



African swine fever and the adaptive capacity of ethnic minority smaller-scale producers of pork in the Northern Mountainous Region of Vietnam

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Abstract

One of the poorest areas of Vietnam, the Northern Mountainous Region (NMR) is largely populated by ethnic minorities. Women in these communities produce heritage breeds of pork on a smaller scale, providing them with opportunities and agency. This production also brings alternative sources of revenue outside of the cultivation of rice and corn, maintains genetic diversity, and continues indigenous knowledge systems of livestock management that have contributed to the resiliency of local communities for generations. Drawing on fieldwork in eight villages in Bac Kan and Lao Cai provinces, each populated differently by Hmong, Nung, San Chi, and Tay peoples, this article focuses on new forms of vulnerability brought on by African swine fever. With fieldwork conducted at different stages of the pandemic, African swine fever was found to be not only devastating local pigs but also strongly impacting the sustainable future of smaller-scale farming and the very livelihoods of many ethnic minority populations across the NMR. Overall, this article draws on this moment of crisis to provide strong evidence in support of nuanced policymaking that considers the complex and multi-scale interactions between geography, marginalization, ethnicity, and culture.

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Introduction

On 19 February 2019, the Ministry of Agriculture and Rural Development (MARD) confirmed the African swine fever (ASF) outbreak in Vietnam. ASF is a virus transmitted by contact with infected pigs and by bodily fluids, or if swine consume pork products that contain the virus. Although it does not transmit to humans, it affects pigs and wild boars with haemorrhagic fever and high mortality rates. Since the original confirmation, all 63 provinces/cities of Vietnam have reported outbreaks and over 6 million pigs have been culled (FAO, 2020). The Northern Mountainous Region (NMR), an area largely populated by ethnic minorities (EM), has been particularly impacted.

The NMR is home to 31 (out of the 54) officially recognized ethnic groups in Vietnam, which together account for more than 50% of the total population of the region. These include the Hmong, Nung, Tay, and San Chi ethnic groups. Each group speaks a different dialect that belongs to one of several distinct linguistic groups, including Viet-Muong, Thai-Tay, and Hmong-Dao (Dien, 2002). The rural communities here are prone to multiple inter-related socio-economic stresses, including food insecurity, rising inequality, high debt rates, poor infrastructure, limited access to government services, and environmental degradation (World Bank, 2009, 2012; Rheinlander et al., 2010; Demombynes, 2013; Son and Kingsbury, 2020; Ha et al., 2021).

Many people here suffer from the direct effects of rapidly changing climatic conditions. While Vietnam is one of the most vulnerable countries in the world to climate change, it is in the NMR that this vulnerability is especially pronounced and visible. The impacts of climate variability in the region—as manifested through the longer and more frequently occurring periods of drought, flooding, and cold spells—have significantly rendered local communities more vulnerable to these and other environmental hazards (Delisle and Turner, 2013; Son and Kingsbury, 2020; Ha et al., 2021). These socio-economic and environmental issues compound existing stresses, thereby further increasing communities' vulnerability.

In social and economic terms, minority groups in the uplands are becoming more marginalized as the gap continues to grow between their living standards and development opportunities, and those of the wealthier lowlands (Cuc and Rambo, 2001; Tugault-Lafleur and Turner, 2009). These variations in income and opportunity are significant insofar as most EM groups in the NMR populate land at different altitudes (Dien, 2002), and their livelihoods are predominately based on agriculture, their main source of income and sustenance. Farming practices have been adapted to these conditions and include cutting down forests to produce new farmland, terracing hill faces, and establishing fruit and forest tree plantations (Son, 2013).

In Vietnam as a whole, the agricultural sector accounts for 22% of GDP and more than 60% of employment (Vietnam Livestock Competitiveness and Food Safety, 2009; Nguyen et al., 2014). Livestock production is one of its fastest-growing sub-sectors and accounts for about 42% of agricultural GDP. Pig husbandry is the most significant contributor to total livestock production, at around 70% (Vietnam Livestock Competitiveness and Food Safety, 2009; Nguyen et al., 2014).

Across the country, rapid urbanization, infrastructural improvements, and rising incomes have provided further choices in the diet for many urban and lowland Kinh (i.e., ethnic Vietnamese) (World Bank, 2009; Cassou, 2017). As a result, the consumption of protein from animal sources, and in particular from pork, has risen exponentially (Lapar, 2014; Nguyen et al., 2014; Hansen, 2018).

Consumers prefer to purchase meat fresh rather than chilled or frozen (Nguyen, 2017). The number of larger-scale pork producers has risen rapidly to match this growing demand (Cassou, 2017). Such producers use hybrid breeds in more intense confinement systems, import feed, and often situate their production in rural communities for cost advantages. Larger-scale pork production supplies domestic supermarkets in urban centres or export markets. Government policy tends to support the intensification of production (Herold et al., 2010).



