Development of GIS-Based Tracking Application and Vulnerability Assessment of African Swine Fever (ASF) Cases in Iguig, Cagayan, Philippines

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ABTRACT

African swine fever (ASF) is an infectious disease of swine notifiable in the European Union and to the World Organization for Animal Health. Furthermore, it doesn't have any cure yet, and vaccines are yet to be developed. As a result, early detection and proper sanitary measures are the only way to prevent it from massive transmissions (Jurado, et al., 2018). Cagayan Valley has a limited testing facility for the possible infected swine, and there's a long process before the swine gets tested and confirmed, there is also a huge barrier in information dissemination to the swine raisers, and barangay officials, LGU's staff, and constituents included in this issue (Gallardo, et al., 2015). Therefore, this study aims to assess and map the vulnerability of the swine in the barangays of Iguig, Cagayan through developing a mapping, informative and communicative website application to track swine with possible infection of African Swine Fever (ASF). Using SPSS, the researchers were able to find the significant relationship between the ASF vulnerability of swine and farm location, housing management, feeding management, breeding management, and health management adopted by the swine raisers. Furthermore, the Geographic Information System was used for mapping and locating swine raisers. The findings show that Iguig Cagayan is still in an infected zone which means level of vulnerability is high until now. A website application was developed for the proposed mode of updates for the current situation in the locality, and a map was embedded in the website for tracking and determining the optimal route for swine transportation, either liveweight or meat.

Keywords: ad-libitum, animal technician, ASF, exposure, GIS mapping, sensitivity

INTRODUCTION

Swine African Fever (ASF) is a highly fatal disease of swine. Furthermore, swine can become infected by direct or indirect contact with infected animals or their fluids, by eating contaminated animal feed, or pig products, or by coming into contact with contaminated surfaces. Also, African swine fever doesn't have any cure yet, and vaccines are yet to be developed. As a result, disease prevention and control are primarily centered on early detection of the disease through quick field recognition and accurate laboratory diagnosis, followed by strict sanitary measures. In addition, proper execution of sanitary measures will reduce the frequency of secondary breakouts on domestic pig farms, lowering the risk of environmental contamination, and ultimately lowering the risk of infection in wild pigs (Jurado, et al., 2018).

According to Cooper Tarni et Al. (2022), African Swine Fever (ASF) was first recorded in the Philippines in July 2019. Furthermore, it states that there are 31 provinces across 8 regions in the year 2020 of September. Also, in the year 2020, Hogs in Cagayan province have been stricken with African swine fever along with the CoVid-19. According to the Department of Agriculture (DA), more than 5,000 cases of African swine fever (ASF) were

recorded in Cagayan Valley and 19,000 hogs were culled to contain the spread of the disease-causing virus. In addition, the Department of Agriculture has warned the hog raisers in Cagayan Valley to be watchful of African Swine Fever, particularly in the towns of Gattaran, Iguig, and Lal-lo in Cagayan province brought by contaminated goods from transporters lacking proper disinfection methods. Furthermore, it has been stated that in the year 2021 there are 78 active cases at Iguig, Cagayan, and up until now, there are still positive cases present. It has been seen that because of limited restrictions and non-consistent protocols at Iguig, Cagayan the cases of ASF in the year 2021 doubled (Domingo, ASF threatens hog raisers in Cagayan, 2022).

There are different ways to determine if the swine is infected. One of the methods is the PCR test, it is a virus detection diagnosis that is the most convenient to do. However, there are limited testing facilities in Cagayan Valley and there's a long process before the swine gets tested and confirmed, there is also a huge barrier in information dissemination to the swine raisers, and barangay officials, LGU's staff, and constituents included in this issue (Gallardo, et al., 2015). Furthermore, as the department of agriculture launched the "Bantay ASF sa Barangay" program, most of the municipalities in Cagayan Valley don't strictly follow or implement it. Therefore, in order to give a timely update, close monitoring, and preventive measure, this study will develop an application that includes mapping. This is pivotal to increasing disease awareness and understanding the risk of clinical symptoms and how viruses spread. In addition, this gives vivid and arranged information. Inputs in the application are from accumulated personal data from the swine raiser, and this will be used in the diagnosis, assessment, and monitoring. The website application will inform the swine raisers on what to do, to prevent the further spread of the possible virus.

