

African swine fever and detection dogs for wild boar carcasses

This is part of a broader study on the possibilities for deploying detection dogs to locate wild boar carcasses in the event of an outbreak of African swine fever (by Hilde Vervaecke and Manon De Meester, Odisee University of Applied Sciences, Belgium; steering committee members: Uta Kielau, Ellen Van Krunkelsven, Kristof Baert, and Arno Thomaes).



Report 6. Assessment of searchable area per habitat, taking into account restrictions due to biotope type and vegetation

Information on searchable area per habitat type and vegetation in the monitoring of African swine fever by detection dog teams was screened from various sources:

1. Scientific literature
2. Information from protocols, reports and related materials on searches with detection dogs for African swine fever.
3. Information from a survey conducted by us, interviews and conversations with people with experience in the training, deployment or governmental management of detection dogs aimed at combating African swine fever.

The sources used in this work include both peer-reviewed scientific literature and grey literature (e.g. protocols, reports and consultations with experts). While peer-reviewed publications provide scientifically validated evidence, grey literature and expert input mainly offer practical and contextual insights and should be interpreted accordingly.

Citation: Vervaecke, H. 2025. Assessment of searchable area per habitat, taking into account restrictions due to biotope type and vegetation. Report 6 for ANB (Agency for Nature and Forests).

Acknowledgements: Kris Cardoen, Anouck Decors, Stéphanie Desvaux, Kai-Uwe Gries, Christina Jehle, Uta Kielau, Céline Malengreaux, Kevin Morelle, Jürgen Schart, Ellen Van Krunkelsven, Kristof Van Langenhove, Heike Wagner.

Further questions: hilde.vervaecke@odisee.be

Content

African swine fever and detection dogs for wild boar carcasses	1
Report 6. Assessment of searchable area per habitat, taking into account restrictions due to biotope type and vegetation	2
Scientific literature	4
Information from interviews and discussions	10
REFERENCES.....	13

Scientific literature

Models to guide searches

Several papers (by Morelle et al., 2019; Cukor et al., 2020; Allepuz et al. 2022) provide recommendations to design a search strategy to find ASF-infected wild boar carcasses, which is a crucial activity in the management of the disease, not just for surveillance purposes - the early detection of an introduction and the regular monitoring to understand the epidemiology - but also for control, namely the disposal of infected carcasses as a virus source.

Rather than encompassing entire territories, both spatial mapping and subsequent search operations should be guided by a **risk-based framework**. In ASF-free countries, priority should be given to areas with an elevated likelihood of ASF introduction, such as border regions or designated hunting grounds. In ASF-affected countries, the prompt detection and removal of ASF-positive wild boar carcasses constitute a critical intervention to reduce environmental viral load, thereby mitigating transmission, limiting disease spread, and facilitating control and potential eradication (Allepuz et al., 2022).

Morelle et al. (2019) developed a search model based on deathbed choice by ASF-infected boar. They found that ASF-infected wild boar selected deathbeds in cool and moist habitats. Deathbed choice was mostly influenced by topographic and water-dependent covariates. In the case of an epidemic, it is important to quickly collect a minimum of 75–100 carcasses with exact locations to build a well-performing and efficient carcass distribution model. They elaborated a general model that provides an indication of where carcasses are most likely to be found and can be used as a guide to strategically allocate resources and guide subsequent searches. They recommend that locally adapted models be developed as soon as enough data on ASF-infected carcass locations are collected. The surveillance and database maintenance was performed by the University of Liege (wildlife sanitarian network).

