EIP-AGRI Focus Group
Wildlife and agricultural production

MINI-PAPER: Conflict management on the farm level

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Background:

Introduction:

Agricultural areas and farmland are frequently the primary lines of conflict between human activity and wildlife population[1] in both industrial and traditional farms, the individual farmers find themselves facing the economic, infrastructural, and emotional results of such conflict.
Farming is also tradition, attachment to the land, self-care for the families, and the communities that compose the rural landscape. However, in the context of human-wildlife interaction, farmers represent only one of many stakeholders. As a result of a growing cultural gap between the urban population and the farming community public opinion is relatively naive regarding the farmer's point of view. The majority of citizens frequently underestimate the amount of damage and difficulties routinely faced by the farmers on such occasions.

The immediate results of Human-Wildlife Conflict (HWC) on the farmer are the direct damages caused to his property, livestock, and crops. Such damage also include the required time and resources for repair and prevention of future damage. Dealing with wildlife can demand substantial investments such as dedicated infrastructure (fencing) or administrative labor (such as the process of demanding compensation payments)[2] as well as carry an emotional impact for the farmer caused by loss of animals, night alarms, and added stress. Any solution proposed at farm level should reflect this context and offer economically and socially sustainable guidelines for the individual farm. A key component of such a solution is establishing an operational plan that includes wildlife as an intrinsic part of the local environment—a program followed by efficient setting up of production and protective infrastructures[3].

A secondary conflict linked to wildlife interaction is the possible tension with other stakeholders, including environmentalists, hunters, customers, and other farmers in the area[4]. Conflicts could emerge from diversified ideas that can further complicate the relationship between wildlife and the farm. In the extreme, such tensions could result in actions such as trasspassing farmer's private land, vandalism, poaching and illegal trapping. Although things may look bleak, nature can also represent a potential source of value to local farmers as many of the invested stakholders share common respect to it. New reveneurevenue streems can be also exlored both in terms of product/ service for hunters/tourists as well as branding for local products[2].

The farmer's population is in decline across Europe with farmer's average age being over 60 years old, which is an indication to low number of new entries into the sector[5]. The decline is a results of a variety of social and economic dynamics in which HWC is only one factor among many.

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[1] C. Herbst, T. Bauch and J. Arnold, The "Round table wild boar" In baden-wurttemberg, 12th International Symposium on Wild Boar and Other Suids (2019), 74-78.
[2] J. T. Storie and S. Bell, *Wildlife management conflicts in rural communities: A case-study of wild boar (sus scrofa) management in erglu novads, latvia*, Sociologia Ruralis 57 (2017), no. 1, 64-86.
[3] B. Frank, A. Monaco and A. J. Bath, *Beyond standard wildlife management: A pathway to encompass human dimension findings in wild boar management*, European Journal of Wildlife Research 61 (2015), no. 5, 723-730.
[4] J. A. Glikman and B. Frank, *Human dimensions of wildlife in europe: The italian way*, Human dimensions of wildlife 16 (2011), no. 5, 368-377.
[5] Research for AGRI Committee - The revival of wolves and other large predators and its impact on farmers and their livelihood in rural regions of Europe

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Nonetheless, HWC inevitably invokes strong emotions in all involved stakeholders, including the farmers. One of the main reasons for such a strong response is that most of the decisions regarding conflict management are out of the individual farmer's hands, yet the farm remains the center of many interactions. The various interactions on the farm level as a production unit are summarized in figure 1.

