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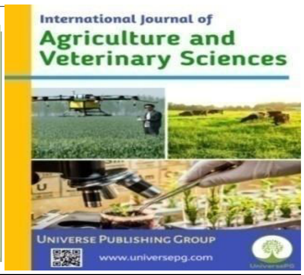
Publisher homepage: www.universepg.com, ISSN: 2663-7529 (Online) & 2663-7510 (Print)

https://doi.org/10.34104/ijavs.022.075085

International Journal of Agriculture and Veterinary Sciences

Journal homepage: www.universepg.com/journal/ijavs



Consequence of Environmental Change on the Animal's Health and Productivity: A Brief Review

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ABSTRACT

The effects of climate change, especially global warming, can greatly affect the production performance and health of animals around the world. The national average temperature has increased by 1°C since 1970. Most livestock owners in the country feel that weather change is affecting farm animal production and health. The main impacts of weather change on animal production include feed shortages, water shortages, reduced livestock genomic resources, decreased productivity, and reduced mature weight and/or longer time to reach mature weight based on their significance. High temperatures resulting from environmental alteration may increase the level of development of few pathogens or parasites that found one or more life cycle levels outside the mammalian host. Besides, the spatial disposition and visibility of pasture and water are largely depending on the pattern and visibility of rainfall. Food and water shortages bestow to deduced livestock abundance and reproductive execution. These include slow growth rate of animals, loss of body condition, decreased milk yield and poor reproductive performance of mature animals. Drought bulls that are debilitated and in poor physical condition cannot provide sufficient drought energy for plowing and thus hinder crop cultivation. Bush encroachment, as well as population pressure, leads to reduced availability of good pastures thus environmental change will have far-reaching consequences for animal yield and health especially in vulnerable parts of the nature where it is essential for nutrients and maintenances. Once more, environmental change affects farm animal health through various mechanisms; which are effects on parasites, effects on hosts, and vectors, such as alters in precipitation and temperature schemes that can influence both the placement and ample of disease careers; and effects on micropaleontology, such as alteration of transmission levels between hosts. This study has focused to investigate the inherent impacts of environmental alteration on livestock health and productivity.

Keywords: Livestock, Adaptation, Global warming, Climate change, Impact, and Production.

INTRODUCTION:

Domestic animals are the only means of livelihood for 10 lac of family worldwide. It is appraised that out of 1 billion people, 701 million who live in poverty depend on their livestock for food, in-come, traction and transportation (Oyhantçabal *et al.*, 2010). The farm animal sector is a fast-growing agricultural subsector, accounting for 34% of agricultural GDP & growing, driven by population growth, urbanization & rising incomes in developing world. Demand for all livestock products is expected to double in sub-Saharan Africa and South Asia by 2049 (Alexandratos and Bruinsma, 2012). As opposed to, weather alteration at the last 31 years has already reduced global agricultural manufacture in the level of 1-6% per decade (Thornton *et al*., 2015; Hassen *et al*., 2022).

Weather change is a likely cause of disease conditions and is anticipate having overwhelming negative impacts on human & the cattle health (Rabinowitz and Conti, 2013). Global weather change threatens serious social upheaval, population displacement, economic hardship and environmental degradation. Not to mention, weather change is now an accepted fact, affecting all ecosystems and will continue if unchecked (Yatoo *et al*., 2012). Weather change affects the appearance and spread of disease hosts or careers and parasites and their reproduction, enlargement and disease dissemination. Consequently, this affects distribution, host-parasite relationships and its assemblages in new areas. Weather change can greatly affect animal health directly and indirectly (ESAP, 2009; Ekhlas *et al*., 2014).

Direct effects of weather on animal diseases may be more pronounced for vector-borne diseases, soil-related, water or flood-related, rodent-related, or air temperature/humidity related and more sensitive to weather (Grace, 2015). Indirect effects follow more complex pathways and include those arising from the efforts of animals to adapt to thermal environments or the effects of weather on pathogen populations, the disposition of vector-borne diseases, and host resistance to the disposition of vector-borne diseases & Immunity to food-borne diseases (Yatoo *et al*., 2012).