Objectives of the Study
The general objective of this study is to assess the vulnerability of African Swine Fever (ASF) in Iguig, Cagayan, and to subsequently create a GIS-Based tracking system application aimed

at effectively tracking swine with potential ASF infections within the region. To achieve this overarching goal, specific objectives have been outlined, including the collection of comprehensive data and information concerning the current status of swine raisers, the identification of key indicators pertaining to sensitivity, exposure, and adaptive capacity, the evaluation and mapping of vulnerability levels within ASF-affected barangays in Iguig, Cagayan, and ultimately, the development of a user-friendly website application for this purpose.

MATERIALS AND METHODS
Research Design
The research methodology employed in this study involved a multi-faceted approach, integrating various techniques and tools to assess the vulnerability of swine to African Swine Fever (ASF) in a selected municipality. The study encompassed both qualitative and quantitative research methods

Sampling Technique
Convenience sampling was utilized for data collection. This method allowed for the selection of respondents and study sites based on practicality and accessibility.

Locale of the study
The researchers chose Iguig Cagayan as their study location based on the parameters established. The set of criteria for site selection can be found in Results and Discussion of this paper.

Research Instrument
Vulnerability Assessment
The researchers used index method and GIS through ArcMap software to assess the vulnerability for each barangay in the chosen municipality. The researchers computed the mean indicators for sensitivity, exposure, and adaptive capacity, separately.

Based on the ASF history of infected swine provided by the Agriculture Office of LGU Iguig, weaner had the highest number, same with through to the highest score in the exposure scoring. On the other hand, the grower

had the least number of swine infected which indicates lower score one.

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Analysis of the Data/ Statistical treatment
The collected data were subjected to both descriptive and inferential statistical analysis. Descriptive statistics were used to summarize the swine raisers' profiles, ASF history, awareness, and swine management practices. Inferential statistics, specifically chi-square tests, were utilized to determine significant associations between ASF vulnerability and various management practices and farm locations.

The vulnerability assessment utilized index methods and GIS technology. The computed vulnerability index, along with spatial data from ArcMap, provided insights into the overall vulnerability of each barangay in the selected municipality. These findings, along with all other relevant information and results, were integrated into the design of a website, which served as a platform for presenting the study's finding and mapping result.

This comprehensive approach allowed for a holistic understanding of ASF vulnerability in the chosen municipality, incorporating both quantitative and qualitative data analysis methods and GIS technology for effective visualization and communication of the research outcomes.

RESULT AND DISCUSSION
Demographic Profile

Table 1.1 Distribution of the respondents according to age.

Age	Frequency, f	Percentage, %
<20 years old	4	3.88
20-30 years old	8	7.77
31-40 years old	14	13.59
41-50 years old	29	28.16
51-60 years old	34	33.01
61-70 years old	12	11.65
>70 years old	2	1.94
Total	103	100.00

The table above revealed that most of the respondents were under age bracket 41-50 years old and 51-60 years old with frequencies 29 and 34 respectively or 28.16 % and 33.01 % of the total respondents.

Table 1.2 Distribution of the respondents according to sex.

Sex	Frequency, f	Percentage, %
Male	31	30.10
Female	72	69.90
Total	103	100.00

With regard to sex, the table shows that majority of the respondents were female having a frequency of 72 or 69.90% of the total respondents.

Table 1.3 Distribution of the respondents according to address.

Address	Frequency, f	Percentage, %
Zone 1	23	22.33
Zone 2	22	21.36
Zone 3	12	11.65
Zone 4	9	8.74
Zone 5	12	11.65
Zone 6	8	7.77
Zone 7	17	16.50
Total	103	100.00

The table above shows that almost all of the respondents or the swine raisers are in zone 1and zone 2 with frequency of 23 and 22 respectively or 22.33% and 21.36% of the total respondents.

Animal Management

Table 2.1 Distribution of the respondents according to swine classification.

