



Islam and Environmental Sustainability: Perspectives and Challenges

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Abstract

Recent studies stressed the importance of religion in addressing climate change and other environmental issues. However, little attention is paid to Islamic perception and challenges toward environmental sustainability. This study addresses a) Islamic prescriptions regarding environmental protection, b) Islamic involvement in environmental organizations worldwide and c) the assessment of the carbon impact of the Hajj. Our investigation shows a large range of Islamic prescriptions for the protection of the component of the environment such as water, air, soil, plants, and animals, making Islam a good defender of the environment. The strict implementation of these prescriptions would contribute to the mitigation of environmental issues that our planet is facing while insuring environmental sustainability. Muslims are as well actively working together with several Islamic environmental organisations around the world to protect our environment. The 2011-2019 Hajj season, for instance, has emitted an average of 5.2 million tonnes of CO₂ per year for pilgrims' transport using cars, boat and airplane. A strong correlation (0.77) was observed between the number of pilgrims and carbon emissions. Moreover about 42,000 tons of waste are produced annually during the Hajj. Actions, such as tree planting and waste recycling, have to be taken to reduce the environmental impact of pilgrimage, so as to support the green Hajj movement and showing the world that Islam is the reference in terms of ecological religion for environmental sustainability.

Keywords: Carbon Emission, Environment Sustainability, Hajj, Islam.

INTRODUCTION

Humanity is engaged in an important historical turning point with regard to the relations it maintains with its natural environment (Downing et al., 2020; Mravcová, 2019). The planet is indeed everywhere marked by the footprints of man, whether in the air, at the bottom of the oceans, in the forests or just in the polar ice (WWF, 2018). In general, environmental degradation is induced by anthropogenic activities related to industry, agriculture, recreation,

transport and urbanization (Nanda et al., 2022). These human activities are most often capable of introducing dangerous contaminants to the soil, water, air and ecosystems (Gret-Regamey et al., 2020).

Over the past century, human's activities have profoundly affected ecological processes, including atmospheric layer on which life depends. The magnitude of the impacts resulting from these activities is now such that the nature is no longer able to perform its regulatory functions autonomously, thus necessitating corrective interventions by humans: and these, in turn, are likely to result in further damage to the environment (Ahmad, 2015; Nanda, Hussein, et al., 2021). If human alterations of ecological processes are inevitable, they must be carefully studied and scientifically conceived, so that humanity can maintain a balanced relationship with its natural environment. Religions play an important role in the lives of people and must also contribute to the protection of the environment (Hulme, 2016; Jenkins, Berry, & Kreider, 2018; Koehrsen, 2021). The importance of religion for understanding how people make sense of environmental issues and also for identifying meaningful responses to the challenges that are raised have recently been recognized by scholars and policy makers (Hulme, 2016; Jenkins et al., 2018; Koehrsen, 2021).

The questions posed by climate change reach to the heart of faith: our relationship to God's earth and to each other; the place of technology; questions about sin and selfishness, altruism and neighbour love; how to work for justice especially for the most disadvantaged parts of the world and for future generations (Atkinson, 2012). (Dasgupta & Ramanathan, 2014) presented religious actors as key contributors to political discourses at local, national, and international levels, whose implication might support reversing the global change issue. Islam is an Abrahamic religion based on the dogma of absolute monotheism and taking its source in the Holly Qur'an, considered as the receptacle of the word of God revealed, in the 7th century in Arabia, to Mohammed, proclaimed as the last prophet of God (Salleh, 2015). Muslims are nearly 25% of the world's population and is the second largest religion in terms of adherents (Hulme, 2016; Jenkins et al., 2018; Koehrsen, 2021; Ribau, 2015).

The pilgrimage to Mecca is one of the five pillars of Islam and the Qur'an makes it obligatory for every responsible believer who has the financial and physical capacity (Gatrad & Sheikh, 2005). Since 1950 the total number of pilgrims has jumped from 50,000 to about 2 million per year, thanks to the modernization of long- distance transport (Bouguerra, 2020). This religious activity likely contributes to the emission of greenhouse gases and pollution

which is still not evaluated today. Over centuries, almost all of international relation theories were produced by the West on their advantage, based on the assumption that Western history and culture is the same all over the world (Acharya & Buzan, 2007). This therefore misrepresents and misunderstands much of world practices as well as it neglects the potential contribution of non-westerns to address the various problems requiring inclusive response. (Acharya & Buzan, 2010) introduced the non-Western traditions, literature and histories relevant to how international relations is conceptualized.