Yet, not all the production of pork has shifted to the industrial scale. In the NMR, EM, typically women, produce most of the local or heritage breeds of pig on a smaller scale. Pork production at this level thus offers substantial opportunities for poorer communities to improve income, accumulate capital, generate family employment, and sustain livelihoods (Xuan et al., 2006; Vietnam Livestock Competitiveness and Food Safety, 2009; Herold et al., 2010; World Bank, 2012). The pigs are partially raised free-range and are able to root and rut in forests and harvested paddies. Heritage pigs mature sexually earlier, tend to be hardier, and are more resistant to diseases than are hybrid breeds (Nguyen et al., 2014). Overall, these smaller-scale systems are low-input, with feed grown or gathered locally, often by the producer. Indigenous knowledge (IK), that is, the systems of understanding that provide many NMR ethnic minority communities with more sustainable ways of reducing risk, are incorporated into management and decision-making (Son, Dong, and Kingsbury, 2019; Son and Kingsbury, 2020; Ha et al., 2021). This is in preference to, or more commonly in lieu of, veterinary services.

In the NMR, pigs represent a range of values in social, spiritual, and economic settings. Pork is consumed regularly at home in EM and Kinh households (Fieldwork, 2019). During holiday periods, it becomes indispensable. Pigs are given as gifts at weddings, funerals, anniversaries, and harvest celebrations, and are used to pay respect to ancestors. For example, the Hmong and Tay both use meals prepared of rice and heritage pork as part of worship ceremonies.

Financially, pigs constitute a form of capital investment for farmers, as the meat from pigs raised on a smaller scale is sold at local fresh markets. Moreover, preserving the smaller-scale producers not only provides benefits attributed to the conservation of genetic diversity and IK systems of management, and maintains higher standards of animal welfare, but also offers the potential for impoverished smaller producers to create unique opportunities to distinguish their production among wealthier urban consumers looking for niche-products (Huyen et al., 2005; Nguyen, 2017; Muth et al., 2017). While the majority of the pigs culled due to ASF were from larger and more industrial pork production facilities, it is these smaller-scale producers who were rendered even more vulnerable and further marginalized by the loss of income, social standing in their communities, and agency in family decision-making.

This article is based on data gathered from those smaller-scale producers in rural communities that are devastated by the effects of ASF immediately before, during, and immediately following outbreaks. It was collected as the mass culling of pigs across the entire northern region of Vietnam added considerable stressors to already fragile and precarious livelihoods. ASF was traumatizing communities and left smaller-scale pig farmers sad, scared, and in real positions of social, economic, environmental, and emotional vulnerability. It would not be an exaggeration to say the NMR was, and remains, in crisis. This study uses the case of the ASF pandemic in ethnic minority villages in two provinces in the NMR to gain a better understanding of the structural basis and diverse parameters of vulnerability, resilience, and adaptive capacity in marginalized communities.

Literature review

Vulnerability, resilience, and adaptive capacity

Vulnerability and resilience are concepts that are increasingly finding currency in several academic fields as well as in various policy and practitioner communities (Cutter, 2003; Knutsson and Ostwald, 2006; Vogel et al., 2007). The concept of vulnerability has roots in the fields of natural hazards, food security, and political ecology, and typically incorporates notions of a system's exposure to a set of hazards (Kelly and Adger, 2000; Klein et al., 2003; Buckle, 2006; Gaillard, 2007; McLaughlin and Dietz, 2008). Despite this, there is little consensus in the literature as to its meaning or how it relates to the concept of resilience.

Holling (1973, 9) defines resilience as 'the capacity of a system to absorb and utilize or even benefit from perturbations and changes that attain it, and so persist without a qualitative change in the system's structure'. In the social sciences, resilience can be defined as the ability of communities to withstand disturbances and

so to maintain their social infrastructures (Adger, 2000). In hazard research, this definition is refined slightly to mean the ability to survive and recover from a disaster event with minimal damage (Cutter et al., 2008). Overall, the views expressed in the literature range from considering vulnerability as the reverse of resilience (e.g., O'Brien et al., 2004), to incorporating resilience as one of the components of vulnerability (e.g., Turner et al., 2003; Manyena, 2006; Turner, 2010). Adger (2006) argues that both vulnerability and resilience research share common elements, including the shocks and stresses experienced by the social-ecological system, the response of the system, and the capacity for adaptive action. In other words, the points of convergence are more numerous and fundamental than the points of divergence.

While vulnerability and resilience may be perceived as two different but related concepts, adaptive capacity comprises the bridge between them (Paton, 2006; Paton and Johnston, 2006). An approach that both reduces vulnerability and enhances the resilience of a system is said to increase adaptive capacity. Focusing on adaptive capacity emphasizes that disaster-affected people should not be seen as helpless victims. Instead, development policy should increase their adaptive capacity to reduce future risk (Gaillard, 2010).

Ethnicity, pandemics, and the building of adaptive capacity in the north of Vietnam

There are clear and causal pathways linking ethnicity and low socio-economic status with poor health outcomes (Kaufman and Cooper, 2001; Mechanic and Tanner, 2007). In this regard, policymakers need to understand social vulnerabilities when developing policies that aim to build resilient communities. Policy interventions based on this approach target specific groups that are considered to be at risk of loss and harm (Paavola, 2008), and may also address the underlying factors that contribute to it. Such factors might include land tenure laws, unequal access to markets or credit, and the lack of social safety nets within unequal power structures and landscapes (Adger, 2006).

