7. DISEASE OUTBREAK

7.1 HAZARD PROFILE

7.1.1 Hazard Description

A pandemic is a global outbreak of disease that occurs when a new virus emerges in the human population, spreading easily in a sustained manner and causing serious illness. An epidemic describes a smaller scale infectious outbreak within a region or population that emerges at a disproportional rate. Infectious disease outbreaks may be widely dispersed geographically, impact large numbers of the population, and could arrive in waves lasting several months at a time (Columbia University 2021). Of particular concern in Sussex County are vector-borne diseases, which are transmitted to susceptible hosts such as humans by an infected transmitting animal called a "vector." Common disease vectors are blood-feeding mosquitos or ticks:

- **Mosquito-Borne Disease—**Mosquito-borne diseases are spread through the bite of an infected female mosquito. The most common mosquito-borne diseases in New Jersey are West Nile virus (WNV), eastern equine encephalitis (EEE), and St. Louis encephalitis (SLE) (NJDOH 2023).
- **Tick-Borne Disease—**Tick-borne diseases are spread to humans through ticks that become infected by micro-organisms when feeding on small, infected mammals (e.g., mice and voles). The most common tick-borne diseases in New Jersey are *Lyme disease*, *ehrlichiosis*, *anaplasmosis*, *Rocky Mountain spotted fever*, and *babesiosis*. It is possible to be infected with more than one tick-borne disease at a time. The three types of ticks in New Jersey that may carry disease-causing micro-organisms are the deer tick, lone star tick, and American dog tick (NJDOH 2013).

For this HMP update, the following vector-borne and other transmissible diseases are discussed:

- **West Nile Virus—**WNV is the leading cause of mosquito-borne disease in the United States. WNV is usually diagnosed starting in the summer months and continuing through the fall (NJDOH 2023). WNV was first identified in the United States in 1999. In New Jersey, 380 human cases of WNV have been reported (CDC 2023). WNV can cause serious illness, and in some cases, death. The symptoms of severe infection can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. Usually, symptoms occur from three to 14 days after being bitten by an infected mosquito (NJDOH 2023).
- **Eastern Equine Encephalitis—**EEE is a virus disease of wild birds that is transmitted to horses and humans by mosquitoes. It is a rare but serious viral infection. EEE is most common in the eastern half of the United States (NJDOH 2023).
- **St. Louis Encephalitis—**SLE is a rare but potentially serious viral infection, although most persons infected with it have no apparent illness. It is transmitted to humans by the bite of an infected mosquito. Most cases have occurred in eastern and central states. Initial symptoms of those who become ill include fever, headache, nausea, vomiting, and tiredness. Severe neuroinvasive disease (often involving encephalitis, an inflammation of the brain) occurs more commonly in older adults (CDC 2023).
- **Lyme Disease—**Lyme disease is the most common vector-borne disease in the United States. It is caused by bacteria transmitted by infected ticks. Typical symptoms include fever, headache, fatigue, and skin rash. Most cases can be treated successfully with antibiotics. If left untreated, symptoms can be severe. Steps to prevent Lyme disease include using insect repellent, removing ticks promptly, and reducing tick habitat

(CDC 2022). In New Jersey, the most common infected tick is the deer tick. Ticks become infected by feeding on infected mice and other small mammals (NJDOH 2012).