On this regard, (Grim & Tucker, 2014) believe that, solving the current environmental issues is not just beyond the capacities of science; it is also beyond the capacities of the state. As with other non- state actors such as businesses, cities and NGOs, religious movements and institutions have the mobilizing power to enlist and de-list multitudes of citizens in influential causes. Furthermore, (Hulme, 2016; Jenkins et al., 2018; Koehrsen, 2021)) at the end of his examination of the varieties of religious engagement with climate change suggested, considering the importance of Islam, that more attention should be paid to how Muslims, in faith and in practice, either engage with or potentially engage with environmental issue. The hajj is useful in understanding how to be a pioneer of Islamic practice on environmental issue, given that Islam offers a broad perspective on environmental sustainability (Abdelzaher et al., 2019). For centuries, industrial sectors have contributed to environmental challenges (Ahmad, 2015; Downing et al., 2020; Mravcová, 2019; WWF, 2018).

However, just few studies have looked into religious practices and environmental problems. According to existing research, pilgrimage and the environment are two challenges that have arisen in religious activities at the same time (Prime, 1992; Shinde, 2007; Sullivan, 1998). For instance, Shinde explored the case of Hindu sacred sites of Vrindavan (Shinde, 2012) in northern India and Tirumala-Tirupati in south India where peoples are performing pilgrimage annually. The studies highlighted the negative impact on the environment with the degradation of the pilgrimage sacred sites by pilgrims who are travelling to fulfil the spiritual ritual. However, the case of Islamic pilgrimage remains poorly known. Therefore, the aim of this paper is to analyse the Islamic perspective and challenges toward global environmental sustainability. Specifically, the study a) analyses the prescriptions of the Koran regarding environmental protection, b) presents the Islamic organizations that work for the protection of the environment throughout the world and c) evaluates the environmental carbon impact of the pilgrimage to propose means of improvement.

METHODS

The study is based on a mixed research method combining qualitative and quantitative methods. The analysis of Islamic prescriptions in terms of environmental protection was done from a literature review following the analysis of documents of interest (articles, books, website). The same qualitative method was used for the presentation of Islamic environmental protection organizations. For the evaluation of the environmental impact of the pilgrimage, quantitative data of the number of pilgrims, their origin and respective mean of transport (car, airplane or boat) for the pilgrimage period 2011 - 2019 were collected on the official website of the Hajj (<https://www.haj.gov.sa/fr/InternalPages/Details/171>).

Data were then processed using Ms Excel. Considering that the average emission of the different mean of transport is 285 gCO₂/km/person and 68 gCO₂/km/person for airplane and car/bus respectively (Fournier, 2019) and 62.2 gCO₂/km/person for boat (MEDDE & AMEDE, 2012), the average carbon emitted for transportation during the Hajj was calculated by taking into account the number of pilgrims and the average distance for each means of transport: 11600 km for air, 4000 km for land and 11600 for sea. The number of pilgrims using the same mean of transport was multiply by the carbon factor of that mean of transport and the average distance to obtain the environmental impact of the pilgrimage. Finally, the Pearson Product Moment Correlation (PPMC) test was used to determine between the number of pilgrims and the amount of carbon emitted.

RESULTS AND DISCUSSION

ISLAM ENVIRONMENTAL PROTECTION PRESCRIPTIONS

The Holy Qur'an makes it clear that every creature in the universe, whether known or unknown to us, has a dual function: a religious function, as evidence of the Creator's existence, wisdom, omnipotence and mercy; and a social function, in the service of man and other creatures (Nana, 2019). God the Highest in his wisdom has placed the creatures in the service of each other. The divine ordering of all the elements and creatures (each of them playing the role assigned to it and having its own value) is the basis of the ecological balance that preserves the creation. Therefore, any waste, degradation, destruction or pollution of natural resources is a violation of this divine order. And since short-sighted selfish interests lead human beings to commit acts detrimental to such an order, the protection of these resources from misuse is a compelling obligation (Bagader et al., 1994).

In this divine order, where creatures are placed at the service of each other, divine wisdom wanted all creatures to benefit man. But the scriptures do not indicate that they were created only to serve him. On the contrary, some Muslim scholars have stated that the service of man is not their only reason for being (Kader et al., 1984). It is in this sense that they interpreted the following verse: "He has subjected to you the ships that split the sea by his command; he has subjected the rivers for your benefit; he has subjected the sun and the moon, pursuing their course in their ruts. He makes the day and the night serve your needs. He has given you all the goods that you have asked of Him. Count the blessings of God if you can! But man is unjust and ungrateful" (Surah 14, verses 32-34).

