EXTERNAL SCIENTIFIC REPORT

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Data generated by camera trapping in 40 areas in Europe including East and South Europe: report of the field activities (May 2022)

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Abstract

The new-born European Observatory of Wildlife (EOW)[2] is a part of the EFSA-funded ENETWILD project, and has the aim of improving the European capacities for monitoring wildlife populations, implementing international standards for data collection, providing guidance on wildlife density estimation, and finally, to promote collaborative, open data networks to develop wildlife monitoring. As a next step, the EOW has engaged and enhanced the existing network of collaborators, and a number of participants are currently preparing field operations to estimate wild mammal density (focused on wild ungulates and other medium to big sized mammals) in certain areas from their respective countries. A field camera trap (CT) based protocol provided by the EOW is going to be applied. An online training course held in May 2022 provided specific training on camera trapping methods and protocols, specifically the random encounter method (REM) and other methods which do not require individual recognition. Here we also present the new field protocol, which is compatible with the subsequent application of artificial intelligence to process and analyze photo trappings using the online app AGOUTI. This strategy aims at promoting a network of professionals/researchers capable of designing, developing field work and analysing data, contributing also to disseminate the experience and train other colleagues in their respective countries. By now, the overall number of countries participating in the EOW is 25. Some participants from 12 countries could already estimate mammal densities during the previous seasons 2019/2020/2021, which will also apply the same methodology in different populations during 2022 in their respective countries. The number of density values finally obtained through this experience by the end of 2022 will exceed 40 different locations in a total of at least 30 countries, since some countries are on the process to confirm their participation. The EOW website is presented. This coordinated field trial activity over a range of European countries, involving different experts and professionals, follows the original plan.

Key words: camera trap, wild boar, density estimation, network, harmonized protocol

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[1] www.enetwild.com
[2] https://wildlifeobservatory.org/

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[3] www.enetwild.com

Summary

In 2022 the European Food Safety Authority (EFSA) is funding the new-born European Observatory of Wildlife (EOW) (https://wildlifeobservatory.org/) as part of the ENETWILD project, with the aim of improving the European capacities for monitoring wildlife populations, implementing international standards for data collection, providing guidance on wildlife density estimation, and finally, to promote collaborative, open data networks to develop wildlife monitoring. As a next step, the EOW has engaged and enhanced the existing network of collaborators, and a number of participants are currently preparing field operations to estimate wild mammal density (wild ungulates and other medium to big sized mammals) in certain areas from their respective countries. A field camera trap (CT) based protocol provided by the EOW is going to be applied. This report summarizes the activities in relation to the generation (by camera trapping following an harmonized protocol) of reliable wild ungulate density values in at least 40 areas in Europe, throughout Europe. The website of the EOW is presented.

The wildlife experts participating in a previous course received training on the methods for determining wildlife abundance and density (https://enetwild.com/2020/10/14/enetwild-CT-course/), and specifically on camera trapping. Participants were trained in applying the random encounter method (REM) and and other methods which do not require individual recognition. Detailed explanations of field protocols to implement such methods were provided and are also available in the guidance produced by ENETWILD. Here we present the new field protocol, which is compatible with the subsequent application of artificial intelligence to process and analyze photo trappings using the online app AGOUTI. The next step consists in defining the study areas, design and start field activities.

In September 2022, a second online training course will be held to participants, so they will be trained specifically in data processing and analysis. This strategy aims promoting a network of professionals/researchers capable of designing, developing field work and analysing data by their own, contributing also to disseminate the experience and train other colleagues in their respective countries. By now, the overall number of countries participating in the EOW is 25 and expected to be 30 once several agreements are materialized in the following days. Several participants of 12 countries already estimating wild boar densities during the previous seasons 2019/2020/2021, which will also apply the same methodology in different populations during 2022 in their respective countries. The number of wild boar density values finally obtained through this experience by the end of 2022 will exceed 40 different locations in a total of at least 30 countries. To sum, this coordinated field trial activity over a range of European countries, involving different experts and professionals, is following the original plan.

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1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

The contract entitled "Wildlife: collecting and sharing data on wildlife populations, transmitting animal disease agents" (Specific Contract number: OC/EFSA/ALPHA/2016/01 – 07) was awarded to the Universidad de Castilla-La Mancha by EFSA. the ENETWILD consortium implemented the EFSA-funded project "Wildlife: collecting and sharing data on wildlife populations, transmitting animal diseases agents", whose main objective is to collect wild boar density, hunting and occurrence data and model species geographical distribution and abundance throughout Europe. This subject is of particular concern due to the continued advance of African swine fever (ASF).

The specific objective 3 (SO3) of the ENETWILD framework contract abovementioned refers to data generation by camera trapping surveys density of wild boar (as part of TASK 3. Targeted wildlife population and health surveillance upon request, access to site, sampling and processing). Deliverable 3.1 of SC9 continues activities for generation of distribution and abundance data of wild animals by camera trapping in 12 countries (see ENETWILD Consortium 2022a for activities performed by these 12 countries in 2021). These countries have been incorporated to the newlyborn European Observatory of Wildlife (EOW, https://wildlifeobservatory.org/). Therefore, here we summarize the activities on generation of distribution and abundance data of wild mammals by camera trapping in these 12 countries in the context of the progress of the EOW. A second report and updated database will be delivered in December 2022.

1.2. Scope of the report

This report summarizes the activities in relation to the generation (by camera trapping following an harmonized protocol) of reliable wild ungulate density values in at least 40 areas throughout Europe.

2. Wild ungulate density estimation: strategy and status

Under SC9, the ENETWILD consortium has offered training to a selected number of collaborators in order to improve the generation of harmonized wild boar (and in general, medium to big size mammals, including all wild ungulate species) abundance data. This activity was essential to enhance the network of wildlife professionals in Europe, especially, in previously identified gap areas for wild boar population data (eastern Europe). The animal health professionals and wildlife experts participating in the course received training on the methods for determining wildlife abundance and density, (https://wildlifeobservatory.org/course-on-the-use-of-camera-trapping-for-monitoring-wildlife/) and specifically on camera trapping, applying the random encounter method (REM) and and and other methods which do not require individual recognition. Detailed explanations of field protocols to implement such methods were provided and are also available in the guidance produced by ENETWILD (ENETWILD consortium 2018, see annexes). We present the new field protocol, which is compatible with the subsequent application of artificial intelligence to process and analyze photo trappings using the online app AGOUTI.

The ENETWILD Project already had contacted and invited collaborators (experts developing field work in their respective countries) to join this initiative before the celebration of the CT course because: (i) they were placed or had access to gap areas for wild boar density (Eastern Europe), and (ii) their appropriate expertise, motivation and willing to participate. In addition, most of them already were part of network since the beginning of the project, and also, active data

providers. When inviting them to join this activity, we indicated that ENETWILD had initiated the way about 4 years ago, and we all together had been able to build the foundations to address the harmonized monitoring of any wildlife over the continent. We manifested to them that they are part of the ENETWILD network, and that we intended to take a step ahead in our level of collaboration with a selected group of experts, for which they and their institutions had been selected. The creation of the EOW aimed at improving the European capacities for monitoring wildlife populations, implementing international standards for data collection, providing guidance on wildlife density estimation, and finally, to promote collaborative, open data networks to develop wildlife monitoring.

Our strategy to catch their attention was based on the fact that only a few density data on wild boar density are available that can be validated. Density data is essential to calibrate other predictions and to define a range of values across large areas that are relevant for any policy. In a long term, even density values can be directly and spatially modeled. Therefore, supporting teams able to generate density values over different European contexts (habitats, landscapes, management, spatial distribution, epidemiology) had become an objective of the project. ***We informed that we wanted to invite, support and provide resources to participate in a coordinated project to generate terrestrial wild mammal density values (particularly attending to wild ungulates and other medium to big sizez mammals), which would be coordinately developed by many collaborators selected over the European geography:***

- *Albania*
- *Andorra*
- *Armenia*
- *Belgium*
- *Bosnia and Herzegovina*
- *Bulgaria*
- *Croatia*
- *Czech Republic*
- *Georgia*
- *Germany*
- *Greece*
- *Hungary*
- *Italy*
- *Lithuania*
- *Moldova*
- *Montenegro*
- *Neatherlands*
- *North Macedonia*
- *Poland*
- *Portugal*
- *Serbia*
- *Slovakia*
- *Slovenia*
- *Spain*
- *Sweden*
- *Turkey*

The collaboration consists of:

- **Training:**
  2 online courses, addressing specifically:
  - Use of camera-trapping and Random Encounter Model for the estimation of population densities.

- Organization and analysis of collected data through the use of AGOUTI (https://www.agouti.eu/) and of artificial intelligence tools for authomatic data analysis.

- **Technical support**:
  - The collaborators have received and keep a set of CTs (a number of 12, but we increased the final number to the study design if needed) and resources to cover their expenses associated to the implementation of the CT protocol.
  - Continuous contact and support to solve any issue that arises during the development of the study.
  - All images will be processed in AGOUTI app, where a specific project will be created for each study area (see ENETWILD consortium 2022b). Training on camera trapping, density estimation, AGOUTI app use and authomatic data analysis (by artificial intelligence tools) are provided.

- **Implementation of the protocol**
  - See annex 1 for more details.
  - Each collaborator selected at least one study site in their respective countries to determine wild boar densities.
  - The CTs deployed for approximately 2 months in each study site.
  - The field protocol, based on an update of the guidance abovementioned, is annexed. Basically, a grid of approx. 12-15 CTs will cover an area of approximately 2000-6000 has.
  - CTs will be moved twice (weeks 3 and 6) in order to reach a minimum of 36 camera points.
  - The criteria to select the study site are:
    - It is safe for CT deployment
    - Minimum 2000 ha of forest habitat (more or less interspersed with other habitats)
    - Intensive feeding is not provided to wild boar (occasional baiting for hunting is not a problem)
    - If possible:
      - Other population monitoring (including densities) is carried out.
      - Wild boar is hunted mainly by communal hunting, and fine hunting statistics per event (nº wild boar sighted, hunted and surface beaten) can be recorded.
      - It must be avoided the temporal overlap of camera trapping and hunting activities to the extent possible. The optimum situation is hunting activities to start immediately once the CT field trial ends, but partial overlapping is possible (e. g., camera trapping carried out in Aug-Sep and hunting in from Sep onwards).

- **Data processing and density estimation**
  - Our goal is that participants become independent to process and calculate density, so they can perform this activity anywhere anytime at their convenience in the future. This is a big step for density data generation and harmonization at European scale. Therefore, collaborators will be trained in the use of AGOUTI and in the use of artificial intelligence tools for authomatic data analysis (specific training course to be held in September 2022). Furthermore, the EOW would participate at any stage at their request to solve any issue and supervise the analyses to verify the final calculations. Other species detected (e.g., ungulates, carnivores, lagomorphs) are also susceptible to be used for density estimation if sufficient data is collected.

The Table 1 summarizes the routemap during 2022:

Table 1: The routemap of the EOW during 2022.