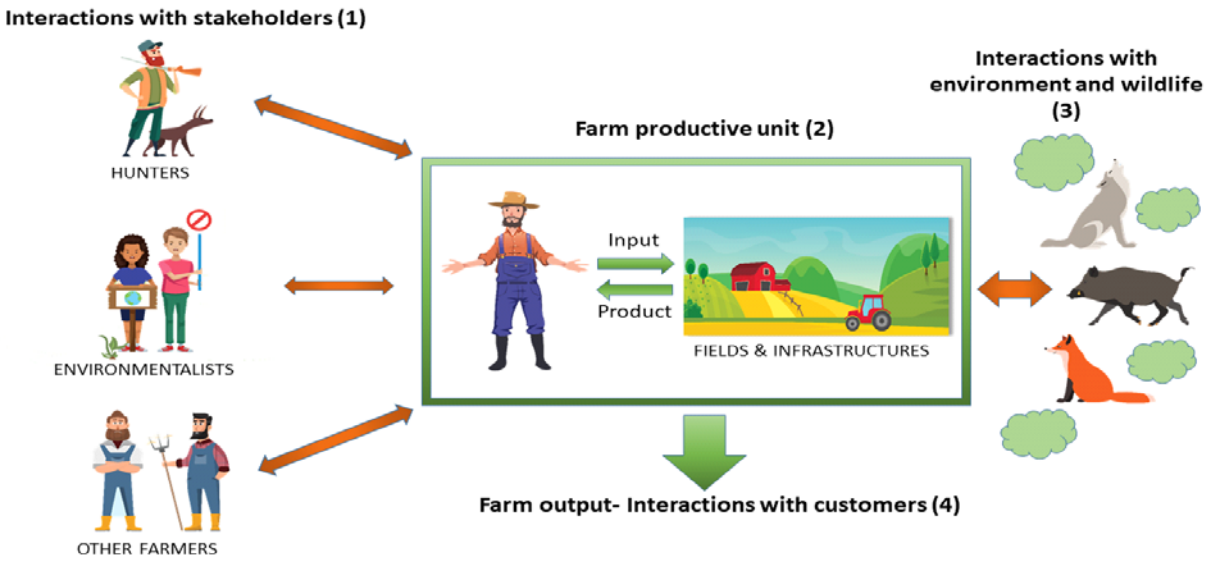

Figure 1: Interactions and possible conflicts on the farm level: 1) Farmers' interaction with various stakeholders 2) Farmers' management of the farm and resources 3) Farmers' interaction with wildlife 4) Farm output and interaction with customers 5) Local authorities acting as policy makers have direct impact on the entire interaction dynamics. Design: Michael Odintsov Vaintrub

Farm damage, direct and indirect conflicts on the farm level:

Predation and livestock loss

Predation and livestock loss represents a type of damage with a significant outcry and emotional impact both for the farmer and the involved stakeholders. As predator populations around Europe recover, livestock predation is increasing all around the continent[5]. In most countries big carnivores such as wolves, lynxes, and bears, are protected species that enjoy a positive cultural perception. In their case, most of the preventive measures include compensation payments for livestock and subsidised preventive infrastructure (electrical fencing). Data collected from farm damage reports is also used for estimation of predators population dynamics and HWC trends. The data collection is not perfect, as predation can be wrongly attributed to one species instead of another, not registered or under reported (mostly in unregistered livestock). Moreover, data regarding trauma (broken limbs), abortion, and other collateral damage linked to stress induced by predator proximity and the predation process are omitted. Despite its limits, this system provides an indicative picture regarding trends and HWC impact of farms in Europe (Table 1).

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Table 1: Number of livestock compensated per year (average for 2012-2016) attributed to wolf, lynx, and bear.

	Sheep	Goats	Cattle	Horses	Dogs	Reindeer	Others
Wolf	22,407	4,837	2,329	645	214	674	222
Bear	3920	31	170	0	20	826	859 (beehives) 140 pigs 80 other
Lynx	5646	12	14	1	3	6885	13
Total	**31,973**	**4,880**	**2,513**	**646**	**237**	**8,385**	**455** (excluding beehives)

Source: Research for the EP AGRI Committee - The revival of wolves and other large predators and its impact on farmers and their livelihood in rural regions of Europe
https://www.europarl.europa.eu/cmsdata/191585/IPOL_STU(2018)617488_EN%20AGRI-original.pdf