The protection of the environment cannot be motivated by the mere satisfaction of our interests, because most of the benefits we derive from it are beyond our comprehension. Since it is impossible for us to comprehend the benefits of all things, if we are concerned with protecting only those things that are of interest to man, we would be leading ourselves to harm the ecological balance established by God the Highest, to degrade the creation, to sacrifice many of its benefits and to cause the loss of many signs of God the Highest (Bagader et al., 1994). On the other hand, when the protection and conservation of the environment is motivated by its intrinsic value (as a divine sign), none of its elements are ignored, for all species of creatures are unique in their specific roles in glorifying the creator and expressing his omnipotence, wisdom and mercy. Henceforth, no element of the universe or species of creation can be allowed to be ruined. In any case, humans and animals alike have the right to enjoy the earth's resources in common. This is why man is forbidden to degrade these resources; it is rather up to him to make the best use of them. The main elements of the environment that are protected by Islam are: water, air, animals and plants, and soil.

ISLAM AND WATER PROTECTION

God has made water the origin of life. God the Most High says: "By means of water we give life to all things" (Surah 21, verse 30). Thus, the existence of plants, animals and humans depend on the availability of water. The Most High said: "This water which God sends down from the sky and with which He gives life to the earth which was once dead" (Surah 2, verse 164). He also said: "It is He who sends down water from the sky. By it we make the seeds of all plants grow" (Surah 6, verse 99). He says: "We send down pure water from the sky to revive a dying

land, and by it we quench the thirst of our creatures, an infinite number of animals and men" (Surah 25, verses 48 and 49); (Surah 25, verses 48 and 49).

God the Highest thus teaches mankind to appreciate the value of this essential life resource. In addition to this vital function, water has another socio-religious function to perform which is purgation of the body and clothes from all dirt, impurities and defilement so that man may encounter God clean, pure and purged. God said in His Glorious Quran, "... and He caused rain to descend on you from heaven to clean you therewith" (Surah 8; verset 11) and says, "... and we send down pure water from the sky" (Surah 25, verset 48). On this regard, the Prophet Muhammad peace and blessings be upon him (PBUH) forbade wasting water even for performing an act of worship such as minor or major ablution. Seeing Sa'd performing ablution, the Prophet said to him, "Do not waste! ". Sa'd then said, "Even when it comes to water? ". The Prophet said, "Yes, even if you were standing by a river! "(Reported by Ibn Majah).

God has also shown us other functions of sea and ocean water. It represents a suitable biotope for many organisms and creatures which play vital roles in the development of this world and the perpetuation of life. God said, "It is He who has made the sea subject, that ye may eat thereof flesh that is fresh and tender, and that ye may extract therefrom ornaments to wear; and thou the ships therein that plough the waves, that ye may seek thus of the bounty of God" (Surah 16, verset 14). He also says, "Lawful to you is the pursuit of water-game and its use for food - for the benefit of yourselves, and those who travel" (Surah 5, verset 96). Conservation of this vital element is undoubtedly the basis for the preservation and continuation of life in its various forms whether vegetative, animal or human.

Whatever fulfils and helps to achieve the basic necessities is itself a necessity. Therefore, any attempt at marring the vital and social functions of this element, whether by spoiling or polluting it with any material that would make it an unsuitable environment for some living organism or any such attempts to mar its function as the source of life, will necessarily lead to a complete halt or cessation of life itself. The juristic rule is "what leads to the forbidden is itself forbidden". Owing to the importance of water as a vital element and the main source of life, God made its use the privilege of all human beings, without discrimination. All mankind is entitled to use it without monopoly, compulsion, coercion, corruption or abuse. God said, "And tell them that the water is to be divided between them" (Surah 54, verset 28) and the Prophet (God bless him and grant him peace) said, "People share three things: water, pasture and fire."

ISLAM AND THE PROTECTION OF AIR

From the divine standpoint, this element is no less important than water for the perpetuation and preservation of life. The air may also have other functions which man does not perceive or which are not of immediate interest to him. However, there are functions which God deliberately meant to create, as man has been made aware of by the Glorious Quran. For example, God sends the wind to torment and torture some races of people in revenge and retaliation. On the other hand, He sends the winds to others as a sign of mercy, benevolence and good omen. Likewise, the Quran attaches a vital importance and a great function to the winds namely that of pollination. God said, "And we send the fecundating winds" (Surah 15, verset 22). Winds are also clear evidence of God's omnipotence, bounty, provision and perfection.

He also said, "Behold! In the creation of the heavens and the earth; in the alternation of the Night and the Day; in the sailing of the ships through the Ocean for the profit of mankind; in the rain which He sends down from the skies, and the life which He gives therewith to an earth that is dead; in the beasts of all kinds that He scatters through the earth, in the change of the winds, and the clouds which they trail like their slaves between the sky and the earth; — here indeed are signs for a people who are wise" (Surah 2, verset 164). Since the air performs all these vital and social functions, it follows that its conservation, pure and unpolluted, is an integral part of life conservation itself, which is as well one of the main objectives of Islamic jurisprudence (Shariah). The juristic rule is "what fulfils and satisfies necessities is itself a necessity". Therefore, any attempt at polluting it or marring its function or even spoiling it is considered an attempt at hindering God's wisdom and creation. This equally hinders and cripples' man's role in the development of this world.