- **Ebola—**Ebola is a rare and deadly disease caused by infection with the Ebola virus (CDC 2023). According to the Centers for Disease Control and Prevention (CDC), the 2014 Ebola epidemic is the largest in history affecting multiple countries in West Africa. Two imported cases, including one death, and two locally acquired cases in healthcare workers were reported in the United States (CDC 2023).
- **Influenza—**Influenza is a contagious virus that affects the nose, throat, lungs, and other parts of the body. It can quickly spread from one person to another, causing mild to severe illness and can lead to death. Symptoms include fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headache, and tiredness (NJDOH 2023). Pandemic influenza differs from seasonal influenza, which is caused by viruses already living among people. Pandemic influenza is a global outbreak of a new influenza virus that can infect people easily and spread from person to person in an efficient and sustained manner. The seasonal flu happens annually and usually peaks between December and February. An influenza pandemic can reduce the health, safety, and welfare of the essential services workforce (CDC 2020).
- **Coronavirus—**Coronaviruses are a type of virus spread through droplets and virus particles released into the air when an infected person breathes, talks, laughs, sings, coughs, or sneezes. Larger droplets may fall to the ground in a few seconds, but tiny infectious particles can linger in the air and accumulate in indoor places, especially where many people are gathered and there is poor ventilation (John Hopkins University 2022). COVID-19 is an infectious coronavirus disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illnesses from this disease (World Health Organization 2022).

New Jersey's geographic and demographic characteristics make it particularly vulnerable to importation and spread of infectious diseases. All 21 counties in the state have experienced the effects of a pandemic or disease outbreak. All counties may experience pandemic influenza outbreak caused by factors such as population density and the nature of public meeting areas. Diseases will spread more quickly in densely populated areas than in less densely populated areas.

7.1.2 Location

Diseases that can infect humans are variable in their nature and methods of transmission. The transmission rates of respiratory disease are often higher in more densely populated areas while the transmission rates of insect-borne disease are often higher in less densely populated areas that provide more habitat for insects. Ultimately, residents need to be vigilant about diseases altogether to better understand and respond to disease outbreaks.

Factors such as population density, visitation, and the length of time the public spends in a location all contribute to the spread of infectious diseases. Indoor areas where people are in close contact with each other appear to be significant locations for diseases that are spread through respiratory droplets, such as coronavirus and influenza.

Infectious diseases spread by insects may be subject to other types of location hazards. For example, the prevalence of standing water can provide breeding grounds for mosquitoes, and wooded areas are favored by the ticks that spread Lyme disease. Sussex County has large areas that have potential to breed mosquitoes. The presence of disease-carrying mosquitoes and ticks has been reported throughout most of the State of New Jersey and Sussex County. These areas include farmland, private yards, stormwater facilities, and sewer plants. These areas need to be addressed as best as possible to control mosquitoes and the viruses they can spread.

7.1.3 Extent

The severity of the next disease outbreak cannot be predicted; however, experts anticipate that its effect on the United States could be severe as demonstrated by the COVID-19 pandemic. The extent of a disease outbreak depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals.

The CDC and public health officials use the Pandemic Severity Assessment Framework (PSAF) to determine the impact of a pandemic. The PSAF uses two main factors to determine the impact of a pandemic. The first is clinical severity, or how serious is the illness associated with infection. The second is transmissibility, or how easily the pandemic virus spreads from person to person. These two factors are used to guide decisions about which actions CDC recommends at a given time during a pandemic. The results help public health officials and health care professionals make timely and informed decisions, and to take appropriate actions (CDC 2016).

The World Health Organization (WHO) defines six phases of a pandemic influenza, as outlined in Table 7-1. The State of New Jersey uses the WHO classification system to determine activities to be undertaken during a pandemic period. The WHO's *Pandemic Influenza Preparedness and Response* document provides guidance to government agencies, individuals, families and communities, and the health sectors at the local and global levels.

Table 7-1. WHO Global Pandemic Phases

Phase	Description
Preparedness and Response—Global, Regional, National, Sub-National Level	
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Containment	
Phase 4	Human-to-human transmission of an animal or human-animal influenza virus able to sustain community-level outbreaks has been verified.
Response—Global Level	
Phase 5	The same identified virus has caused sustained community-level outbreaks in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in Phase 5, the same virus has caused sustained community-level outbreaks in at least one other country in another WHO region.
Post-Pandemic	
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible New Wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post-Pandemic Period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance

Source: WHO 2009

The United States and other countries are constantly preparing to respond to disease outbreaks. The U.S. Department of Health and Human Services and others are developing supplies of vaccines and medicines. In addition, the United States has been working with the WHO and other countries to strengthen the detection of disease and response to outbreaks and pandemics. Community preparedness efforts are ongoing via NJDOH and local health departments. These programs empower local health departments and their community partners to promote local readiness, foster community resilience, and to ensure comprehensive, coordinated, and effective responses.