Swine Classification	Frequency, f	Percentage, %
Sow	120	21.47
Gilt	160	28.62
Boar	4	0.72
Fattener/finisher	228	40.79
Weaner	44	7.87
Grower	3	0.54
Total	559	100.00

In table 2.1, the fattener/finisher has the highest population with 228 or 40.79%, followed by gilts with 160 or 28.62% and sows with 120 or 21. 47%. For the least population are boars and grower, with 4 or 0.72 % and 3 0.54 %, respectively. The number and classifications of swine can affect the transmission of diseases especially airborne viruses like African Swine Fever, Swine Influenza, and many more. These viruses can spread quickly when there are many swine present in one area.

According to Desrosiers R. (2011), there are two main types of pathogens that can cause diseases to swine through direct pig contacts, and those that are often, and in some situations mainly introduced by indirect transmission means. However, in the case of ASF when there is a possible positive swine around the area and not detected early, all the present swine in that area will be culled immediately.

Table 2.2 Distribution of the respondents according to number of caretakers in the farm.

Number of Caretakers	Frequency, f	Percentage, %
1-5	102	99.03
6-10	1	0.97
>10	0	0.00
Total	103	100.00

In table 2.2, shows that 102 or 99.03% of caretakers range from one to five (1-5), compared to 1 or 0.97% for six to ten (6-10) caregivers and 0 percent for those caretakers for more than 10 people.

Table 2.3 Distribution of the respondents according to surrounding parameters.

Surrounding Parameters	Frequency, f	Percentage, %
Away from numerous houses/compound	30	22.39
Near the water reservoir (River, Pump Well…etc.)	32	23.88
Surrounded by trees	72	53.73
Others	0	0.00

In table 2.3, the 72 or 53.67% of swine houses were surrounded by trees, followed by 32 or 23.88% of swine houses located near the water reservoir. Lastly, there 30 or 22.39% of swine

houses which were located away from numerous houses; And 0% for the "others" category. The swine raisers usually have their pig pens surrounded by trees, which was quite easy to allocate in the area because Iguig, Cagayan was located downstream, which was obviously densely forested and near a water reservoir.

Housing Management

Table 3.1 Distribution of the respondents according to type of housing.

Type of Housing	Frequency, f	Percentage, %
Concrete Housing	91	80.53
Indigenous Material	18	15.93
Free Range	4	3.54

Table 3.1 shows that the concrete type of housing had the largest number with 91, or 80.53%, indigenous type of housing came second having a number of 18 or 15.93% and free range had the lowest percentage with 4 or 3.54%. The type of housing of swine in the Iguig, Cagayan were mostly concrete.

According to PAES 401:2001 (Agricultural Structures-Housing for Swine Production), there should be different types of housing depending on the age of the swine. However, most of the swine raisers at Iguig, Cagayan Valley don't practice it. A possible reason why there are a lot of cases of African Swine Fever in the area. Furthermore, swine living at a free-range area has a higher risk of transmission. While the lowest risk of transmission would be concrete housing.

Table 3.2 Distribution of the respondents according to materials for roofing.

Materials of Roofing	Frequency, f	Percentage, %
Corrugated G.I. sheets	101	98.06
Kugon	1	0.97
Nipa	0	0.00
Others	1	0.97

The table above shows the distribution of respondents on their materials used for roofing. Furthermore, corrugated G.I. sheet had the most used materials with 101 or 98.06%, while kugon, nipa, and others (black canvas) had 1 or

0.97%, 0%, and 1 or 0.97%, respectively. Most of the swine raisers used corrugated G.I sheets as a material used for roofing which was the recommended material according to PAES 401:2001 (Agricultural Structures- Housing for Swine Production). It was stated that the roof should be equipped with gutters so that rain water can be drained away separately. Also, it has been seen that corrugated G.I sheet has the least effect on the transmission of ASF virus.

Table 3.3 Distribution of the respondents according to materials for flooring.

Type of Housing	Frequency, f	Percentage, %
Concrete	100	97.09
Plastic	2	1.94
Metals	0	0.00
Combination of such Materials (Concrete, Plastic and Metals)	0	0.00
Other (Ground)	1	0.97

Table 3.3 shows the frequency and percentage of the materials used for flooring at 100 or 97.09% for concrete, 2 or 1.94 % for plastic, 1 or 0.97% for other materials, and 0% for both metals and combination of concrete, plastic and metals. So, finding the right type and flooring materials can be a great way to prevent the spread of the virus.
The type of flooring like the concrete has the least effect on the transmission of the virus. On the other hand, ground (other) as a material for flooring has the highest risk on the transmission of ASF.