ISLAM AND THE PROTECTION OF PLANTS AND ANIMALS

No one can doubt the importance, great use and benefit of plants and animals for mankind. In addition, the Glorious Quran mentions the aesthetic and decorative functions of these creatures in addition to their other functions and, since peace of mind is one of the religious requirements which should be fully satisfied. God in creating all plants and animals provides pleasure and enjoyment to man so as to satisfy his peace of mind, as a factor which is essential for man's proper functioning and full performance. The Glorious Quran also mentions other functions which these creatures perform and which man may not perceive, namely the mandatory

functions of worshipping God, declaring His praise and bowing down to Him. God said, "Seest thou not that to God bow down in worship all things that are in the heavens and on the earth — the sun, the moon, the stars, the hills, the trees, the animals ..." (Surah 22, verset 18) and God says, "There is not a thing but celebrates His praise, and yet ye understand not how they declare His glory!" (Surah 17, verset 44) and He says, "Whatever beings there are in the heavens and the earth do prostrate themselves to God — with good will or in spite of themselves" (Surah 13, verset 15).

Islam emphasizes all measures for the survival and perpetuation of these creatures so that they can fully perform the functions assigned to them, for He considers them living communities, exactly like mankind. God says "There is not an animal (that lives) on the earth, nor a being that flies on its wings, but (forms part of) communities like you" (Surah 6, verset 38). Also, the Prophet (God bless him and grant him peace) has rightly shown us, through his commandments and teachings, how to rear and conserve these creatures. An ant once stung one of the Prophets who then ordered a whole colony of ants to be burned down in retaliation. God taught him in rebuke, "Thou hast destroyed a whole nation that celebrates God's praise for an ant stung thee"¹⁶. The Prophet of Islam also told us of a woman who would be sent to Hell because of a cat she locked up without feeding or releasing to feed on vermin of the earth¹⁷. God thanked a serf who saved a dog from death by giving it water to drink, thus quenching its thirst. The Prophet of Islam has forbidden leaving animals to starve and damned a group of people who used a bird as a target.

The Prophet Muhammad (PBUH) through his Hadiths (revealed prophecies) calls for the preservation of all components of the environment. In this regard, he forbids harming animals by saying, "Whoever kills a bird unnecessarily, that bird will complain on the Day of Resurrection saying, 'So-and-so killed me unnecessarily. He did not kill me for a profit'" (Reported by an-Nasa- y). He also forbade attacking plantations saying, "Whoever uproots a jujube tree, God will put his head in Hellfire" (Reported by Abu Dawud). He said: "When the Muslim plants a tree, whatever is eaten from it will be counted as alms for him, whatever is stolen from it will be counted as alms for him. Whatever the wild animals eat from it will be counted to him as alms, whatever the birds eat from it will be counted to him as alms, and whatever is taken from it will be counted to him as alms" (Reported by Muslim). He added: "If the time of the end of the age comes to any of you while he is holding a shrub in his hand, if he can make sure that the Hour does not come before he plants it, then let him plant it. The development of the environment demanded in this hadith goes beyond the need of the human

being to vegetate, which proves that the supreme goal of the development of the environment is the preservation of the ecological balance and the ecosystem, because any failure in this balance is detrimental to life, and the preservation of life is one of the supreme goals that Islam aims to achieve.

PROTECTION OF SOIL BY ISLAM

Like air and water, soil is essential for the continuance of our life and that of other divine creatures. For God the Most High designed the earth to serve as a source of substance for ourselves and other creatures. He made the soil fertile so that the plants that animals feed on could be cultivated. He made the mountains to catch and store rainwater, as the famous Qur'an says: "Did we not make the earth to contain the dead and the living? We have set up high mountains on it, and we make people drink fresh water" (Surah 77; verses 19 and 20). The Most High says: "Let the land that is dead of drought be a sign to them of our power. We give it life, and bring forth from it grain for them to eat. We planted gardens of dates and vines in it; we made springs flow from it. Let them eat of their fruits and enjoy the work of their hands. Will they not be grateful to you? (Surah 36; verses 33-35). (Bagader et al., 1994) believes that to express our gratitude to the benefactor, it is up to us to perpetuate his blessings, by preserving the fertility of the soil and protecting it from erosion.