This article focuses on the impacts of African swine fever, an animal pandemic, albeit one with direct consequences to human health and welfare. The majority of academic literature on the vulnerability of ethnic minorities during pandemics is centred on the effects of underlying social issues on human health, largely in communities situated in the Global North. This has included studies on how minorities struggle with community mitigation measures such as self-quarantine (Blendon et al., 2008), have higher rates of distrust of the government (Quinn, 2008), suffer more from pre-existing health disparities (Pellowski et al., 2013), and are limited by educational, cultural, and linguistic barriers (Hutchins et al., 2009).

Michaud and Forsyth (2011) argue that ethnic minority communities in the NMR have been misrepresented as being marginalized and therefore powerless against social and environmental stressors. There is indeed a rapidly growing body of literature focused on how EM communities continually draw from various cultural sources to circumvent and respond, to maintain their livelihoods (see the examples of Hardy, 2003; Michaud and Forsyth, 2011; Turner, 2012; Turner et al., 2015; Turner and Bonnin, 2018). The present article does not suggest a lack of individual, collective, or even cultural agency. Rather, it explores how the adaptive capacity of these communities, already affected by pre-existing socio-economic marginalization, hazards, and climate change, is being modified by an ongoing pandemic. The aim is to more optimally determine how they and their cultural sources can best be supported. In other words, this article seeks to identify the appropriate measures that will help them to increase adaptive capacity.

This understanding will assist local governments in finding answers to the questions about who is vulnerable, what they are vulnerable to, the degree of their vulnerability, what the causes of that vulnerability are, and what responses can alleviate it (Cutter et al., 2012). As vulnerability is complex, evolving, and situation-specific, not all communities should be understood as being uniformly vulnerable. This article provides strong evidence in support of vulnerability-based policies, grounded on a more holistic consideration of the complex and multi-scale interactions between geography, marginalization, ethnicity, and culture. It looks at vulnerability, resilience, and adaptive capacity during an ongoing crisis, for both humans and animals, and is one of the first to focus on the numerous social, cultural, and economic impacts of the ASF pandemic on rural communities



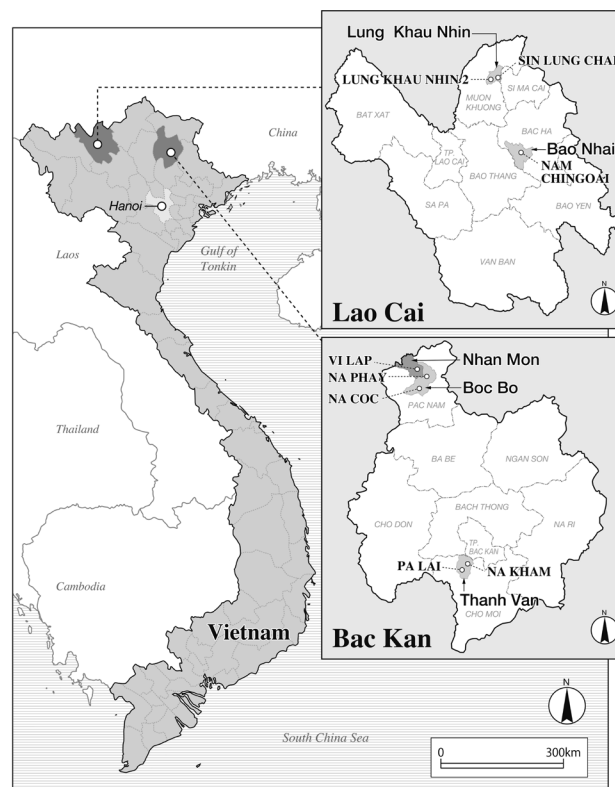
in the Global South.

Research methodologies

Study areas

Data for this study were collected from ethnic minority small-scale pork producers in Bac Kan province in the northeast and Lao Cai province in the northwest of Vietnam in August and September of 2019. These locations were selected as they are communities with majority EM populations that raise pork. Sites were also chosen based on the past occurrence, ongoing occurrence, or nearby proximity of African swine fever. In Bac Kan province, interviews were conducted in five villages. These included Na Phay and Na Coc villages (both in Boc Bo commune), Vi Lap village (in Nhan Mon commune), and Na Kham and Pa Lai villages (both in Thanh Van commune). In Lao Cai province, interviews were conducted in three villages. Sin Lung Chai and Lung Khau Nhin 2 are villages in Lung Khau Nhin commune and Nam Chi Ngoai village is in Bao Nhai commune. See Figure 1 for a map depicting the location of the study villages.