Cukor et al. (2020) also highlighted the habitat preferences of ASF-positive wild boars for their death sites, providing valuable insight for improving the efficiency of locating infected carcasses. Most carcasses (71%) were discovered in forests, although forests covered only 26.6% of the high-risk Zlin region in the Czech Republic, with a particular preference for younger forest stands. Among infected wild boars found in forests, 91.3% were located in stands younger than 40 years, as the boars probably looked for calm and secluded areas. Younger forest stands were significantly more preferred by infected individuals ($p < 0.001$). On meadows, infected wild boars favoured areas with taller herbaceous layers compared to non-infected ones ($p = 0.002$). Additionally, infected individuals tended to select locations farther from roads and forest edges ($p < 0.001$ for both). No notable differences in death site habitat were found between sex-age categories. The proximity of carcasses to water sources varied with mean temperature, with carcasses closer to water at higher temperatures. Given the similarity of landscapes, these models are broadly applicable across Central Europe and could greatly enhance the search for infected carcasses.

Allepuz et al. (2022) analysed the temporal and spatial distribution of found dead African swine fever (ASF)-positive wild boar carcasses from 2017 to January 2021 in Bulgaria, Estonia, Germany, Hungary, Latvia, Lithuania, Romania, Poland, Serbia and Slovakia. A total of 21,785 cases were confirmed in 19,071 unique locations. The highest likelihood of finding ASF-positive wild boar carcasses was in areas of transition between woodland and shrub, green urban areas and mixed forests. The presence of a path and a higher abundance of wild boar also increased slightly the odds of finding an ASF-positive dead wild boar. When trying to find carcasses around an already confirmed ASF-infected wild boar, active searches should take place within 1 week after the event and in a 2 km radius, focusing in those areas in which it is more likely to find them. Standardising recommendations to focus on specific areas is simpler than generating risk maps.

Providing a list of the **main risk zones** is a simple yet powerful way to direct search efforts toward locations where the likelihood of finding an ASF-positive wild boar carcass is highest.

The most important factors identified by the model are (in order of importance):

1. Transitional woodland-shrub
2. Mixed forest
3. Broad-leaved forest
4. Inland marshes
5. Coniferous forest
6. Land principally occupied by agriculture
7. Water courses
8. Natural grasslands
9. Pastures
10. Rice fields
11. Vineyards
12. Areas with the highest wild boar density.

Assessment of search area per habitat

Operational data on the deployment of dog teams, types of areas, searched surfaces, duration of deployment and number of findings are already available in several countries. The analysis of these data would fill an important knowledge gap and has not yet been described in the scientific literature. Access to raw data held by governmental authorities could provide valuable indications. Such data are not publicly available but can be requested from the relevant authorities, for example from the German government (via contact persons K. Schart & C. Jehle, at TCRH).

Studies on efficiency indicate that terrain type is an important factor. Determining factors may include the **accessibility of the area** for both humans and dogs, as well as the steepness of the terrain.

The study on the Polish experiences with detection dogs for ASF-surveillance states that every search should commence with a comprehensive analysis of the area. The initial step involves carefully mapping watercourses, evaluating forest characteristics (such as tree age and species), and identifying the type and spatial layout of nearby agricultural fields. Support from hunters and forestry personnel can be particularly valuable in this phase. Moreover, ongoing forestry operations must be taken into account, as they strongly influence wild boar movement. The presence of wolves is another relevant factor, especially since their activity peaks during the wild boar perinatal period. ASF-infected boar appear more susceptible to wolf pressure and predation, which drives pregnant and leading sows to seek quieter and safer habitats. Mobile applications allow to assess the locations of areas earmarked for search and utilize online platforms like ZIPOD (in Poland: ZIWET) (Kruszynski et al., 2023; Kruszyński et al., 2026).

Classification of terrain types

OFB-rapport 2025: In France, a methodology was developed, in collaboration with an INRAE team, to assess the accessibility of landscapes. The INRAE team previously created the CHLOE software for analysing landscape structure. Initially applied in the Grand Est region, the method should be refined and tested elsewhere to produce maps that support active carcass-search operations.

Summary of the landscape-characterization methodology

The study aimed to identify which landscape elements could create difficulty for an observer to move through the environment. Experience has shown that factors such as tree species, slope, understory, and streams can disrupt observer concentration and therefore reduce detection capacity. To best describe the environment in which observers must operate, they assigned a friction score to two key criteria considered essential for carcass searches: penetrability (linked to effort and difficulty) and visibility.