West Nile Virus

WNV cases increase in parts of New Jersey during the late summer and early fall as mosquito populations increase. Mosquitos become infected when they feed on infected birds. There are no vaccines to prevent or medications to treat WNV in people; however, those infected rarely experience symptoms (John Hopkins University n.d.).

Eastern Equine Encephalitis

The risk of contracting EEE is highest from late July through early October (NJDOH 2023). The State of New Jersey documents this viral activity nearly every year. Horse cases are most common in the southern half of the state because the acid water swamps that produce the major mosquito vectors are especially prevalent on the southern coastal plain (Crans 1993).

St. Louis Encephalitis

Cases of SLE have been reported throughout the country, but periodic outbreaks and epidemics have primarily occurred in the Mississippi Valley and along the Gulf Coast and more recently in the Southwest. In temperate areas of the United States, SLE cases occur primarily in the late summer or early fall (CDC 2021).

Lyme Disease

Ticks can be active any time the temperature is above freezing (Occi, et al. 2019). Adult ticks, which are approximately the size of sesame seeds, are most active from March to mid-May and from mid-August to November. Most cases of Lyme disease in New Jersey are reported from May through September, which corresponds to the peak activity period for young deer ticks, called nymphs (NJDOH 2022). Both nymphs and adults can transmit Lyme disease, but this annual trend suggests that many Lyme disease cases are transmitted by nymphal deer ticks. Nymphs are active from mid-May to mid-August and are about the size of poppy seeds.

Ebola

The risk of getting Ebola is highest from late July through early October when mosquito activity is most active. However, those who travel abroad, particularly to countries where the virus is prevalent, are more likely to contract the virus (NJDOH 2022).

Influenza

Fine droplets and particles spread and accumulate more rapidly in an indoor setting. Therefore, the transmission of respiratory illness from contact with infected individuals is more likely to occur in indoor spaces. The seasonal flu happens annually and usually peaks between December and February (CDC 2020).

Coronavirus

Coronaviruses are spread through droplets and virus particles released into the air when an infected person breathes, talks, laughs, sings, coughs, or sneezes, which is more likely to occur in indoor spaces. While the statistics of COVID-19 are subject to change during the publication of this HMP, the New Jersey COVID-19 dashboard shows that Sussex County is within the lower quarter of the impacted counties in the state.

7.1.4 Previous Occurrences

FEMA Major Disaster and Emergency Declarations

Sussex County has been included in three major disaster (DR) or emergency (EM) declarations for disease outbreak-related events (FEMA 2024). Table 7-2 lists these declarations.

Table 7-2. FEMA Declarations for Disease Outbreak Events in Sussex County

Event Date	Declaration Date	Declaration Number	Description
May 30 to November 1, 2000	November 1, 2000	EM-3156	West Nile Virus
January 20, 2020, to May 11, 2023	March 13, 2020	EM-3451	New Jersey COVID-19
January 20, 2020, to May 11, 2023	March 25, 2020	DR-4488	New Jersey COVID-19 Pandemic

Sources: FEMA 2024

USDA Declarations

The U.S. Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans from the U.S. Department of Agriculture (USDA) to producers suffering losses in those counties and in contiguous counties. Since the previous Sussex County HMP, the County has not been included in any USDA disease outbreak-related agricultural disaster declarations (USDA 2024).

Previous Events

Known disease-outbreak events that impacted Sussex County between January 2020 and June 2024 are listed in Table 7-3. For events prior to 2020, refer to the 2021 Sussex County HMP.