Besides, weather change may affect farm animal health through a ratio of factors, including the magnitude and plentiful of careers and wildlife reservoirs, and the survival of pathogens in the environment (ESAP, 2009).

This can shorter the regeneration time and, possibly, enlarge the total value of generations every year, thereby increasing the pathogen/parasite population size (Chauhan and Ghosh, 2014). Rising temperatures increase the spatial distribution and intensity of existing pests and diseases, which in turn can affect livestock productivity or, in some extreme cases, lead to livestock mortality (Musemwa, 2012).

As claimed by the ECARD, (2012) the developmenttal stages of careers such as flies and ticks are often largely dependent on temperature & passes most diseases. Cattle, goats, sheep and horses are also vulnerable to a wide range of nematode worm infections, many of which are influenced by climatic conditions at specific temperatures during their developmental stages. Understanding the relationship between weather change & livestock diseases is important for better regulation of the animal health problems. However, current knowledge of the relationship between weather change impacts and carnal health is lacking, especially in Africa despite the economic significance of farm agriculture. Therefore, one of the schemes of this paper is to provide an overview of the upshot of weather alters on livestock health. Ethiopia is home to Africa's largest livestock population and is the continent's top livestock producer and exporter. Even if, domestic demand for farm animal products in Ethiopia is propel by the export potential of the urban middle and upper classes, the main force driving the expansion and intensification of the animal production (McDonald and Simon, 2011). Ethiopia's recent livestock population appraises that the country has about 57.82 million cattle, 28.88 million sheep, 29.71 million goats, 2.09 million horses, 7.89 million goats, 60.52 million poultry, 5.93 million bees, 0.42 million chickens and 42 million has chickens (CSA, 2016). They are an important component of almost all agricultural systems in Ethiopia and provide draft energy, milk, meat, manure, hides, skins and other products (Funk *et al*., 2012; Bekere *et al*., 2022).

Ethiopia has a diverse climate, with different sizes and diversity of major agronomic zones that make it suitable for supporting large numbers and classes of livestock (Funk *et al*., 2012). However, the country is isolated from weather variability and extremes (Alebachew & Woldeamlak, 2011). Long-term climate outcomes associated with changes in rainfall patterns, rainfall variability and temperature have increased the frequency of droughts and floods (World Bank, 2010). Thus weather and location are undoubtedly the most advantages of the factors affecting live-stock production. In fact, climatic features such as ambient temperature and rainfall patterns have a great influence on the cycle of availability of pasture and food resources throughout the year in animal populations. This point to that pastures in the rainy season have high availability and show good nutriational quality whereas dry season pastures have poor nutritional quality with high fiber and low protein content, often resulting in reduced animal production (Abebe, 2017).

Review of Literature

Animal Diseases and Weather Change Linkage

The dissemination of pathogenic diseases & timing and severity of disease outbreaks are often linked to climate. Weather alteration may affect animal diseases through both direct & indirect pathways. The direct effect of climate on animal diseases is pronounced for vector-borne, soil-related, water or flood-related, rodent-related, or air temperature humidity related and climate-sensitive diseases. These direct or indirect effects of environment can be spatial, affecting climate distribution, affecting the timing of an outbreak with temporal weather, or related to the severity of an outbreak (Grace *et al.*, 2015). Global climate change alters ecological architecture, causing both geographic and acoustic changes (Slenning, 2010). These changes affect the efficiency and transmission pattern of the pathogen and increase its spectrum in the host (Brook and Hoberg, 2007). An expanded spectrum of parasites increases the amenability of animals to disease & thus, underwrites the pathogenicity of the causative agent. Therefore, farm animal systems are sensitive to alters in the severity and disposition of the cattle diseases. The incidence of external parasites (43.4%) ranked first as a problem in warm temperate regions. Vector-borne diseases are particularly sensitive to climate change; particularly as alters in rainfall & temperature dominions can affect both disposition & abundance of disease careers (Dhakal *et al.*, 2013). Arthropod vectors are more active at high temperatures, thus they feed more regularly to maintain their increased metabolic activity, increasing the feasibility of transmission of infection between hosts. Small changes in vector characteristics can lead to significant changes in disease (Grace *et al.*, 2015). There is a link between climatic and epidemiological conditions of disease agents. Temperature, precipitation, humidity & other weather factors that affect the reproduction, enlargement, growth and population dynamics of helminths, arthropod vectors and the pathogens they carry. Weather change affects the emergence, spread of disease hosts or careers, pathogens and their reproduction, development & transmission (ESAP, 2009). The OIE Scientific Commission concluded that weather change may be a significant factor in determining the spread of some diseases, particularly those that are vector-borne. The two most commonly reported emerging and resurgent goat's diseases in recent OIE surveys are catarrhal fever and RVF (OIE, 2008). The global distribution of bluetongue virus infections has changed greatly in recent years and weather change may be partly responsible for these profound changes in the global distribution of bluetongue disease (Wilson & Mellor, 2008). Studies have shown that disease vectors are affected by temperature and indicate the possible role of humidity and rainfall (Wittmann, 2002).

