seen as the description of people involvement with biodiversity protection and relationship with liminal species. They are precious information about their sensitivity, interest and blind spot. Every dissemination and communication deliverable will use them as a starting point.

NEXT STEPS

These results will be the starting point of the communication plan. The web page/blog that should be created in the next step should probably have a more visual aspect that it was first intended, as this seems to be a major interest for people. The pedagogical aspect should be strongly visually documented in order to create and maintain the interest of inhabitants and to encourage empathy or willing of protection.

ANNEXES

REFERENCES AND LINKS

REFERENCES

Hallmann, Caspar A., Martin Sorg, Eelke Jongejans, Henk Siepel, Nick Hofland, Heinz Schwan, Werner Stenmans, et al. 2017. « More than 75 Percent Decline over 27 Years in Total Flying Insect Biomass in Protected Areas ». *PLOS ONE* 12 (10): e0185809. https://doi.org/10.1371/journal.pone.0185809.

Sánchez-Bayo, Francisco, et Kris A. G. Wyckhuys. 2019. « Worldwide Decline of the Entomofauna: A Review of Its Drivers ». *Biological Conservation* 232 (avril): 8-27. https://doi.org/10.1016/j.biocon.2019.01.020.

LINKS TO WEBSITES AND DOCUMENTS

Citizen science data base (calibrated for Tartu city only): https://elurikkus.ee/regions/Linnad/Tartu%2520linn

Citizen science program Suvine aialinnupäevik: https://www.eoy.ee/aed/

Citizen science program Suvine aialinnupäevik 2020 report: https://www.eoy.ee/aed/content/materjalid/aialinnupaevik_2020.pdf

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Marko Mägi for assistance with common names of birds in Estonian and habits of inhabitants about using them.

DOCUMENTS

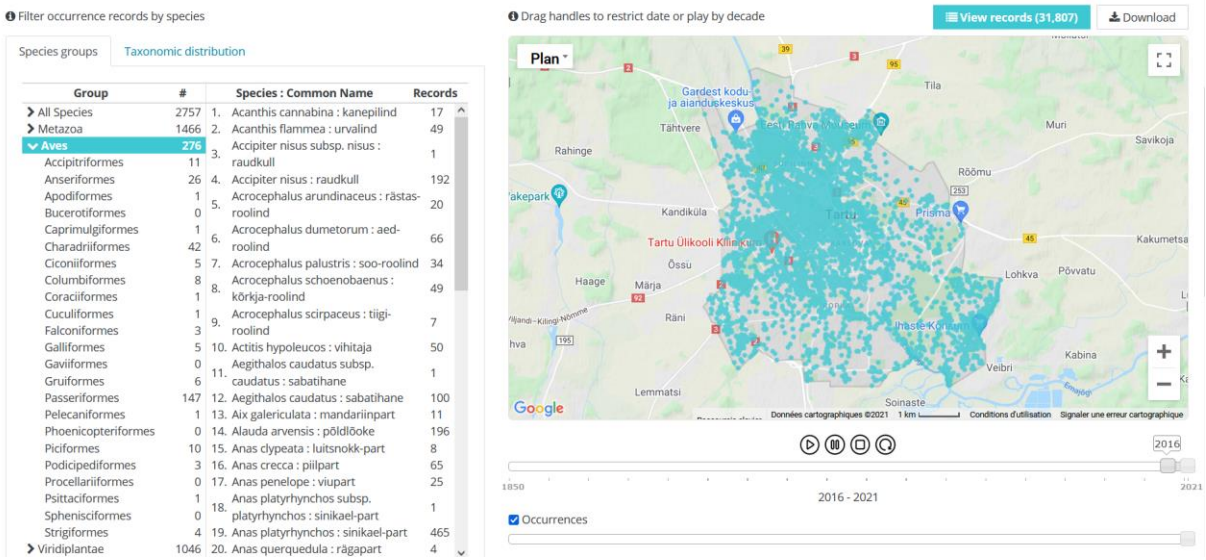

Figure 1 - Visual of the data base Elurikkus with settings: Tartu (area) - 5 last years (time) - Aves (species)

Aedades sagedamini kohatud linnuliigid aastatel 2015 – 2020.

