

On the Risks of Wild Boars (*Sus Scrofa* Linnaeus, 1758) in Palestine, with Particular Emphasis on the West Bank

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ABSTRACT

The Wild Boar (*Sus scrofa* Linnaeus, 1758) is now one of the most widely distributed and largest mammalian fauna in Palestine 27,000 km². It is a highly adaptable ungulate that is able to occupy a variety of ecological habitats in Palestine including the Negev Desert. The Wild Boar poses a direct threat to the lives of Palestinians, their farms, domestic animals and their property in the West Bank, which covers an area of about 21% of the total area of Palestine. Wild Boars formed part of the political and military battle in Palestine through the release of huge numbers of these ferocious animals in the West Bank by some Israeli settlers to spread havoc and destruction and to drive the Palestinians away from their lands and properties. The current study aims to determine the potential agricultural, ecological and environmental, and health

risks posed by Wild Boars and their piglets in Palestine with particular emphasis on the West Bank. The study, which lasted five years (2018 – 2022), was based on direct observations, frequent meetings and discussions with stakeholders, follow-up of news and social media sites in addition to photography for documentary and confirmatory purposes. The stories and events told by the Palestinians about the Wild Boar and its dangers stretch back decades. There are many risks of Wild Boars in Palestine, especially the West Bank, to include damage to agricultural crops, green houses, chicken farms and sheep pens, predation on native wildlife and destruction of native plants and propagation of invasive ones, deterioration of water quality, soil erosion and landscape alterations, attacks to Palestinians causing injuries, fear and perhaps fatalities, possible transmission of swine flu, swine brucellosis and other pathogenic parasites. The study also showed how COVID-19 pandemic affected the infiltration of Wild Boars into Palestinian cities and their spread of terror and fear among citizens, and devastation and destruction in urban environments. The study focused on Wild Boar control methods used to varying degrees in the West Bank, including poisons, chemical pesticides, fences, live traps, and shooting. In conclusion, the study recommends dealing skillfully and intelligently with Wild Boars because they are considered a natural part of the Palestinian biodiversity.

Keywords: Wild Boar; Feral Boar; *Sus Scrofa*; Risks; Agricultural Crops; Attacks to Humans and Domestic Life; COVID-19; Control Methods; West Bank; Palestine

Introduction

The Wild Boar (*Sus scrofa* Linnaeus, 1758) is a brave eutherian mammal that males can weigh up to 150 kilograms. It belongs to the order Artiodactyla (even-toed ungulates) and the Suidae family (boars, hogs, swine or pigs). The animal has many common names such as Wild Swine, Common Wild Pig, Eurasian Wild Pig, Wild Pig, or Wild Hog. It is native to much of Eurasia and North Africa and has been introduced to many other countries of the world [1,2]. The species is now one of the most widely distributed mammals in the world. In fact, it has been ranked as Least Concern on the IUCN Red List due to its wide range, large numbers, and ability to adapt to a variety of habitats [3,4]. It has become an invasive species in part from its introduction range [5,6]. The term Feral Boar (*Sus scrofa* Linnaeus, 1758); having the same scientific name of Wild Boar, is a domestic pig that has escaped or been released into the wild and is living more or less as a wild animal. The Wild or Feral Boar is a nocturnal animal meaning that it hides in rough places during the day and is active at night [2]. Wild Boars are one of the forms of wild animals found in Palestine and neighboring countries [1,4,7-11]. They are more common in the northern parts of Palestine (Figure 1). Nowadays, the species are highly adaptable and able to defend themselves, which makes them able to exist in a variety of ecological habitats in Palestine [12].

Despite the presence of the Wild Boar (and even the Feral Boar) in Palestine from a long history (Figure 2), the animal became a threat to the life and existence of the Palestinians during the

modern history that witnessed the occupation of Palestine by Israel (the politically nascent state produced by the West in the heart of the Arab and Islamic nation in the late 1940s).

The Israelis and their settlers who live in colonies in the West Bank deliberately released dozens, if not hundreds, of them in the West Bank lands to spread corruption, and accordingly, the Wild Boar entered the political and military battle in an attempt to dissuade the Palestinians from their lands and farms and even displace them [13]. In fact, wherever Wild Boars are found, they become a problem, damaging livestock, agricultural fields, forests and the environment, and threatening wildlife [14,15]. It was considered a pest due to its attacks on farms, and sometimes humans. It can destroy agricultural crops and spoil fields [15,16]. The strong, long, and straight snout (Figure 3) and sharp fangs of this animal are two specific signs that cause fear and injury to humans and destroy farmland. It digs the ground to reach the roots of plants and worms with the help of its sharp fangs [2]. At the global level, studies related to Wild Boar, especially its ecology, hunting, control and risks to agriculture, vegetation, livestock and humans are increasing day by day, whether it is in its original places of existence or in the places of its invasion. This was apparent from the volume of the available literature surveyed [6,17-26]. Studies of Wild Boar in the Middle East and the Arab world are available, but with less luck. In Israel, Davidowitz and Horwitz [27] worked on the morphometric variation between populations of recent Wild Boar. They ensured that the animal was abundant in historic Palestine

and the population size of the species was severely reduced by hunting. Davidson [11] studied in his ecological Ph.D. thesis the effects of hunting and landscape structure on Wild Boar behavior,

social structure and physiology in urban, agricultural, and natural settings in Israel.



Figure 1: A Wild Boar (*Sus scrofa*) roams in the jungles of the West Bank, Palestine [Photo: Ahmad Jbareen October 1, 2018].



Figure 2: A preserved specimen of the Wild Boar (*Sus scrofa*) in the Jerusalem's Nature Museum, Al-Quds (Jerusalem), Palestine [Photo; Daoud Al-Hali in July 9, 2019].



Figure 3: The Wild Boar (*Sus scrofa*) has a long, straight snout which enables it to have an incredibly acute sense of smell [Photo: Abdullah Amara February 23, 2020].