- Penetrability / difficulty

This relates to the obstacles observers encounter when moving through an area. These can slow them down, divert their path, hinder them, or distract them, meaning observers may focus more on safety and clearing their way than on searching for carcasses. These obstacles include the same landscape elements that also affect visibility: branch height, vegetation density, watercourses, slopes, rocks, brambles, etc. Steep slopes combined with dense vegetation form a major obstacle. At this stage, slope was not included in the model used to assess landscape openness.

• Visibility

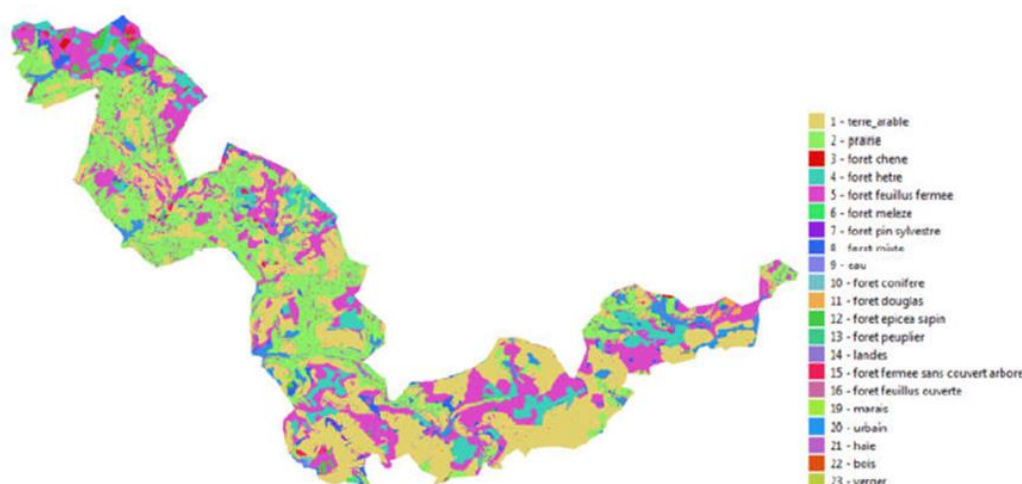
This refers to the difficulty observers face when attempting to view the area effectively. Landscape features such as more or less open forests (e.g., deciduous forests or beech stands), branch height (young vs. mature forest), and micro-topography may obstruct the observers' field of view.

Conversely, prairies and agricultural fields generally provide an open, unobstructed view.

Initially, several maps of the study's "white zone" and surveyed areas were produced (biophysical landscape description, topography, and vegetation structure) using Corine Land Cover 2012, BD Topography, and BD Forest datasets.

To construct the initial map, several data sources were used and compiled. The land-use categories obtained are those for which visibility and penetrability were evaluated.

Figure: Construction of the initial map for the autumn–winter period, at 5 m resolution.



They assigned penetrability and visibility scores to each landscape element depending on the season (autumn–winter and spring–summer). Indeed, depending on the season, vegetation density may vary, fields may have crops in vegetative growth or not, etc.

Habitat code	Habitat type	Penetrability_AH	Visibility_AH
1	Arable land	2	6.5
2	Grassland	1	1
3	Oak forest	2.5	3
4	Beech forest	2	2.5
5	Closed deciduous forest	3.5	3.5
6	Larch forest	5	4.5
7	Scots pine forest	4	4
8	Mixed forest	4	4

Habitat code	Habitat type	Penetrability_AH	Visibility_AH
9	Water	3.5	3.5
10	Coniferous forest	5	5
11	Douglas fir forest	6	6
12	Spruce-fir forest	7	6.5
13	Poplar forest	8.5	8.5
14	Heathland	8	8
15	Closed forest without tree cover	8.5	9
16	Open deciduous forest	6.5	7.5
17	Deciduous forest with bramble understory	7.5	7.5
18	Deciduous forest with fern understory	6	7.5
19	Marsh	10	10
20	Urban	5	5
21	Hedge	5	5
22	Woods	5	5
23	Orchard	5	5

By linking these scores with geographic land-use layers, they can model maps of visibility and penetrability. By summing the visibility and penetrability scores of each pixel on these maps, they can create a model characterizing the openness of the environment.