Figure 1: Map of study sites



Source: The authors

In Bac Kan, respondents were ethnic Hmong and Tay in Vi Lap village; San Chi in Na Phay village; Tay in Na Coc village; and Tay in Na Kham and Pa Lai villages. In Lao Cai, respondents of the Lung Khau Nhin commune were mainly Hmong and Nung people, while in Bao Nhai commune, they were Hmong and Tay. Table 1 categorizes the study villages by province, commune, and dominant resident ethnicities.

Table 1: Study site locations and ethnic composition of residents

Province	Commune	Village	Dominant Ethnicities
Bac Kan	Boc Bo	Na Phay	San Chi
	Boc Bo	Na Coc	Tay
	Nhan Mon	Vi Lap	Hmong, Tay
	Thanh Van	Na Kham	Tay
	Thanh Van	Pa Lai	Tay
Lao Cai	Lung Khau Nhin	Sin Lung Chai	Hmong, Nung
	Lung Khau Nhin	Lung Khau Nhin 2	Hmong, Nung
	Bao Nhai	Nam Chi Ngoai	Hmong, Tay

Source: Fieldwork, 2019

The number of villages in this study situated in Lao Cai province was less than in Bac Kan as research followed the data collection theory of saturation (Lewis-Beck, Bryman, and Liao, 2004). To identify respondents at each location, village elders and/or heads were consulted to obtain a list of households engaged in smaller-scale pig production. From these lists, 5 to 10 producers at each study site were invited to participate in a group discussion at the cultural house of the village. Participants included both men and women. A total of 8 group discussions were organized across both provinces, including 5 in Bac Kan and 3 in Lao Cai, with a total of 40

women and 20 men participating. The research team also visited and observed the production situation in just over half of the households.

Additionally, 5 in-depth interviews with women and 2 with men were conducted in Bac Kan, and 3 in-depth interviews with women and 3 with men were conducted in Lao Cai. Interview participants were randomly selected from small-scale pork producers who self-identified as being highly affected by the African swine fever pandemic. Interviews allowed for more nuanced questions on sensitive and/or personal matters not suitable for group discussions. This permitted respondents to share stories of a private nature, including those related to economic loss and mental struggle. Finally, participant observation, including assisting villagers in burying their culled pigs, was used in this study to have informal conversations and gain first-hand experience of the impacts of the pandemic.

Vulnerability assessment

This study adopted a participatory approach to vulnerability assessment. Based on the work of Schroter, Polsky, and Patt (2005), this study began by defining the areas of geographic focus, including the relevant communities and stakeholders. Thus, the scale of the investigation was delimited by drawing artificial boundaries around the coupled human-environment systems of interest. In this context, it was essential to develop the stakeholders' knowledge of their own communities, the government services they valued, and the drivers of vulnerability. The vulnerability of the human-environment systems was evaluated using ethnographic methods (e.g., focus group discussions, semi-structured interviews, and participant observation).

Given the study's focus on social vulnerability processes and adaptive capacity building, qualitative research methods were considered more appropriate than quantitative methods (Denzin and Lincoln, 2003; O'Leary, 2010). A range of techniques was employed to generate information, triangulate insights, and construct an accurate and detailed picture of the dynamics of vulnerability at the household, village, and commune levels. Rather than focusing only on official reports and statistics, this article explores how local smaller-scale producers conceptualized, experienced, and reacted to the ASF pandemic.

Within a short period in the field, collected data began to reveal the emergence of several major themes. Section 4 is divided into sections based on the temporal relation of the study site to the development of the ASF pandemic and is centred on vulnerability and resilience. Due to the small population size of many rural villages in the NMR, the names and specifics of individual villages have been generalized to maintain the respondents' anonymity. Identification of ethnicity is included only when relevant to the analysis.

Results

Before the arrival of ASF at the study sites

The production of pork has long been vital to rural EM communities and generates the main source of income for many households (Fieldwork, 2019). The average annual income from pig production accounted for 30-70% of the total income of all surveyed families (with the remainder largely derived from off-farm labour). Those with a higher total percentage were Nung and Tay people, who often live at lower altitudes and raise more pigs.

Depending on the community, the pigs raised were hybrid or heritage breeds alone or in combination, although Hmong respondents residing at the highest elevations kept a smaller number of heritage and no hybrid breeds. Many communities, regardless of ethnicity, raised only heritage pigs. At each of the study sites, women, in particular, benefited in various ways. Pigs constitute a form of investment, and the pork from these pigs provided local women with agency in how production was managed and the dominant voice in deciding where profits were spent. Female respondents across all study sites mentioned that their pig farming helped them fund communal celebrations, buy agricultural equipment and agrichemicals, cover family expenses and



school fees, and supply nutrition. Many also expressed that it provided them with an enhanced sense of purpose and worth to themselves, their families, and their communities.

It is important to note that pig farming is occasionally integrated with a side business of alcohol production. While the price of corn or rice is low, it can be fermented into alcohol and sold for high profits locally. The dregs of this production, combined with available rice bran and/or banana stems, provide a nutritious and inexpensive feed for pigs. The nutrient-rich manure from the pigs can be spread back on the fields. As with the profits earned from selling pork, in many cases the women dictated how the money from the sale of alcohol was utilized.