Table 3.4 Distribution of the respondents according to types of flooring.

Type of Flooring	Frequency, f	Percentage, %
Solid Floor	103	100
Slotted Floor	0	0

Table 3.4 shows the percentage of the types of flooring used by swine raisers wherein 100% of them have solid type of flooring. Furthermore, solid type of flooring has the least effects on the transmission of ASF virus than slotted floor.

Table 3.5 Distribution of the respondents according to adapt space requirements.

Adapt Space Requirements	Frequency, f	Percentage, %
Yes	90	87.38
No	13	12.62

As regards to adaptation of space requirements, most of the respondents have considerably acquired it, with a frequency of 90, or 87.38 %, while those that did not meet the requirements have a frequency of 13, or 12.62 percent of the total respondents. The space requirements of the swine were mostly followed. However, there were some swine raisers that didn't follow the right space requirements.

According to PAES 401:2001 (Agricultural Structures-Housing for Swine Production), there are different space requirements for different age and size of swine. Furthermore, the possibility of mass infections can occur when swine raisers don't follow the right space requirements per swine.

Table 3.6 Distribution of the respondents according to type of ventilation.

Type of Ventilation	Frequency, f	Percentage, %
Natural Ventilation	103	100
Mechanical Ventilation	0	0

Table 3.6 shows that the type of ventilation used by swine raisers in Iguig, Cagayan is 100% natural ventilation.

Table 3.7 Distribution of the respondents according to building orientation.

Building Orientation	Frequency, f	Percentage, %
East-West Orientation	35	33.98
Not Followed	68	66.02

Table 3.7 shows that 35 or 33.98% of the respondents follow the east-west standard orientation of pig pens while with the frequency of 68 or 66.02% do not follow this standard orientation.

According to PAES 401:2001 (Agricultural Structures-Housing for Swine Production), the building shall be constructed in an east-west

orientation. Furthermore, it shall be located where the prevailing winds will not carry odors to the farmhouse. However, the result shows that a lot of swine raisers don't follow the right building orientation, which can lead to certain problems later.

Breeding Management

Table 4.1 Distribution of the respondents according to breed of swine.

Breed of Swine	Frequency, f	Percentage, %
Pietrain	18	3.22
Landarace	99	17.71
Duroc	134	23.97
Hamsphire	10	1.79
Large White	156	27.91
Berkshire	0	0.00
Native	14	2.50
Mixed-breed	128	22.90

Table 4.1 shows that the highest frequency in the breed of swine that swine raisers usually purchased is large white having a 156 or 27.91 % and followed by Duroc having a frequency of 134 or 23.97%. The mixed-breed has a 128 or 22. 90 % while landrace is 99 or 17.71%. Pietrain is one of the least breeds of swine that has 18 or 3.22% followed by the native and Hampshire having 10 or 1.79%. On the other hand, Berkshire is 0% that means swine raisers don't usually purchase this breed.

Table 4.2 Distribution of the respondents according to types of breeding.

Breed of Swine	Frequency, f	Percentage, %
Pen Mating	85	95.51
Hand Mating	0	0.00
Artificial Insemination	4	4.49

In Table 4.2, the pen mating is the highest type of breeding which is commonly used by swine raisers to produce swine that has a frequency of 85 or 95. 51% as compared to artificial insemination with 4 or 4.49%. Artificial Insemination indicates that swine raisers don't usually prefer this type of breeding for swine production and 0% Hand mating means that swine raisers in Iguig never used this type breeding. Furthermore, pen mating indicates higher risk of transmission of ASF virus than artificial insemination. It is because the swine is

exposed to different possible carrier of the virus.

Table 4.3 Distribution of the respondents according to source of breeder.