Date	Task
June 2022	Cameras sent to participants
	Study designs agreed with particpnsts,
July/September 2022	Cameras on the field
	Check design
September 2022	Course on image processing using AGOUTI and AI
September/October 2020	Data analized by collaborators (at least databases ready)
November 2022	Database and results checked
15th November 2022	Frist draft report to EFSA
Continuous	Coordination with IREC and UNISS for administrative issues
	EOW website (new contents, inbox, queries)
	Folowing up and data collection from collaborators activities
	· Report by participants when CTs are moved and communication of new CT locations (coordinates)
	· Report by participants when CTs are placed and communication of definitive CT locations (coordinates)
	· Following up data processing and analysis

3. The website of the European Observatory of Wildlife (EOW)

https://wildlifeobservatory.org/

Home page

- Logo and slogan:

  "Understanding human effects on the European wildlife communities"

  The logo is shown in Figure 1.

Figure 1. The logo of the European Observatory of Wildlife (EOW).

- Intro
  - A network of "observation points" capable to monitor wildlife population at European level.
  - The aims of the EOW are to provide:
    - ***guidance on methods and protocols***
    - ***support*** *and* ***training, facilitating field design, data processing and analysis***
    - ***independent information on wildlife population abundance*** *and* ***trends*** over time
  - Initially, the EOW prioritizes the inclusion of different study areas representing all European countries and bioregions
  - Further, the design of the observatory will be optimized to provide representative unbiased estimates of population trends
  - Integrative, Interdisciplinary, multi-sectoral, multi-institutional wildlife monitoring approach, initially focused on terrestrial mammals, and willing to meet other wildlife monitoring frameworks at the different study sites
  - Monitoring applying systematic and rigorous protocols, however, not at odds with the fact that it can be applied routinely and easily

- EOW map viewer
- List of collaborators
- Navigation Menu:
  1. Wildlife monitoring
  2. Wildlife in Europe
  3. Our approach
  4. The Observatory
  5. Engage and register
  6. Guidance
  7. International wildlife monitoring, news, and publications
  8. Social nets
  9. Collaborator space
  10. About ENETWILD

1. Section **Wildlife Monitoring**

What is wildlife monitoring?

- Wildlife monitoring is conceived as monitoring of the natural environment or any of its components. In other words, the regular observation and recording of parameters on a long-term scale to show trends over time. This could focus on a certain species, its population, an ecosystem, human factors involved and the relationship and impacts among them.

- To pursue useful results, all monitoring must guarantee a correct design and subsequent data analysis.

- Wildlife monitoring provides information to involved stakeholders, not losing its true essence: usefulness for wildlife management.

Why monitoring wildlife?

  - Determining and monitoring wildlife population trends and driving factors allow obtaining baseline data to compare over time. It provides not only a better understanding of the essential ecological, and epidemiological but also socioeconomic processes.

  - The information collected, once analyzed, is essential for further understanding ecological relationships and for subsequent improved decision-making with a technical and scientific basis.

  - Wildlife monitoring also allows calibrating and better understanding the relationship between population abundance and damages (overabundance), so as detecting early possible threats to biodiversity, agriculture, animal health, and human well-being.

- Based on the above, wildlife monitoring is essential to develop proactive conservation of wildlife resources so as preventive actions when the impacts are still minor, to be more effective in the response and to save economic, social, and environmental costs.

- Wildlife monitoring helps to "reconcile" stakeholders with different interests and favor the "agreement", helping to adopt an adaptive management model in decision-making.

- The harmonization of the European data framework for wildlife population monitoring already possible thanks to the availability of standards that allow the aggregation of data on presence, abundance, and hunting statistics.

- Thanks to the spatial component, monitoring potentially contributes to identify the preferred or necessary habitats for conservation, the impact of infrastructures and the management models for species over the wildlife spatial distribution ranges, or where their impacts occur. This allows implementing management plans adapted to specific contexts.

- European wildlife and human health surveillance programs lack integration with proper monitoring of populations (integrated monitoring).

- Evaluating the management and fulfillment of objectives, for example, to regulate population control activities. An ADAPTIVE management model informed decision-making continually adjusts to objectives and resources, becoming more effective and practical over time (Figure 2).

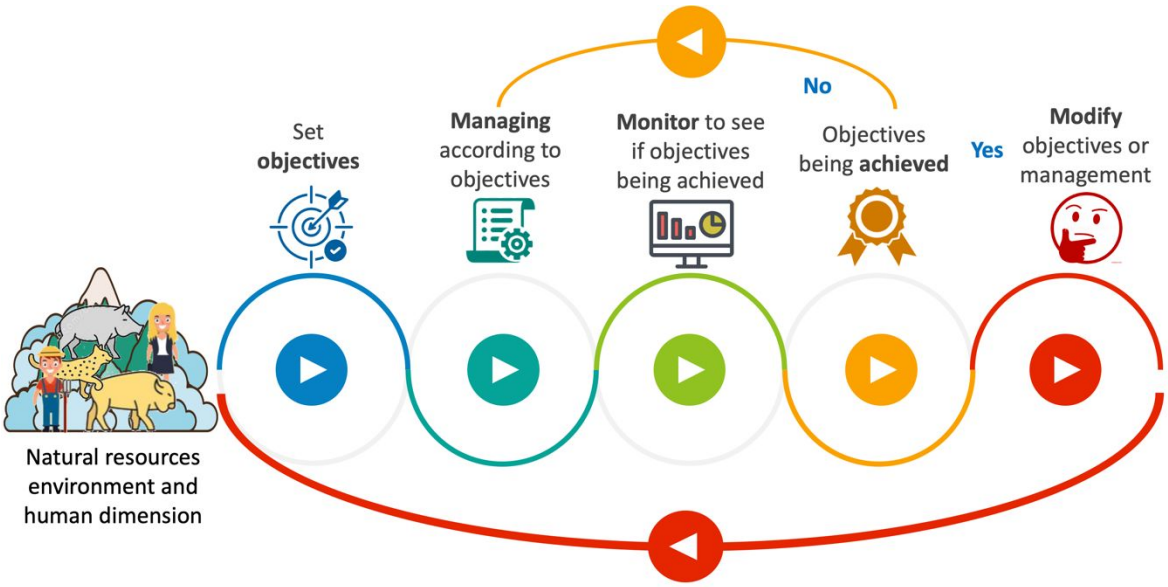

Figure 2. The adaptive management of wild species, habitats, ecosystems, consists of dealing with evaluating their operation in an iterative way, adjusting actions and practices to the results obtained, through continuous monitoring.

What to monitor?

- Developing clear monitoring objectives (target parameters, what specific objectives and final scientific and policy uses) is the first step in the implementation of effective monitoring programs, and they will determine which variables to measure in relation to the different dimensions of the problem, and how to do it.

- As for population data, wildlife professionals must choose between two main options when trying to assess population dynamics (Figure 3): i) estimate population size / absolute density; or ii) estimate a relative index of variation (usually annual) in the size

/ density of the population (or even monitor only the damage caused as an indirect index of abundance).

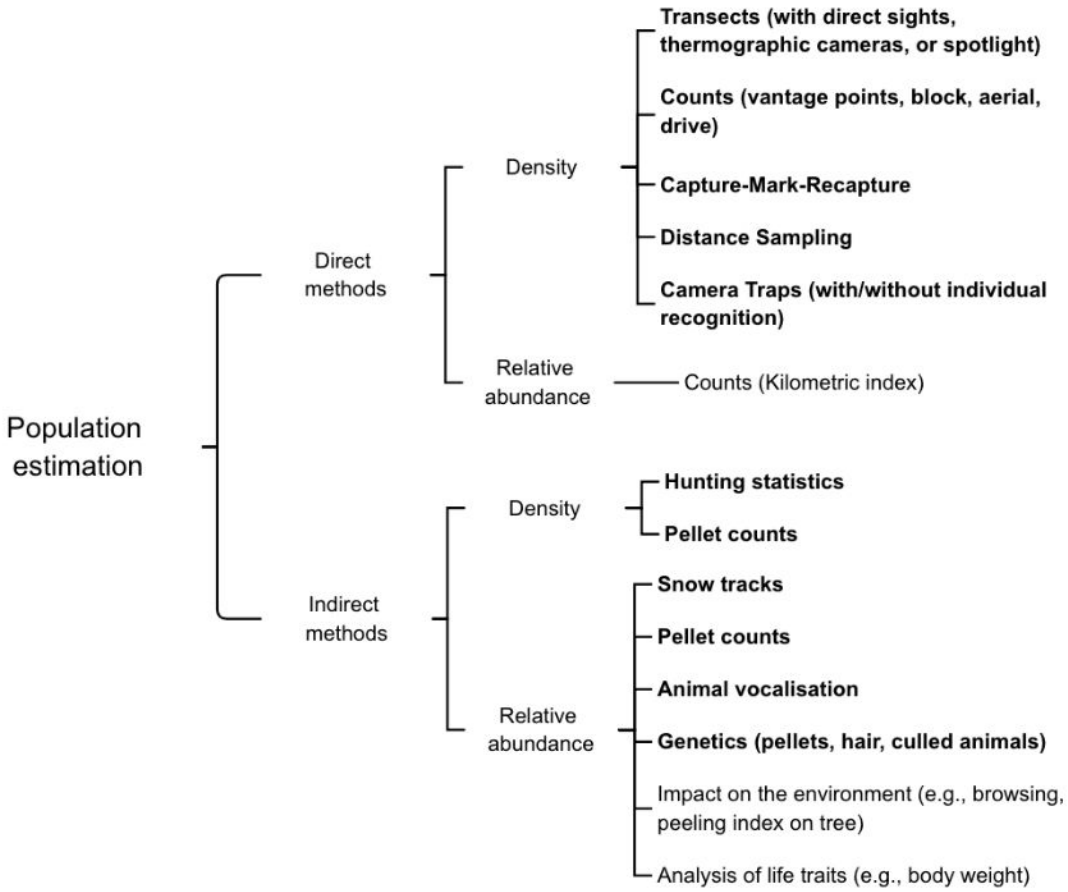

Figure 3. Classification of available methods for estimating of wild mammal population density and relative abundance. Direct methods: methods based on the direct observation of animals, Indirect methods: methods based on the detection of presence signs, see the text for more details (Source: ENETWILD consortium et al, 2019, https://efsa.onlinelibrary.wiley.com/doi/10.2903/sp.efsa.2020.EN-1876).

- A method that gives a density estimate rather than relative abundance, if possible, should be used because they are less suitable for planning the management and conservation of mammal populations.
- Wildlife monitoring must integrate different taxa and ecological variables (integrated monitoring), such as wildlife diseases.

How monitoring wildlife?

- *Proposed questions*

- **The questions** (research, management related) that we are interested in answering determine the scale at which to initially propose the monitoring, the frequency and nature of the samplings, and, therefore, the accuracy and precision that we consider sufficient for our monitoring estimates.

- Normally answering the questions requires multidisciplinary teamworks and monitoring several parameters, such as population and diseases, i.e., the so-called integrated monitoring.

- *Methods*

- Methods to estimate abundance provide accurate (unbiased) and accurate data if the study design is representative and the effort is sufficient.
  (link to guidances and protocols here)
- This is especially true for species with an aggregate pattern of spatial distribution and marked habitat selection.
- On a local scale (e.g., in management units), every method on estimating wild mammal populations has its own advantages, depending on the habitat, the weather conditions and other ecological factors.