		2020	2019	2018	2017	2016	2015
1.	Rasvatihane	89,8%	94%	95,60%	90,60%	93,30%	91,50%
2.	Linavästrik	86%	85,20%	85,90%	86,30%	89,00%	91,10%
3.	Musträstas	82,7%	88,50%	81,40%	77,80%	82,00%	77,10%
4.	Vares	82,1%	87,60%	79,30%	78,30%	83,80%	81,60%
5.	Metsvint	79,7%	86,60%	79,30%	83,80%	83,50%	86,70%
6.	Sinitihane	77%	84,20%	83,50%	75,50%	80,30%	67,20%
7.	Kuldnokk	75,6%	79%	74,50%	74,80%	81,80%	77,50%
8.	Kaelustuvi	74,9%	72,60%	58%	63,20%	56,30%	53,60%
9.	Punarind	72,2%	69,50%	66,90%	77,60%	73,00%	62,80%
10.	Harakas	67,4%	78,50%	72,20%	70,30%	75,30%	69,60%
11.	Rohevint	64,9%	80,40%	84,40%	74,80%	79,30%	71,00%
12.	Hallrästas	64,7%	67,50%	63,90%	65,40%	60,00%	55,60%
13.	Põldvarblane	60,70%	63,50%	60,5%	55,6%	61,50%	56%
14.	Sookurg	60,3%	64,90%	65,20%	58,10%	63,00%	57,70%
15.	Suur-kirjurähn	59,3%	70,60%	69,20%	54%	65,30%	54,30%

Table 1 - Comparative table (2020-2015) of the most common species of birds observed in the Suvine aialinnupäevik program (from the 2020 report)

Aedades sagedamini pesitsenud linnud aastatel 2015 – 2020.

	Liik	2020	2019	2018	2017	2016	2015
1.	Kuldnokk	46,3%	50,5%	49,5%	53,1%	55,6%	54,4%
2.	Rasvatihane	39,2%	41,9%	48,0%	46,9%	49,3%	42,8%
3.	Musträstas	27,2%	21,5%	17,9%	18,7%	19,3%	22,3%
4.	Linavästrik	26,7%	36,3%	36,2%	33,5%	38,6%	41,0%
5.	Must-kärbsenäpp	26,2%	30,4%	24,6%	26,2%	27,4%	29,3%
6.	Põldvarblane	22,6%	24,1%	21,9%	19,2%	21,0%	23,3%
7.	Sinitihane	21,5%	20,1%	20,4%	19,5%	15,6%	19,1%
8.	Hallrästas	18%	19,1%	20,4%	22,7%	19,3%	15,9%
9.	Suitsupääsuke	15,5%	21,8%	21,6%	22,7%	25,1%	25,1%
10.	Hall-kärbsenäpp	12,3%	18,2%	15,2%	18,1%	15,0%	19,8%
11.	Metsvint	11,4%	13,5%	13,1%	14,6%	13,8%	20,5%
12.	Vares	11,4%	9,9%	11,9%	11,7%	13,0%	9,5%
13.	Piiritaja	10,1%	14,2%	17,3%	13,4%	15,0%	14,5%
14.	Punarind	8,7%	7,9%	8,8%	10,8%	10,7%	8,5%
15.	Rohevint	8,4%	8,3%	12,5%	11,4%	10,7%	14,1%

Table 2 - Comparative table (2020-2015) of the most common species of birds observed in the Suvine aialinnupäevik program (from 2020 report)