Crop and infrastructure damage

Crop and infrastructure damages are another type of damage caused by wildlife at farm level. It is usually caused by ungulates (wild boar, red deer, and moose) that feed on farm output, trample crops, and, in the case of wild boar, uproot the soil and destroy silos. The amount of damage is extensive. It is estimated that wild boars alone cause more than 80-million-euro damage around Europe[6]. Other species, such as the European brown bear, tend to damage specific structures such as beehives as shown in Table 1 and Figure 2. The predominant response to ungulate-caused damage includes both direct compensation for destroyed crops or infrastructure, as well as planned culling carried out by government agencies and private hunters[7]. In the last case, the hunters become critical stakeholders that frequently interact with farmers, especially during hunting season (September-December in most Europe) and the organized culling operations (May to July in southern Europe)[8]. Thus, in addition to the primary conflict between farmers and ungulates , a secondary conflict between farmers and hunters may occuroccur. This conflict reaches its highest peak at local level, where hunting rights, land trespassing, and collateral damage caused by hunting activities can escalate into open disputes between individuals. In some countries such as Finland, where hunting rights are in the farmer's hands, an open dialog and pre-season goal setting are reached between hunting clubs and farmer associations. However, application of such system depends on local legislation, land rights, and farmer's average property size in the specific country, therforetherefore not easly applicable across Europe. When hunting rights are owned by the state, as for example in Italy or Slovenia, the farmers find themselves almost completely excluded from the decision making process and the wild game harvesting value chain.

Bio-hazards and bio-security

It is a well-established fact that wildlife can serve both as a harbor and a vector for transmitting infectious diseases[9]. In particular, migrating waterfowl which tend to travel long distances and frequently stop in water sources or crop fields can carry pathogens across long distances[10]. While

[6] Forest management system as a component of ungulate pest management .Friedrich Reimoser
[7] L. Tauer, Age and farmer productivity, Review of Agricultural Economics (1995), 63-69.
[8] T. N. Smith, M. D. Smith, D. K. Johnson and S. S. Ditchkoff, *Evaluation of continuous-catch doors for trapping wild pigs*, Wildlife Society Bulletin 38 (2014), no. 1, 175-181.
[9] S. Mykra, M. Pohja-Mykra and T. Vuorisalo, *Hunters' attitudes matter: Diverging bear and wolf population trajectories in finland in the late nineteenth century and today*, European Journal of Wildlife Research 63 (2017), no. 5, 13.
[10] H. Najdenski, T. Dimova, M. M. Zaharieva, B. Nikolov, G. Petrova-Dinkova, S. Dalakchieva, K. Popov, I. Hristova-Nikolova, P. Zehtindjiev, S. Peev, A. Trifonova-Hristova, E. Carniel, Y. A. Panferova and N. K. Tokarevich, *Migratory birds*

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contamination is always a risk on a farm, extensive livestock farming systems are more vulnerable to biohazards as their bio-security is not as rigid and carefully controlled as industrial farming facilities. Extensive farms usually belong to smaller farmers, family farms, and smallholders with less economic means to invest in new infrastructure. Aside from the direct damage of infectious disease to presented livestock, farmers may also face quarantine and movement restrictions due to the presence of pathogens placed under eradication plans. Such impact can ruin an entire season of production for the farmer and his/her family.

Farmers' perspective and farmer-to-farmer interactions

Most farmers view wildlife negatively as it may endanger their economic security and farm production output. They face the issue of livelihood security, with up to 40% loss of annual production crops as a real possibility in farm operating marginal areas. Problem-solving varies from farmer to farmer, and most often, the achieved solutions do not expand beyond the boundaries of the individual farm. Local solutions are implemented in forms such as subsidised fencing, grants for livestock guardian dogs (LGD) in Italy[11] or hunting rights distribution, which provide an added value to wildlife on a farm property in Finland[12] while keeping population under control. However, a growing cultural gap between farmers and other stakeholders, such as urban environmentalists, increases farmers' perception of being the main stakeholder facing the consequences while having little to say on the matter. When added with the farming sector's mentioned difficulties, the HWC outcomes may result in sense of isolation and frustration with “the system”, a sentiment that pushes many farmers to accept no solution to the conflict.