- *Sampling design and possible extension of the results*

- A standardized wildlife monitoring network requires selecting sampling locations, which are then used to infer our monitoring results to a larger area, encompassing the population, ecosystem, or range of interest.
- On a large scale, we will be able to obtain information throughout the entire distribution area of a species or carry out samplings in certain populations, for example, stratifying the main sampling regions to monitor species **(Figure 4)**.

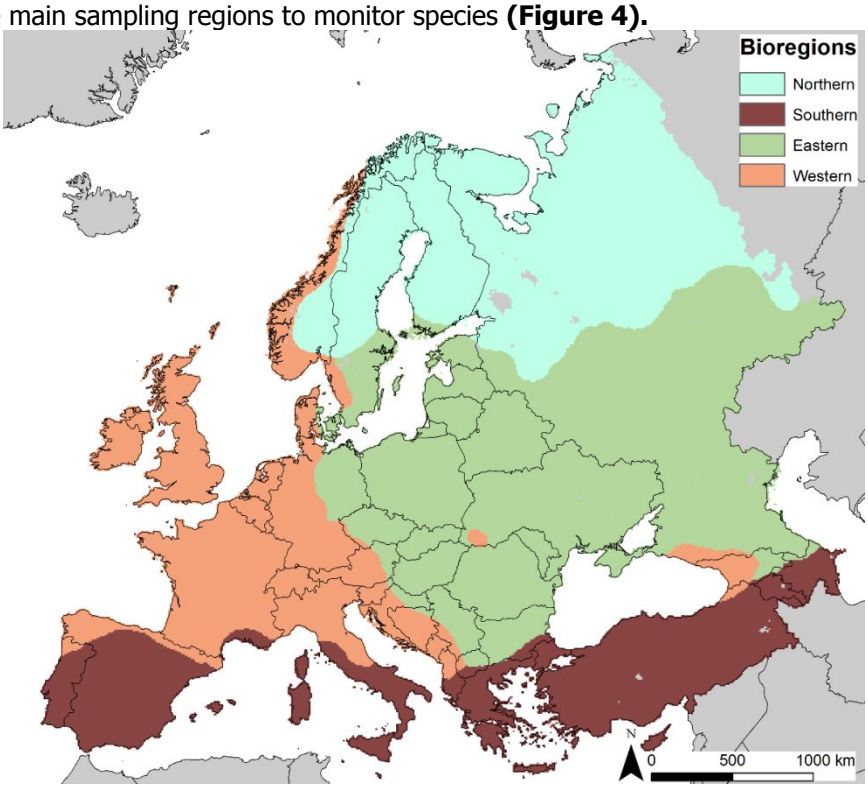

Figure 4. Bioregions proposed for monitoring the abundance of wildlife populations at the European level (ENETWILD 2021, https://www.efsa.europa.eu/en/supporting/pub/en-6825).

- *Team coordination and data storage*

- The way information is collected and recorded by different, often multidisciplinary teamworks, must always follow agreed standards, which will allow us to make comparisons among study areas.

- Data storage and management must ensure that the integrity, traceability, and original quality of the data are maintained.
- The recent development of information technologies has allowed the appearance of APPS of great applied value to facilitate the collection and management of information: the data is digitized from the same field.

2. Section **Wildlife in Europe**

Terrestrial wildlife in Europe

- Of the 11 bioregions defined by the European Environmental Agency, the largest ones are the Continental (large parts of central and eastern Europe) and the Boreal (Baltic and northern Russia), followed by the Mediterranean (the Iberian, Italic and Balcanic peninsulas) and the Atlantic (northern Iberia and central and northern European west coasts) ones. The Alpine bioregion is split into several spots following the main mountain chains.
    - Many small mammal species are poorly studied, and their distribution and ecology are often unknown. Nevertheless, small mammals are extremely important as they provide many ecosystem services and are also increasingly used in ecological and ecotoxicological studies, as indicators, and they play a role for shared diseases.
    - Lagomorphs (hares (*Lepus* spp) and the European wild rabbit (*Oryctolagus cuniculus*) may represent key components of the trophic cascade and have been recently demonstrated to be a maintenance host for vectors and zoonotic vector-borne disease. Generally, rabbits are locally abundant, while hare population trends are generally declining.
    - Among the wild ungulates, the generally widespread red deer, roe deer and wild boar are possibly the most relevant species involved in conflicts in Europe. They are expanding both in geographical range and in number throughout Europe (specially the wild boar).
    - Carnivores are specialized predators with a relevant ecological role inside the trophic cascade. In total there are 35 species ("IUCN Red List of threatened species," 2012) of carnivores in Europe including native and exotic ones. Several wild carnivore species are widely distributed across Europe, whereas the distributions of others are more restricted or associate to certain regions or habitats.
    - Bats, insectivores, and other mammals are relevant for ecosystems (e.g., plant pollination and seed dispersal) and conservation.
    - There are about 700 bird species in Europe, and they represent an enormous biodiversity and recreational value (http://ec.europa.eu/environment/nature/conservation/wildbirds/eu_species/index_en.htm).

European environment under continuous change *and wildlife answer*

- Massive changes in habitat (e.g., rural abandonment) and human population growth have had significant effects on European wildlife communities (Figure 5).

- Land use changes are still going on at a high rate. In the last 60 years however, deforestation has been reverted and forest surface has grown in most if not all European countries.

- Biodiversity loss due to human-mediated habitat change (e.g., due to agriculture intensification) has been more intense in Europe than in other less densely or more recently populated regions of the world (Figure 5).

- All these changes have favoured the population growth of a few successful species, including several carnivores such as the red fox (*Vulpes vulpes*), most ungulates and relatively few

highly adaptable bird species. In general terms, opportunistic species that benefit from anthropogenic habitat change have seized this opportunity.

- Large predators are recovering almost Europe-wide due to a decrease in human persecution driven by widespread rural land abandonment, paralleled by forest cover increase. By contrast, specialist species and lowland species which are more susceptible to modern agriculture and habitat loss are in general terms declining.

- Driven by the changes in habitat and animal populations, as well as in human behaviour, there is an emergence or re-emergence of infections shared between wildlife and livestock, and considering that some of them are zoonotic, an increased impact of wildlife health on human health.

- Linked with this spatial change also the human dimension has greatly changed with a move from the "rural approach" that consider animal as useful or pest, towards a conservationist approach and in the last decades with some fringe that shown an animalist approach.

- In most European countries, the number of hunters is declining, and this can pose a problem in the control of some opportunistic species such as wild boar.

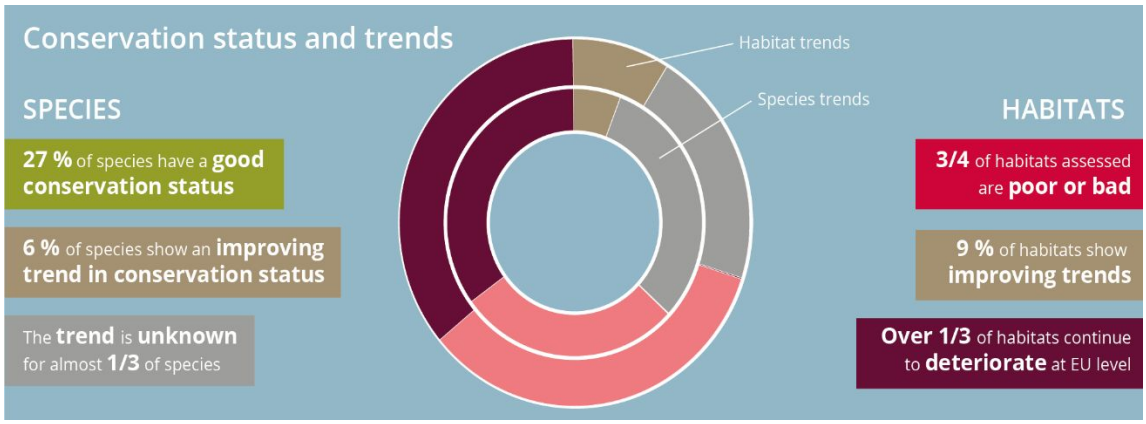

Figure 5. Biodiversity loss due to human-mediated habitat change (e.g., due to agriculture intensification) has been more intense in Europe than in other less densely or more recently populated regions of the world.

The European Union (EU) protects 1 389 animal and plant species and 233 habitat types. Our latest assessment shows that habitats and species protected under the EU Habitats Directive have a predominantly unfavourable conservation status at 81 % for habitats and 63 % for species. EU Member States report on the conservation status and trends in species and habitats within each biogeographical and marine region every six years under the EU Habitats Directive. Additionally, such reporting collects comprehensive data on pressures and threats, conservation measures and the role of Natura 2000 sites. This information is then used to assess the implementation of the Directive and the progress in implementing the EU Biodiversity Strategy (https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030_en). Only 15 % of habitats and around 27 % of species have a good conservation status (source: EEA, https://www.eea.europa.eu/themes/biodiversity/state-of-nature-in-the-eu/habitats-and-species-latest-status).

The disease at the interface with wildlife in Europe: One Health perspective

- Shared diseases have a strong impact on the European economy, with implications beyond the wildlife and livestock sectors.
- More and more, interventions at the wildlife-livestock interface will require prior negotiations and involvement of stakeholders from the livestock sector, the hunting scene, and the more open-minded conservation NGOs as animalists fringe are unlikely to enter any agreement. For that, wildlife monitoring data is essential.
- We are facing a new era where the rewilding of many lands, with the consequent increase in many wild species, will cope with a more fragmented landscape with an increment of suburban areas that will boost the overlapping of wild and domestic animals and of animals and humans also for pathogen transmission.
- Land use and climatic changes are reshaping also vectors distribution and abundance such as sandflies and ticks.
- To face the challenge represented by this complex network between local and global chances, wild and domestic animals, vector and pathogen and human activities, wildlife medicine will move from the small circle of adept and embrace clearly the One Health approach, but moreover that wildlife diseases issue must be fully embedded in policy maker decisions.
- Risk assessment for pathogens of interest for humans and livestock requires the availability of presence and abundance data on wildlife which can represent reservoirs for pathogens.

3. Section **Our approach**

- "The term 'Observatory' was chosen to stress the purpose of building a the fact that the European Observatory of Wildlife (EOW) pretended role is gaining a general and reliable view on the status and trends of European wildlife populations.

- In the mid/long-term the observatory will provide access to a broad collection of harmonized comparable data on wildlife, analyses and forecasting population abundance and distribution patterns.

- A network of "observation points" is its essential core, with common population estimation protocols and data collection standards to facilitate harmonization and interoperability.

- Integrated monitoring wildlife (population and diseases) requires MULTIDISCIPLINARY TEAMWORKS, with different managers in the different phases of the process.

- Rather than focusing on the mere number of individuals in a population, long-term monitoring programs should provide information on its trends, habitat requirements, the impacts of anthropogenic activities, and the damages that species caused to agriculture and forestry.

- The aims and approach of the EOW is as displayed in the Figures 6, 7 and 8 below.