In Jordan, the closest country to Palestine, Wild Boars are the most common wild ungulate species and occupy many different habitats including nature reserves, river valleys, cultivated areas, forested hills and even desert areas not far from water sources [3,4,28]. Eid and Handal [29] reported as many as 40 specimens of the Wild Boar killed, based on Facebook posts by Jordanian hunters. There are no significant threats to Wild Boars in Jordan. In 2010, the Jordanian government allowed the hunting of Wild Boars in an attempt to control their population due to the escalating damage to agricultural crops, and as a precautionary step in the fight against swine flu [30]. In Syria, the Wild Boar is common among other extant artiodactylous species, and most of the wild ungulates which inhabited the Syrian territories have been exterminated in historical times [31]. In Algeria, the Wild Boar caused a lot of damages and is considered in rural areas as a permanent threat to the crops, livestock and people [14]. Abdelwahab, et al. [32] described the Wild Boar as a predator of scorpions in north-western Algeria. The Wild Boar was tested for cystic echinococcosis and other helminthes infections in Morocco and Tunisia [33,34]. Work on Wild Boars is neither extensive nor deep in Palestine, so few studies are available. Qumsiyeh [1] described the presence of Wild Boars in Palestine, and he referred to some of the threats these ferocious animals pose to the lives and property of Palestinians. Albaba [16] studied the impact of Wild Boars on different agricultural crops in northern Palestine (the governorates of Salfit, Nablus, Qalqilya, Tulkarm, and Tubas). His study showed that olive trees, almonds, stone fruits, grain crops and vegetables were strongly affected by these animals. Similarly, Sawalha, et al. [15] studied the effect of Wild Boars on agricultural crops in the West Bank. They focused on the control strategies using poisons and fences against the animal. Al-

Baba [35] indicated that the Wild Boar was one of the mammalian road-kills in the West Bank, in reference to the commonness of that animal in occupied Palestine. Dagher [13] wrote on the Wild Boar as an Israel's weapon against Palestinian farmers in the West Bank. More-recently, the Wild Boar was stated to occur and roam in the Gaza Envelope (Gaza Envelope is the populated areas of Israel that are within 7 kilometers of the Gaza Strip border) as stated by Abd Rabou et al. [12] and N12.co.il [36].

Complaints are high from Palestinians living in the West Bank because of the harm that Wild Boars cause to them, their property, farms, and orchards, especially since most or all of this harm is not compensated by government agencies because the Palestinian government does not consider Wild Boars and their repeated attacks among natural disasters that need compensation (Special Communication). The problem of the Wild Boar has become in many of its times artificial due to the deliberate use of the animal as a weapon by the settlers of the Israeli occupation. They release it in dozens or hundreds in various places to undermine the steadfastness of the Palestinian people on their land and their ability to cultivate it [13]. In light of the above, the current study comes to shed light on the possible agricultural, environmental, ecological and health risks posed by Wild or Feral Boars (*Sus scrofa* Linnaeus, 1758) and their piglets in Palestine with particular emphasis on the West Bank.

Methodology

The Study Area (The West Bank)

Palestine 27,000 km² is a geographic region in Western Asia usually considered to include three political masses: The West

Bank, the Gaza Strip and the rest of the Palestinian lands occupied by Israel since 1948 (Figure 4). The West Bank (5,655 km²), which represents about 21% of the total area of Palestine, is bordered by Jordan and the Dead Sea to the east and by the Palestinian lands occupied by Israel since 1948 to the south, west and north. It is composed of 11 governorates: Nablus, Qalqilya, Tubas, Salfit, Tulkarm, Jenin, Jericho and the Jordan Valley, Ramallah and Al-Bireh, Bethlehem, Hebron, and Jerusalem. The West Bank is nowadays studded with Israeli settlements into which Israeli law is pipelined [37]. The climate of Palestine is similar to that of the

Mediterranean region, which is characterized by four months of hot, dry summers and short winters with rainfall from November to March. The main water resources in Palestine include groundwater, rivers, lakes, ponds, springs, and harvested rainwater. The Jordan River, one of the main rivers in Palestine, has a length of about 260 km and drains a total area of 18,300 km² [37]. The Jordan River and other rivers, streams and lakes in Palestine are home to a variety of plant and animal species including the Wild or Feral Boar (*Sus scrofa* Linnaeus, 1758), the main focus of the current study.



Figure 4: Palestine includes three political masses: The West Bank, the Gaza Strip and the rest of the Palestinian lands occupied by Israel since 1948.

Procedure

The current study, which lasted five years (2018 – 2022), was based on the following procedures:

- The carry out of direct observations of the Wild or Feral Boar among other vertebrate fauna occurring in different ecosystems and habitats lying within the boundaries of the West Bank (Figure 4). Of course, this was done by a group of wildlife observers and hunters.
- The carry out of frequent meetings and discussions with stakeholders including local inhabitants, farmers, and wildlife watchers and hunters in order to get more info and to close the gaps regarding the risks of Wild Boars in the West Bank.

- The pursuit of news and social media sites those are always full of local news concerning the animal in question. It is worth mentioning that the Wild Boar is treated by the Palestinians in most cases as an enemy, despite the fact that it has become part of the Palestinian biodiversity. This is due to the fact that the Israeli occupation and its settlers in the West Bank throw large numbers of Wild and Feral Boars through trucks to wreak havoc on the land and sometimes kill the Palestinians [13]. The issue here has become political and military, not purely environmental. Wild and Feral Boars have become a lethal weapon in the hands of the Israelis, threatening the people of the West Bank, their crops and their properties. Based on the foregoing, the Palestinian and sometimes non-Palestinian media attach the utmost importance to this stubborn and fierce

animal.

d) The use of professional binoculars and digital cameras was a priority during the succeeding stages of the current study for documentary and confirmatory purposes.

Although the study is for a period of five years, the stories and events that are told or read may extend to 10-20 years because the problems of Wild Boars and the suffering of the Palestinians in all parts of Palestine, especially the residents of the West Bank from these animals are not a new one, but rather extend to decades ago, and this will become clear during the study stations.

Results and Discussion

Wild Boars are an element of wildlife that characterizes most regions of Palestine from north to south and from the Jordan River to the coastal plain. In general, the animal population increased significantly in Palestine for various reasons. First, the Wild Boar has such a fast reproductive rate that females can breed twice a year with at least 6-8 piglets per litter [38,39]. Secondly, there are almost no natural enemies of the animal that can regulate its numbers. Unfortunately, the number of Grey Wolf (*Canis lupus*), which is a main predator of Wild Boars, is decreasing in Palestine. In Spain, Wild Boars are a main prey of the Grey Wolf [40,41]. Third, Wild Boar is rarely hunted for meat purposes because most Palestinians are Muslims, so they are forbidden to eat pork according to Islamic regulations. Finally, most Wild Boars live in Area C of the West Bank, which is designated as nature reserves or protected areas according to the oppressive Israeli-Palestinian peace agreements (1994). These areas are rarely accessed by Palestinians because they are under Israeli security sovereignty. Furthermore, Wild Boars prefer to live in areas close to the Israeli Apartheid and Separation Wall which most Palestinians cannot access due to security considerations. Wild Boars enjoy wallowing in the mud of swamps that are infested with insects, worms and some invertebrates on which they usually feed. They began advancing towards the outskirts of Palestinian cities and villages, and with the fall of the evening they began to leave their burrows and walk in the form of herds that pose a threat to Palestinian farmers and their properties, causing different agricultural, ecological, environmental and health risks.

