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Perspective

A transdisciplinary approach to combatting the threat of African swine fever in Philippine Endemic Pigs

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ABSTRACT

African swine fever (ASF) is an infectious viral disease clinically presented with a massive mortality rate in domestic and wild pigs. The Philippines is home to four endemic wild pigs vulnerable to population wipeout due to ASF. However, current ASF programs are directed toward saving the commercial pig industry, with little effort to protect the country's endemic wild pig populations. Here, we suggest a transdisciplinary collaborative action to examine the impact of ASF for data-driven strategies against the spread of ASF and toward the conservation of the endemic wild pig population. To achieve this, projects should anchor on Citizen Science and Conservation Medicine approaches, aiming at determining the distribution of endemic pigs, characterizing the epidemiology of ASF in endemic wild pig populations, and identifying conservation strategies suitable for and tailored to endemic wild pigs at a targeted area. These strategies should further leverage stakeholders' knowledge and expertise in local ecosystems by sharing valuable insights and observations as they take a holistic and community-driven approach, recognizing the intricate relationship between the ecosystem, animals, and humans.

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INTRODUCTION

ASF outbreaks in the Philippines have caused significant losses to the swine industry due to massive pig mortality. Since the first case in July 2019, the Department of Agriculture-Bureau of Animal Industry (DA-BAI) has instituted measures to combat the spread of ASF. However, the disease continues to havoc the backyard and commercial pig farms. The situation has become so dire that a state of calamity was declared on May 11, 2021, aiming at augmenting government efforts to contain its spread and financially assist the local pig farmers (Presidential Proclamation No. 1143, 2021) (Presidential Communication Office 2021). While ASF programs are directed toward saving the swine industry, there has been little effort to protect the Philippine endemic wild pigs, which are also vulnerable to population wipeout (Rode-White et al 2024). It is crucial to highlight that the endemic wild pigs in the Philippines had no prior exposure to the ASF virus before the disease entered the country. Therefore, they cannot be considered as the source of infection.

The Philippines is home to four endemic *Sus*: The Philippine Warty Pig (*Sus philippensis*), classified as "Vulnerable" by the International Union for Conservation of Nature (IUCN) (Heaney and Meijaard 2017); Palawan Bearded Pig (*S. ahoenobarbus*), classified as "Near Threatened" (Meijaard and Widmann 2017); Visayan Warty Pig (*S. cebifrons*), classified as "Critically Endangered" (Meijaard et al 2017); and Mindoro Warty Pig (*S. oliveri*), classified as "Vulnerable" (Schütz 2016). An assessment conducted by (Luskin et al 2021) identified these endemic wild pigs among the susceptible and at very high-risk population from the onslaught of ASF, given their declining numbers in shrinking habitats. We speculate that in areas with cases of ASF among domestic pigs, the virus may have reached the natural habitats of the Philippine endemic wild pigs, causing infection and a possible population wipeout. This high risk of ASF spillover might be the reason for the reported cases of ASF detected in Philippine warty pigs (*Sus philippensis*) in Davao del Norte, Mindanao (Chavez et al 2021, Fernandez-Colorado et al 2024). Although there are no published reports of dead Visayan warty pigs caused by ASF in its natural geographical range, there is an urgency to take action on co-creating strategies to address the threat of ASF to Philippine endemic wild pig populations.

The Threat of ASF in Philippine Endemic Pigs

The Philippine government has implemented various programs to mitigate the impact of ASF as countermeasures to address the looming food insecurity and abrogate billions of financial losses in the pork industry. However, ASF cases are still reported in many parts of the country, implying that the problem is multifaceted with no signs of immediate elimination. While efforts are commendable, almost all programs against ASF are virtually directed toward saving the backyard and commercial pig farms, leaving behind the initiatives to protect the endemic wild pigs in the Philippines. The Wildlife Resources Conservation and Protection Act (Republic Act No. 9147) indicates that it is the policy of the State to conserve the wildlife resources of the Philippines. The Philippine endemic wild pig species constitute the country's unique biodiversity; thus, programs to protect them are crucial in times of ASF epidemic.

With ongoing ASF outbreaks across regions, the virus may have spread to their natural habitats, potentially resulting in an outbreak that could lead to a population wipeout. Indeed, ASF was implicated in the massive mortality of Philippine Warty Pigs in Mindanao , with some samples tested positive for the virus. Furthermore, transmission may have happened from domestic to wild pigs through human activities. Recent works suggest ongoing exposures of domestic pigs to the virus based on seroprevalence data during a “non-outbreak” period in Leyte Island, implying that ASF cases are likely unreported and undiagnosed (Portugaliza 2024). Personal communication with locals who hunt wild pigs reported frequent findings of wild pig carcasses and declining sightings in their habitats during the height of ASF outbreaks in Leyte Island.