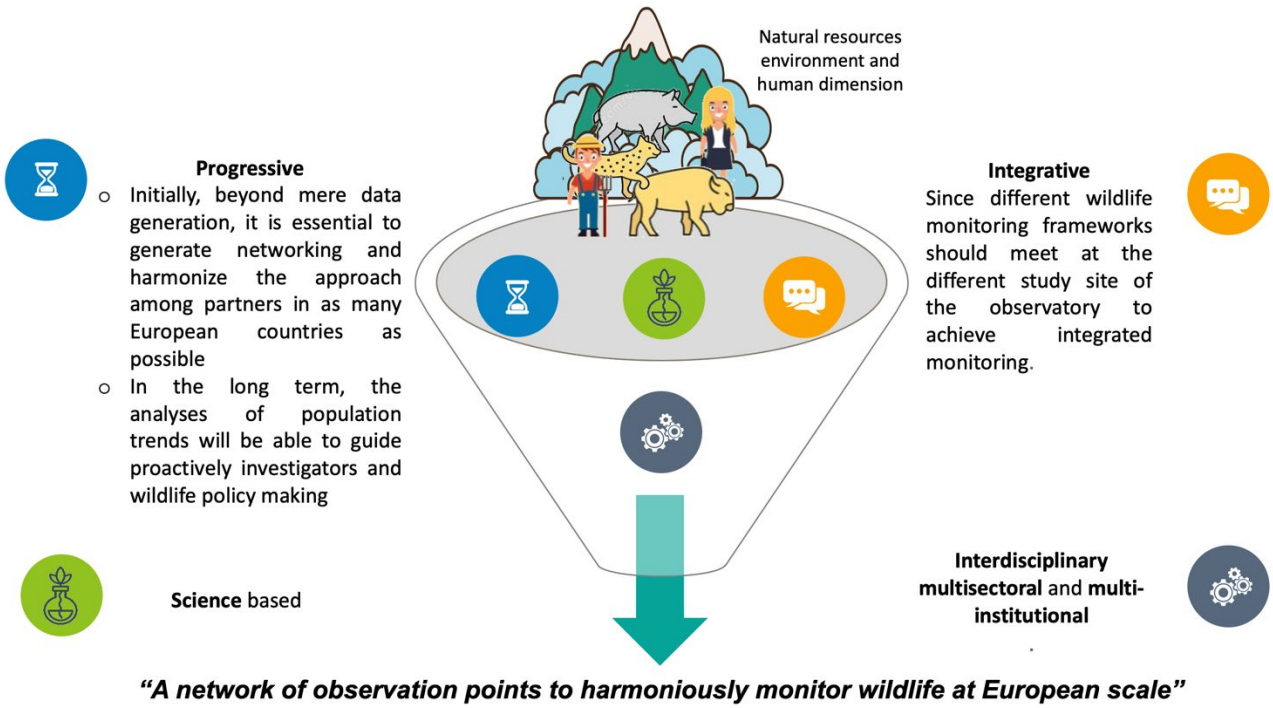

Figure 6. The expected outcome of the EOW.

- **Main aims**

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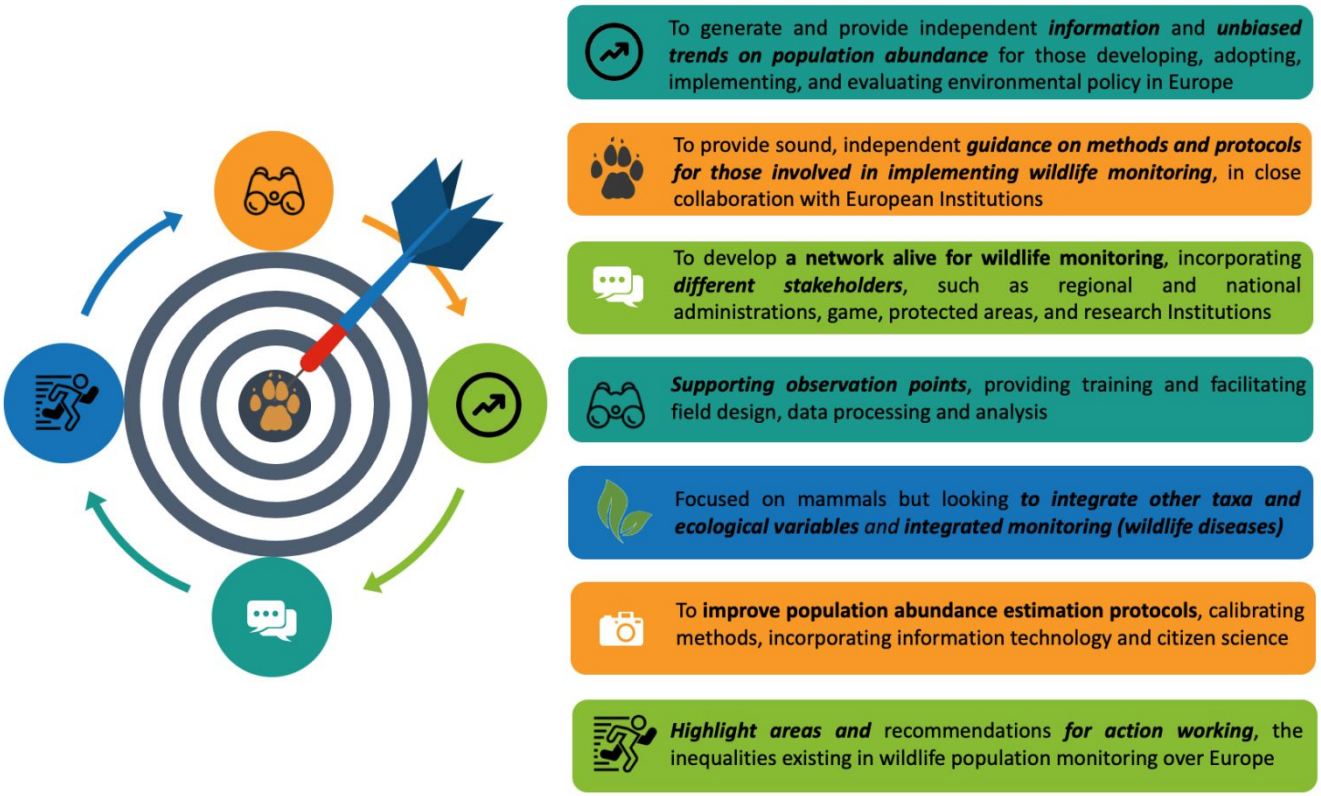

- **Figure 7.** Main aims of the European Observatory of Wildlife.

- **How:**

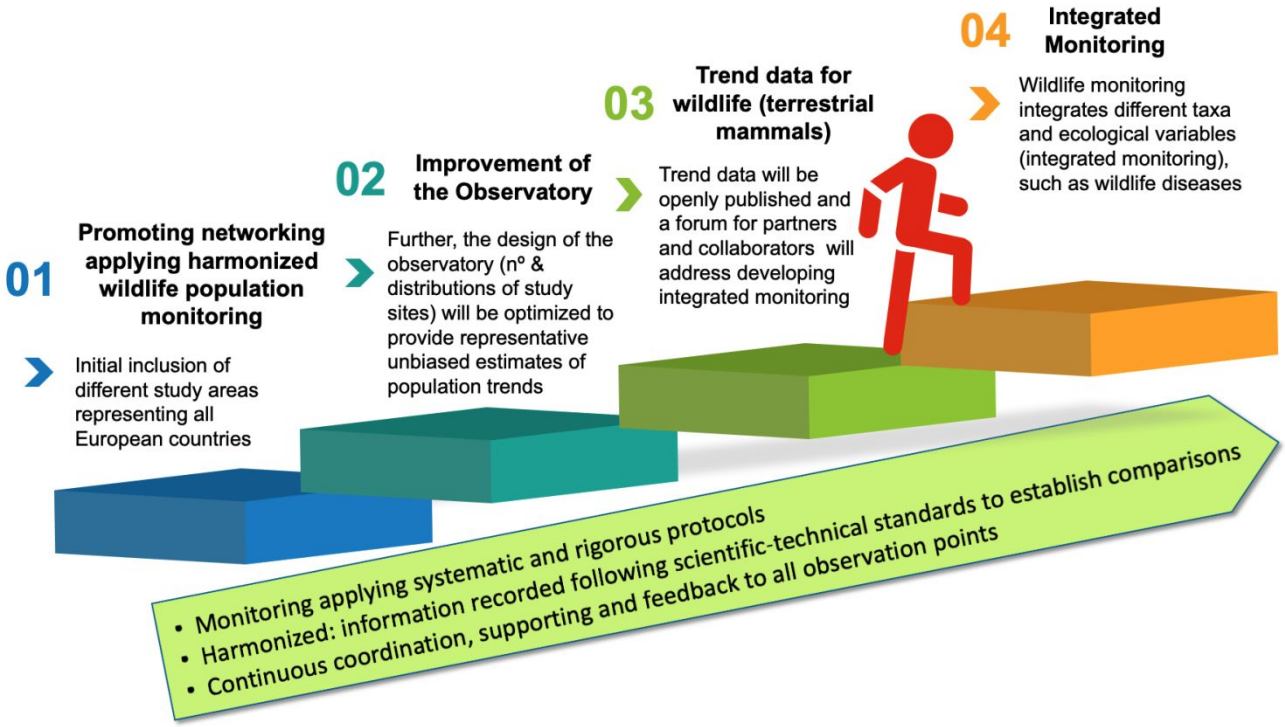

Figure 8. General approach of the European Observatory of Wildlife.

Initially (Figure 8), the EOW is born prioritizing the initial inclusion of different study areas representing all European countries. Initially, beyond the population data generated by the observation points, it is key to promote networking applying harmonized wildlife population monitoring at European level, as a pilot experience. Further, the design of the observatory (number and distributions of study sites) will be optimized to provide representative unbiased estimates of population trends.

4. Section *The European Observatory of Wildlife* (*EOW*)

Map viewer

The Figure 9 shows the interactive maps displaying the study sites of the EOW and associated information.