However, this is a simplified model because some elements that seemed necessary to include in the landscape analysis are missing, for example, the forest understory, which could be reconstructed using other information layers. For characterizing the concepts of visibility and penetrability, a calculation method with a 20 m resolution was chosen for its precision. This allows functional window sizes to be calculated at every point in the area. They decided to sum the visibility map with the penetrability map using a 1:1 coefficient, meaning that visibility and penetrability are given equal weight. A modelled map of the “white zone” for each of the two seasons was thus obtained by summing the penetrability and visibility criteria.

Figure: Example of the map showing the sum of visibility and penetrability in the white zone for the spring/summer season



As was done for the white zone, the three maps describing the Meuse landscape and the friction scores were combined to generate penetrability and visibility maps of the white zone. These were then summed to produce the map below.

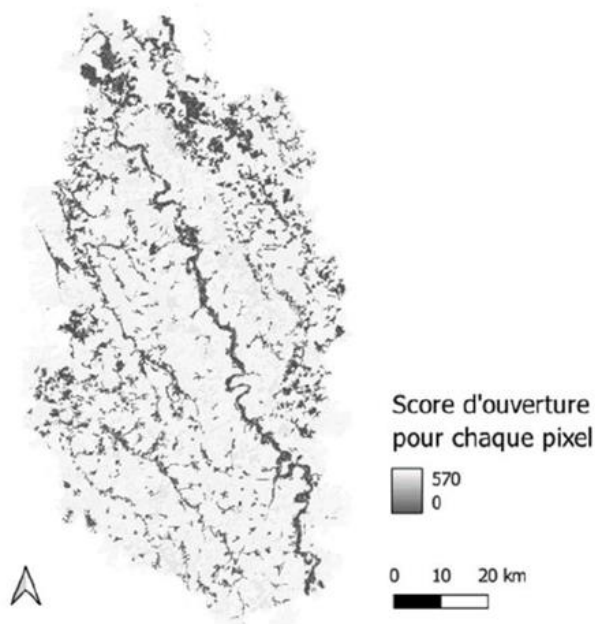


Figure: Result of the modelling of landscape openness (sum of the visibility and penetrability models) in Meuse. Higher scores indicate better visibility and penetrability.

Using the maps of the sum of visibility and penetrability for the white zone with 120 m and 80 m pixels, three pixel classes were defined for each map based on their friction scores, creating the most homogeneous classes possible. Then the average of each class was calculated and the score closest to the mean of each class was identified. This yielded three values corresponding to the three levels of openness (i.e., value 1 = low openness, value 2 = medium openness, and value 3 = high openness).

Main perspectives for refining landscape characterization for carcass searches

Add a difficulty (effort) criterion

The characterization criteria used in this study—visibility and penetrability—could be complemented by a third criterion: **difficulty or effort**. Adding relief would account for an additional source of friction and challenge encountered during searches. For example, being at the top or bottom of a slope changes visibility on the opposite side, and moving uphill or downhill requires physical effort, which can reduce concentration compared to flat terrain.

Validate landscape element scores with more experts

In this study, two field agents with extensive experience, particularly in forested environments were consulted. Due to time constraints, no additional opinions on landscape evaluation were gathered. For a new landscape characterization, it would be necessary to include more assessments by forest specialists to refine the friction scores.