Therefore, in our urban, agricultural, pastoral, forestry and mining activities, we must be careful not to degrade the soil and to use practices that maintain and improve its fertility. To cause the degradation of this providential good, on which so many living beings depend, is to deny divine providence. And insofar as any attack on the integrity or quality of the soil necessarily leads to destruction and life, it can only be strictly forbidden. The Prophet (peace be upon him) through his Hadiths says: "When one of you wants to urinate, let him look for a place where his urine can be easily removed" (Reported by Abu Dawud). That is, let him choose a place where the traces of urine can be removed quickly so as not to pollute the surroundings. It is in this sense that he says in another version: "Beware of the three sources of curse: excrements in watering places and springs, in the open and in the shade" (Reported by Abu Dawud and Ibn Majah). In this regard, for the Messenger of God, prayer and salvation upon him, the whole earth was conceived as a place of worship, all in purity. Thus, the earth is coated that we must treat it with all the respect due to the places of worship and preserve it against any impurity or defilement. These Islamic prescriptions make Islam an eco-friendly religion,

defender of the sustainable management of natural resources for environmental sustainability. The implementation of these prescriptions would contribute to adapt and mitigate the environmental problems that the world is facing today as it was highlighted by (Flower, 2014).

CONTRIBUTION OF ISLAMIC ORGANIZATIONS FOR ENVIRONMENT PROTECTION INTERNATIONALLY

Muslims are similarly concerned about environmental issues, a fact that many outside those communities do not realize. There is a stereotype of faithful Muslims praying and fasting, but not engaged or involved in social issues. However, the reality is that Muslims are not only concerned about the environment but actively working to protect it all around the world. These are some examples of Islamic organisation that are fighting to protect the environment around the world. Green Muslims (USA); it is perhaps the most widely known Muslim Environmental Group in the United States. Created after the success of zero-trash potluck dinners in 2007 in the Washington D.C. area, Green Muslims has become a vocal and visible representation of earth- friendly Islamic practices in action. Through tool-kits and guides, community programs like river clean ups, and consulting for religious leaders, Green Muslims is at the forefront of shaping the discussion around environmental issues in the American Muslim community (Green Muslims, 2021). The biggest challenge is a lack of awareness regarding Islamic guidance related to the environment.

Like their Christian counterparts, many traditionalists of the older generations scoff at the idea of climate change or the expectation to take care of the planet as being a religious duty. Green Muslims, based in Washington D.C. aims to remove these barriers by educating directly from scripture. Green Muslims have created guides for the Muslim layperson as well as for religious leaders with countless scriptural and other religious textual readings. These include ideas for sermons, tools for organizing community programs and volunteer opportunities – all very practical ways for Muslims and people of other faiths to save the planet, a blessing from God. Khaleafa (Canada), derived from the Arabic khalifa or steward, the organization derives its mission from the urge of God in the Quran that human beings are stewards of the earth and everything in it “...and it is he who has made you successors (khalifa) upon the earth” (Surah 6; verses 165). A prime aspect of Khaleafa is the Green Khutba (Arabic for sermon) campaign which aims to provide resources for religious leaders to train their congregations about environmentally friendly practices. Started in 2016, the campaign is now gearing up for new

activities in 2018 (Khaleafa, 2021). Wisdom in Nature (UK), is a British organization offering curriculum and trainings to teach ecology from an Islamic perspective. The team members of WIN provide talks, lectures and guidelines for schools, civic agencies, mosques, interfaith groups and much more.

The group claims to “draw on the practicality of permaculture, the richness of a spiritual tradition – Islam – and wonderful contemporary approaches to conscious group work that draw on diversity as a strength.” The challenges are well understood by online and print resources catering to Muslims as well (Wisdom In Nature, 2021). Other organisations include (Green Prophet, 2021), a website dedicated to showcasing eco- friendly efforts in the Middle East, whether in the field of business or education or lifestyle. Created by blogger and environmental activist Karin Kloosterman, it is a space to bring environmental ideas and news to the consciousness of a Middle Eastern audience. Also, (The EcoMuslim, 2021), by British Muslim British Muslim Zaufishan Iqbal is chock-full of news, tips and advice. Iqbal re-imagines jihad (an Arabic word meaning struggle for the sake of God) as an eco-jihad or environmental struggle, and therefore an intrinsic part of the Islamic faith. In Indonesia, (Mangunjaya, 2011) noticed a support, rather than resistance, from the ulema in mobilizing Muslims to participate in natural and environmental conservation. This positive acceptance is largely due to the ulema's understanding of the severity of environmental damage and the religious responsibility to halt and reverse it.