Agricultural Risks

Damage to Agricultural Crops: Agriculture is the backbone of the economy of Palestine, especially the West Bank, and therefore any damage to it has a strong impact on the economy. The people of the West Bank compete in cultivating various types of crops (fruit orchards, almonds, olives, roses, vegetables, grains, etc.), all of which are in place of the arrows and attacks of Wild Boars. In fact, there is a lot of almost daily news about Wild Boars attacking Palestinian agricultural lands to wreak havoc on them, and this is of course what worries farmers the most because Wild Boars cause huge

losses to the soil, agricultural crops and even forest trees [13]. Long-running interviews with West Bank farmers and follow-up to media reports reveal a long list of agricultural crops (Table 1) targeted by Wild Boars, causing damage and loss (Personal Communications). Cultivated grains and herbs were the most commonly consumed items, leading to a high carbohydrate intake. Most of the protein content of Wild Boars comes from animal sources represented in invertebrates of various kinds, as well as some vertebrates that they may prey on as will appear later.

There were many short stories that have been heard or read on news sites about the Wild Boar attack on agricultural crops in the West Bank, as follows:

- a. Herds of Wild Boars launched by the Israeli colonists or settlers of Ariel in 2008 attacked the agricultural fields in the vicinity of the city of Salfit and destroyed and ravaged them, as wheat, barley and apple crops were attacked and the agricultural fields left a trace after an eye.
- b. A farmer in southern Salfit went to his land, as usual, to be surprised by the breaking of seedlings and branches of apricot and peach bushes due to the attack of herds of Wild Boars from Israeli settlers. The farmer stated that all his attempts to prevent Wild Boars from reaching his lands by poisoning them had all been unsuccessful.
- c. In 2013, a 55-year-old farmer from Tulkarm governorate in the northern West Bank said that his farm, which occupies an area of 32 dunums, has been subjected to many and intense raids for more than two years by Wild Boar herds, which caused me to lose many agricultural crops, the last of which was my loss of the corn crop due to milling and cracking the veins and branches of crops.

Sawalha, et al. [15] and Albaba [16] addressed the impact of Wild Boars on agriculture in the northern West Bank, although the number of crops included in this study (Table 1) is more numerous. In countries and places where Wild Boar is considered invasive, it has been rated for its severity to the environment and agriculture as one of the world's 100 worst alien invasive species [42]. Many of the stories that were told during the study showed that Wild Boars are very greedy for many agricultural and non-agricultural crops, and thus cause losses to farmers who are mostly poor and cannot cope with the Wild Boar's risk to their property. There are a lot of global and regional studies showing the impact of Wild Boars on many agricultural crops, which may vary in nature depending on the countries in which they grow [20,21,43-57].

Destruction of Greenhouses and Honeybee Hives: Greenhouses (glasshouses or hothouses) are structures with walls and roof made chiefly of transparent material in which plants require regulated climatic conditions are grown. Greenhouses of different shapes and sizes are also subject to destruction

and sabotage due to the attack of Wild Boars. The nature of the bodies of Wild Boars and their heaviness often makes their effect remarkable. Farmers usually complain about the destruction of nylon, plastic, iron rods, water pipes, and a lot of greenhouse materials, which increases the cost of their agricultural inputs miserably. Such attacks of Wild Boars were also recorded in the Jordan Valley, where they caused severe damage to agriculture and greenhouses [58]. The problem here is that the Palestinian farmers are unable to repair what the Wild Boars spoiled because of their poverty or repeated incidents of destruction by the animals and the lack of government compensation for them, which may cause them to abandon open agriculture and greenhouses as a source of livelihood and go to other work, which in turn increases the catastrophe of desertification [13]. On the other hand, West Bank farmers did not record attacks by Wild Boars on honeybees (*Apis mellifera*) (Hymenoptera, Apidae) inside the beehives, but they confirmed that the attack of Wild Boars to agricultural lands is sometimes accompanied by destruction, cracking and laying down of beehives, which causes losses to farmers who are active in raising honeybees as a source of livelihood for them and their families. All that Wild Boars can do is run into and damage the honeybee hives. One farmer mentioned that he once had a problem when he placed feed buckets on top of the beehives, causing the Wild Boars to try to knock over the hives to get to the feed bucket. Wild Boars usually do not like to mess with honeybees for fear that bees sting them in sensitive places in their bodies, which hinders their activity and attack on farms and property. In general, the harm of Wild Boars on beehives and honeybee farming is very small compared to their impact on agriculture and greenhouses, as previously mentioned.

Attacks to Chicken Farms and Sheep Pens: The impact of Wild Boars is not limited to agricultural crops, but also extends to animal production in the West Bank, where sheep and animal pens and chicken farms are a major phenomenon. As an example of the damage, large herds of Wild Boars, released from the nearby Israeli settlements attacked a sheep farm in the town of Yamoun, west of Jenin, in the northern West Bank, and killed a number of them incurring heavy losses. In another example, Palestinians from Tulkarm, northern West Bank, were able in 2016 to exterminate about 25 Wild Boars, by poisons after their herds attacked their poultry farms. It could be deduced from the examples stated that Wild Boar attacks on sheep, lamb and poultry sheds are a common phenomenon in the West Bank as they were known to cause great losses. In different parts of the world, the situation is not the best, and it could be worse. In India, as many as 50 chickens in their small poultry farm were killed in Wild Boar attacks as stated by Media news [59]. In Scotland, livestock owners have recently claimed that large Wild Boars are ripping up their pastures, spreading disease, and eating their livestock. One of those who witnessed the position

of predation said that three Wild Boars of large sizes surrounded a ewe and put it on its back, and then they began to tear it and separate it from each other and eat it [60]. Feral Boars have a distinct pattern of feeding on lambs that distinguishes them from other predators. For example, Boars sometimes trample lambs when they are eaten, while predation by dogs or foxes is characterized by tooth marks on either side of the bitten area [61]. In Israel, Wild Boars and Golden Jackals were stated as possible predators on cattle neonates [62].

In fact, there are many stories and narratives about the dangers of Wild Boars to domesticated life in many countries of the world, as indicated by various studies [48,63-67]. Adult livestock are vulnerable to predation by Wild Boars while giving birth. Attacking domesticated animals and chicken farms with Wild Boars is not always a danger. Wild Boars can act as reservoirs for many important infectious diseases that target domestic animals and cause losses as well. Wild Boars may contribute to the transmission of many diseases to domestic animals such as traditional swine fever, brucellosis, trichinellosis, and many other diseases [68-71]. Although the use of poisons or direct killing with gunpowder in the West Bank may sometimes kill Wild Boars as many farmers claimed, the situation is made worse by the frequent attacks of Wild Boars, which exacerbated the issue and made the search for sustainable management of the problem vital.