Source of Breeder	Frequency, f	Percentage, %
In the Barangay	16	20.78
Outside Baranagay within Iguig, Cagayan	54	70.13
Outside Iguig, Cagayan	7	9.09

Table 4.3 shows that the sources of breeder are mostly coming from the outside barangay within the municipality of Iguig, Cagayan which has a frequency of 54 or 70.13% followed by 16 or 20.78% coming from barangay. Lastly, frequency of 7 or 9.09% of breeders are from outside Iguig. Furthermore, it is seen to be one of the possible factors that contributes to the spread of ASF virus in the area. Furthermore, some of the barangay has only one source of breeder so there is a high possibility that the virus can transfer to different barangays. The highest risk of transmission is breeders that comes from outside of Iguig, Cagayan Valley especially those places with history of ASF virus. Furthermore, the second-high chance of transmission would be the breeders that come from outside of the barangay. It has seen that most of the swine raisers at Iguig, Cagayan Valley has one breeder that the swine raisers would go to. Therefore, the rising cases of ASF is because of the breeders.

Table 4.4 Distribution of the respondents according to source of swine.

Swine of Swine	Frequency, f	Percentage, %
Farm Produced	32	28.32
w/in Barangay	36	31.86
Outside Barangay within Iguig, Cagayan	25	22.12
Outside Iguig, Cagayan	20	17.70

As shown in the table above, most of the sources of swine that swine raisers prefer to purchase is within barangay having a frequency of 36 or 31.86%. It was then followed by farm produced with 32 or 28. 32%. Swine are also

purchased outside barangay within Iguig and outside Iguig, Cagayan having a frequency of 25 or 22.12% and 20 or 17.70%, respectively. The source of the swine is also a possible factor that can contribute to the spread of ASF virus.

Table 4.5 Distribution of the respondents according to mix farming.

Do you practice mix farming (having other animals on the same farm)?	Frequency, f	Percentage, %
Yes	48	46.6
No	55	53.4

In Table 4.5, the 55 or 53.40% of the swine raisers were not practicing mix farming while 48 or 46. 60% of the swine raisers do practice it. Therefore, the swine raisers that does not practice mixed farming can minimize the risk of the swine having infected with the ASF virus.

Feeding Management

Table 5.1 Distribution of the respondents according to type of feeding materials.

Type of Feeding Materials	Frequency, f	Percentage, %
Home-made Ration	1	0.97
Home-made plus Premixes	5	4.85
Commercial Feeds	97	94.17

With regard to the type of feeding materials, the table shows that the majority of the respondents are using commercial feeds with 97 or 94.17% while for home-made plus premixes and home-made ration having a frequency of 5 or 4.85% and 1 or 0.97%, respectively.

Table 5.2 Distribution of the respondents according to source of feeding materials.

Sources of Feeding Materials	Frequency, f	Percentage, %
Within Barangay	32	31.07
Outside Barangay within Iguig, Cagayan	59	57.28
Outside Iguig, Cagayan	12	11.65

Table 5.2 shows that feeds are generally purchased outside of barangays but within Iguig, Cagayan having a frequency of 59 or 57.28%, whereas feeds purchased outside barangay and Iguig, Cagayan having a frequency of 32 or 31.07% and 12 or 11.65%, respectively. It has seen that commercial feeds are commonly bought at one place. Furthermore, ASF virus can spread through possible contaminated feeds or feed ingredients (Niederwerder, 2021). Therefore, the source of feeding influences the transmission of ASF virus.

Table 5.3 Distribution of the respondents according to pattern on feeding.

Pattern of Feeding	Frequency, f	Percentage, %
Ad Libitum Feeding	17	16.50
Restricted Feeding	86	83.50

Table 5.3 shows that restricted feeding is practiced by 83.50% of hog owners, while ad libitum feeding is practiced by just 16.50%. Furthermore, restricted feeding has a higher effect on the transmission of the virus rather than Ad libitum feeding. It is because restricted feeding has multiple exposure to swine.

Table 5.4 Distribution of the respondents according to how often do you feed the swine if it is in restricted feeding?

How often do you feed the swine	Frequency, f	Percentage, %
Once a day (Morning)	0	0.00
Once a day (Evening)	0	0.00
Twice a day (Moring and Evening)	56	56.57
Thrice a day	43	43.43

The table above shows that most swine raisers feed their swine twice a day with a frequency of 56, or 56.57%, whereas 43 respondents, or 43.43%, feed their swine three times a day. The raisers rarely feed their swine once a day, which was revealed as 0% of the interviewed raisers.