CHALLENGES WITH MODERNITY: CARBON IMPACT OF PILGRIMAGE

Due to the exceptional global health circumstances caused by the coronavirus pandemic, strict precautionary measures have been applied by Saudi authorities to ensure a healthy 2020 Hajj for all pilgrims (Karadsheh & Qiblawi, 2020). Previously, Saudi authorities had hinted that the annual pilgrimage, one of Islam's five major pillars, could be cancelled, calling on potential pilgrims to put their plans on hold. But finally, only a thousand of pilgrims attended the 2020 Hajj out of more than 2 million people usually expected at the holy sites in the cities of Mecca and Medina during the pilgrimage (Karadsheh & Qiblawi, 2020; Rhouma, 2019). Our investigation will thus focus on the period from 2009 to 2019 Hajj, with Figure 1 presenting the yearly change in the number of pilgrims over this period.

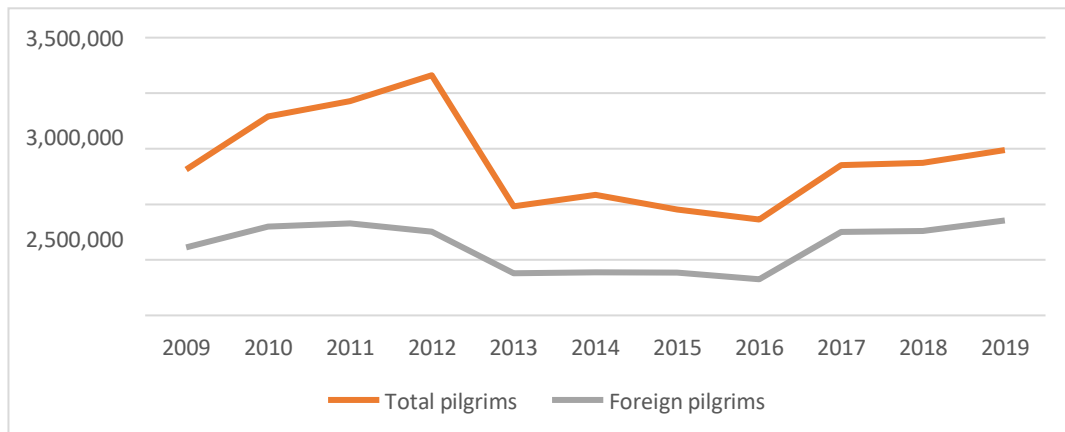


Figure 1. Evolution of the number of Hajj pilgrims from 2009 to 2019

From Figure 1, it can be seen that the total number of pilgrims has increased, from about 2.4 million in 2009 to over 3 million in 2012. The number of foreign pilgrims has remained relatively stable at around 1.7 million per year. This is in line with the visa quotas policy in application by Saudi Arabia at that time. However, in 2013, the Saudi authorities decided to reduce the quota of pilgrims for each country by 20% and for Saudis by 50%, due to the renovation and expansion of the Grand Mosque in Mecca (Ben Rhouma, 2017b). The restriction lasted five years and the original quota for the majority of countries was restored in 2017, justifying the increase in pilgrimage numbers recorded in that year. It should also be noted that due to strained diplomatic relations with Iran, Syria and Qatar, Hajj visas were suspended for nationals of these countries during this period but were restored in 2017 except for Syria (Ben Rhouma, 2017a). However, for Yemen, which are countries in crisis, quotas were restored in 2018.

Globally, a yearly average of 2.4 million pilgrims performed Hajj from 2009 to 2019. The highest number was recorded in 2012 nearly 3.2 million pilgrims. Only 32.1% of the pilgrims (767912 people) are living in the Kingdom of Saudi Arabia while the other 67.9% (1.6 million) are coming from abroad to attend the pilgrimage. The foreigners are those who have to travel using several means of transport to perform the Hajj. Table 1 summarize the average number, percentage and average round trip distance of foreign pilgrims per countries groups for the period 2011 to 2019. Pilgrims from Asian countries are the most numerous foreign pilgrims performing the Hajj with 58% of all the foreigners for the period 2011-2019. They are followed by pilgrims from Arab countries outside the Gulf Cooperation Council (GCC) (24%) and African countries outside the Arab world (10%) during the same period. The least represented are citizens of GCC countries (2%) and America (North and South) countries and Australia

(1%). The average round trip distance to Mecca is very high for people from America and Australia (25000 km). The distance is about 9000 km for European, African and Asian countries and 4000km for GCC countries which are neighbour of the Saudi Arabia Kingdom.