Ecological Risks

Predation on Native Wildlife: Palestine is home to more than 540 species of bird fauna [72]. In fact, a wide variety of Palestinian birds' nest on the ground, including shorebirds (avocets and sandpipers), wading birds or waders (cranes and rails), waterfowl (ducks and geese), game birds (quails and chukars), etc. Some of ground nests are subject to destruction, vandalism and predation of eggs or even young chicks, whether by Wild Boars or other animals. Usually, these animals are not perceived as predators, but they also perform this role. Wild Boars are opportunistic omnivores, meaning that they eat any available plant or animal matter. The eggs of many ground-nesting birds occurring in the Palestine environment are on their menu. Wild Boars can be significant predators of eggs and newly hatched young of ground-nesting birds, small mammals, amphibians (frogs and toads), snakes and many others. (Table 2) shows a group of terrestrial and aquatic ground-nesting birds occurring in the Palestine environment and may be harmed by Wild Boars. In the West Bank, the Nutria (*Myocastor coypus*) has been known to destroy many aquatic bird nests such as waterfowls and wading birds in rivers, streams and swamps [73]. As for the amphibians occurring in the West Bank, there are at least four species living in swamps, water bodies and ponds [74], which may be exploited by the Wild Boar during rooting and wallowing or immersion activities (Table 3).

Table 1: A list of Agricultural crops attacked by Wild Boars in the West Bank, Palestine.

Orchards	Vegetables	Cereals
Olives	Garlic	Barely
Almonds	Onion	Wheat
Apricot	Tomato	Corn
Apples	Potato	Chickpeas
Peach	Sweet potato	Lupine
Guava	Cucumbers	Beans
Figs	Parsley	Peas
Grapes	Spinach	
Berries	Molokhia	
Banana	Cucumis	
Melon	Eggplant	
Watermelon	Squash	
Pomegranate	Carrots	
Citrus	Pumpkin	
Sugarcane	Zucchini	
Date Palm	Cabbage	
	Cauliflower	
	Watercress	
	Lettuce	
	Kalokami	
	Okra	
	Pumpkins	

Table 2: Some ground-nesting birds existing in the West Bank, Palestine.

Family	Common Name	Scientific Name
Rallidae	Eurasian Coot	<i>Fulica atra</i>
	Common Moorhen	<i>Gallinula chloropus</i>
Anatidae	Mallard	<i>Anas platyrhynchos</i>
Recurvirostridae	Black-winged Stilt	<i>Himantopus himantopus</i>
Charadriidae	Spur-winged Plover	<i>Vanellus spinosus</i>
Burhinidae	Stone Curlew	<i>Burhinus oedicnemus</i>
Phasianidae.	Chukar	<i>Alectoris chukar</i>
Alaudidae	Sky Lark	<i>Alauda arvensis</i>

Table 3: Amphibians existing in the West Bank, Palestine.

Family	Common Name	Scientific Name
Bufo	Eurasian Green Toad	<i>Bufo variabilis</i>
Hyla	Savigny's Treefrog	<i>Hyla savignyi</i>
Pelobates	Eastern or Syrian Spadefoot	<i>Pelobates syriacus</i>
Rana	Levant Water Frog	<i>Pelophylax bedriagae</i>

The most important result is the decline in the reproduction of ground-nesting birds. A lot of studies related to this interesting subject, whether from native Wild or Feral Boars in Europe or

invasive Wild or Feral Boars in America [75-82]. In the United Kingdom (UK), five species of birds; namely Hen Harrier (*Circus cyaneus*), Pallas's Gull (*Ichthyaeetus ichthyaeetus*), Little Curlew (*Numenius minutus*), Common Crane (*Grus grus*), and Common Pochard (*Aythya ferina*) are most affected by Wild Boars [80]. In Texas, the eggs of ground-nesting birds like the Northern Bobwhite (*Colinus virginianus*) and Wild Turkey (*Meleagris gallopavo*) are on the Wild Boar's menu as well Tolleson et al. [83] constructed 192 simulated quail nests in Texas and reported that Feral Boar was the most common predator of simulated nests. As a result, nest destruction by Wild Boars may lead to decreased nest success and population numbers. Furthermore, Feral Boars have been found to destroy the critically endangered Houston Toad (*Bufo houstonensis*) habitat in the Lost Pines of Texas [84] in similar ways that Wild Boars may threaten native frog species in the West Bank of Palestine. Jolley et al. [85] estimated the herpetofauna (amphibians and reptiles) affected by a population of Wild Boars. The danger of Wild Boars did not stop there, but rather to marine creatures. Lots of sea turtle hatchlings on the beaches have been preyed upon by Wild Boars [86]. In conclusion, since Wild Boars are omnivores, they consume invertebrates while foraging in vegetation such as insects, annelids, crustaceans, gastropods, and nematodes. The eggs and chicks of some ground-nesting birds as well as some small species of reptiles and amphibians can also be consumed by the animals [6].

Destruction of Native Plants and Propagation of Invasive Plants: Palestine is home to a great variety of plant species that flourish in different environments and habitats. Wild Boars rooting, wallowing, and trampling damage native plant communities that provide habitat and food sources for native wildlife species. Wild Boars are actually known as «ecosystem engineers» by altering or modifying some of its characteristics. The term «rooting» is the behavior in which a Wild Boar uses its snout to turn over soil in a manner similar to using a spade to locate underground food [87]. By their rooting behavior, Wild Boars are a source of significant disturbance for local plant communities by foraging and facilitating the spread of invasive species. In other words, the mixing of soil horizons that often accompanies the rooting of Wild Boars has also been shown to alter plant communities, allowing the establishment and spread of invasive plant species [88]. In fact, rooting reduces plant growth, survival, cover, reproduction, and species diversity. It is commonly found at places of rooting that the total plant cover was significantly lower on the rooted plots compared with the non-rooted plots. Additionally, the impacts of foraging by Wild Boars can result in the local extinction of Palestinian plant species. Local extinctions permanently alter the composition of the plant community, which can have significant and cascading impacts on the health and function of the ecosystem. What confirms this controversy is that Cuevas et al. [24] found that Wild Boars consume energy-rich plant species, such as bulbs and

fruits with high concentrations of carbohydrates and fats. By this practice, Wild Boars produce a variety of effects that are reflected in plant species composition, structure and biomass, and changes in soil properties such as increased soil degradation in the Monte Desert in Argentina. Wild Boars usually come from several regions to practice their rooting, wallowing, and trampling activities in agricultural areas and water streams and courses. Wild Boars usually carry seeds in their fur from far distances. Accordingly, by destroying native plants, they leave those invasive seeds to grow and thus the Wild Boars engineer the places they invade in their own way. A lot of work discussing the impact of Wild Boar in plant composition in various ecosystems worldwide was referred to and the studies confirmed the animal's role in altering native plant species with invasive ones [21,24,87-94].