Initiatives Toward Protection of Philippines Endemic Wild Pigs

We propose a transdisciplinary collaborative project to examine whether ASF has reached the habitat of the Philippine endemic wild pigs and identify suitable conservation strategies to safeguard this species amidst the threat of ASF. One of the strategies is to adopt a Citizen Science approach to mobilize and engage the community in data collection and conservation initiatives through knowledge capacitation. This will provide baseline information about the level of threat ASF might have caused to the endemic wild pigs in their natural geographical range. An initiative centered on a Citizen Science approach could empower local stakeholders to participate actively in developing the project toward a common goal(Vohland et al 2021). The incorporation of citizen science underscores the value of community engagement in conservation efforts, creating an avenue for locals to contribute to the data collection, analysis, and decision-making processes. By involving local stakeholders, especially those who hunt wild pigs, the project leverages the knowledge and expertise of these stakeholders in the local ecosystem, enabling them to share valuable insights and observations during project implementation. The project also promotes a sense of community ownership and fosters a deeper understanding of the ecosystems surrounding the protection of Philippine endemic wild pigs. It may also change the mindset of local communities favoring the conservation of endemic wild pig species.

We further propose employing a Conservation Medicine approach to understand the interconnectedness of the ecosystem, local communities, endemic wild pig population, and ASF occurrence towards species conservation (Figure 1). A Conservation Medicine approach is a transdisciplinary method that seeks to understand the interconnectedness of the ecosystem, communities, endemic wild pig population, and ASF occurrence (Aguirre et al 2002). This approach takes a holistic view of conservation. It aims to address the underlying factors that contribute to the decline of the species, considering the intimate relation of the environment (eg, habitat), humans (eg, local hunters and the community), and animals (eg, population density and ASF infection). Through this approach, a project could identify key threats and challenges to the endemic wild pigs' survival and devise measures to mitigate them.

One specific example of the initiative is to create a project that determines endemic wild pigs' distribution and evolutionary relationships among other *Sus* species, including native and domesticated populations, characterizes the

epidemiology of ASF in endemic wild pig populations, and identifies conservation strategies suitable for and tailored to endemic wild pigs in the local community (Figure 2).

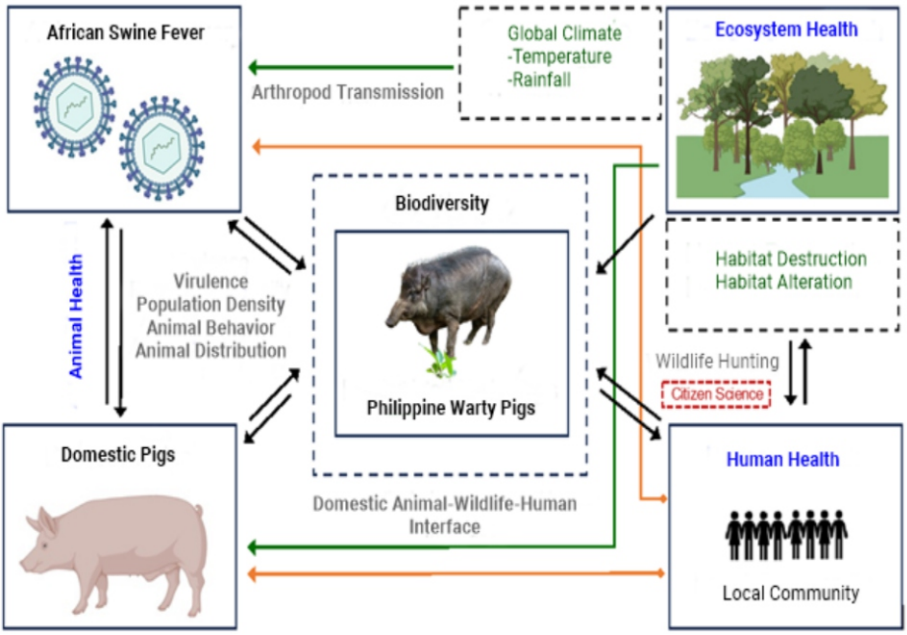

Figure 1. A sample framework that takes a holistic and community-driven approach to understanding the impact of ASF on the endemic wild pigs. This framework is adopted from Aguirre et al (2002).

The first approach would address endemic wild pig population size and genetic diversity and clarify which species inhabit the forest. This will further examine cases of hybridization between *S. scrofa* and other Philippine endemic *Sus* species or interbreeding among Philippine endemic wild pig species (eg, *S. philippensis* and *S. cebifrons*), assuming that their distributions overlap. Indeed, (Layos et al 2022) observed that rescued wild pigs in Leyte Island exhibited a closer phylogenetic relationship to *S. cebifrons*, an endemic species currently isolated in Negros and Panay islands(Melletti and Meijaard 2017).