Poaching, trapping, and poisoning

One of the results of HWC is the case of individuals - in many cases, farmers - hit by wildlife damage, taking the matter into their own hands. Whether legally or not, actions such as shooting, snare trapping, poisoning, and other improvised measures are taken to reduce the numbers of local damaging species. These measures have dubious success regarding overall wildlife population management while frequently causing collateral damage to other species. This activity is also a burden on local authorities, as they require policing and preventive measures of their own. Such action is frequently an indicator of frustration levels of local popualtion with wildlife management dynamics.

along the mediterranean - black sea flyway as carriers of zoonotic pathogens, Canadian Journal of Microbiology 64 (2018), no. 12, 915-924.

[11] Public grant dedicated for livestock protection: https://bur.regione.emilia-romagna.it/dettaglio-inserzione?i=da39d80fcdf74978954bf815a79f66e7. P. Willeberg, A. Perez, M. Thurmond, M. Ascher, T. Carpenter and M. AlKhamis, *Visualization and analysis of the danish 2006 highly pathogenic avian influenza virus h5n1 wild bird surveillance data by a prototype avian influenza bioportal*, Avian Diseases **54** (2010), no. 1, 433-439.

[12] Hunting management in Finland: https://face.eu/sites/default/files/finland.en_.2009.pdf

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(a)

(b)

(c)

(d)

Figure 22: a) Deer damages are common in the orchards and vineyards, Croatia. (source: Valentina Hažić). b) *Bee hive damage caused by a bear activity, Finland, (source: Thomas Snellman). c) Wolf predation on cows, Slovenia. (source: Valentina Peternelj). d) Apennine wolf caught in a wild boar illegal trap ("Laccio"), Italy (source: Umberto Di Nicola).*

Farm management under HWC:

Farming practices and prevention measures:

Animal registry and data deposition

EU law requires the registration and Radio Frequency Identification (RFID) tagging of all ruminants, including sheep[13], which are the most vulnerable species. Some farmers however, especially smallholders and part-time hobby producers, tend to keep unregistered animals either as an entire stock or only several animals. Unfortunately, smallholders are also the type of farmers who suffer greater losses to predation for a single animal represents a more significant percentage of the total farm livestock. As a result, there is a tendency for under-reporting of animal loss to authorities. As such, there is an increase in the negative view of predators' local presence and their impact. On the

[13] L. Bertocchi, F. Fusi, A. Angelucci, L. Bolzoni, S. Pongolini, R. M. Strano, J. Ginestreti, G. Riuzzi, P. Moroni and V. Lorenzi, Characterization of hazards, welfare promoters and animal-based measures for the welfare assessment of dairy cows: Elicitation of expert opinion, Preventive Veterinary Medicine 150 (2018), 8-18.

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other hand, over-reporting of dead animals from various causes as predator losses results in an overextension of the compensation mechanism with veterinarian service needed for verification in the field and requires additional economic resources. Reliable farm data, even regarding species that can be considered pets such as Pigmy goats, is crucial in establishing a trust-based relationship with the authorities as well as a more objective view of predator presence.

Another critical problem frequently raised by farmers concerning farm compensation for predatory loss is that the value is based on the carcass's market value. Carcass evaluation does not consider other costs such as breading role, genetic value, milk production (in case of dairy) or the emotional value of the animal to the farmer. Although the last is very difficult to quantify, a good farm registry, which include breading policies, available animal tracking, and production career values, can better quantify the value of each animal. precisePrecise registry practices are more common among intensive farmers, for example in dairy cows farming, on the other hand, among pasture-based extensive farmers the registry is less complete and data tracabilitytraceability is not frequently verified.

Regular welfare assessments and real-time monitoring systems

One of the more significant problems of predator activities is the collateral damage caused to the herd. The damage may be physical such as broken limbs or abortions resulting from predator chase, or long-term exposure to stress with predators' presence in the proximity. Such damage is difficult to quantify as an herd's overall view is needed to establish a baseline status. This could be done through several insturments, including welfare assessments or technological solutions which provide real-time data deposition.