Environmental Risks

Soil Erosion and Landscape Alterations: Soil stability is closely related to vegetation; when large areas are cleared, whether by Wild Boar or for any other reason, the soil becomes subject to erosion [94]. The loosening of the soil surface caused by the rooting of Wild Boars leads to erosion of the steep places that characterize most of the areas and topography of the West Bank. This is simply due to foraging where Wild Boars often overturn large areas of soil and leave it devoid of vegetation [90]. This in turn increases the erosion and movement of agricultural soils from its place of origin to other places due to the movement of wind and running water as well as gravity and the action of topography, which leads to landscape destruction, soil loss (the basis of agricultural ecosystems), reduced soil fertility and deterioration of biological productivity, which in turn leads to desertification, which means the deterioration and lack of biological productivity of ecosystems of all kinds. It should be noted that most of the Palestinians in the West Bank work in agriculture, and therefore the problems of erosion and desertification lead to abandonment of agricultural lands unless vigorous efforts are made to improve the soil. Furthermore, the rooting, immersion and trampling activities of Wild Boars in compacted soils may disrupt water infiltration and nutrient cycling. It can be concluded from the above that the rooting of Wild Boars has negative effects on the vegetation cover and the physical, chemical and microbiological properties of the soil. These new soil properties may be responsible for the reduced vegetation cover and reduced soil bulk density, which may increase soil degradation due to erosion. The effects of Wild Boar in one form or another on soil properties have been discussed in various studies [48,50,87,90,94-98]. As far as the Palestinian landscapes are concerned, Wild Boars can quickly destroy homeowners' efforts to maintain and quickly improve their private property. The destruction of vegetation and wallowing by Wild Boars reduces the aesthetic value of private property, as well as public parks and recreational areas. Foraging, rooting, and mulching of Wild Boars also damage landscapes, recreational fields, cemeteries, parks, sports stadiums, meadows, and other natural areas.

Deterioration of Water Quality: Unable to thermoregulate effectively, Wild Boars spend a significant amount of time in and around water sources such as ponds, streams, and swamps, where they rumble, drink, feed, and defecate. Rooting and wallowing behaviors of Wild Boars in water bodies reduces water quality by increasing turbidity (excessive silt and particulate suspension) and bacterial contamination over time. There is no doubt that turbidity and pollutants added by Wild Boars adversely affect some forms of native aquatic life including fish, amphibians and insect larvae. They can alter pH levels and caused prolonged anoxia (complete oxygen depletion). Defecation of Wild Boars in streams may increase enteric bacteria or fecal coliform (*Escherichia coli* or *E. coli*) concentrations to levels beyond human health standards. Doupe et al. [99] indicated that in addition to direct *E. coli* deposition in watercourse systems, wallowing and rooting behavior is detrimental to the ecological communities surrounding water bodies by destroying key vegetation and causing soil disturbance. This leads to increased sedimentation, turbidity, pH imbalance, high levels of bacteria, and other disturbances in water quality. In fact, a lot of studies have dealt with the various environmental impacts of Wild Boar practices in ponds, streams, rivers and swamps, which contribute to their pollution and reduce opportunities for recreation and even the impacts targeting wildlife and domestic animal forms as a result of their consumption of water contaminated with different pathogens [100-104].

Health risks

Attacks on Palestinians: The people of the West Bank and some media outlets mentioned the numerous attacks on Palestinians of both sexes by Wild Boars, which caused health damage to them, in the form of cuts, wounds and bruises. There is unconfirmed talk about the killing of a Palestinian citizen because of Wild Boar attacking him. From the stories showing the exposure of West Bank residents to Wild Boar attacks:

- a) A 59-year-old Palestinian woman from Jamala village, west of Ramallah, was attacked violently by a huge Wild Boar and knocked her to the ground, then bit her hand and caused her to bleed heavily. The lady mentioned that the Boar was a wild black type indicating its old age, and that its fangs were about ten centimeters long.
- b) Workers from the West Bank who were sleeping under olive trees in a hill near Umm al-Fahm were attacked by several Wild Boars at dawn, but they managed to escape to another area. The workers added that they are obliged to sleep in the mountainous areas for fear of being arrested by the Israeli police, after they had to enter the lands in 1948 without obtaining the necessary permits, which puts their lives at risk.
- c) In 2008, Wild Boars released by Israeli settlers from Ariel settlement, south of Nablus, attacked a 53-year-old Palestinian from Salfit governorate, seriously injuring him, one of which

reached 30 cm.

d) An elderly woman from a town in the northern West Bank, who was attacked by Wild Boars in 2014, said: "I went out of my house in the early hours of the morning to the mountains, to search for natural mushrooms. As I was walking, I was surprised by a herd of Wild Boars attacking me after they came out of the heart of the forest trees, As a result, I was injured in different parts of my body, after which I stayed for two weeks in Rafidia Governmental Hospital in Nablus.

e) In 2017, a young man from Rummana village, west of Jenin, sustained broken ribs and scratches on the rest of his body after Wild Boars attacked him while he was in a rugged area near his village.

The incidents of Wild Boars attacking citizens of the West Bank and other areas of Palestine were frequent, causing severe cuts, wounds and injuries to their bodies that required hospitalization and treatment. This scene does not happen in Palestine alone, as the aforementioned stories and novels have shown, but extends to take place in various countries around the world, whether they are in developed or developing countries. In Turkey, lower extremity lacerations up to 10 cm in length and 4 cm in depth were seen in three cases reviewed [105]. There were numerous studies and reports that refer to these violent incidents, and sometimes describe the nature of the injury [105-117]. In some cases, serious infections or blood poisoning result from the injuries [110]. Of course, killings as a result of Wild Boars attacking citizens were also recorded in different parts of the world due to the severity of the injury, the occurrence of bleeding, and perhaps the delay in first aid [118-121]. For example, a 38-year-old Thai male who was attacked by a Wild Boar and inflicted a laceration wound 10 cm long and 6 cm deep above the medial side of the right thigh severely destroyed the soft tissues and blood vessels in the region, resulting in severe bleeding to death [122].