Overwhelmingly, before the outbreak of ASF in their communities, smaller-scale pig producers expressed little fear of it influencing their livelihoods. Generally, when respondents first heard of an outbreak, they assumed it 'was some disease far off in Africa'. Even when ASF was found in villages less than 100 km away, many noted that they remained confident that the problem would not affect them. Some villages took proactive measures, slaughtered all adult hogs before ASF was detected, and then shared the meat among households in the village. Such foresight was rare, government warnings went unheard or unheeded, and it was only when the disease was directly affecting the animals of their neighbours that smaller-scale producers really grasped the extent of the problem.

As ASF spread closer to the study sites and it became obvious to the producers that their animals would be affected, there were several immediate responses. First, if a freezer was available, a pig would be slaughtered and frozen for household consumption rather than for the market. More commonly, smaller-scale producers slaughtered their pigs and attempted to sell them at greatly reduced prices (i.e., 40,000 VND/kg or US\$1.75/kg down from US\$3.50 before the outbreak of ASF). Producers knew that once an ASF case was confirmed in their village, their pork would have no value.

Finally, some village-level leaders (e.g., village heads, party secretaries, youth union secretaries, and representatives from women's union branches and veteran's associations) forbade the purchasing of pork from outside the village, in an attempt to prevent the introduction of ASF through contaminated meat. This beneficially (and perhaps serendipitously) also secured a market for pork produced locally. It is important to note that most of these leaders were elected by their communities to represent them and provide a bridge with the commune government. As such, community members were very responsive initially to the regulations of their village leaders. With this way of self-protection, for example, some villages around Thanh Van commune were found to have limited or slowed the spread of ASF in their communities (Fieldwork, 2019).

During the ASF pandemic

Responses by the government

Once ASF was confirmed in a community, support from various levels of government was distributed in multiple forms. Most of this flowed down through a hierarchical bureaucratic structure in response to information transmitted bottom-up from the village/commune levels. For example, ongoing statistical data on swine mortality and location in affected villages were updated daily by the commune veterinary staff and reported twice a week to the commune People's Committee, and then to the district People's Committee. When a new outbreak occurred, however, it was relayed immediately to district authorities. Twice a week, the district People's Committee and the Department of Agriculture reported on the ASF situation in their district along the chain up to the provincial government.

The provincial Departments of Agriculture and Rural Development provided documents to guide subordi-

nates in disease prevention and control. These included instructions relevant to still unaffected communities such as lime sprinkling routines.¹ For locations where an outbreak was occurring, as an example, instructions were transmitted from the provincial level down to district People's Committees on how to handle diseased pigs and spray disinfectants. All of this information was in turn shared with commune officials to operationalize everything at the village and household levels.

As an example of this process, the provincial People's Committees regulated the actual culling and disposal of infected pigs. Pigs found to be sick were culled in the community but buried or cremated away from residential areas and water sources (See Figures 2 and 3). This burial process was closely monitored by rapid response teams formed at the commune level to prevent sick pigs from being slaughtered and sold for food (Fieldwork, 2019). Following the guidance of the district People's Committees, communes also organized security forces to staff quarantine checkpoint gates 24/7, to control the transportation of pigs. During the pandemic, it was forbidden to transport pigs from an infected area (either live or slaughtered), to avert the spread of ASF. In practice, however, many of these checkpoint gates were found simply left open and unguarded, especially due to cost or when discipline slacked during non-peak ASF periods.

According to respondents, the quality of the initial response from the government was mixed. While they tended to trust the village leadership (whom they knew), respondents were more critical of advice originating from higher levels within the bureaucracy. Most farmers across study sites also expressed considerable confusion when first hearing about the outbreak. They were not aware of whether the disease was already present in or would spread to their village, how to identify symptoms in their animals, and what the effects might be on their livelihoods. They felt that this type of information should have been made more readily available. Respondents also voiced scepticism and trepidation when quick response teams arrived to spray disinfectant around their barn areas and homes. Many believed that these people likely carried the very disease they were sent to prevent.

Figure 2: Culled pigs collected in Boc Bo Commune



Source: Fieldwork, 2019

¹ According to the information provided by the staff at one district Department of Agriculture, lime powder is used as a disinfectant that limits the spread of ASF.



Figure 3: The burial of culled pigs in Boc Bo Commune



Source: Fieldwork, 2019

The human dimension

Perhaps the most commonly held view among respondents was the disbelief that ASF had arrived in their village. When the pigs of one villager tested positive, neighbours bought lime and frantically began to spray disinfectant in and around their own homes. Others became preoccupied with thoughts about when their pigs would also be affected. Others took no action at all. As one San Chi female respondent explained:

When I saw information about ASF on the news, there were a lot of dead pigs that needed to be buried. I was sure it wouldn't happen to me, but it did. I did nothing to prepare for it.

One ethnic Tay female respondent explained she lost 4 kg during the time of the pandemic.

Over a period of two months, [she said,] I could neither eat nor sleep. Every time the radio/TV announced something about the pandemic, I became more worried and overwhelmed... African swine fever is hard to prevent and we don't know when it will occur or end.