Map the forest understory

Mapping the forest understory could provide additional precision when creating new friction maps. The French Scientific Interest Group SOL (GISSOL) has published maps with information on pH, humus, etc., at the national scale, which could help model soils favorable to the growth of ferns, brambles, and similar understory vegetation. Other methods may now also be available to characterize the forest understory. These efforts on landscape characterization are currently not continued by the OFB. However, detailed reports are available for any team wishing to continue the methodological development (OFB rapport 2025 by Decors et al., 2025).

Information from protocols and related sources

The tests for certification of dog teams are based on realistic practices in the field coupled to a certain level of performance quality. Information on expected performances linked to habitat type was extracted from these protocols.

Table: Information on terrain types and surfaces, and requirements for the dogs regarding search time in different dog protocols for certification:

Protocol land area or organisation	Level	Nr of cadaver parts	Terrain	Surface	Maximal time
TCRH	Green	1	unusual terrain with ground changes	-	10 minutes
TCRH	Green	1	at the edge of a forest, in a meadow area	about 10 m wide and about 500 m long	10 minutes
TCRH	Green	2	clearing, in a fenced area or young plant enclosure	max. 4000 m ²	15 minutes
TCRH	Yellow	3 in different stages of decay minimum weight of 2 kg	low or sparse vegetation	approximately 18,000 - 20,000 square meters	30 minutes
TCRH	Red	3 in various stages of decomposition, with a minimum weight of 2 kg	at least 50% of the area being dense and difficult to see through terrain	30.000 m ²	30 minutes
Mainfranken & Bavaria		3	corresponds to the natural habitat of wild boar and has sufficient underbrush. Corn fields and reed belts are also allowed. There must be sufficient visibility for observing the dog	10,000 m ² to 15,000 m ²	30 minutes - maximum of 90 minutes
Mecklenburg-Vorpommern		at least three search objects per search area (hide/head or entire wild boar carcass), in total, at least six search objects	areas corresponding to the natural habitat of wild boar	two search areas, each at least one hectare in size	20 minutes to find at least two of the three search objects per search area. Total for two areas:

					maximal 40 minutes
Niedersachsen		2 to 5	a natural terrain area (forest)	Two search zones of approximately 1 hectare (total search area of about 2 hectares).	30 minutes (or more if granted by evaluators)
Sachsen-Anhalt		2 to 4 (parts of a wild boar, e.g. limb or head in different stages of decomposition).	corresponding to the natural habitat of wild boar	Two areas of at least one hectare each, or one search area of two hectares	40 minutes
Schleswig-Holstein		1 (carcass or part of a carcass)	all possible types of vegetation are permitted (e.g. reed, moor, rushes/sedges, forest, or agricultural land).	About 2 hectares	30 minutes

Information from interviews and discussions

Approach Wallonia-France 2018:

Terrain zones based on ASF-risk and accessibility for humans/dogs:

The wildlife-disease surveillance network conducts both general and targeted monitoring, including African swine fever (ASF) in wild boar. After ASF outbreaks appeared in Belgium in 2018, the team realised that passive reporting of carcasses was insufficient and began active carcass searches.

Dog teams and human search teams were deployed in **terrain zones selected based on risk**, especially:

- Border areas close to Belgian ASF cases
- High-risk forested areas where wild boar densities are high
- Difficult, heavily vegetated terrain requiring dog assistance
- More accessible zones, which were searched by human teams through systematic ground sweeps

This mixed approach—dogs in complex or high-risk terrains, humans in more accessible areas—was used for about 18–24 months before COVID-related travel restrictions disrupted the programme.

Identification of intervention zones:

The French team worked in collaboration with Belgian colleagues, particularly to define the protocols and identify the intervention areas. A **model was developed by Kevin Morelle**, a Belgian researcher, who had created a landscape model initially applied to Belgium and later extended to northern France between 2018 and 2021. This published model enabled to target the most likely areas for intervention and to establish prospection priorities. A model should be developed for the Flanders region, with experts (eg. Jim Casaer from the INBO, expert in wild boar monitoring; due to the past experience dealing with ASF in Wallonia, Alain Licoppe and his team of the SPW-DEMNA; Kevin Morelle can apply the model to Flanders).