Welfare assessments - originated from the EU project of Welfare Quality ®[14] are now evolved to various protocols for different species and different levels of complexity. Livestock industries, especially those aiming for a high-quality product for conscious consumers, are in the process of voluntary adoption of welfare protocols. In other cases, such as in Italy, the protocols and the farm evaluation are incorporated into the farm control process[15]. By establishing a baseline of the animal welfare state, which inevitably includes data regarding the herd's health and productivity, can provide an objective evaluation baseline for the amount of damage caused by predators. The measurement could be done by including predator presence and/ or livestock losses during a production cycle. Other option is the inclusion of genrala general welfare assessment in the veterinarian verification and evaluationthat follows animal loss. With both methods there is a possibility to detect damage that wasn't included in the direct compensations and better evaluate the stock conditions.

An even better way of tracking herd general conditions and activity is by applying real-time data analysis coming from a single animal. Precision livestock farming (PLF) is an increasingly growing technological field that specialises in transforming animal activity into measurable data by using a series of sensors, software programs, and communication lines. Such technologies could provide an alarm for the farm during the predator's presence and attack. Stored data can be also confronted in order to have better estimation of herd impact during damage evaluation. Unfortunately, high costs and infrastructure requirements limit the adoption of PLF technologies to extremely industrialised

[14] https://ec.europa.eu/food/animals/identification_en
[15] http://www.salute.gov.it/imgs/C_17_pubblicazioni_2875_allegato.pdf

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farming operations, with almost no commercial products available for the extensive farming sector[16].

Biowaste management on the farm level

Biowaste and organic material left in fields or proximity to the farm are key points attracting wildlife to human habitations. Whether carnivores such as foxes, wolves, and wolverines or omnivores such as wild boars and bears, wildlife is drawn to the "easy meal" offered in these places. In particular, lack of carcass disposal on the farm can bring predators into frequently used pasture lands. Although carcass disposal is a regulated process in most countries, the law enforcement is often lacking[17]. For example, in the "Gran Sasso e Monti Dell Laga" national park in central Italy (the Park), more than 14 tons of sheep carcasses were recorded to be left in the field. The farmers reported carcasses as wolf predations (confirmed or not attributed alike) remained in the areas even seven days after the inspection. Interviewed farmers routinely asserted their familiarity with the law requiring burial of the carcass. However, due to costs and labor involved in the process, they opted to ignore it. The Park also registers a continuous increase in wolf predation on livestock and hybridisation with domestic dogs. These factors are attributed both to wolf population growth and expansion of active territory in proximity to humans as well as the availability of food in pastures and farms. Vegetable waste, kitchen waste, and vineyard production waste left in the field or proximity to farmhouses have the same effect on wild boar populations as carcasses on carnivores. In particular, fermentation of dumped maize is a significant attraction stimulus to wild boars, attracting them from long distances[18]. According to regulation, management of the waste, especially regarding burial depth and coverage, are among the immediate, simple actions that could be taken to reduce HWC on the farm area.

Introduction of wildlife into management protocols

Most farming primary production activity is not as planned as an industrial process. Usually, it follows a cyclical process linked to seasonal change and weather conditions. Even so-called concentrated animal farming operations (CAFO) follow the natural cycle of animal production while extensive livestock farming and crop production are defined. Most of the planning is already pre-defined, and only minor adjustments are implemented in the specific case of climate (drought, hail, etc.) or condition change. There is rarely a written protocol of management or a thinking and monitoring process. Although protocols such as "holistic management"[19] dedicated to farm management's thinking process exist for a long time, their penetration into mainstream farming is limited. Management protocols are a crucial tool in bringing agriculture to the speed of the modern market's ever-changing condition. In the case of HWC, they are also instrumental in damage reduction and assessment. Risk and damage assessment, sign monitoring, and deployment of preventing measures can help reduce the costs of preventive tools (fences, electric fences, etc.) and farm loss (crop and livestock) with the cost of several hours of planning a year. Such protocols may include:

[16] Y. Vecchio, G. P. Agnusdei, P. P. Miglietta and F. Capitanio, *Adoption of precision farming tools: The case of italian farmers*, International Journal of Environmental Research and Public Health 17 (2020), no. 3.
[17] http://www.fao.org/3/ca2073en/ca2073en.pdf
[18] https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1254&context=hwi
[19] D. D. Briske, A. J. Ash, J. D. Derner and L. Huntsinger, *Commentary: A critical assessment of the policy endorsement for holistic management*, Agricultural Systems 125 (2014), 50-53

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1) Early sign detection of wildlife activity and communication with relevant authorities/ stakeholders.
   Example: detection of wolfs on security cameras in the area to local wildlife authorities.

2) Identification of critical areas, seasons, and wildlife risk in deployment of prevention measures.
   Example: early autumn vineyards seasonal protection by low placed two electric string fencing to prevent wild board damage to the ripening grapes. The fence can be later dismantled and reused in other areas.

3) Evaluation of newly available materials/ solutions.
   Example: the pros and cons of traditionally built barn in the protection of alpine sheep flock compared to fabric/electric/ metal portable corrals temporarily constructed in the field.

4) Evaluation of using presented wildlife as an additional income stream present on the farm such as B&B, restaurants, or the farm shop.
   Example: conversion of woodland areas harboring wildlife into trails to attract customers to the farms B&B.

Community empowerment:

A vital component of any policy based on farm management is understanding the farmer's perspective regarding wildlife and the adoption solutions. It is essential to mention that all the possible management practices, infrastructure, and technologies discussed above will require investment in time and resources on the farmers' side. While human-wildlife balance is an important feature, it is also important to remember that the farming sector, mostly small scale farms, is continuously declining[20]. Therefore, the incorporation of any solution must include its financial feasibility. As mentioned earlier, most farmers see themselves as the predominantly invested stakeholders because the HWC has an immediate effect on their family and livelihood. Their perception of wildlife and the HWC managment frequently receives rationalised responses from the authorities, leaving many farmers in a state of disillusionment and disappointment.

Therefore, in this mini-paper, we opted to include a short section regarding community empowerment that can be critical if any solution is to be implemented voluntarily.The best approach should be one that shortens the distance between the farmer and wildlife management tools. It could allow local farmers to impact the HWC directly. For example, hunting rights ownership by the farmers, as practiced in Finland, will enable farmers to derive direct monetary value from the game animals, providing stable income. However, hunting rights are a matter of local legislation. In these cases, the intermediary solution within the legal framework can be applied. One example is the distribution of limited hunting and culling rights to local farmers in northern Italy, which resulted in increased efficiency of culling wild boar population while reducing tensions between landowners and hunters[21]. Unfortunately, there is no clear cut solution fit for all EU members in this matter. The underlying logical process however is to simplfy the response to fedbacks coming from the field.

[20] G. Pulina, M. J. Milan, M. P. Lavin, A. Theodoridis, E. Morin, J. Capote, D. L. Thomas, A. H. D. Francesconi and G. Caja, *Invited review: Current production trends, farm structures, and economics of the dairy sheep and goat sectors*, Journal of Dairy Science 101 (2018), no. 8, 6715-6729.
[21] S. Giacomelli, M. Gibbert and R. Vigano, *Community empowerment for managing wild boar: A longitudinal case study of northern italy 2001-2018*, Ecology and Society 23 (2018), no. 4.

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One of such processes can include the reduction of intermediate stakeholders involved in responding to farmers' problems.

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Possible innovation and project ideas:

Field research concentrated on policy efficiency evaluation - direct compensfation vs. farm insurance system:

As mentioned in the mini paper, there are various public policies aimed to support farmers in the management of HWC. The most widespread is the direct compensation scheme described earlier, which promotes an ongoing debate regarding its value and efficiency. Farmers frequently claim policy inefficiency in their specific cases, while other stakeholders claim it disincentivises farmers to invest in fencing and other conflict management infrastructure. An alternative option, practiced in other countries (e.g. Israel), is establishing a mandatory insurance scheme to farm damage. Either subsidised or not, insurance may present a more flexible mechanism adapted to local regions, farm management. On the other hand, delay in re-funding or increased bureaucratic complexity may lead to mistrust in the system and increased conflict with wildlife. Surprisingly, there is very little literature regarding the actual evaluation of policy efficiency, including user (farmer) feedback.