7.1.5 Probability of Future Occurrences

Probability Based on Previous Occurrences

As long as mosquitoes and ticks are found in Sussex County, the risk of contracting diseases carried by these insects exists. Based on available information regarding mosquito and tick populations, it is anticipated that mosquito- and tick-borne diseases will continue to be a threat to Sussex County. However, vaccines are currently being developed for Lyme Disease, which may slow the contraction rates (CDC 2022). For communicable diseases spread from person to person, the likelihood of a disease outbreak is influenced by population density and can change with changes in population. Based on historical records and input from the Steering Committee, the probability of occurrence for disease outbreak in the County is considered “occasional.”

Table 7-3. Disease Outbreak Events in Sussex County (2020 to 2024)

Event Date	FEMA Declaration or State Proclamation Number	Sussex County included in declaration?	Location Impacted	Description
2020	N/A	N/A	Sussex County	278 confirmed cases of Influenza in Sussex County
2020	N/A	N/A	Sussex County	142 confirmed cases of Lyme Disease in Sussex County
2020	DR-4488-NJ, EM-3451-NJ	Yes	Sussex County	4,896 positive cases of COVID-19 and 175 deaths in Sussex County.
2021	N/A	N/A	Sussex County	90 confirmed cases of Influenza in Sussex County
2021	N/A	N/A	Sussex County	362 confirmed cases of Lyme Disease in Sussex County
2021	DR-4488-NJ, EM-3451-NJ	Yes	Sussex County	17,627 positive cases of COVID-19 and 109 deaths in Sussex County.
2022	N/A	N/A	Sussex County	1,425 confirmed cases of Influenza in Sussex County
2022	N/A	N/A	Sussex County	438 confirmed cases of Lyme Disease in Sussex County
2022	DR-4488-NJ, EM-3451-NJ	Yes	Sussex County	13,786 positive cases of COVID-19 and 83 deaths in Sussex County.
2023	N/A	N/A	Sussex County	537 confirmed cases of Lyme Disease in Sussex County
2023	DR-4488-NJ, EM-3451-NJ	Yes [a]	Sussex County	2,193 positive cases of COVID-19 and 9 deaths in Sussex County.
2024 [b]	N/A	N/A	Sussex County	303 confirmed cases of Lyme Disease in Sussex County
2024 [c]	N/A	N/A	Sussex County	773 positive cases of COVID-19 and 9 deaths in Sussex County.

Sources:NJDOH 2022; NJDOH 2023; NJDOH 2023; NJDOH 2023; NJDOH 2022
Notes: 2023 and 2024 occurrences of Influenza in Sussex County were not available at the time of writing this HMP update.
a. The declarations for the COVID-19 Pandemic expired on May 11, 2023
b. Last updated August 12, 2024
c. Last updated August 12, 2024

Effect of Climate Change on Future Probability

The relationship between climate change and increase in infectious diseases is difficult to predict with certainty, but there are scientific linkages between the two. Some scientists anticipate an increase in mosquito-borne diseases due to changing climate conditions creating suitable habitats for mosquitoes (CDC 2013). Projections of climate change for New Jersey predict more intense rainfall events and increases in total annual precipitation (see Section 3.3.4). Increased rainfall and heavy rainfalls increase the chances of standing water where mosquitos breed (National Geographic 2022). Projected warming temperatures across New Jersey (see Section 3.3.4) are likely to increase the length of the insect season, increasing the potential rates of transmission of insect borne disease. Localized changes in climate and human interaction may also be a factor in the spread of disease.

7.1.6 Cascading Impacts on Other Hazards

There are no known cascading impacts that disease outbreaks can have on other hazards of concern for Sussex County. However, disease outbreak events can require changes to emergency response and sheltering procedures to prevent the spread of disease.

7.2 VULNERABILITY AND IMPACT ASSESSMENT

All of Sussex County is at risk from the impacts of disease outbreak events. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and its potential impacts.

7.2.1 Life, Health, and Safety

Overall Population

The entire population of Sussex County (144,221) is vulnerable to the disease outbreak hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease due to their proximity to potentially infected people.