German ASF Trainer (Uta Kielau) information:

Based on practical experience, it appears that, depending on wind strength, dog teams can search between 60 and 100 ha per hour under favourable conditions. "Favourable" here means wind conditions between calm and 5 Beaufort. Under unfavourable conditions, 5 to 10 ha per hour can be covered with dogs (moderate to strong: 6–7 Beaufort; severe: > 7 Beaufort – potentially dangerous).

The type of vegetation on agricultural land can result in varying search durations. There is a difference in search speed between sugar beet fields, maize fields and potato fields.

It can differ widely. For instance in a study on sand lizard detection, a dog needs about 2 hours per ha when searching for lizards. For Search and Rescue, when we look for human bodies, we expect a team to be able to finish 3 ha in maximum 20 minutes for an assessment, the better ones can do it within 2 minutes (= 90 ha/hour). It depends on the size of samples you can expect (fresh cadaver or some tiny remains), area and wind. A well trained hunting dog with a good nose in open area (imagine a good working Gordon Setter) will make it no problem, a slower and closer working Spaniel in the bushes will take much longer.

German experienced ASF-handler (HW) information:

You can't put a fix number on the area. For training and exams, you can, but the condition of the working ground should be defined. The search areas we are covering in the ASP search have circumference from 600-800m. The shapes differ; therefore, the ha is not easy to calculate. It can take everything from 30 minutes up to 2 hours.

The time is depending on the different variables:

- Ground: how is the ground vegetation, how walkable, swamplike, steep or flat
- Weather: the hotter the more rest do the dogs need
- Condition of the dog
- Condition of the humans

What also plays a role is the accessibility of the terrain. If you have to walk 30 minutes to get into your area this takes energy out of the teams.

Here some examples:

- Steep hill, no underbrush, early morning, cooler night with sunshine beginning to shine on the slope: we climb to the top, go along the ridge and do a second cover crossing through the middle. Time 30 minutes.
- Flat square area with lots of breast high blackberry scrubs, mid-day, slow breeze: search pattern is relatively close due to the brushes, we have to navigate a lot because we can't see the terrain not good and have to go around the brushes where you can't go through – 1,5 hours and very exhausting. Takes a lot out of the dogs and can, depending on the fur, lead to lots of superficial scratches on the legs and paws
- Same square a few meters further, no brush, light vegetation on the ground – 40 minutes.
- Area next to a river 100m long, 20m wide – natural reserve area, lots of fallen trees and branches – handler has to crawl to get through - 60 minutes

Some let their dogs range out of sight, they are tracked via Garmin, and it is ensured that the ground is covered. But I'm no fan of this. In a strange terrain you never know what risks there are. We had everything from glass, barbwire, holes, leftover fences and sudden drops. (nov 2025)

TCRH visits (Training Center Retten und Helfen, Mosbach, Germany):

TCRH visit June 2025 One factor taken into account is the density of potential ASF carcasses. Search duration is longer in ASF hotspots because each find requires a photograph to be taken and GPS coordinates to be communicated to the teams responsible for carcass removal. The search team already reports what is found, the veterinarian subsequently decides whether the carcass must be removed.

Sick wild boar go to water because they often have a fever. Death can occur anywhere, not only in thorns or scrub; it can also be in a cornfield — everything has to be searched (TCRH, CJ & JS).

TCRH visit November 2025:

Search tactics are very personal and depend on the handler and the dog. Some dogs stay close to the handler while searching, others range farther away. They must not search too far away: the dog must always remain in sight. You must be able to assess whether it has found something. Some always search on-leash, others only on-leash in areas where it is necessary, such as near a road. The length of the leash varies individually.

Dogs that are used in mantrailing can often systematically “quarter” left and right. Dogs used as hunting dogs will often search chaotically. They must switch to more systematic searching. This is the handler’s task. The dog must allow itself to be guided in a certain direction.