Research project example:

1) A project could establish two pilot funding schemes with a statistically significant cluster of farms in each of them. One cluster can be based on the existing damage compensation scheme, while the other on an insurance-based scoring and payment system. The farms participating in the pilots may provide first-hand user-based feedback, while research observation can provide evidence-based measures of conflict management progress. The two farm clusters can then be changed to obtain further input, with farmers experiencing both systems.

Practical welfare protocol application and PLF technologies research:

Both welfare assessment and PLF are two subjects being extensively researched in the last two decades. However, the penetration of products to farm daily management practices is still limited, especially among extensive farmers and smallholders. Although some research has been done in reducing the complexity of protocols and technology, it is still a cumbersome approach to the user interface. However, there is still a need for further research regarding the end user in consumer satisfaction, ease of use, motivation for application, and user feedback. While some legislation regarding animal welfare is increasingly introduced on a national level, a bottom-up approach is still needed.

Research project examples:

1) Animal welfare assessments, which are researched and carried out in many farms, include a series of structure based parameters such as water points, feeding positions, and cooling systems. However, the protocols predominantly based on the Welfare Quality ® system do not include evaluating the local fauna for predators, the number of livestock lost to predation, biosecurity measures, and critical infrastructure (fences, closed bins, etc.). Adding such items to the evaluation process can provide indication both to the farmer and the local authority regarding HWC aspects of the farm.

2) Data in farms using PLF systems is now acquired automatically throuyg the deployment of sensors and data loggers. It is also registered and readily available both to the farm managers and farm veterinarians for monitoring health conditions. The same data can also

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be used by local authorities when called regarding the presence of predators or livestock loss. The data can be confronted with the farm trends of previous weeks, and losses (for example milk production in dairy cows or weight gain in beef or sheep) can be factored into the damage estimation. Based on automatically registered data, such a process can reduce the tensions regarding the "fairness" of compensation payments.

Community empowerment:

As mentioned earlier, one of the critical aspects of recruiting farmers with a positive approach towards HWC passes through the single farmer's empowerment. Guidelines, practices, and regulations require a population willing to execute them; otherwise, their implementation's efficiency may be at risk. Hunting rights management and involvement in culling procedures are examples of such collaboration. Comparative research of different management systems, including evaluation of user feedback (farmer/hunter), can significantly transform the discussion from a hypothesis based on a factual dialogue.

Research project examples:

1) Establishment of two different management systems in the same area, and montoring the efficiency of culling, amount of farmer-hunter conflicts and other population based parameters. One approach may be based on a Finnish model and include farmer-owned hunting rights. These rights can usually be rented and transferred to a local hunting group for a specific time. In this decision-making system, landowners, including farmers, are quite strong since they own the hunting rights and have a good negotiation position. Another approach may be based on the Italian model. Hunting rights belong to the state, and out of season culling operations are carried out by hunters coordinated by local authorities. Similar studies were already carried in northern Italy[22] and provided valuable user feedback on community dynamics linked to HWC.

2) Bridging the cultural gap between farmers and other stakeholders, causing numerous off-farm conflicts. Establishing pilot projects that include a qualitative-anthropological approach and not only the collection of data or surveys on a scientific or statistical basis. One example may be the Pasturs project, which involves young volunteers for five years in helping breeders coexist with predators in the Italian Alps[23]. The real strength of the project consists of building a bridge between skills and people from different realities. Working together produces mutual trust and sharing of problems, even when the positions on a topic are partly different, up to creating a community that confronts itself without tension.