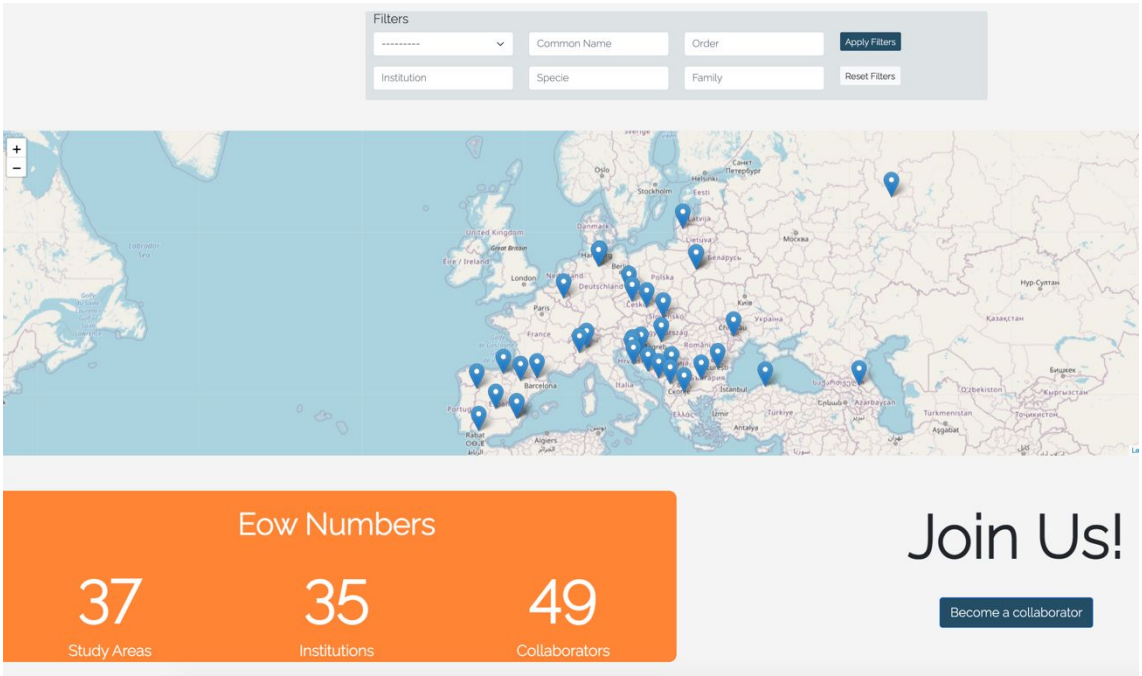

Figure 9. Interactive maps displaying the study sites of the EOW and associated information.

5. Section **Engage and register**

Register (link to register system)

Become a member of the Observatory

- The EOW is a collaborative initiative **opened to professionals, researchers, administrations (from local to European), NGOs**, etc. (referred to as collaborators), willing to contribute by providing at least one observation point for wildlife (terrestrial mammal) monitoring.

- How to **become a collaborator**
    - First, register in the project. This will allow you to be informed of the activities of the EOW
    - For further involvement, fill the application form you will receive after registration to provide one or more observation points to the EOW (links to sheets)
    - We will contact you soon for further details

- **The CONDITIONS of this collaboration** are detailed in an "Agreement" document (link to the document here). To summarize:

- The EOW provides to collaborators:
  - Resources in form of camera traps in case of need by the collaborator and availability by the project
  - Online training
  - Protocols to estimate wildlife density based on camera trapping without need of capture/recapture. Other density estimation methods can be validated according to ENETWILD guidances (link here)
  - Continuous assessment on study design, implementation in the field, data processing and analysis
  - Update on new developments of methods so as new tools for data processing and analysis. We expect information technology tools, including artificial intelligence for image processing, and a friendly to use online module for data analysis, to be available by 2022
  - Participation in networking activities, such as conferences and webinars
  - Access and participation in reports and publications

- The COLLABORATORS contribute to the EOW:
  - Providing details of the study area (link to sheet, see "collaborator space" section)
  - Implementing the field protocol in the study area
  - Processing and analyzing data following the indications of the project
  - Reporting to their activities (link to sheet, see "collaborator space" section)

*We all benefit from a **collaborative approach***

- The benefits of collaborators are also those of the whole community and stakeholders that monitor, conserve, and manage wildlife in Europe, and of course, European society

- The work and contribution of collaborators will be done in a framework where data will be comparable, interoperable, and openly accessed at European level

- Continuous networking will allow continuous on live exchange of experiences and optimization of efforts; contribute and benefit!

- Possibility of access to resources to implement a field study in the incorporated observation points/s and data analysis, if collaborators are short of them

- Continuous training, support, and assessment at any stage of the process of wildlife monitoring (density estimation): study design, implementation in the field, data processing and analysis

- Access to updated protocols to estimate wildlife density. The project continuously updates protocols (making them more practical) as new developments of methods come, so as will provide new tools for data processing and analysis. We expect information technology tools, including artificial intelligence for image processing, and a friendly to use online module for data analysis, to be available by 2022

- Access to population dynamics parameters of wildlife over their distribution range in Europe, collected by the project, of utility to model population dynamics of species, or for instance, disease dynamics. We start with the wild boar (link)

- Collaborators will be in the forefront of wildlife monitoring at international level: participate in networking activities, such as conferences and webinars; and be part of reports and publications

Newsletter

This space is to put our newsletters, first will be the letter of invitation. Links to ENETWILD and *MammalNet* newsletter will be also place here.

6. Section **Guidance**

- **Guidances**
    - Original guidances on population abundance estimations by ENETWILD
        - Wild boar
        - Wild ruminant
        - Carnivores
        - Etc
    - Friendly cards organized by methods (for density)
- **Protocols**
    - Camera trapping
    - Distance sampling
    - Driven counts
- **Population dynamics parameters**
- **External links**

7. Section **International wildlife monitoring, news, and publications**

- Other monitoring framework, projects, and initiatives
    - GBIF
    - EuropaBon
    - EFSA
    - Other European administrations: DGs environment, EEA, EASIN, DG Agro ….
    - Citizen science
    - International organizations and wild bird monitoring
    - One health: PREZODE, etc.
- Relevant publications

- News

8. Section **Collaborator space**

- Link to register
- Monitoring systems
- Access to guidances (link to above section)
- Access to protocols (link to above section)
- Access to population dynamics parameters
- Access to agreement and reporting forms (link to above section)
- Chat for open discussions
- ¿Anything else?

9. Section **About ENETWILD**

ENETWILD, a network providing reliable data on distribution and abundance of wildlife

- Many European countries and organizations collect spatial data on distribution and abundance of wildlife, but each one has its own specific characteristics with respect to the methodology used, the type of data acquired, the repository implemented and their accessibility.
- the **European Food Safety Authority (EFSA)** funds ENETWILD (www.enetwild.com) project to collect comparable data at European level to analyse risks of diseases shared between wildlife, livestock, and humans; data that are also essential in conservation and wildlife management.
- This project attempts to improve the European capacities for monitoring of wildlife population, developing standards for data collection, validation and, finally, create and promote a data repository.
- The harmonisation of European data framework for wildlife (distribution and abundance) is a key milestone since it opens the space to aggregate these data from the whole Europe.
- Initially (see Figure 10) ENETWILD developed standards for presence/abundance data of the required species under the criteria of being effective for filtering data by quality as needed to produce high-quality maps and models, and compatible with existing biodiversity data collection systems in order to guarantee inter-operability between them, thus widening the possible use of such data within a global framework of wildlife monitoring (https://efsa.onlinelibrary.wiley.com/doi/10.2903/sp.efsa.2020.EN-18419).

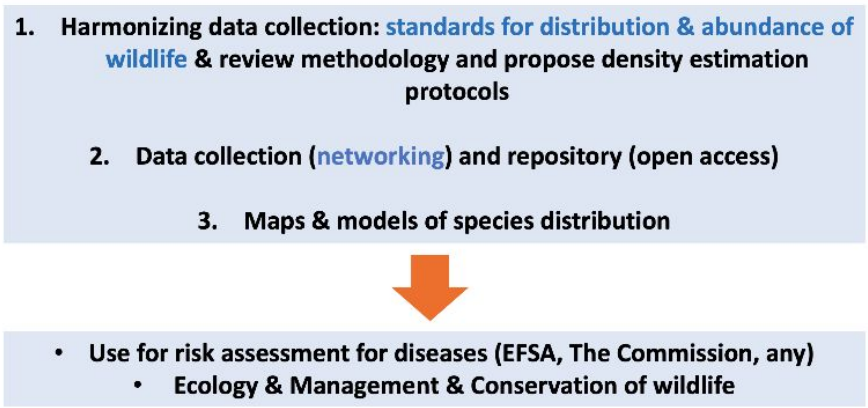

Figure 10. General appporach of ENETWILD project.

ENETWILD (www.enetwild.com) approach to harmonize data collection on wildlife species at the European level (link to ENETWILD 2020).

- On a large spatial scale collected data are available, and comparable across Europe for use in the predictive spatial modelling of wildlife.
- Finally, the organisation and collection of wildlife population data and their analysis is essential for research, risk assessment and developing wildlife policies (conservation, conflict management)
- As illustrative (see Figure 11), the sources of hunting statistics are lacking are not harmonised across Europe, as well as incomplete, dispersed and difficult to compare. A feasible effort is needed to achieve harmonisation of data in a short time for the most basic statistics at the hunting ground level, and the coordination of the collection of hunting statistics must be achieved first at national and then at European level.

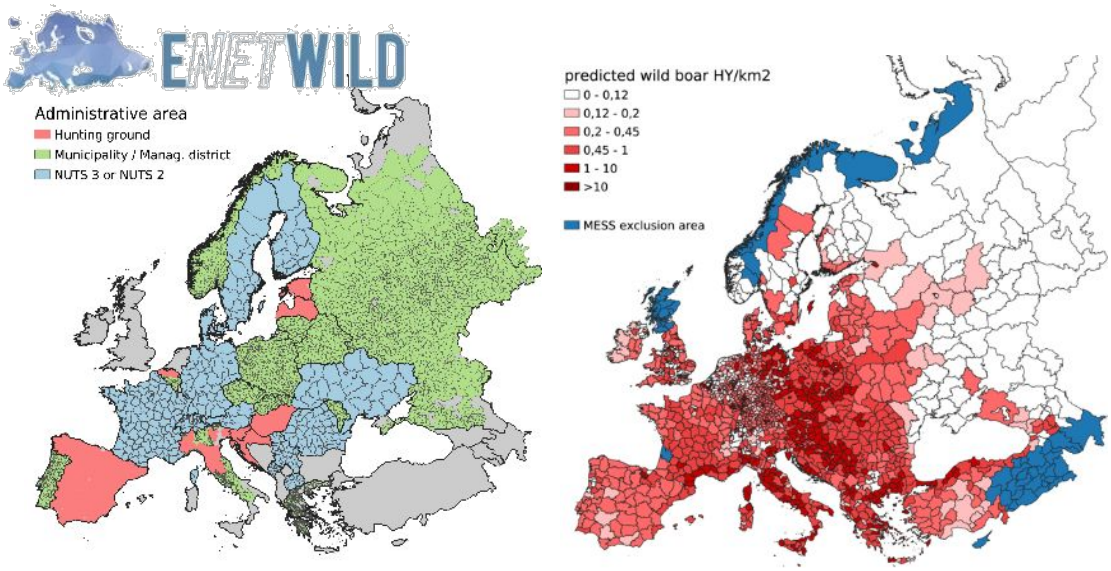

Figure 11 Top: Spatial distribution and resolution of hunting bags data collected for wild boar by ENETWILD (Sep 2021). Bottom: output of wild boar spatial model for abundance (hunting yield by km^2, https://enetwild.com/reports-docs/).
FIGURE ZZZ…..

Composition of the consortium

The Figure 12 shows the logos of ENETWILD partner Institutions.

Figure 12. Logos of ENETWILD partners.

4. Status of field trial by country

The Table 2 summarizes the list participants and populations under study, Figure 1 displays examples of CT placements, and the Table 3 shows the of the study sites and their main carachteristics. A total of 35 field sites have already been identified among 22 different countries so far, however the overall number of study sites is going to be at least 40 among 30 countries as we are currently negotiating agreements with some representatives from new countries.

Table 2: Participants (network of collaborators) estimating wild boar density in specific populations form their respective countries.