Source of Fear and Lesions Due to Falling in Cracks: Some areas that have been subjected to activities, wallowing, rooting and flipping of Wild Boars may pose a danger to the health of Palestinians or even their domestic animals such as donkeys, horses, mules, dogs or even livestock as a result of falling or sliding in those burrows, cracks, holes or soft places, which may lead to bruises or fractures or other injuries. Although rare, some cases have been reported. In a recent study carried out by Abd Rabou, et al. [73], the same risk has been recorded by Nutria or Coypu (*Myocastor coypus*); a large invasive rodent that occupies the wetlands, rivers and streams of northern and central Palestine. On the other hand, most of the Wild Boar's activity and movement is concentrated at night when the weather is relatively cold, and these fierce animals may approach the homes and gardens of Palestinians in the West Bank and the rest of Palestine, causing fear, terror and panic, especially for women and children who live in marginal areas

that may be invaded by Wild Boars. Eyewitnesses stated that some residents of the West Bank avoid leaving their homes at night for fear of Wild Boars and the possibility of being attacked by them, which may result in fatal injuries. This comes because the Israeli settlers in the northern West Bank often throw large numbers of Feral Boars to frighten the Palestinians on the one hand and to make them leave their lands and agriculture on the other, and many local studies have shown that [13,15,16,58]. In conclusion, to reduce the risk of exposure to Wild Boars in the West Bank or other areas in Palestine, it is preferable to avoid areas that they prefer to frequent such as swamp areas, valleys, green and sometimes rugged areas, woodlands and areas with high primary productivity [123]. Moreover, walking alone and defenseless in areas where Wild Boars are expected is a risk factor that must be avoided in order to preserve health and life. From another angle, when on the roads and streets, Wild Boars can collide with vehicles and various modes of transport, endangering the safety of drivers and passengers. It should be noted that Wild Boars were among the roadkills in the West Bank, as indicated by the Albaba [35].

Possible Outbreak of Swine Flu: Waves of swine flu (H1N1) infect many countries of the world and may record deaths and injuries, and accordingly countries, including Palestine, are racing to conduct the necessary tests and provide special vaccines. Symptoms of the disease include a high fever, sore throat, stuffy or runny nose, body aches, barking cough, decreased appetite, headache, and fatigue [124]. Swine influenza virus spreads among pig populations worldwide, and transmission of the virus from pigs to humans is not common and does not always result in human influenza. People who are exposed to pigs on a regular basis are at increased risk of contracting swine flu [125]. The disease can be fatal [126]. Swine flu is transmitted from an infected person to a healthy person by inhaling or swallowing droplets contaminated with the virus while sneezing or coughing [124]. It is not the custom of Palestinians, especially Muslims, to be in contact with Wild or even Domesticated Pigs, and from here it is very unlikely that swine flu will occur among Muslims in Palestine, as well as among other religious sects that do not deal with pigs. The close link between the disease and the spread of Wild Boars in the Palestinian territories creates a panic in ways to combat these animals to avoid contracting this dangerous disease. Over the past years, the Palestinians have chased and killed a lot of Wild Boars in an effort to mitigate the extent of the disease's catastrophe, but the rapid reproduction rate of the animal, the difficulty of accessing it in its rugged and dangerous areas, and the difficult security conditions in which the people of the West Bank live, all stand in the way of the success of an integrated fight against the Wild Boar and its possible swine flu. Residents of the northern West Bank expressed their fear of the spread of swine flu due to the widespread spread of Wild Boars there. Rather, they called on all responsible parties to intervene immediately to eliminate Wild Boars and swine flu as much as possible.

Possible Transmission of Swine Brucellosis and Other Parasites: It is well known that Wild Boars carry numerous pathogens, some of which are transmissible to wild and domestic animals as well as humans. The good thing is that most of the citizens of Palestine do not eat pork in all its forms, as Islam and some heavenly religions forbid eating pork, and this exempts Muslims and others who do not eat pork from many diseases that can be transmitted to humans through Wild Boars, such as brucellosis. Humans can contract the disease from contact with Wild or Feral Boars. This disease presents a significant public health threat to hunters or others who may have direct contact with these animals. Trichinosis or trichinellosis is a disease of man and other animals caused by a tiny parasitic round worm, most commonly *Trichinella spiralis*. Humans and other animals may be infected by eating raw or undercooked meat of infected Wild Boars or Domestic Pigs [127-129]. Other harmful pathogens related to Wild, Feral and Domestic Boars which can infect humans include leptospirosis, toxoplasmosis, tuberculosis, tularemia, salmonella, hepatitis, pathogenic *Escherichia coli* (*E. coli*), the previously mentioned swine influenza, etc. Fortunately, the most common way of transmitting pathogens and parasites from Wild or Feral Boars to humans is through direct contact with these animals, slaughtering them, or eating their meat that has not been thoroughly cooked. Of course, some of these diseases may be transmitted to humans by animals or agents other than Wild Boars. In fact, Wild Boars are reservoirs for a number of viruses, bacteria and parasites that are transmissible to domestic animals and humans. This was confirmed by Lahmar, et al. [34,68,130], Meier and Ryser-Degiorgis [131] who pointed out those Wild Boars can act as reservoirs for many important infectious diseases and parasites in domestic animals and humans. The incidence of tuberculosis due to *Mycobacterium bovis* has increased in Wild Boar, which is a potential infection concern in cattle and humans. Six hunters have been documented infected with *Brucella suis* from Wild Boars in Florida [68,132] pointed out that a person was infected by *Actinobacillus suis* after a pig bite. According to Riju and Jayson [133], a case of Wild Boar rabies was recorded in Kerala, India. Several parasitic worms have been diagnosed in Wild Boars in Mexico, indicating the potential danger to the Wild Boar as a transmission channel for parasites that could have an impact on public health [134]. Fredriksson-Ahomaa et al. [135] revealed that Wild Boars are infected with several human and animal pathogens and as a result they are important reservoirs of a long list of foodborne pathogens.

Islam and Wild Boars

Hunting, eating and trading the meat of Wild, Feral and Domesticated Boars are forbidden or «haram» under Islamic law. The Quran prohibits the consumption of pork (pig, hog or boar) in no less than four different verses. Pork prohibited in Surat Al-Baqara Verse 173; Surat Al-Maida Verse 3; Surat Al-Anam Verse 145, and Surat An-Nahl Verse 115. However, based on the number

of iterations in which pork is mentioned as forbidden, no amount of interpretation can change the message of the Holy Quran. Even when one travels to the Middle East or Islamic countries in modern, high-tech airlines, companies generally tell all passengers that the diets offered to them do not contain pork. In some non-Islamic countries, Wild Boars may be hunted and domesticated, and they are considered delicacies, but in most Islamic countries this act is forbidden. In Bangladesh, only non-Muslim minority people raise pigs [136]. Palestine is the land of the monotheistic religions and now harbors within it a mixture of Muslims, Christians and Jews in addition to some small ethnicities. Despite this, Wild Boar hunting in Palestine for the purpose of eating does not appear to be widespread. Therefore, these Wild Boars wander and roam in most areas of Palestine in their comfort, and their herds attack agricultural lands, tamper with and destroy crops, and sometimes attack people, as previously mentioned. The rapid breeding rate of Wild Boars coupled with not being hunted for their meat in contempt of Islam makes them a major problem in Palestine that requires proper management.