One ethnic Tay male farmer commented:

The dead pigs made me very sad. I skipped meals and cried like a child. I was really shocked, and lost 40 million VND [around US\$1,750 – a considerable amount of money] because of African swine fever.

Although ASF does not spread directly to humans, its increase throughout the NMR has also led to a human health crisis. Local villagers and smaller-scale producers explained they suffered from anxiety and

changes in diet. Residents near affected sites expressed feelings of impending loss. Smaller-scale producers were found to obsessively watch their pigs all day for signs of disease, and many admitted privately to suffering from bouts of insomnia and panic attacks. As a female respondent noted: 'Now we don't know when the outbreak will stop or if we can re-invest in raising pigs'. In short, ASF brought mental anguish and depression as respondents felt vulnerable and saw their future as uncertain.

The aftermath: Finding adaptive capacity

What makes ASF different?

Multiple respondents noted that ASF affected them differently to other disasters. As one explained,

While flash flooding may bury one rice paddy, other crops can compensate for the loss, and I can still cultivate the land again the following growing season.

Cropland in the NMR is also small and geographically dispersed, so excessive flooding in one plot would not affect the farmer's other plots. Furthermore, communities in the NMR of Vietnam are closely knit and tied by larger kinship networks. The loss of a failed crop of one farmer can be eased via informal assistance and aid through their extended familial, ethnic, and other social networks (Fieldwork, 2019). While this provides resilience in the form of income and/or nutrition in a time of a disaster, the ASF pandemic proved more complex. Pigs from the entire village, commune, and region were uniformly gone. ASF was therefore experienced by respondents as considerably more frightening and devastating. With the death of their animals, farmers lose investment and earning potential, sink further into debt, and are unsure if they will ever be able to raise pigs again.

Other forms of animal husbandry

One common suggestion of the government was for affected producers to replace pig production with poultry or cattle. This proved unrealistic for many reasons. Culturally, while households in this study consumed pork 4-7 times per week, chicken and beef were eaten less than once. Respondents mentioned that this local dietary preference for pork meant it was easier to sell. Overall, however, their decision not to invest in non-swine animal husbandry operations was based on more complicated practicalities.

Respondents in this study were EM and typically used IK in their production. Many had been breeding pigs since childhood and this knowledge did not transfer to other animal husbandry operations. The timing, skills, and infrastructure required to raise poultry or cattle also bear no relation to those of pigs. For example, pens for pigs tend to be simple and the animals do not require additional heating in winter (unlike chicken coops which require a larger area and need to be built sturdier in a way that maintains warmth to protect the more cold-sensitive birds). Some respondents mentioned that they had considered raising cattle, only to find that the high initial investment costs proved insurmountable. Similar complaints were expressed by respondents who contemplated transitioning to ducks or horses.

Most respondents felt that raising unfamiliar animals was riskier than pigs and that their lack of experience would lead to the new livestock being more susceptible to disease and death. This potential loss of more animals, they argued, would further complicate their tenuous economic situation. Furthermore, pig production systems can support the fermentation of alcohol to sell for additional profits, something not applicable to chicken or cattle. Finally, other value-added products produced from pork in some villages before the pandemic (e.g., sausages), require a different array of technology and equipment when using chicken. As an example, commonly used equipment that removes bones from pork is too coarse to remove finer chicken bones. With a lack of viable options, respondents across study sites were very confused, scared, and uncertain as to what to do next.



Policies of compensation

Financial compensation details for culled animals were formalized in late June 2019 in a document entitled Decision 793, and the funds promised were US\$1.10/kg for piglets and US\$1.30/kg for sows and boars (Nguyen, 2019). Respondents remarked that the value was far lower than that achievable at the market for a healthy pig. Some respondents cynically noted they had yet to receive compensation for pigs culled six months earlier, which further contributed to their distrust in authority.

To limit future ASF outbreaks, previously affected villages were required to wait a mandatory full year before being allowed to raise pigs again. Respondents also expressed fear of restarting pig production, as they were uncertain as to whether or when ASF would return. As a result, the majority of financial compensation that was received from the government was found to have been used on activities unrelated to agriculture or animal husbandry. Respondents spent the money on things immediately essential to daily life including food, clothing, and fuel. In other cases, especially in ethnic Tay communities, the compensation money was used to pay bank loans and reimburse feed debts. After a couple of months, the money was spent and there was nothing tangible in place to generate more income. Without other viable alternatives, a few months following an outbreak, some farmers were found illegally raising pigs again. In these cases, they gambled on not being caught and on their pigs remaining uninfected.

Changing economic realities

Before ASF, residents of villages in this study had grown accustomed to relying on the income from small-scale pork production. It provided a form of self-employment that allowed for time and proximity to raise children and reside locally, without requiring traveling to manual labour jobs in distant industrial zones. In particular, EM women had come to rely on this income to support themselves, their families, and their communities. ASF changed this in dramatic ways. A Tay female farmer explained,

Now I have no money to pay for my children's school fees. Two pregnant sows which were ready to give birth perished due to African swine fever. I had expected them to give birth to about 20 piglets. I would have raised 10 and sold 10, earning about 8 million VND [US\$345] to pay for my children's schooling. Now I have nothing, no money, no piglets, and also no mother pig. I don't know when I can raise pigs again.