Maintaining certain key functions is important to preserve life and decrease societal disruption during disease outbreaks. Heat, clean water, waste disposal, and corpse management all contribute to public health. Ensuring functional transportation systems also protects health by making it possible for people to access medical care and by transporting food and other essential goods. Critical infrastructure groups have a responsibility to maintain public health, provide public safety, transport medical supplies and food, implement a pandemic response, and maintaining societal functions. If these workers were absent due to pandemic outbreak, these systems will fail (Cybersecurity and Infrastructure Security Agency n.d.).

Socially Vulnerable Population

Persons 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2020).

Without a quantitative assessment of potential impacts of a disease outbreak on socially vulnerable populations, the Planning Partners can best assess mitigation options through an understanding of the general numbers and locations of such populations across Sussex County. Section 3.5.3 provides detailed data on socially vulnerable populations within the planning area. Table 7-4 summarizes highlights of this information. For planning purposes, it is reasonable to assume that percentages and distribution of socially vulnerable populations affected by a disease outbreak will be similar to the countywide numbers.

Table 7-4. Distribution of Socially Vulnerable Populations by Municipality

Category	Sussex County Total		Municipality Highest in Category		Municipality Lowest in Category	
	Number	Percent	Number	Percent	Number	Percent
			Vernon (Twp)	Walpack (Twp)	Walpack (Twp)	Sparta (Twp)
Population Over 65	**25,451**	**17.65%**	**3,687**	**100.00%**	**7**	**13.38%**
			Sparta (Twp)	Lafayette (Twp)	Walpack (Twp)	Walpack (Twp)
Population Under 5	**6,500**	**4.51%**	**1,160**	**7.21%**	**0**	**0.00%**
Non-English-Speaking Population	**1,922**	**1.33%**	Hopatcong (B) **339**	Hamburg (B) **10.17%**	Andover, Frankford, Sandyston, Stanhope, Stillwater, Walpack **0**	Andover, Frankford, Sandyston, Stanhope, Stillwater, Walpack **0.00%**
Population With Disability	**15,697**	**10.88%**	Vernon (Twp) **2,318**	Franklin (B) **17.32%**	Walpack (Twp) **0**	Walpack (Twp) **0.00%**
Population Below Poverty Level	**7,320**	**5.08%**	Vernon (Twp) **877**	Sussex (B) **18.03%**	Walpack (Twp) **0**	Walpack (Twp) **0.00%**
Households Below ALICE Threshold	**14,428**	**21%**	Vernon (Twp) 1,833	Sussex (B0 **48%**	Branchville (B) 90	Green (Twp) **14%**

Note: B = Borough; Twp = Township

7.2.2 General Building Stock

No structures are anticipated to be directly affected by disease outbreaks.

7.2.3 Community Lifelines and Other Critical Facilities

While the structures of critical facilities and infrastructure will not be impacted by a disease outbreak, the demand for community lifeline services may increase, and the effect of absenteeism on workers will impact the ability to meet that rising demand.

The most significant impact on critical facilities would be the increase in hospitalization and emergency room visits that would take place as a result of the outbreak. This would create a greater demand on these critical facilities, their staff, and resources. The healthcare system may be severely taxed, if not overwhelmed, from the large number of illnesses requiring hospitalization and critical care. Ventilators can be face critical shortage if an outbreak of a respiratory disease were to occur (Homeland Security Council 2006).

Mortuary services could be impacted due to the increased numbers of deaths. The timely, safe, and respectful disposition of the deceased is an essential component of an effective response. Pandemic influenza may quickly rise to the level of a catastrophic incident that results in mass fatalities, which will place extraordinary demands on local jurisdictions (Homeland Security Council 2006).