Countries Groups	Number of pilgrims	Percentage	Average round trip distance (km)
Gulf Cooperation Council (GCC) countries	32,015	2	4000
Arab Countries Excluding GCC Countries	418,502	24	6000
Asian Countries Excluding Arab Countries	1,017,775	58	9000
African Countries Excluding Arab Countries	178,372	10	9000
European countries	77,106	4	9000
North and South America countries and Australia	23,342	1	25000
Total	1,672,784	100	

Table 1. Number, percentage and average round trip distance of foreign pilgrims per countries groups for the Hajj from 2011 to 2019 Source: (General Authority for statistics, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019)

With modernity, pilgrims use various means of transport to travel from their place of residence to Mecca. Each of these means of transport emits CO₂ into the atmosphere which is summarised in Table 2.

Means of transport	Air (airplane)		Land (car/bus)		Sea (boat)	
	NP	ACE	NP	ACE	NP	ACE
2019	1,741,568	5,757,624	96,209	26,169	17,250	124,462
2018	1,656,936	5,477,830	85,623	23,289	16,163	116,619
2017	1,648,332	5,449,386	88,855	24,169	14,827	106,980
2016	1,246,883	4,122,195	65,766	17,888	12,723	91,799
2015	1,334,247	4,411,021	37,771	10,274	12,923	93,242
2014	1,315,850	4,350,200	59,204	16,103	13,999	101,006
2013	1,292,098	4,271,676	72,535	19,730	14,898	107,492
2012	1,621,982	5,362,272	113,020	30,741	17,930	129,369
2011	1,684,876	5,570,200	128,350	34,911	14,969	108,004
Average	1,504,752	4,974,712	83,037	22,586	15,076	108,775
Percentage (%)	93.9	97.4	5.2	0.4	0.9	2.1

NP = Number of pilgrims; ACE = Average carbon emitted

Table 2. Average carbon emitted (ACE in tCO₂) per means of transport during Hajj for the period 2011-2019

Table 2 shows that the total average emissions due to transportation varies among the means of transport for the consider period (2011-2019). Air transport is the most used means

of transport by 93.9% of foreign pilgrims, an average of 1.5 million each year. This contributes to about 97.4%, an average of 4.9 million tonnes CO₂, of emissions due to transportation per year. The others mean of transport (land and sea) are less polluting with an average of 22 and 108 thousand tonnes CO₂ respectively, representing 0.4 and 2.1% of emissions respectively. This is due to the fact that the airplane is the most used means of transportation by most of the pilgrims (93.9% of foreign pilgrims), especially those who come from Europe, Africa, America and Australia. The evolution of carbon emitted and the number of foreign pilgrims for the period 2011- 2019 is resumes in Figure 2.