A Nung male farmer added,

Pigs were the main economy in our village and accounted for 70% of the total income of my family. Now that the pigs are dead, we have given up all our plans. Normally, we worked in the field to get rice and corn to raise pigs. But the pigs are dead, and I don't know where to sell the rice and corn. We have no idea what to do to earn money.

Finally, the destruction of small-scale pig production is changing the dynamics of family and village life. Group discussions revealed significant losses in family income, and households going deeper into debt not only to banks but also to friends and extended family. Higher poverty rates² are forcing more out-migration of working-age males and youth to urban areas and abroad (e.g., China³) to secure new forms of income (Fieldwork, 2019).

² The word "poverty" in this article is defined in two overlapping ways. First, respondents explained their endogenous conceptualizations of poverty and their situation resulting from African swine fever. Second, on 27 January 2021, the Vietnamese government issued Decree No. 27/2021/ND-CP, stipulating the poverty line for the period of 2021-2025. This guideline defines poverty as: 1) earning an average monthly income of less than VND 1.5 million (around \$65), and 2) lacking three or more indicators from twelve listed basic social services.

³ Note that the research of this study was conducted prior to the COVID-19 pandemic. Before COVID-19, there was a more regular migration of men over the northern border of Vietnam into China for unskilled labour jobs.

Discussion

Across the NMR, ASF quickly rendered vulnerable people even more vulnerable. The death of pigs resulted in a substantial loss of both income and nutrition, especially as so many livelihoods are intrinsically interconnected to animal husbandry. Smaller-scale pig farming, such as keeping a few pigs at home, may not seem like a substantial investment, but it kept many from poverty. While the Vietnamese government has promised compensation for animals culled, farmers consider that their pigs are undervalued, and communities expressed insecurity as to when or even if the money would arrive. As studies of other ethnic and racial minorities globally have found (Quinn, 2008; Hutchins et al., 2009), cultural barriers and a pronounced lack of trust in government are also limiting the exchange of information between stakeholders. This is resulting in resistance to state-sponsored support programmes and ultimately increasing vulnerability at the study sites.

While no clear relationship was found between the different methods of pig husbandry and the adaptive capacity of specific ethnic groups when encountering ASF, this study uncovered considerable variation across ethnic groups as to the level of impact of ASF. In both Bac Kan and Lao Cai provinces, the Nung and Tay people residing at lower elevations lost the greatest number of animals due to the pandemic. This correlates directly to fact of them breeding more pigs. Overall, when pigs die or are culled, most families across ethnic groups were found to be left with greatly reduced income, little money to cover daily expenses, increased food costs, and mounting debt. Women with younger children cannot easily seek off-farm work, and those of any gender over the age of 40 also find it difficult to secure employment elsewhere. Many communities are also only marginally connected to the opportunities available in more urban settings at lower elevations. A combination of geographic isolation, low levels of formal education, a distrust of the government, and higher rates of illiteracy also mean that small-scale farmers tended to be more passive instead of proactively contacting officials when issues arise or reimbursement for their culled animals is sought (Fieldwork, 2019).

While broader generalizations of this nature are accurate, they fail to adequately depict the necessary complexity of how ASF uniquely affects people differently within the region. For example, ethnic Tay families raised the most pigs and some had developed their operations along slightly larger business models. Bank loans were taken to expand operations and purchase industrial feed. These families consequently lost more due to ASF. However, Tay ethnic people reside at lower elevations and tend to be better integrated into Kinh society. This allowed them to rely more on social networks and existing infrastructure to more easily replace their culled animals with those sourced from unaffected lowland communities. Tay people were also more likely to be able to counterbalance losses by securing off-farm employment. Thus, ethnic Tay people were found to be less or at least differently vulnerable than other groups.

By contrast, Hmong communities residing at the highest elevations enjoy the least social and economic connections to lowland communities and are the most isolated and impoverished. Yet, while they did also lose pigs due to ASF, they were less affected by the pandemic as culturally they tend more to have water buffalo and cattle. Under typical conditions of unequal power structures and varying social safety nets (Adger, 2006; Son and Kingsbury, 2020), this highlights the importance of deconstructing the relationship between geography, marginalization, ethnicity, and culture when scripting policy. It also further underscores the complex and situation-specific components of social vulnerability, and the lack of uniformity in adaptive capacity across and within different groups of people in relatively small spaces.