7.2.4 Economy

Costs associated with the activities undertaken to address disease outbreaks have not been quantified in available documentation. The COVID-19 pandemic had significant economic impacts across the State of New Jersey. Over the course of two months, New Jersey lost nearly 720,000 jobs as businesses were forced to close their doors and residents entered a period of quarantine. This sudden halt of business activity forced the closure of schools, emptied the state's typically busy roads, and disrupted a previously healthy economy. Every industry sector in New Jersey declined by at least some margin. The leisure and hospitality sector, which includes restaurants and casinos, lost nearly twice as many as any other sector, and accounted for 28 percent of all jobs lost during that time. Employment levels in the retail trade and health care sectors each declined by more than 100,000 jobs. Most of the decline in health care was due to temporary closures and limited capacity of ambulatory care services such as dentist's offices and other outpatient care centers. Many small businesses did not make it through the COVID-19 pandemic, and those that did had to significantly reduce payrolls to make ends meet (New Jersey Department of Labor and Workforce Development 2021).

7.2.5 Natural, Historic and Cultural Resources

Natural

While disease outbreaks do not have an impact on the environment, mitigation efforts against disease outbreak may have such an impact. Pesticides used to control disease-carrying insects such as mosquitos and ticks could leach into waterways and harm nearby terrestrial species. These pesticides have been reviewed by the EPA and U.S. Department of Health, and New Jersey's Pesticide Regulations state that, "no person shall distribute, sell, offer for sale, purchase, or use any pesticide which has been suspended or canceled by the EPA, except as provided for in the suspension of cancellation order" (New Jersey Department of Environmental Protection 2020).

Historic

Disease outbreak may limit access to historic resources. During the COVID-19 pandemic, historic monuments, facilities, and sites imposed restricted access to minimize the spread of the disease. The limitation of access during a disease outbreak can assist in lowering the rate of contraction.

Cultural

Similar to historic resources, cultural resources may have limited access during a disease outbreak to minimize the spread of disease.

7.3 CHANGE OF VULNERABILITY SINCE 2021 HMP

Overall, the County's vulnerability to the disease outbreak hazard has not changed, and the entire County will continue to be vulnerable to this hazard. Any change in vulnerability since the previous HMP would be attributed to changes in population density and new development. This updated HMP used updated building stock and critical asset inventories to assess the County's risk to these assets. The building inventory was updated using RSMeans 2022 values, which are more current and reflect replacement cost rather than the building stock improvement values reported in the 2021 HMP. Further, the 2021 5-year population estimates from the American Community Survey were used to evaluate the population exposed to the hazard areas.

7.4 FUTURE CHANGES THAT MAY AFFECT RISK

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The following sections examine potential conditions that may affect hazard vulnerability.

7.4.1 Potential or Planned Development

Any areas of growth could be impacted by the disease outbreak hazard because the entire planning area is exposed. As population counts change in the County, there may be increased risk from certain diseases. Higher concentrations of persons traveling via public transportation may become more vulnerable to the exchange of disease through airborne transmission. Increase development in rural areas may expose a higher percentage of the population to insect-borne diseases.

7.4.2 Projected Changes in Population

Changes in population density could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are at risk of greater exposure to disease outbreak. Density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities. Further, as the population ages there may be increased risk to this demographic. Older adults and people who have severe underlying medical conditions like heart or lung disease or diabetes seem to be at higher risk for developing more serious complications from certain diseases, such as COVID-19.

The New Jersey Department of Labor and Workforce Development produced population projections by County from 2014 to 2019, 2024, 2029, and 2034. Sussex County is projected to have a decrease in population in the upcoming years. These projection estimate a population of 140,400 by 2024, 137,300 by 2029, and 136,600 by 2034 (State of New Jersey 2017).

7.4.3 Climate Change

Changes in the environment may create a more livable habitat for vectors carrying disease (CDC 2021). Localized changes in climate and human interaction may also be a factor in the spread of disease. The question of whether rising temperatures will increase the number of mosquitoes that can transmit malaria among humans (rather than just shift their range) has been the subject of debate. Some researchers point out that climate is not the only force at work in increasing the spread of infectious diseases. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Baker, et al. 2021).