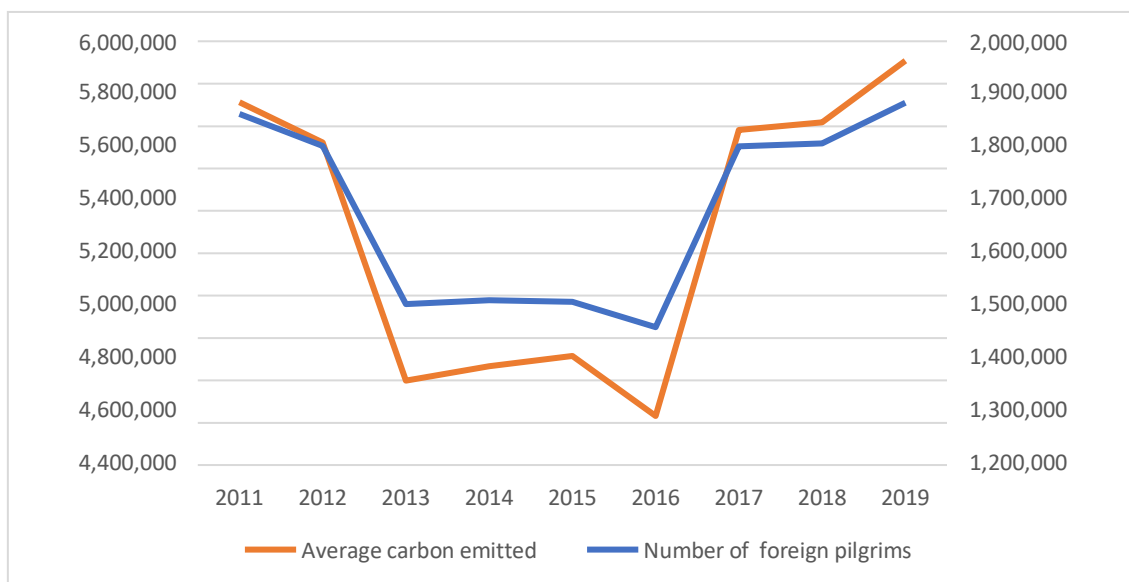


Figure 2. Evolution of the carbon emitted and the number of foreign pilgrims

It appears from Figure 2 that for the period 2011-2019, an average of 5.1 million tonnes CO₂ emitted each year for all the means of transport. The highest emission was recorded in 2019 (5.9 million tonnes CO₂), when the number of foreign pilgrims was also the highest (1.85 million people). The lowest emission was recorded in 2016 (4.2 million tonnes CO₂), when the number of foreign pilgrims was also the lowest (1.32 million people). Figure 2 also shows that the CO₂ emission rate is closely linked to the number of pilgrims. This was confirmed by the Pearson correlation coefficient that reveal a strong positive correlation ($r^2=0.77$) between the number of foreign pilgrims and the carbon emitted. With the increasing forecast rate of emissions, the solution could come from choosing fewer polluting means of transport or planting trees to absorb the CO₂ emitted. Indeed, considering that pilgrimage is an important faith activity, the Saudi kingdom is targeting the increase of the number of pilgrims.

The ambitious vision to reach five million pilgrims (Hajj and Umrah) by 2030 was announced by the Deputy Minister for Hajj and Umrah (Vision 2030, 2018). This will surely increase the amount of CO₂ emitted. The promotion of less polluting means of transport such as land (car/bus) and sea (boat) which emit only 68 and 62.2 gCO₂/km/person respectively, four times less than air travel (285 gCO₂/km/person). This would reduce the emission rate from transport by four times. In addition, according to several authors (Akbari, 2002; Govindasamy, 2014; Jo et al., 2019; McPherson & Simpson, 1999; Nanda et al., 2021), tree planting can be seen as one of the ways of reducing carbon emissions since plants remove CO₂ from the atmosphere during photosynthesis. Thus, planting trees would help redirect the CO₂ emitted into the atmosphere. In addition to CO₂ emissions, (AFP, 2018) reported environmental pollution related to pilgrimage. Indeed, the site of Mecca is facing a real environmental challenge after the passage of over two million pilgrims. During the Hajj period, streets and alleys are sometimes littered with all kinds of garbage after the passage of the faithful. According to Mohammed al-Saati, head of sanitation at the Makkah Municipality, more than 42,000 tons of waste are produced during the annual Muslim pilgrimage.

The authorities aim to reduce the volume of waste by two-thirds by 2030, Saati said, with a plan that takes into account both environmental ethics and religious beliefs (AFP, 2018). The idea of an environmentally friendly Hajj is really important in order to preserve the sanctity of the site. For this, initiatives must be developed and implemented to reduce the ecological footprint of the hajj. This passes through reduction of wastes and sensitisation of pilgrims to be responsible and self-disciplined to make the Hajj "green". Muslim should also be encouraged to offset their emissions by planting trees or by funding the planting and stewardship of these trees. This support the 2015 Islamic Declaration on Global Climate Change that was pronounced during the international symposium of representatives of academics, religious authorities, inter-governmental organisations, and civil society across a broad cross section of Muslim communities ahead of the Paris Climate Change Conference (Abdellah, 2020). Through that declaration, Muslim leaders recognise the responsibility of human for all the environmental disturbance recorded. They further call for all to tackle habits, mind-sets, and the root causes of climate change, environmental degradation, and the loss of biodiversity in their particular spheres of influence, following the example of the Prophet Muhammad PBUH and bring about a resolution to the challenges that now face us.

CONCLUSION

This study aims to analyse the Islamic perspective toward global environmental issues. Specifically, the study addresses a) Islamic prescriptions regarding environmental protection, b) Islamic involvement in environmental organizations worldwide and c) the assessment of the environmental impact of the Hajj to propose means for an environmentally friendly pilgrimage. The investigation shows a large range of Islamic prescriptions that make Islam a real defender of the different elements of the environment, including air, water, soil, plants and animals. Islam also appears as a promoter of sustainable management of natural resources. The implementation of these prescriptions would surely contribute in mitigating the environmental issues that our planet is facing. Muslims are not only concerned about the environment but they are actively working to protect it all around the world through several environmental organisations. For the period 2011- 2019, an average 1.6 million foreign pilgrims travel to the Mecca to perform the Hajj each year. The transportation of these pilgrims has emitted an average of 5.2 million tonnes CO₂ annually. Airplane alone contributed to about 97% of these emissions. The analysis also reveals a strong correlation between the number of foreign pilgrims and the quantity of CO₂ emitted. These emissions are combined with about 42,000 tons of waste are produced, contributing to environmental pollution. Actions have to be taken to reduce the environmental impact of pilgrimage so as to support the green Hajj movement. Suggested actions are either to promote fewer polluting means of transport (land and sea) or to offset the emissions by planting trees or to ensure the recycling of the waste produced during the pilgrimage. This will preserve the sacrality of the site and keep the world clean as the Highest wants while showing the world that Islam is the reference in terms of ecological religion for environmental sustainability.

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