Name	Email	Institution	Country	Region
Bledi Hoxha	bledihoxha@ppnea.org	Protection and Preservation of Natural Environment in Albania (PPNEA)	Albania	SE
Jordi Solá de la Torre	jordi_sola@govern.ad	Department of the Environment and Sustainability - Government of Andorra.	Andorra	SW
Marine Arakelyan	arakelyanmarine@gmail.com	Yerevan State University	Armenia	SE
Jim Casaer	jim.casaer@inbo.be	Research Institute for Wildlife and Forest	Belgium	NW
Dragan Gacic	dragan.gacic@sfb.bg.ac.rs	University of Belgrade - Faculty of Forest Sciences	Bosnia and Herzegovina	SE
Stoyan Stoyanov	stoyans@abv.bg	University of Forestry, Sofia	Bulgaria	SE
Nikica Sprem	nikica.sprem@gmail.com	Faculty of Agriculture, University of Zagreb	Croatia	SE
Radim Plhal	r.plhal@seznam.cz	Mendel University in Brno	Czech Republic	NW
Alexander Gavashelishvili	aleksandre.gavashelishvili@iliauni.edu.ge	Ilia State University	Georgia	SW
Oliver Keuling	oliver.keuling@tiho-hannover.de	Institute for Terrestrial and Aquatic Wildlife Research- ITAW	Germany	NW
Alexios Giannakopoulos	alexiosg@yahoo.gr	Faculty of Veterinary Science	Greece	SE
Sandor Csanyi	s.csanyi@vadbiologus.net; s.csanyi@gmail.com	Szent István University	Hungary	SE
Ezio Ferroglio	ezio.ferroglio@unito.it	Piedmont Forets Service	Italy	SE
Olgirda Belova	olgirda.belova@lammc.lt	Lithuanian Research Centre	Lithuania	NE

		for Agriculture and Forestry		
Victoria Nistreanu	vicnistreanu@gmail.com	Institute of Zoology, Moldova	Moldova	SE
Marina Djurovic	marina.djurovic84@gmail.com	Public Enterprise for National Parks of Montenegro	Montenegro	SW
Patrick Jansen	patrick.jansen@wur.nl	Wageningen University and Research	Netherlands	NW
Lidija Fajdiga	lidija.fajdiga@gmail.com	Hunting Federation of Macedonia (HFM)	North Macedonia	SE
Tomasz Podgorsky, Kamila Plis	t_podgorski@ibs.bialowieza.pl; kplis@ibs.bialowieza.pl	Mammal Research Institute (MRI)	Poland P	NE
Joao Santos	joaosantos@palombar.pt; contabilidade.palombar@gmail.com	Palombar - Conservation of Nature and Rural Heritage	Portugal	SW
Dragan Gacic	dragan.gacic@sfb.bg.ac.rs	University of Belgrade - Faculty of Forest Sciences	Serbia	SE
Jozef Bučko (goverment)	jozef.bucko@nlcsk.org	National Forest Centre	Slovakia	SE
Bostjan Pockorny	bostjan.pokorny@gmail.com	Ecotoxicology-University of Primorska	Slovenia	SW
Lars Hillström	lhm@hig.se	University of Gävle	Sweden	NE
Alper Erturk, Anil Soyumert	erturk@kastamonu.edu.tr; soyumert@gmail.com	University of Kastamonu	Turkey	SE

Table 3: List of the study sites (still not complete as some still have to be identified/communicated). All those listed in the table are already visible on the EOW website (https://eow.wildlifeobservatory.org/), the complete list is going to count at least 40 sites.

Country	Name study site	Adminstrative figure	Area (ha)	Start of monitoring	Habitat	Big animals
Albania	Çajupi Mountain(Gjirokastra region)	Protected Area	24447	2021	Mixed broad-leaved forest	Roe deer, wild boar, wolf and brown bear, chamois
Andorra	Vedat de caça de la Vall de Ransol	Hunting Reserve	2813	2022	Aciculifolia forests, Pinus sylvestris and Pinus uncinata scattered with moors, pastures and other low scrub in the middle and high mountains.	Roe deer, wild boar, pyrenean chamois, mouflon, brown bear (very occasionally)
Belgium	Marche-en-Famenne	Military camp	2500	2022	Quecus + Carpinus betulus, scattered with meadows	Red deer, Roe deer, wild boar
Bosnia and Herzegovina	Romanija	Public estate (forest management company)	6000	2022	Mountain mixed forests, mainly *Abies alba* and *Picea abies*, scattered with pastures	Roe deer, wild boar, wolf, brown bear
Bulgaria	Voden-Iri Hisar	Hunting ground (State hunting ranch)	8000	Data collected in Nov-Jan (2020-2021)	Broad-leaved mixed oak forest in lowlands, the most suitable for wild boars, surrounded by arable land	Red deer, fallow deer, roe deer, wild boar
Bulgaria	Panagyurishte	Hunting ground	3600	Data collected in mid July - mid September (2021)	Beach and spruce forests in mountain area, 1000-1500 m a.s.l.	Roe deer, wild boar
Croatia	Biokovo	Hunting ground	20000	2020	Mediterranean: mountain rises vertically from the Adriatic Coast. The upper border of hornbeam on the mainland side comes into contact with beech (Fagus sylvatica) and fir (Abies alba). On the coastal side, the pine forest is expanding as a pioneer species.	Balkan chamois, European mouflon, wild boar and wolf

Croatia	Prolom	Hunting ground	7700	2019	Mixed broad-leaved forest (~ 60 %) with graslands (~10 %) and shrubs (~30%)	Wild boar, red deer, roe deer, fallow dear, wolf
Croatia	Rab island	Hunting ground	1611	2021	Scrublands and woodlands of Euro-Mediterranean vegetation	European mouflon, axis deer
Croatia	Dugi Otik island	Hunting ground	2500	2022	46% of habitat is covered in woods, 37% of habitat is covered with grass and small bushes, 9% of the habitat is scrubland, 5% are agriculture areas and 3% of the habitat is coast (rocks without vegetation)	mouflon, axis deer, feral goat and sheep
Croatia	Senj	Hunting ground	3548	2022	47% of habitat is covered with small bushes and grass, 43% is without vegetation cover and 10% is covered with forest	Roe deer, wild boar, red deer, european mouflon, brown bear, eurasian lynx, gray wolf, golden jackal
Czech Rep.	Niva	Hunting ground	2000	2018	mainly coniferous forest, surrounded by open land	wild boar, red deer, roe deer, fallow deer
Czech Rep.	The Bohemian Switzerland National Park	National Park	8000	2021	mainly coniferous forest strongly affected by the bark beetle calamity	red deer, roe deer, wild boar, chamois, wolf, lynx
Czech Rep.	Kostelec nad Cernymi Lesy	University forest, hunting unit	7000	2019	mixed and coniferous forest, surrounded by crop fields	wild boar, red deer, roe deer, fallow deer
Georgia	Lagodekhi National Park	National Park	24450	2022	Highly rugged terrain covered with mesic temperate broad-leaved forests, sub-alpine vegetation, alpine meadows and sub-nival tops.	Red deer, roe deer, wild boar, chamois, East Caucasian tur, bezoar goat, brown

						bear, wolf, lynx, leopard (possible)
Germany	Alt Oerrel	2 hunted forestry office grounds, Forestry Office of Oerrel, Niedersächsische Landesforsten	4130	2020	mixed forest, dominated by pine, spruce and oak, surrounded by arable land	wild boar, red deer, roe deer, wolf
Germany	Süsing	2 hunted forestry office grounds	2720	2021	mixed forest, dominated by pine, spruce and oak, surrounded by arable land	wild boar, red deer, roe deer, wolf
Hungary	Gemenc	State forestry	20000	2022	Floodplain forests, mainly *Quercus robur*, Fraxinus spp., Populus spp. and Salix spp., scattered with some meadows and minimal arable plots	Red deer, wild boar, golden jackal
Italy	La Mandria	Regional Park, Protected area	1604	2020	Broad-leaved foresrt dominated by oaks, mainly Farnia, and common hornbeam	Roe deer, wild boar, red deer, fallow deer, wolf
Italy	CACN1	Hunting ground	34851	2021	From broadleaved and coniferous forest to alpine meadows	Roe deer, alpine chamois, alpine ibex, red deer, wolf, wild boar
Lithuania	MMMPV	National Park	5646	2022	Mixed spruce forests, mainly Norway spruce (47%), Scots pine (26%), birch (13%), ader (4.4%), oak (4.1) including BAST habitats of Western taiga, broadleaves mixed, Fennoscandian herb-rich forests with *Picea abies* scattered with meadows, grasslands, swamps	

Moldova	Forest-Hunting enterprize "Sil-Razeni"	Hunting Reserve	7373,7	2022 (oct-2020 independently)	Central-European forest, with dominance of Quercur petraea, Q. robur, Fraxinus excelsior, Carpinus betulus, scattered with farming and arable land	Roe deer, wild boar
Montenegro	Orjen Mountain	Grahovo hunting society property	6000	2022	There are various vegetation types,from macchia to the slopes of Bosnian pine, karstic medows, which continue to mainly *Fagus sylvatica* forests *and Pinus heldreichii* on peaks	Roe deer, wild boar, wolf, brown bear,chamois
North Macedonia	Mrezicko	Hunting ground	2500	2021	Forest, Pine *(Pinus)*, Fir (*Abies)* and Beech (*Fagus sylvatica*	Roe deer; Chamois*;* Bear *;*Wild boar, wolf
Poland	Białowieża Forest	State Forests Holding	2947	2022	temperate lowland deciduous and mixed forest	Roe deer, red deer, moose, wild boar, european bison, wolf, lynx
Portugal	ZCA Santulhão	Associative Hunting Area	2948	2021	Mainly Mediterranean shrubland and forests, fragmented with farming and arable land. Also patches of coniferous and deciduous forest and semi-natural meadows	Roe deer, red deer, wild boar, wolf
Serbia	Studenica	Hunting ground	11000	2022	Mountain forests, mainly *Fagus sylvatica*, scattered with pastures and farming	Roe deer, red deer, wild boar, wolf, brown bear
Slovakia	central Slovakia	State organization	10000	2022	Mixed forest spruce, beech, oak	Roe deer, roe deer, falow deer, wild boar, bear, wolf, lynx, wild cat
Slovenia	Rižana (Primorsko HMD)	Hunting ground	3657	2022	Sub-meditteranean forests, mainly different associations with *Quercus*	Wild boar, roe deer, red deer

					ssp., scattered with farming and arable land	
Spain	Parque Natural Sierra del Carche	Regional Park, Protected area	5942	2021	Mediterranen forst, mainly Pinus halepensis	Wild boar, rare Barbary sheep and Iberian ibex
Spain	Riglos (Huesca)	Riglos Hunting ground	2500	2021	Transition Mediterranean to Atlantic forest	Roe deer, wild boar
Spain	Amudio (Araba)	Lezama Hunting ground	6000	2020	Atlantic forests, aminly Fagus sylvatica, scattered with farming and arable land	Roe deer, wild boar
Turkey	Kartdag Wildlife Reserve	Protected Area	> 10000	2021	Mixed broad-leaved forest	Brown bear, red deer, wild boar, roe deer, wolf

Figure 13: Examples of CT placements in different study sites: (1) Croatia, (2) Poland, (3) North Macedonia, (4) Bulgaria, and (5) Portugal.