Weather change Impact on health of livestock

Weather change may have a noteworthy role on the emergence, spread and distribution of livestock diseases. For example, the disposition and impacts of animal vector-borne diseases such as African mare sickness, Rift Valley fever, and bluetongue vary significantly with seasonal and long-term climate change (Thornton & Gerber, 2010). Weather alter may affect horses pathogenic diseases in several ways; Effects on pathogens, such as high temperatures affecting pathogen or/& parasite growth rates, Effects on the host, such as alters in disease distribution that may affect populations of susceptible animals, effects on careers, such as changes in rainfall and temperature dominions that may act on both the disposition and prevalence of disease careers, and effects on micropaleontology, such as changed infection ratios between hosts (Baylis & Githeko, 2006). Although there is no consensus that a warmer world will necessarily lead to a more disease-ridden world, disease risk may increase for a variety of other reasons, such as the increasing complexity and scale of market chains and, in particular, the inevitable intensification of yield systems the place (Randolph, 2008).

Environmental change impact on the careers

Arthropod careers are cold-blooded and thus particularly sensitive to climatic factors. Temperature, rainfall, humidity and other weather factors affect the survival, production, development, and behavior and population dynamics of arthropod vectors. Subsequently, climatic factors influence habitat suitability, disposition and copious; Intensity and temporal pattern of vector activity throughout the year. Weather alter may act on disease vectors through several mechanisms. First, temperature & humidity often impose limits on their disposition. Often, low temperatures are limiting because of high winter mortality and relatively slow rates of population recovery in warmer seasons. Conversely, high temperatures are limiting therefore, cold regions that were previously too cold for vectors may begin to flourish with climate change; Warm regions can become warmer and still allow for vectors if rainfall or humidity increases. Conversely, these areas may become less suitable for vectors if moisture levels remain unchanged or decrease, with concomitant increases in moisture-stress (Baylis & Githeko, 2006). Weather change will affect arthropod vectors, their life cycles & life histories, thereby altering the disposition of both vectors and pathogens and the ability of arthropods to convey of pathogens. Therefore, animals will be exposed to different parasites and/or diseases, as indicated by predicted alters in the disposition of, for example, the tsetse fly in Africa, which will put more pressure on production & horse's survival (Tabachnick, 2010). Research studies in India have shown that meteorological parameters such as temperature, humidity and rainfall explain 53 and 85% of the variation in seasonality of FMD in cattle in the hyper-endemic division of Andhra Pradesh and the mesoendemic region of Maharashtra state, respectively (Ramara, 1988). Horse's infestations are exacerbated by hot-humid weather, *B. microplus*, *H. bispinosa* and *H. anatolicum* (Kumar *et al.,* 2004). Feeding constancy of arthropod careers may also increase with increasing temperature. Many careers must intake twice on a suitable host before infection is possible-once to acquire infection and, after EIP, once to transmit it. For many blood-feeding arthropods, feeding frequency is determined by the time required for egg development. For example, *C. sonorensis* females feed every 4 days at 31 °C but every ~15 days at 14 °C. At warmer temperatures, the vector is more likely to receive the two feeds of suitable hosts required for successful transmission (Baylis and Githeko, 2006).