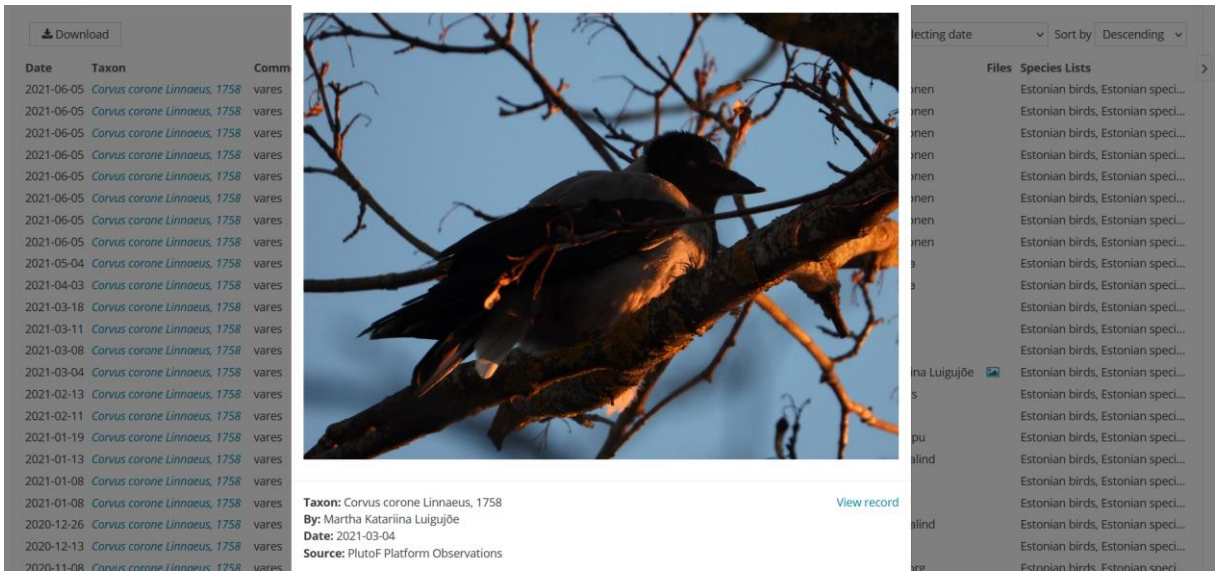

Figure 2 - Example of naming error: here a "hallvares" individual (*Corvus cornix*) registered as "vares" (*Corvus corone*) in Elurikkus database - Picture by Martha Katariina Luigujõe