The Figure 13 shows examples of CT placements in different study sites: (1) Croatia, (2) Poland, (3) North Macedonia, (4) Bulgaria, and (5) Portugal.

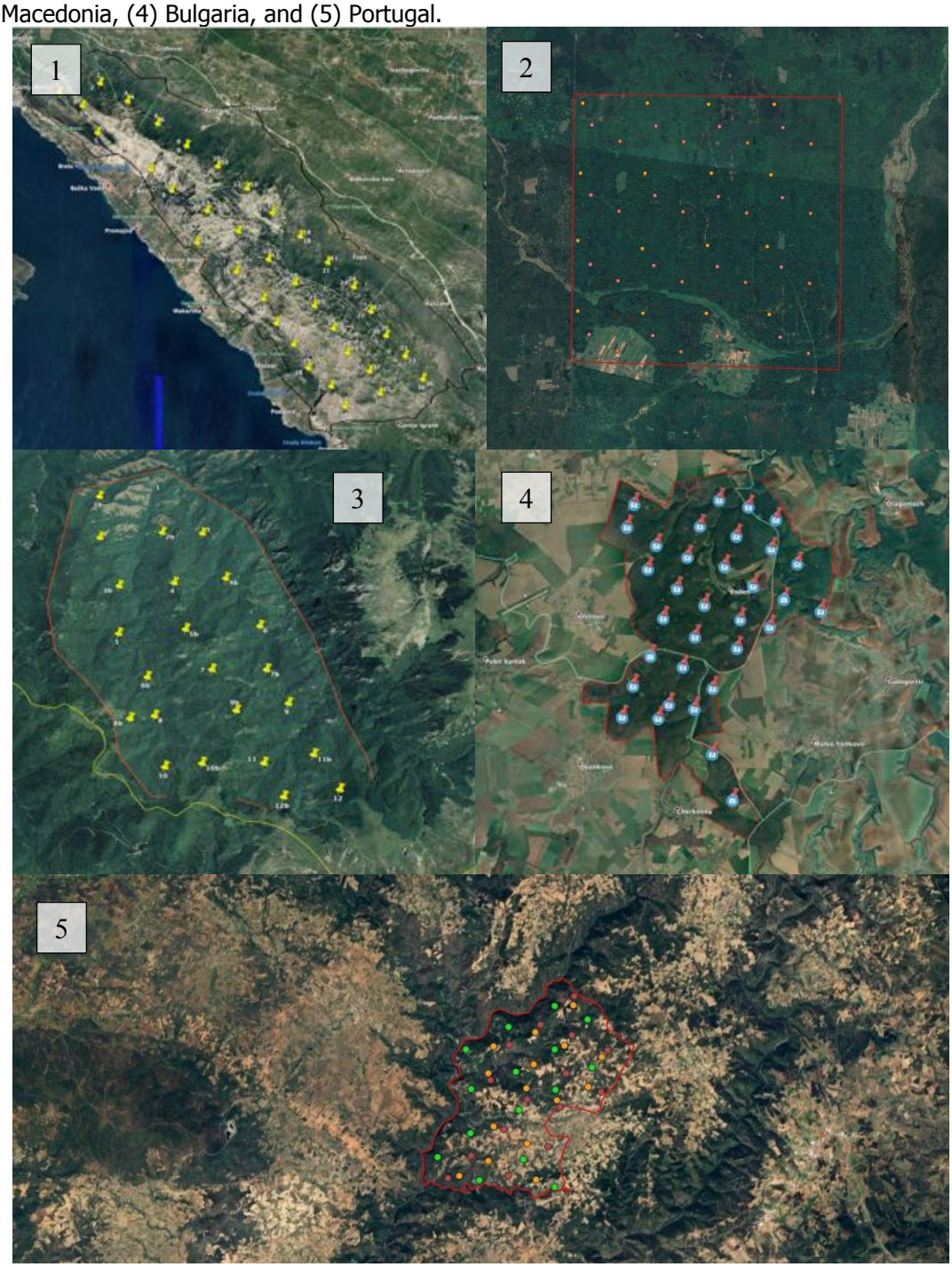

Figure 13: Examples of CT placements in different study sites: (1) Croatia, (2) Poland, (3) North Macedonia, (4) Bulgaria, and (5) Portugal.

3. Conclusions and next steps

By now, 35 field studies are already registered but some still have to be identified/communicated (see table 2) and at least 40 are expected to be operative in the next months. The study design of each study site is currently been defined in collaboration with the EOW experts and CTs have already been shipped to each collaborator. In the next few months the field activities are going to be implemented in each study site with the constant support of the EOW team.

In September 2022, ENETWILD is organizing an online training course to participants, so they will be trained specifically on data processing, use of artificial intelligence tools (implemented in online app AGOUTI, https://www.agouti.eu/) and specific apps. This strategy aims promoting a network of professionals/researchers capable of designing, developing field work and analysing data by their own, contributing also to disseminate their experience and train other colleagues in their respective countries.

4. References

ENETWILD Consortium, Keuling O, Sange M, Acevedo P, Podgorski T, Smith G, Scandura M, Apollonio M, Ferroglio E, Body G, Vicente J, 2018. Guidance on estimation of wild boar population abundance and density: methods, challenges, possibilities. EFSA supporting publication 2018:EN-1449. 48 pp. doi:10.2903/sp.efsa.2018.EN-1449.

ENETWILD Consortium, Acevedo P, Aleksovski V, ApollonioM, Berdión O, Blanco-Aguiar JA, del Rio L, Ertürk A, Fajdiga L, Escribano F, Ferroglio E, GruychevG, Gutiérrez I, Häberlein V, Hoxha B, Kavčić K, Keuling O, Martínez-Carrasco C, Palencia P, Pereira P, Plhal R, Plis K, Podgórski T,Ruiz C,Scandura M, Santos J, Sereno J, Sergeyev A, Shakun V, Soriguer R, Soyumert A, Sprem N, Stoyanov S, Smith GC, Trajçe A Urbani N, Zanet S and Vicente J, 2022a. Wild boar density data generated by camera trapping in nineteen European areas.EFSA supporting publication 2022:EN-7214. 21pp. doi:10.2903/sp.efsa.2022.EN-7214.

ENETWILD Consortium, Blanco-Aguiar JA, Smith GC, Vicente J, 2022b. Update on the development of an app (adaptation of *iMammalia*) for early reporting of wild boar carcasses with a warning system 2022:EN-7192. 36pp. doi:10.2903/sp.efsa.2022.EN-7192

5. Annexes

Annex 1. Instructions for the placement of camera traps and calculation of density of medium to big size mammals - June 2022

This annex presents basic instructions to estimate the density of wild boar through the use of camera traps (CTs). Since different methods are available, we will focus on a practical one that is capable of generating reliable data in a wide range of situations (and species) throughout Europe. The random encounter (REM) model does not require individual recognition. However, it is necessary to collect certain information to determine the speed of movement (average daily movement range) of the wild boar. Therefore, it is necessary to place marks or stakes at a distance from the CTs that serves as a guide to subsequently mark the path followed by each animal, as indicated below. These instructions also apply to REST and Distance sampling methods.

During 2022 the European Observatory of Wildlife (EOW, https://wildlifeobservatory.org) will implement the use of artifical intellence to already available online tools (Agouti, https://www.agouti.eu) to authomatically process and analize images. Since 2022 is a transitional year, from manual processing (e. g.; see (https://efsa.onlinelibrary.wiley.com/doi/abs/10.2903/sp.efsa.2021.EN-6771) to authomatic image processing, this field protocol is compatible with both approaches.

General

- The work should be developed during summer/early autumn, with the CTs placed for a minimum of 60 days.
- They will be placed (registering the geographical coordinates) following a regular uniform distribution as a grid with a minimum of 36 CT placements. The separation between CTs will be approx. 1.5 km. The exact location can be within a diameter of fewer than 100m around the points of the grid. If the number of CTs available is not enough to sample the 36 placements at the same time, the CTs should be moved during the experiment to cover a minimum of 36 locations. For instance 12 CTs moved twice (every 3 weeks), which fits a study area of approximately 2500-3000 has. In case the number of CTs is 15, the final sampling will be 45 CT placements.
- However in case the study area is bigger, the distances between camera traps can be larger that 1.5 km, and if possibe, it is recomened placing more camera sites.
- The grid must cover at least one patch beaten for hunting big game during the hunting season, if possible more; or several grids for several patches. This is not compulsory (there are study sites of the EOW where hunting is not practiced)
- Place stakes in 2.5m intervals (Figure). Connecting the stakes with signalling tape helps to better visualize distances (Fig C). Finally, ensure that a photograph is taken from the CT where these stakes are evident. Take also one picture with yor movile device from standing position. These two pictures will later help to position animals observed in the pictures. Put natural marks (stones, branches…) before remove the stakes for later identification of the path of the animals photographed (Figure D)
- The CT will be placed on poles or vegetation 50cm above the ground.
- The CT is configured with the operation of 24 hours per day and to take up to three consecutive images (the maximum number possible), with the minimum waiting time (0 sec. if possible) between activations. Use medium sensitivity. If the time lapse between consecutive photos of the same burst is high (>2-3 sec.), video mode is recommended.
- The flash intensity should be set at medium (if possible) to avoid "overexposed photos".
- Check that the date and time are correctly set, and that they are printed automatically on each image.

- The CT should be reviewed at least in half of the study period (ideally once a month) to check its functioning and placement. Normally it will not be necessary to change the batteries and the memory cards, since the CTs are placed at random points and high wildlife activity is not expected.
- Choose a field of vision of the CT that is cleared of vegetation (it is not necessary to be totally clean, but that allows the detection of any wild boar that passes within the first 5 m), being better a north orientation.
- A form must be filled in, collecting the information of each CT during its placement (see below). All the information that is subsequently extracted must keep the traceability of the CT (mark the source camera of each memory card extracted, and keep this nomenclature in the folders that are created on the computer to archive the images). Shortly, Enetwild will provide an app based on *Smart* which will be usefull to collect this information in the filed.