Health Management

Table 6.1 Distribution of the respondents according to allowing of visitors per barangay.

Allowing of visitor per barangay	Frequency, f	Percentage, %
Yes	68	66.01942
No	35	33.98058

Table 6.1 shows that there is 66.02 % of hog farmers who allow visitors to visit the swine with a frequency of 68. Furthermore, swine raisers who allow visitors coming from different places has a high risk in transmitting African Swine Fever rather than those swine raisers that doesn't allow visitors with a percentage of 33.98% and a frequency of 35.

Table 6.2 Distribution of the respondents according to number of visitors.

Allowing of visitor per barangay	Frequency, f	Percentage, %
1-5	67	89.71
6-10	4	5.88
>10	3	4.41

In Table 6.2, the swine raisers with 1–5 visitors in a week obtained a rating of 89.71 % and a frequency of 67, while visitors with 6–10 visitors got a rating of 5.88 % and had a frequency of 4, and no swine raisers with more than ten visitors had a rating of 4.41% and a frequency of 3. Furthermore, it has seen that majority of the swine raisers let 1-5 visitor only to visit their swine. Also, as the number of visitors increases, the risk of transmission increases.

Table 6.3 Distribution of the respondents according to Animal Vaccination.

Are your animals subjected to regular deworming and vaccination schedule?	Frequency, f	Percentage, %
Yes	90	87.38
No	13	12.62

In Table 6.3, the majority of swine populations were vaccinated, with 87.38% and a frequency of 90, and the remaining 12.62% were not vaccinated having a frequency of 13. The result shows that most of the swine at Iguig were

subjected to regular deworming and vaccinations. Although, most of the swine were vaccinated, it doesn't minimize the transmission of ASF virus. Furthermore, vaccine development has been hindered by large gaps in knowledge concerning ASF virus infection and immunity (Rock, 2021).

Table 6.4 Distribution of the respondents according to seeking help from veterinarians or animal technicians.

Do you often seek from veterinarians or animal technicians?	Frequency, f	Percentage, %
Yes	91	88.35
No	12	11.65

In the Table 6.4, most of the swine raisers were asking for help from animal technicians or veterinarians with an obtained percentage of 88.35% and a frequency of 91, while the percentage of the population who were not in contact with the animal technicians or veterinarians was 11.65% having a frequency 12. The swine raisers who seek for veterinarians have a lower risk of transmitting the virus than those who doesn't seek any veterinarians. On the other hand, one of the reasons of ASF transmission was the presence of animal technician as observed by swine raisers. This is due to the nature of work of the technician that visits different places for consultations.

Table 6.5 Distribution of the respondents according to isolate sick animals in the farm.

Do you often seek from veterinarians or animal technicians?	Frequency, f	Percentage, %
Yes	66	64.08
No	37	35.92

Table 6.5 shows the percentage of swine raisers who practice sick animal isolation which is 64.08%, while 35.92% of swine raisers did not consider the isolation method for the swine. In addition, the frequency of swine raisers who practice sick animal isolation and swine raisers who don't consider isolation method are 66 and 37, respectively. The swine raisers who practice

isolation method has a low risk of transmission of ASF rather than those who doesn't practice isolation method.

Table 6.6 Distribution of the respondents according to history of the swine diseases experienced in the farm.

What is/are the history of the swine disease/s experienced on your farm?	Frequency, f	Percentage, %
None	33	27.73
Fever	12	10.08
Diarrhea	18	15.13
Higher Mortality	5	4.20
Reduced Eating	31	26.05
Joint Swellling	2	1.68
Coughing	5	4.20
Bloody Diarrhea	2	1.68
Vomiting	5	4.20
Redness of the Ears, Belly, and Legs	4	3.36
Redness on the Skin in the form of Diamond	2	1.68
Collibacillosis	0	0.00
Swine Dysentery	0	0.00
Gastric Ulceration	0	0.00