- Starting point versus wind direction: many dogs instinctively head into the correct wind direction.
- If there is no wind: every part of the area must be searched, with some overlap in search zones.
- With wind: searching overlapping areas is not necessary because scents are carried farther. (TCRH, KUG)

TCRH mail dec 2025: There are very many variables involved (weather conditions, terrain structure, number of finds, condition of the individual teams, and so on). Broadly speaking, you can say that a human–dog team can thoroughly search approximately 8–10 hectares per day (TCRH, CJ)

Conversation with police trainer and human remains dog handler:

Carcasses can be surrounded by brambles. In spring these brambles can grow very quickly, and there may no longer be any pathways the dogs can use to reach the carcass.

Conclusion:

The time needed to search an area can differ widely. Determining factors are weather conditions, terrain structure, number of finds, condition of the individual teams, ... If you should define a time for a search area for training or exams, you should define the condition of the working ground. Predicting search durations for each search area is unlikely to be very reliable.

REFERENCES

- Allepuz, A., Hovari, M., Masiulis, M., Ciaravino, G., & Beltrán-Alcrudo, D. (2022). Targeting the search of African swine fever-infected wild boar carcasses: A tool for early detection. *Transboundary and Emerging Diseases*, 69(5), e1682–e1692.
- Arnett, E. B. (2006). A preliminary evaluation on the use of dogs to recover bat fatalities at wind energy facilities. *Wildlife Society Bulletin*, 34, 1440–1445. [https://doi.org/10.2193/0091-7648\(2006\)34\[1440:APEOTU\]2.0.CO;2](https://doi.org/10.2193/0091-7648(2006)34[1440:APEOTU]2.0.CO;2)
- Beebe, S. C., Howell, T. J., & Bennett, P. C. (2016). Using scent detection dogs in conservation settings: A review of scientific literature regarding their selection. *Frontiers in Veterinary Science*, 3. <https://doi.org/10.3389/fvets.2016.00096>
- Cukor, J., Linda, R., Vaclavek, P., Šatrán, P., Mahlerova, K., Vacek, Z., ... & Havránek, F. (2020). Wild boar deathbed choice in relation to ASF: Are there any differences between positive and negative carcasses? *Preventive Veterinary Medicine*, 177, 104943. <https://doi.org/10.1016/j.prevetmed.2020.104943>
- Dargan, R., & Forbes, S. L. (2021). Cadaver-detection dogs: A review of their capabilities and the volatile organic compound profile of their associated training aids. *WIREs Forensic Science*, 3, e1409. <https://doi.org/10.1002/wfs2.1409>
- Deák, G., Katona, K., & Biró, Z. (2021). Exploring the use of a carcass detection dog to assess mowing mortality in Hungary. *Journal of Vertebrate Biology*, 69. <https://doi.org/10.25225/jvb.20089>
- Domínguez del Valle, J., Cervantes Peralta, F., & Jaquero Arjona, M. I. (2020). Factors affecting carcass detection at wind farms using dogs and human searchers. *Journal of Applied Ecology*, 57, 1926–1935. <https://doi.org/10.1111/1365-2664.13714>
- Furtado, M. M., Carrillo-Percegué, S. E., Jácomo, A. T. A., Powell, G., Silveira, L., & Vynne, C. (2008). Studying jaguars in the wild: Past experiences and future perspectives. *CAT News*, 4, 41–47.
- Hall, N. J., Johnston, A. M., Bray, E. E., Otto, C. M., MacLean, E. L., & Udell, M. A. R. (2021). Working dog training for the twenty-first century. *Frontiers in Veterinary Science*, 8. <https://doi.org/10.3389/fvets.2021.646022>
- Hansen, I., & Winje, E. (2021). Efficiency of livestock carcass detection dogs. *Rangelands*, 43, 194–199. <https://doi.org/10.1016/j.rala.2021.03.004>
- Heinle, W., Beswick, N., Wapman, E., & Royle, J. A. (2024). Experimental evaluation of Eastern box turtle (*Terrapene carolina carolina*) detectability in visual search surveys. *bioRxiv*.
- Hohmann, U., Kronenberg, M., Scherschlicht, M., & Schönfeld, F. (2021). The possibilities and limitations of thermal imaging to detect wild boar (*Sus scrofa*) carcasses as a strategy for managing