Wildlife-based value streams

The concept of added value derived from local wildlife is not new and has been explored in various methods, including hunting, product marketing, tourist attraction, and more. However, most farmers rely on commodity production of crops or livestock as a primary source of income. Unfortunately for these farmers, trends such as international competition are driving down commodity prices. As a

[22] https://www.regione.abruzzo.it/content/attivita%E2%80%99-di-controllo-delle-popolazioni-di-cinghiale-sus-scrofa-nei-territori-della-regione

[23] Project Pasturs: https://pasturs.org/eng

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result, many small to medium-scale farmers move from commodity production into more niche markets, including short-chain direct sales and additional revenue streams such as agro-tourism and agro-education. The real question in this case is: does the additional value that can be gained from wildlife through these activities worth possible loss in production capacity to the farm? Rough data from Slovenia estimate that in order to make up for the damage that a wolf causes on one visit to a farm, there will be needed 20 tours with average price of 50,00€ each. Additionaly, local legistlation can limit the value a farmer may derive from tourists by introducing new mandatory figures and "tour rights". Therefore, there is a need for close assessment and objective data gathering (financial/ direct farmer feedback) both from existing case studies and from organised pilot projects.

Research project example:

1) A pilot project may consist of a cluster of farms introducing additional activity, for example, bird watching. In this case, farms can be closely followed by a research registry of both income coming from the activity (tourists payments) and possible additional services (restaurant, coffee shop, B&B). This data can be then confronted with potential losses to production (fruit/ grain/ bio-contamination) caused by the extended presence of the birds on the farm or by possible damage coused by tourists (crop trampling, negligent damage etc.). This data can be further integrated with periodic surveys and semi-structured interviews of the farmers regarding feedback, efficiency, and perception of the alternative income method. With such data available, a bottom line can be drawn regarding the efficiency of programs, including wildlife value as part of the farm revenue.

Challenges:

From the layout of the proposed projects, it is clear that this field's predominant research method is direct data collection from a semi-experimental setting. In this case, we have identified two main difficulties in applying the proposals to be considered feasible and reliable.

1) Farm data collection is not equivalent to the experimental farm setting:

In contrast to experimental farms operated by universities and research centers, a real commercial farm has an entirely different set of priorities. Farmer's first interest is the livelihood of his family and the farm's operational capacity, unlike experimental farms where a lot of work is invested in rigorous data collection, application of experimental protocols to the letter, and the search for innovative solutions. As such, both the recruitment of farms to the pilot project and the monitoring of protocols are of prime importance. Such difference may require frequent visits to the farm and conflict management skills when farmers and researchers' priorities don't align.

2) Recruitment of farmers into the projects:

As a continuation of the previous point, it is not easy to find farmers willing to participate in pilot projects, especially if there are requirements for additional work or drastic changes in working habits. Some of it may be offset by the possibility of adding value to the farm, including tourist attraction, improved payments schemes for damage, new technologies or infrastructure on the farm covered by the project, etc. However, these solutions require funding, sometimes extensive, which increases the difficulty in carrying out large-scale pilot projects. Possible mitigation strategy for the challenge may include involving farmers from the outset of the project, however, it is a challenge that needs to be addressed in every experimental setting.

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Conclusions:

TheThe farm is a center of convergence for many different aspects of HWC in which the main responsibility lies in the hands of the farmer. Farm management inevitably includes wildlife fencing techniques, interactions with hunters and authorities, financial considerations, and more. A holistic pproach to farming that relies on accurate planning for HWC management and good management practices (GMPs) of the farm may significantly increase farm resilience and productivity. The addition of new tools for production monitoring and quantification, such as PLF and herd assessment protocols, may further increase the ability to exact assess the damage and plan accordingly. However, these practices and tools require investments from the farmers' side, both in terms of time and money, the transition to new methods, and a suitable empowerment scheme should be devised. With farming being already a sector with low profitability margins and a decline of practitioners, a lack of such schemes may result in low compliance or increase the resistance among the farmers. Therefore, we propose that pre-implementation research should include field data collection in pilot projects with multiple farms. Although it is a slow and logistically challenging project, we consider it a key milestone in-field validation of future projects and policies.

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