Another important finding of this study relates to the continued deterioration in the genetic diversity of heritage pig breeds in the NMR. This further exacerbates a disconcerting trend of decline already noticed before the ASF pandemic (Huyen et al., 2005; Xuan et al., 2006). The culling of large numbers of animals has furthermore removed considerable sources of breeding stock to repopulate the region. In turn, this will greatly undermine the relevancy and applicability of IK systems of farming that have provided valuable forms



of resiliency to minority populations over multiple generations. It also means that these more sustainable production systems have possibly been terminally disrupted. In short, ASF has resulted in a serious cultural and environmental loss not only to the NMR but also to Vietnam and beyond. This directly evidences the fragility of many forms of adaptive capacity in marginalized communities.

Overall, the majority of financial compensation that was distributed to replace culled animals was found to have been used on activities unrelated to agriculture or animal husbandry. Payments have not resulted in sustainable and longer-term options to generate income. In this case, passive welfare has decreased self-reliance and proven more harmful than supportive. As such, rather than simplistic compensation pay-out schemes, the government needs to organize more targeted investments and aid programmes that seek to reduce social vulnerability to enhance capacity.

At a time when affected communities would benefit from state support, a pronounced disconnect between aim, activity, and outcome limited effective response. Expanding on Cutter et al. (2012), degrees of social vulnerability significantly determine communities' responses, while directly providing clues to policymakers on appropriate actions to lessen vulnerability. In the case of the NMR, this would imply that policies target specific communities in the case of disasters or pandemics, and focus on those poorer households with less land or available labour. It also argues for a more active engagement and the development of more open lines of communication between policymakers and communities, to build trust and better conceptualize social protection.

This study also afforded valuable insights into how respondents perceived ASF to have differed from other environmental or climate-induced disasters. If there were a large flood, for example, planted vegetables and grains would be lost. However, this loss would only be for one season and other crops could be used to compensate for the caloric and monetary lapse. Supportive social, ethnic, and extended family networks could also help fill the temporary void. This study found ASF to be considerably more threatening. Whole villages are being required to reshape economic livelihoods, and previously utilized cultural sources of response are proving partially ineffective. How and under what conditions these new dynamics will play out, and how EM populations will circumvent them, will shape the future of the region.

Finally, the results of this study directly relate to the role of women in agricultural and community development, as well as the importance of gender in adaptive capacity building. The small-scale production of pork was culturally accepted in EM communities as a meaningful social and economic contribution of women. Female respondents explained that they were the decision-makers on how these earnings would be spent. To this, the interconnected side-business of alcohol production added valuable income. Following the culling of pigs, many female respondents expressed feelings of guilt at not being able to further invest in their children's education or the family's welfare. Questions must also be asked about the fate of family structures and village communities with many working-aged men and youth now forced to seek distant wage-earning jobs. Women have moreover added agricultural fields previously cropped by men to their unpaid domestic duties. Gender inequalities across ethnic minority groups will likely continue to worsen, as many families devote their scarce resources to educating sons, whereas daughters are kept at home to provide domestic labour. This highlights the importance of reducing inequality in order to reduce vulnerability, and further illustrates the structural factors that marginalize some members of society and keep them vulnerable. It also offers numerous points to inform direct policy intervention in support of EM communities in the NMR.

Conclusions

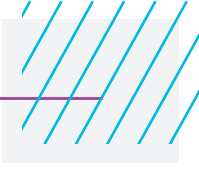
This article was centred on vulnerability, resilience, and adaptive capacity during an ongoing crisis in a marginalized region of the Global South. Through case studies of small-scale pig producers in Bac Kan and Lao Cai provinces in the Northern Mountainous Region of Vietnam, it identified how the adaptive capacity of ethnic minority communities was severely reduced by African swine fever, with more far-reaching effects

than those of previous hazards. From this, the following overarching developments can be predicted. First, a further deterioration in the genetic diversity of heritage pig breeds will continue. Questions as to the future of smaller-scale pig production are pressing, and this will have pronounced effects on those EM communities that most rely on pigs for food, income, cultural traditions, and resiliency. The ASF pandemic will likely become endemic, and smaller-scale producers cannot afford the biosecurity measures necessary to prevent further outbreaks. Second, EM women in particular will be further negatively affected by ASF. With childrearing traditionally considered the role of the women in the family, and with few opportunities for off-farm labour or training, pre-existing social strains will become greater. Family debt will increase. Those communities situated at higher altitudes and in more remote settings will face greater economic and emotional burdens. Third, with the lack of pork in the marketplace, Vietnam may be unable to supply the demand for pork through its domestic production. The predicted increase in price and its effects on consumers and future smaller-scale producers remain uncertain. What is certain, however, is that this void will be filled by imported and/or industrially-produced meat owned by those originating outside the EM communities of the NMR.

Overall, with interacting stressors, including poor infrastructure, geographic isolation, natural disasters, and climate change, now further exacerbated by ASF, the people of the NMR will face a more challenging future. Immediate and targeted policies that reduce these vulnerabilities by providing opportunities for agency and the building of adaptive capacity are essential. Increasing communication among all stakeholders is of paramount importance, as is the building of trust between stakeholders and government. Across many regions in the Global South, more informed policies based on supporting self-reliance guided by constituents, rather than simply distributing social welfare, would support communities in becoming more adaptive and responsive to environmentally-induced stress and change.

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