African swine fever outbreaks. *Berliner und Münchener Tierärztliche Wochenschrift*, 134, 1–14.
<https://doi.org/10.2376/1439-0299-2020-46>

Johnen, D., Heuwieser, W., & Fischer-Tenhagen, C. (2013). Canine scent detection—Fact or fiction? *Applied Animal Behaviour Science*, 148, 201–208. <https://doi.org/10.1016/j.applanim.2013.09.002>

Kruszynski, M., Sroda, K., Juskiewicz, M., Siuda, D., Olszewska, M., Wozniakowski, G., 2023. Nine years of African swine fever in Poland. *Viruses* 15 (12). <https://doi.org/10.3390/v15122325>.

Kruszyński, M., Larska, M., Banaszak, B., Świlak, J., Tarka, P., Pejsak, Z., ... & Woźniakowski, G. (2026). Use of dogs trained to search for wild boar carcasses in passive surveillance as the most effective tool to control the spread of African swine fever in Poland. *Preventive Veterinary Medicine*, 106784.

Lazarowski, L., DeGreeff, L. E., Simon, A., Singletary, M., & Angle, C. (2020). Methodological considerations in canine olfactory detection research. *Frontiers in Veterinary Science*, 7.
<https://doi.org/10.3389/fvets.2020.00408>

Mathews, F., Swindells, M., Goodhead, R., August, T. A., Hardman, P., & Linton, D. M. (2013). Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: A blinded randomized trial. *Wildlife Society Bulletin*, 37, 34–40.
<https://doi.org/10.1002/wsb.256>

McKeague, B., Finlay, C., & Rooney, N. (2024). Conservation detection dogs: A critical review of efficacy and methodology. *Ecology and Evolution*, 14, e10866. <https://doi.org/10.1002/ece3.10866>

Morelle, K., Jezek, M., Licoppe, A., & Podgorski, T. (2019). Deathbed choice by ASF-infected wild boar can help find carcasses. *Transboundary and Emerging Diseases*, 66(5), 1821–1826.

Morelle, K., Licoppe, A. M., Ježek, M., Ježek, T., & Podgórski, T. (2019). Modelling ASF-positive wild boar carcasses distribution. *Symposium de l’AESA – Peste porcine africaine*.

OFB – Decors, Toulet, & Desvaux. (2025). Expérimentation terrain pour comparer l’efficacité de plusieurs modalités de recherche active de cadavres de sangliers. *OFB/DRAS*.

Paula, J., Leal, M. C., Silva, M. J., Mascarenhas, R., Costa, H., & Mascarenhas, M. (2011). Dogs as a tool to improve bird-strike mortality estimates at wind farms. *Journal of Nature Conservation*, 19, 202–208. <https://doi.org/10.1016/j.jnc.2011.01.002>

Reynolds, M. H., Johnson, K. N., Schvaneveldt, E. R., Dewey, D. L., Uyehara, K. J., & Hess, S. C. (2021). Efficacy of detection canines for avian botulism surveillance and mitigation. *Conservation Science and Practice*, 3, e397. <https://doi.org/10.1111/csp2.397>

Sandor, C., Desvaux, S., Palumbo, L., Larrat, S., Charabidze, D., D’Artois, P., & Decors, A. (2025). Benefits and limitations of using innovative tools like detection dogs, thermal imaging and drones to

increase wildlife carcass finds. *Frontiers in Conservation Science*, 6, 1443255.
<https://doi.org/10.3389/fcosc.2025.1443255>