The second approach would answer whether ASF is actively circulating in the endemic wild pig population and its habitats. It will also identify potential factors associated with ASF outbreaks in the wild and its possible link to domestic pigs and human activities. So far, phylogenetic analyses of the ASF virus in the Philippines are limited to those isolated from domestic pigs.

Lastly, the third approach involves engaging local communities and stakeholders in the conservation efforts and developing culturally sensitive and environmentally sustainable conservation plans. It further involves co-creating solutions based on stakeholder inputs and the scientific information derived from the other two objectives.

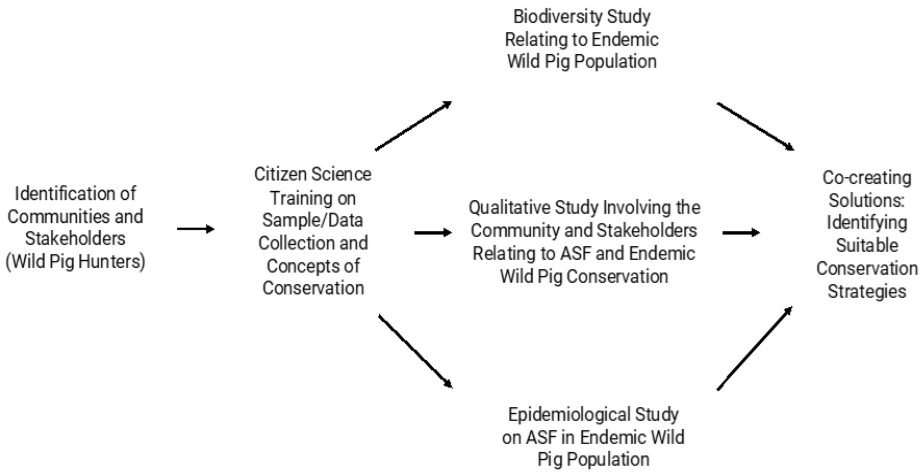

Figure 2. A sample study aimed at determining the impact of ASF on endemic wild pig populations toward its conservation

Potential Challenges

Initiatives that utilize a Citizen Science approach often face complications in effective communication and feedback due to large participants in a diverse group. It can also be challenging to ensure volunteers understand the scientific principles behind the project, particularly in the technicalities of ASF. In the Philippine setting, most local stakeholders lack knowledge of ASF etiology, transmission, and clinical presentation, which may affect disease recognition and early case reporting (Wheless and Portugaliza 2023). In addition, there may be apprehension at the local community level about working on projects related to ASF because of the severe implications on livelihood. Farmers tend not to report cases since it could lead to pig depopulation within the 500m radius of a pig farm with an ASF-confirmed case (Department of Agriculture 2021). Maintaining long-term engagement among volunteers can also be quite challenging. When volunteers are not adequately trained or do not fully understand the research objectives, their participation may wane, especially as tasks become more complex or monotonous. Interest in a project may also diminish due to time constraints, insufficient recognition, or decreased personal motivation.

In Conservation Medicine, a common challenge will likely involve balancing the protection of endemic wild pigs with safeguarding local communities' livelihoods and traditions. Many conservation efforts occur in regions inhabited by indigenous or local populations, whose traditional ways of life and connections to the land must be considered in projects that conserve endemic wild pigs. In the Philippines, hunting wild pigs is associated with culture (eg, hunting rituals) and as an alternative livelihood and food source (Rosales 2021, Tanalgo 2017). Conflicts can arise when conservation objectives clash with the needs of these communities, potentially leading to disputes over land use and hunting rights.

CONCLUDING REMARKS

Current strategies addressing ASF in the Philippines primarily focus on safeguarding the backyard and commercial pig industry, partly neglecting the IUCN-threatened endemic wild pig populations. This paper underscores the need for a coordinated transdisciplinary effort to tackle ASF and conservation needs. Research initiatives on ASF among endemic wild pigs and providing evidence of wild pigs' genetic diversity are crucial for developing tailored conservation measures and addressing the potential risk of ASF spread into wild populations. Importantly, involving local communities through Citizen Science can enhance data collection and conservation efforts, fostering a sense of ownership and encouraging participation in protecting the endemic wild pig species. Incorporating Conservation Medicine will also facilitate a better understanding of the interactions between ecosystems, local communities, and the ASF. This approach can help identify key threats to endemic wild pigs and facilitates informed conservation strategies.

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AUTHOR CONTRIBUTIONS

HPP conceptualized and designed the research initiatives and wrote the article. CJPG conceptualized and wrote the first initiative on endemic pig biodiversity and genetics.

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AVAILABILITY OF DATA AND MATERIALS

There are no date to be made available.

ETHICAL CONSIDERATION

This article did not involve human participants and animal experiments.

COMPETING INTEREST

The author has no relevant financial or non-financial interests to disclose.

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