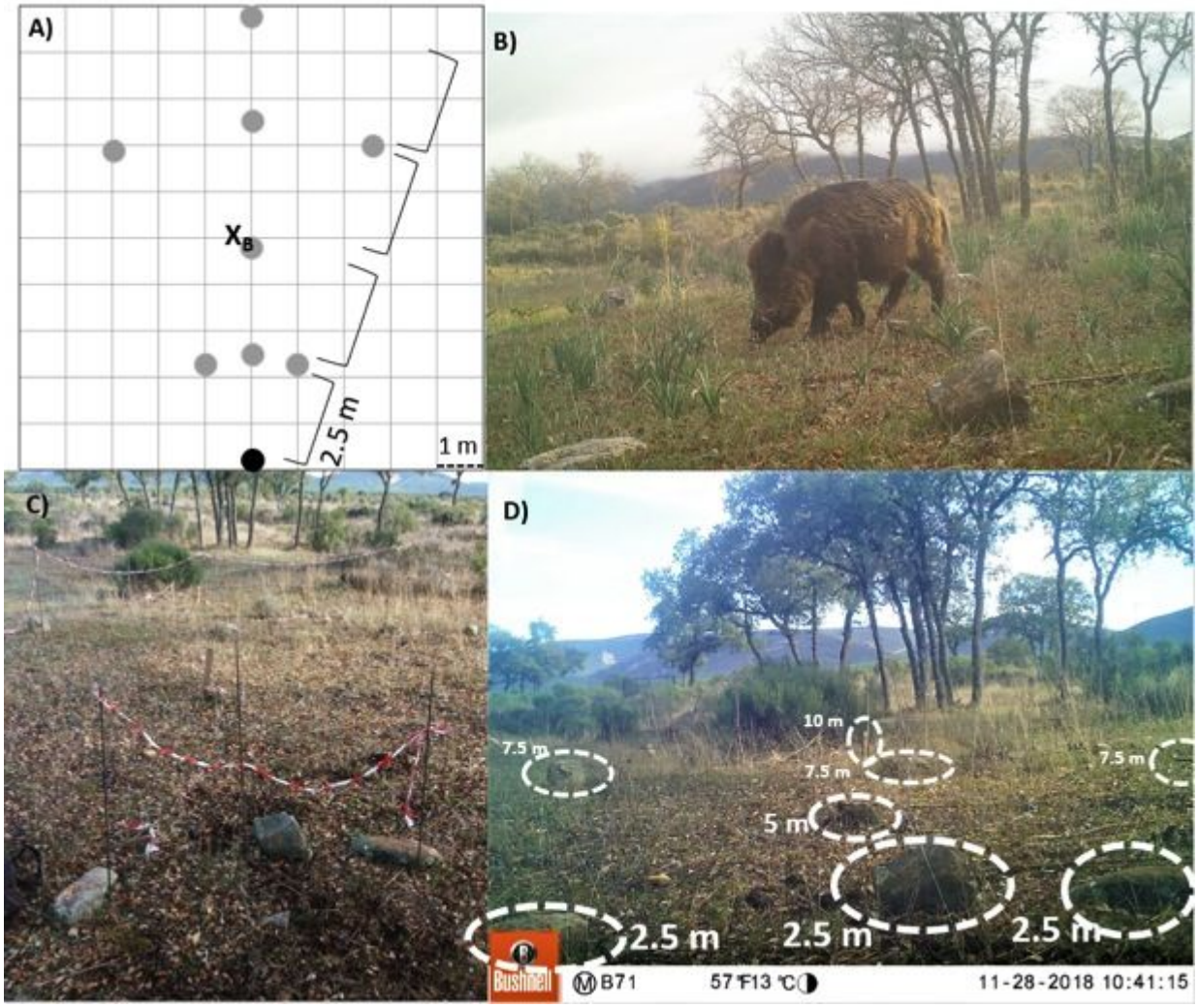

Figure 1 (annex 1). A) Scheme of the stick-structure (grey dots) used to reference the animal captured by the camera-trap (black dot). X_B indicates the position of the wild boar captured in the image B. B) Wild boar photo-captured. C) Photo of the structure installed in one photo-trapping sampling point. The camera should be oriented so that the well-centred stakes are displayed. D) Natural marks (stones) used as references after removing stakes.

Camera trap calibration for measuring animal positions using AGOUITI tool

After setting up the CT firmly, and in a position ready to capture wildlife images, hold the pole with is based on the ground and held perpendicular to the camera's line of sight.

link to video with instructions to manufact the calibration pole
https://youtu.be/FkEKxlTWTwY

- Hold the pole still long enough to ensure a clear image (5-10 seconds). In order to indicate when the pole is resting on the ground, give a distinctive hand gesture when this is the case. For example, thumbs up!
- Repeat it 20-25 times covering homogeneously all the field of view of the camera. From very close to at least as far as the furthest distance you expect to record animals (Fig. 2).
- The calibration should be repeated when removing the camera, as well as when setting and checking it.

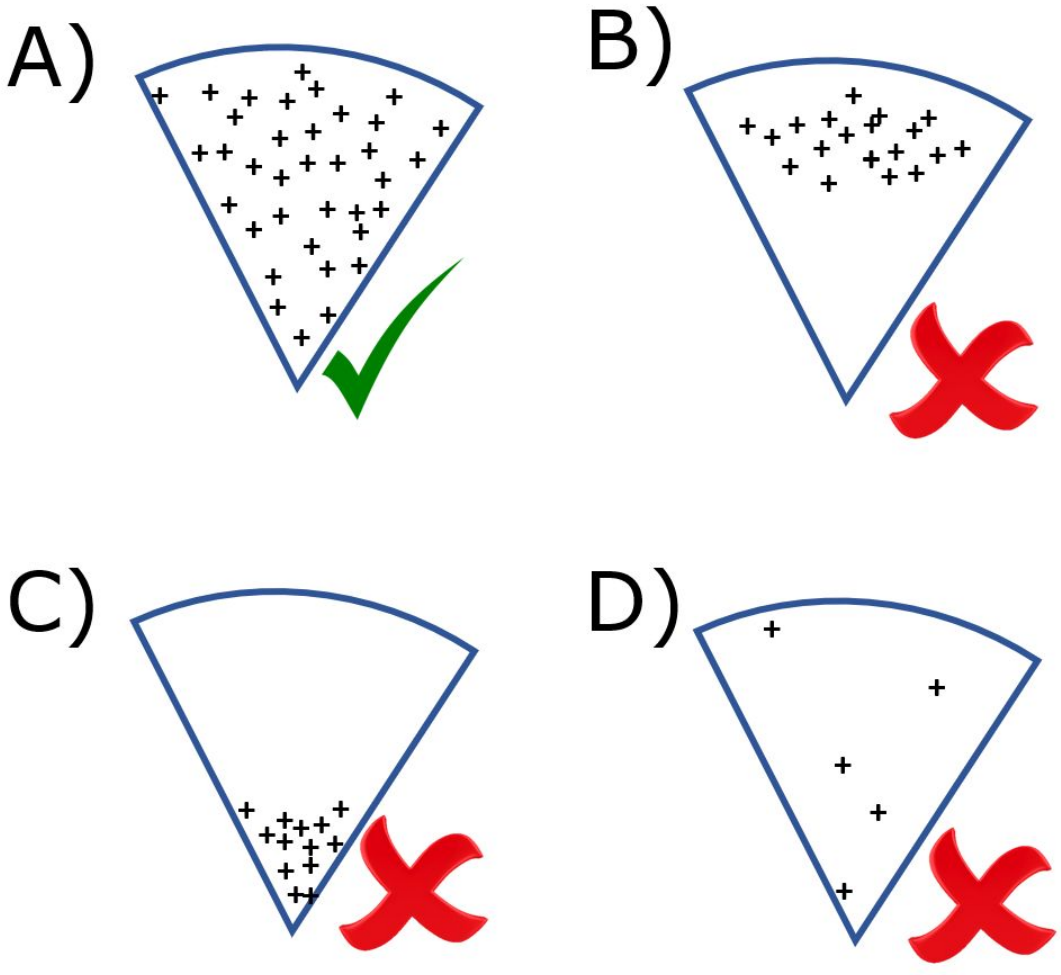

Figure 2 (annex 1). Example of four squemes of calibration of a single camera trap. Crosses represent all the locations of the calibration pole. Panel A represents an adequate calibration (more than 20 points

covering homogenously all the detection zone). Panels B, C and D represent wrong calibrations; in panels B and C the points are not homogenously distributed; in panel D, few points were recorded.

Required material

- CT adequately configured (see above), with proven batteries (alkaline) and compatible memory card. Check that the cards save the photos well, since sometimes they are not compatible with the camera model
- Memory card of 8 GB minimum size, recommended 16 GB if the camera supports it
- 50 cm stakes (or poles) and hammer to place them. 8 of them are required for the initial photograph of each study point. 2 of them will stay (5 and 10 m)
- Signalling tape
- GPS for recording geographical coordinates
- Single-use camps are very practical for fixing the cameras
- Hoe for vegetation cleaning, only the strictly necessary within the first 5 meters
- Calibration pole

Nº of the study point	Nº CT and memory card	Coordinate X	Coordinate Y	Date setting-up CT in the field	Time setting-up CT in the field	Picture of vision field with marks taken? (Y/N)	Calibration is done when setting the camera (Y/N)	Calibration is done before remove the camera (Y/N)	Date CT removal	Time CT removal	Observations: any eventuality, indicate if revision is made, the date of this, aspects of functioning of the CT, if it dropped down, if still correctly attached, any failure, change of memory or batteries, etc.
1	1/1	4620530.32E	523454.42N	05/07/22	09:25	Y	Y	Y	31/08/22	19:46	Al right, camera in the same positio and orientation it was placed, apparently active all time, batteries OK.
2	2/2	4628573.32E	523493.42	05/07/22	10:45	Y	Y	Y	31/08/22	17:16	Camera trap drop down, check when in pictures.
3	3/3										

Nº of the study point	Nº CT and memory card	Coordinate X	Coordinate Y	Date setting-up CT in the field	Time setting-up CT in the field	Picture of vision field with marks taken? (Y/N)	Calibration is done when setting the camera (Y/N)	Calibration is done before remove the camera (Y/N)	Date CT removal	Time CT removal	Observations: any eventuality, indicate if revision is made, the date of this, aspects of functioning of the CT, if it dropped down, if still correctly attached, any failure, change of memory or batteries, etc.

Use as many forms as necessary

Annex 2. Instructions for the placement of cameras of phototrapping and calculation of density of wild boar

FORM TO COLLECT DATA DURING HUNTING DRIVES (one drive one form)		
Name and position (organizer, ranger, etc.) of count coordinator: /		
E-mail:	Telephone:	
Date:	Municipality:	
Hunting ground ID:	Hunting ground name:	
Hunting drive (name of the patch covered and/or consecutive number within the season):		
Start time:	End time:	
Name and/or name of the stalking site:		
Nº hunters (stalking sites):	Nº beaters:	Nº dogs
Did you look for tracks before?		
Did you bait the hunted area?		
Beaten area (has):	Is there GIS file available? (yes/no):	
Total Nº sighted wild boar (including those hunted):		
Total Nº hunted wild boar:		
Total Nº sighted red deer (including those hunted):		
Total Nº hunted red deer:		
Total Nº sighted roe deer (including those hunted):		
Total Nº hunted roe deer:		
Total Nº sighted other species (including those hunted): Indicate species and nº		
Total Nº hunted other species:		
Total Nº sighted other species (including those hunted): Indicate species and nº		
Total Nº hunted other species:		
Total Nº sighted other species (including those hunted): Indicate species and nº		
Total Nº hunted other species:		
INSTRUCTIONS TO FILL THIS FORM		
• Each stalked hunter must fill in this form for his position (fields indicated in grey) • Next, all data must be summarized in a single form by the co-ordinator of the drive count, who will fill in the form for the total count of the event. You should consider the possible double counting by neighbour hunting positions • It is very important to fill in the form even if no piece has been seen or hunted, in this case in the corresponding boxes it will be set 0		