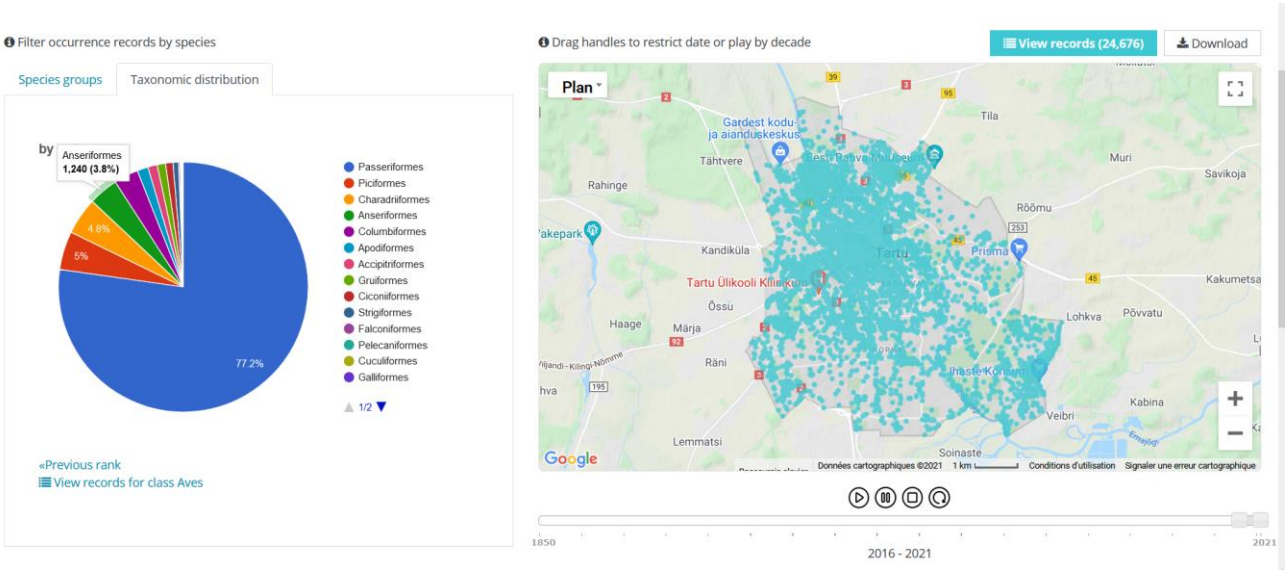

Figure 3 - Illustration of the "remarkable" bias with 1.240 Anseriformes (593 Anas) versus 1.601 Piciformes (1.471 Dendrocopos) - Settings: Tartu (area), 5 last years (time)

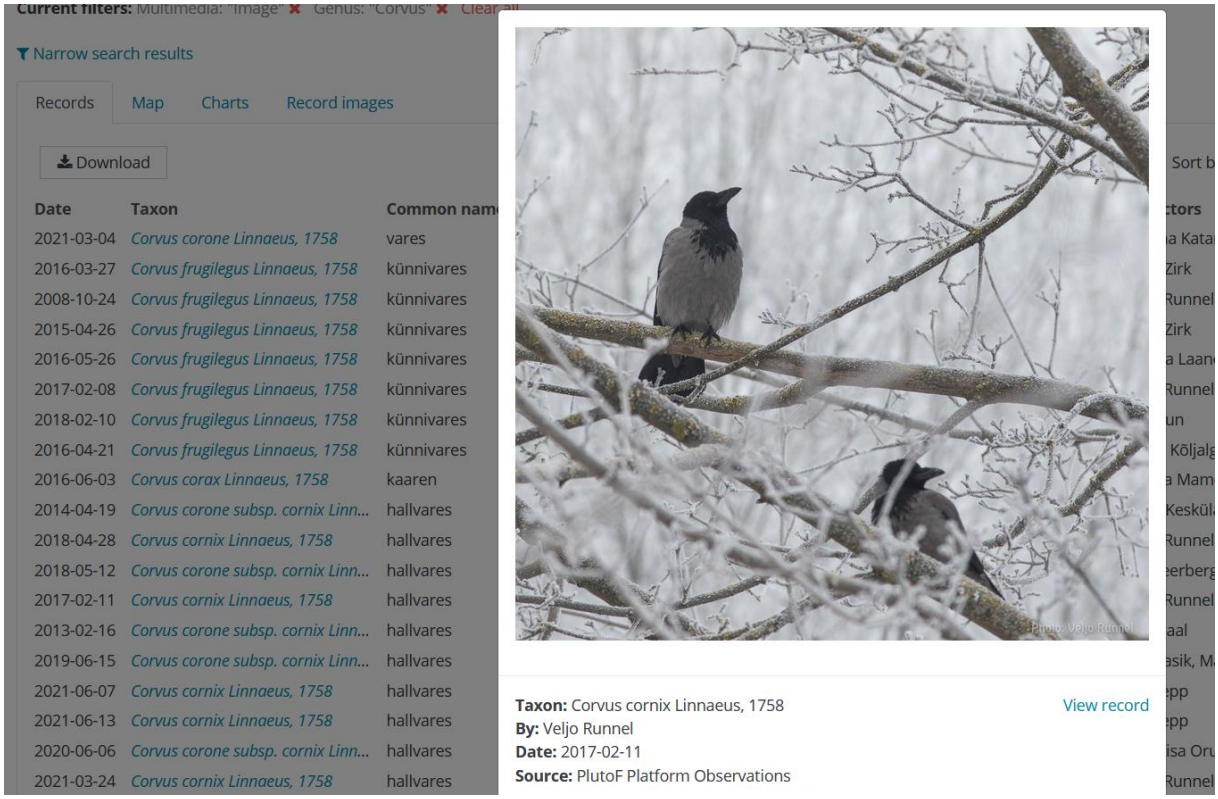

Figure 4 - Example of observation during winter of *Corvus cornix* in the Elurikkus data base - Picture of Veljo Runnel