There are many reasons for the prohibition of eating pork, some of which are cultural; some are medical, and so on. From a cultural point of view, the pig is the dirtiest animal on earth. It lives and thrives on mud, feces, and dirt. It is the best-known scavenger of the earth's animals. From a medical point of view, both Wild and Domesticated Boars are a haven and source of infection for many dangerous viruses, bacteria, microbes and parasitic worms (helminthes) that destroy the health of humans and their domestic animals [68,130,131,134,135]. In fact, the fact that the pig is an impure animal and that its meat contains parasites and diseases harmful to humans may come to mind as a justifiable reason to refrain from eating its meat and this is of course a secondary reason. Muslims simply do not eat pork or pork products because God forbids it. A Muslim submits to God's commands voluntarily without having to know the reason for divine judgment [137].

COVID-19 and Wild Boars

There have been no reports that Wild Boars can naturally contract the virus that causes Coronavirus disease 2019 (COVID-19) or transmit it to humans [138,139]. But most importantly, since the emergence of COVID-19 pandemic, many forms of wildlife have found the opportunity to get out of their habitats, dens and burrows to invade urban environments that they did not dream of before [140]. This came with the imposition of quarantine and curfew in cities and towns [138]. The fierce and violent Wild Boar was among those wild animals that had the opportunity to roam in residential neighborhoods and public streets, causing terror among residents and civilians in different parts of Palestine as well as in some parts of the world. Wild Boars roamed individually and in herds in some streets, gardens and yards of the West Bank and other parts of Palestine, such as Jerusalem (Al-Quds), Tel Aviv, and Haifa. Haifa is of great importance in the roaming of wildlife during COVID-19

pandemic, as it is a coastal city located at the foot of Mount Carmel [141]. This mountain is an important habitat for a variety of wildlife including Wild Boars, Red Foxes, Golden Jackals, and other animals. Therefore, it was easy for wild animals to infiltrate Haifa from the Mount Carmel and roam in it with comfort and reassurance.

Two years prior to COVID-19 pandemic, Wild Boar infiltration was recorded in the coastal city of Haifa due to the availability and distribution of food resources in urban areas and land cover [142] and the proximity of Haifa to Mount Carmel, which is teeming with various forms of wildlife, including Wild Boars. Wild Boars have been recorded wandering between cars and pedestrians (Figure 5), destroying garden fences, damaging some garden plants, overturning and messing with trash containers, and occasionally entering homes and some establishments. In certain circumstances, they caused attacks and injuries to humans. According to The Times of Israel [143], it can be funny when social media users follow a photo of a Wild Boar sleeping on a mattress next to trash cans after eating their contents of organic wastes in the coastal city of Haifa during COVID-19 pandemic (Figure 6). The risks of the COVID-19 pandemic are not limited to the infiltration of Wild Boar into

residential areas in cities and towns, but it has been proven that there is an increase in African swine fever in the European Union countries during the COVID-19 pandemic as well [144].

Control of Wild Boars: In spite of the risks caused by Wild or Feral Boars to Palestinian farmers, crops and properties, this does not mean that there should be a state of absolute hostility to these creatures. All Palestinians are invited to look at these animals as an element of the Palestinian environment and biodiversity. There should be a Palestinian intelligence to deal with these animals and to minimize their impacts on agricultural crops. No doubts that the return of Palestinian farmers to take care of their agricultural lands and orchards is of utmost priority in the way of protecting their lands and properties. Such actions will open minds to finding various solutions to deal with Wild Boars and prevent them from reaching their orchards. In fact, Wild Boar populations are difficult to control due to their high reproduction rate. Females can breed twice a year with at least 6-8 piglets per litter. Several control techniques can be used, including poisoning, fencing, hunting and trapping as follows:



Figure 5: Wild Boars (adults and piglets) wandered and roamed in Haifa in April 13, 2020 under COVID-19 closure [Photo: Ohad Zwigenberg; Source: 141].



Figure 6: A Wild Boar takes a nap on a mattress next to solid waste containers after eating a lot of its trash [Source: 143].

Poisoning Using Pesticides: According to many Palestinian farmers, many chemical pesticides have been used to combat Wild Boars that damage their agricultural crops and property. Sawalha et al. [15] and Albaba [16] reported that toxic carbamate pesticides such as Lannate and Methomyl have been used in the West Bank to control Wild Boars. Some farmers may dissolve pesticides in water or may mix them with baits wanted by Wild Boars. In both cases, pesticides or poisons must be placed in the appropriate places frequented by these animals. Landowners and breeders of livestock and poultry must be informed of the places used to put these poisonous substances in order to protect their pets and other non-target species from exposure to poisoning. A farmer from Salfit, in the northern West Bank, reported that after Wild Boars destroyed his crops, he was forced to put poison in water containers, and confirmed that this method contributes to mitigating their spread in the area for a temporary period. At the same time, he added, placing pesticides on remote farmlands threatens livestock and other non-targeted wildlife. He claimed that the use of pesticides to control Wild Boars in addition to other harmful pests is characterized by its relative and fast effectiveness. The problem of the widespread use of pesticides to control agricultural pests is causing adverse effects on non-target species. According to Berny [145], the acute toxicity of these dangerous pesticides due to their biological activity has resulted in the death of non-target organisms worldwide.

Many pesticides and poisons have been used around the world to combat Wild Boars. Coblenz and Baber [146] estimated that the use of toxicants (pesticides or poisons) in the management of

Feral Boars was 11 times cheaper than removal by shooting and 80 times cheaper than removal by trapping when trying to eradicate Feral Boars from the island of Santiago, Ecuador. Brendan et al. [147] indicated that sodium nitrite (NaNO_2) is a cost-effective and readily available methaemoglobin-forming compound and is highly toxic to Domestic Pigs, causing several accidental poisonings. The same results were obtained by Shapiro et al. [148] when they applied sodium nitrite as a new tool to control Wild Boars. In Namadgi National Park of Australia, Warfarin was effectively used to control Wild Boars [149,150]. Similarly, low-dose Warfarin bait has been found to effectively reduce Wild Boar populations and pose minimal risk to non-target wildlife and domestic animals in North Texas [151]. In fact, many poisonous agents for vertebrates with different potentials have been used to control Wild Boars in many countries of the world, the most famous of which are sodium nitrite, sodium fluoroacetate or the killer poison (1080), cyanide, cholecalciferol, anticoagulants (especially Warfarin), zinc phosphide and phosphorous [152].