In the Table 6.6, most swine raisers claimed that none of their swine had illnesses, giving a population percentage of 27.73 and a frequency of 33. There were 15.13% of hogs that had diarrhea having a frequency of 18, and 26.05% of hogs that had eating issues with a frequency of 31. Swine also experienced other diseases, including fever at 10.08% having a frequency of 12. Also, diseases such as higher mortality, coughing, and vomiting have the same percentage rate of 4.20% and having the same frequency of 5. Joint swelling also is the same with bloody diarrhea and redness on the skin in the form of a diamond with 1.60% and having a frequency of 2. There was 3.36% for Redness of the ears, belly, and legs and having 4 as its frequency. There is 0% and 0 frequency for diseases like gastric ulceration, swine dysentery, and colibacillosis There is not enough evidence showing that the history of disease of swine can affect the risk of transmission. However, the history of diseases that the swine experienced can weaken the immune system of swine.

Table 6.7 Distribution of the respondents according to number of ASF infected barangays.

Has your farm been infected with the ASF virus?	Frequency, f	Percentage, %
Yes	27	26.21
No	76	73.79

In Table 6.7, it shows that the percentage of the swine raisers who were infected with ASF having a percentage of 26.21% and a frequency of 27 while there were 73.79% of the swine raisers who were not infected with ASF virus disease having a frequency of 76. It shows that there are more swine raisers that aren't affected by the virus. However, these results may not show the exact number of cases because not all swine raisers want to be interviewed. On

the other hand, hog farmers who had previously encountered African Swine Fever have had it again.

Table 6.8 Distribution of the respondents according to source of information.

Sources for the information of ASF in your community	Frequency, f	Percentage, %
Radio	27	12.98
Television	28	13.46
Internet	26	12.50
Test message	16	7.69
Agricultural Office Staffs	49	23.56
Swine Raisers in your own Municipality	62	29.81

Table 6.8 shows the percentage and frequency of the sources for the information of ASF in Iguig. As shown, swine raisers who got information about ASF in their community was through their co- swine raisers having a highest

percentage and a frequency of 29.81% and 62. While Radio and television as swine raiser's sources of information had a percentage of 12.98% and 13.46% and a frequency of 27 and 28 respectively. Other sources of information of the swine raisers are the internet and agricultural office staffs as the internet had a percentage of 12.50% and a frequency of 26 while agricultural office staffs had a percentage of 23.56% with a frequency of 49. Text message as a source of information had a least percentage and frequency of 7.69% and 16 respectively.

CONCLUSIONS

According to the study, Iguig Cagayan is still in an infected zone which means as of today, Iguig is still at high risk of ASF. The reason why ASF tracking, and mapping is very important, because it will serve as a prevention to the said virus. Furthermore, the findings indicate that there is a significant relationship between the ASF vulnerability of swine and farm location, housing management, feeding management, breeding management, and health management adopted by the swine raisers. Although many swine raisers are aware of the ASF virus, restrictions on its supposed prevention are not acknowledged properly. The Philippine government set protocols to prevent the spread of the ASF virus, but these were neglected by some raisers. Farmers may be more knowledgeable about handling and raising swine, but not when it comes to the wide impact of ASF. They may be aware of the virus, but not to its extent; some may not even be aware of its signs and symptoms, and the allowing visitors are still open to the public where it is one of the main transmissions of the virus. The swine raisers were forced to sell their sick swine either live weight or per kilo at a lower price to avoid a huge loss and to avoid the possible massive culling rather than report them, which increases the chances of the virus spreading during transportation or directly from the swine. The ASF EYE website is used, and EYE stands for Engaging Yourself to Evaluate the current phenomena about the ASF, assessing how devastating its effect or how ASF copes amid the nationwide outbreak. It serves as a medium of communication between department and institute, animal technician swine raisers and others, through the GIS based mapping tracking application.

RECOMMENDATIONS

To enhance the development of the GIS-based tracking application and vulnerability assessment for African Swine Fever (ASF) cases in Iguig, Cagayan, future researchers should collaborate with diverse stakeholders, departments, and institutes to broaden their expertise and knowledge of the disease. Access to up-to-date swine raiser data and historical livestock information should be a priority for these researchers. Additionally, this project can serve as a valuable foundation for tracking other animal diseases in the future. Furthermore, government agencies can utilize this tool for streamlined communication and as a central source of information, promoting greater interactivity and convenience in managing such outbreaks.

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