Fencing: The main drawbacks of fences that are used to prevent Wild Boars from infiltrating farmland and orchards are the high initial cost as well as the need for constant monitoring and maintenance of the fences to ensure their safety [153]. For this reason, the fences of most farms, especially large ones in the West Bank, are not tight and Wild Boars may infiltrate through them to cause damage to crop and property. Wild Boars cannot pass over or under fences if they are of appropriate height. Also, Wild Boars will not jump over fences unless they are forced to. Therefore, the

use of fences woven with barbed wire in its lower part contributes to discouraging these animals from entering orchards and farms, or even the rooting behavior that they practice and harm the crops. Despite all this, fences remain an important and considered means of combating Wild Boars in the Palestinian environment. Sawalha et al. [15] and Ababa [16] considered poisons and fences (although they are more expensive) to be the best and most effective means of combating Wild Boars and may be alternatives to prohibited firearms that may create security problems with the Israeli occupation. The views of Sawalha et al. [15] and Ababa [16] agree with many researchers in considering fences an effective way to fight Wild Boars [46,152-155]. In certain localities of the world, the fence management option is only practicable and affordable for protecting small areas of high conservation value [152].

Trapping: Live cage traps (known locally as Maltash) are an effective technique for controlling Wild Boars in different countries worldwide [156]. For example, in Kosciusko National Park, New South Wales, 62% of Wild Boars exposed to traps were captured [157]. Although trapping is less commonly used to hunt Wild Boars in Palestine, especially in the West Bank, live traps are a flexible method that can be implemented in conjunction with other activities in orchards and agricultural fields, thus reducing labor costs associated with control. Live traps are portable and can be moved and reused in a variety of habitats and seasons, allowing

hunters to target Wild Boars while changing their ranges or places of activity. Trapping requires much less time and effort than other methods such as hunting. This is all related to the advantages of live traps, as explained by Latham and Yockney [152]. Most of the farmers and sufferers of Wild Boar in the West Bank claim that live traps are an expensive method, depending on their type or the way they are prepared locally, and according to the numbers needed to control the populations of local Wild Boars. The results of this study are consistent with the local studies of Sawalha et al. [15] and Albaba [16] who revealed that the method of using live traps is not feasible, because of their danger to citizens, livestock and other wild animals in addition to their high prices and scarcity. The noticeable increase in the number of Wild Boars in the northern West Bank requires a large number of live traps, and this is of course not appreciated by farmers and those affected. In the Gaza Strip, small and medium-sized live traps have been used in trapping different carnivores such as Golden Jackals, Red Foxes, Egyptian Mongooses, Jungle Cats and others [158-163]. But the traps will certainly be larger in size for Wild Boars, which vary in size between piglets and adults, which may exceed 100 kg. This makes the task of hunting Wild Boars more difficult and potentially futile in the environment of the West Bank which is occupied by Israel. The Israeli settlers have been known to release Feral Boars from time to time to damage Palestinian lands and farms [13].



Figure 7: A Palestinian shot and killed a giant Wild Boar in Ramallah, West Bank to relieve people of its evil and attacks in December 19, 2020 [Source: Jamal Alimwase's Facebook].

Shooting: Wild Boars in the West Bank are shot with gunpowder, cartridges, or firearms at limited ranges [15,16]. This comes because of security reasons due to the proximity of the targeted places to the Israeli settlements or to the locations of the Israeli occupation army, which may respond to the source of the shooting and things develop militarily. Despite this, it is sometimes heard or read in news sites and Facebook that some Wild Boars of frightening and small sizes have been shot and killed in separate areas of the West Bank in order to neutralize them and stop harming Palestinian farms and property (Figure 7). In any case, shooting, despite its danger and low occurrence, remains one of the available and sometimes effective options in combating Wild Boars in Palestine, especially the West Bank. At regional and global levels, the use of firearms to kill Wild Boars that are harmful to the environment, agriculture and humans is acceptable and permissible by governments in a lot of cases. Again, in 2010, the Jordanian government allowed the shooting and killing of Wild Boars in an attempt to reduce their negative effects on agriculture and agricultural crops, and as a precautionary step in the fight against swine flu [30]. In the developed world, gunfire is probably the most common technique used to control Wild Boar populations. It may occur in the context of recreational shooting, or it may be conducted by professionals as part of a deliberate control program. In either case, shooting programs must be extensive and consistent to effectively reduce Wild Boar populations and associated damage [6,164-166]. In Brazil, hunting using guns and ammunition is the main technique used to control Wild Boars in order to reduce their populations and crop damage [167].

Means Of Other Countries: With different levels of use in the Palestinian territories to combat Wild Boars, chemical pesticides and poisons, fences, live traps and shooting are the four existing methods. Sometimes there are secondary control methods that no one hears or reads about. At the regional and global levels, there are certainly other types of control of Wild Boars, and they may be common in the countries which have vast areas, but they certainly do not exist in the West Bank due to the sensitivity of the political, military and security situations under the brutal Israeli occupation of Palestine. These include aerial shooting or gunning using aircrafts such as helicopters [168-170], night shooting using night vision technology and sound-suppressed weapons [165], electric fencing [157,171,172], hunting dogs [173-176]. Espera hunting allows for highly selective harvesting systems of Wild Boars based on sex or age, and is a very effective tool for managing their populations and eradicating a large proportion of adult males [177]. Immunocontraception, which reduces pregnancy rates in treated Wild Boars when compared to controls, is capable of limiting Wild Boar populations over time [178]. Odor repellents are sometimes used [179]. Vaccination may become a non-lethal method to control disease spread in Wild Boar populations [165].

Snares are commonly used with caution in areas where cattle, deer and other non-target species are present [165].

In conclusion, the methods used in combating Wild Boars in many countries of the world, most of which are considered strange or unavailable in the Palestinian environment due to the Israeli occupation to Palestine on the one hand and the small area administered by Palestinians in the West Bank which equals about 21% of the total area of Palestine. The above-mentioned methods are still used and relied upon to varying degrees in the control of Wild Boar in the West Bank. However, it must be borne in mind that Wild Boars are an integral part of Palestinian biodiversity and should be handled with caution. They are intelligent mammals and often act intelligently during their various activities, including dealing with means of control that target them.

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