Environmental alter impact on the pathogens

Higher temperatures and greater humidity generally increase the level of enlargement of parasites and pathogens that spend level of their life span outside the host. Changes in air can affect the spread of pathogens. Flooding following extreme weather events provides favorable conditions for many waterborne pathogens. Dry spell and desiccation are detrimental to most pathogens (Grace *et al.,* 2015). Increased rates of development due to higher temperatures may shorten the generation time and, possibly, increase the total number of generations per year, thereby increasing the pathogen/parasite population size. Conversely, some parasites are sensitive to large temperatures & their survival may losses with weather warming. Parasites and pathogens sensitive to wet or hot conditions may contrived by alters in rainfall, soil moisture & load frequency (Kimaro & Chibinga, 2013). Weather change can affect the layout of a few pathogens and careers. A few pathogens/ parasites and many careers experience significant mortality during cold winters; Warm winters can increase the likelihood of successful overwintering (Harvell, 2002). Lengthening the warm season may increase or decrease the number of warm- or cold-related disease transmission cycles in a year, respectively. Arthropod vectors require warmer weather so the conveyance season for arthropod-borne diseases may be extended. A few pathogens/parasites and many careers experience significant mortality during cold winters; Warm winters can increase the plausibility of successful over-wintering (Witman & Bayliss, 2000). Maximal weather events, for example, flooding can carry a risk of *Cryptosporidium* parasites and enterohaemorrhagic *E. coli* Appears as diffuse pollution from agricultural land. It poses a clear threat to the other cattle and is also a zoonotic risk to humans through contamination of water supplies. Production-limiting diseases also deserve increasing attention (Wittmann & Baylis, 2000; Hayle *et al*., 2020).

Weather change effect on epidemiology of disease

Weather change may not only affect the survival of parasites or pathogens or intermediate vectors but may also alter transmission levels between hosts in other ways. Future motifs of international trade, local farm animal transport, and farm size are issues that will be driven in part by weather alter & may effect of the disease transference. The other indirect effects: Weather alters may also act on the abundance and/ or disposition of competitors, pests, predators & vector parasites, thus influencing disease patterns & It may also that alters in ecosystems, driven by weather change & other drivers that affect land use, may give rise to new mixes of species, thereby expressing hosts to new pathogens & vectors and leading to the broadcasting of new type of diseases (WHO, 1996). The acts on of weather change on cattle diseases are likely to be complex, & studying them will require going beyond any easy estimation of temperature effects on rainfall and disposition, although this is a start and Examples of the type of analysis are done for various animal diseases in developing countries. It appears that weather change is likely to affect the disposition of the brown-eared tick, *R. appendiculatus*, & the primary career of ECF, is a disease that acts on both grazing and mixed systems in East & Southern Africa. Expand into western & central areas of South Africa (Rogers, 1996). In the another study looking at the potential impact of weather change on a major disease of cattle in African farm animal systems, trypanosomiasis of cattle (Thornton *et al*., 2006) investigated climate-driven alters in habitat aptness for ticks fly vectors. Although climate will alter habitat aptness for the tsetse fly, population levels may impacts on trypanosomiasis risk through bush clearance may be greater than those caused by weather change. Randolph, (2008) warns that weather change will necessarily lead to an increase in disease risks in general, and there is no a priori reason to expect that infectious agents in general determine a greater risk of infection and exposure of farm animal to that risk and more consolidated assessments, which go beyond the distributional effect of disease careers have been attempted; although to date these have had developed-country focus (Randolph, 2008). White *et al*. (2003) imitation the increased amenability of live-stock to ticks in the Australian goat industry (*B. microplus*). They calculated the economic losses associated with reduced tick populations & productivity, and assessed breed change as an adaptation option. Their findings are perhaps more interesting in relationship to the uncertainties and assumptions made & their main conclusion that weather change risk assessments should be extended to all similar variables, where possible. It noted that new research focusing on the spread of carnal diseases & pests from lower to mid-latitudes due to melting.

Replicas project that bluetongue, which mostly affects sheep & occasionally goats and deer, will spread from the tropics to the mid-latitudes. Most assessments do not explicitly consider impacts on livestock health as a combined function of CO_2 and climate. Whether CO_2 effects are important in this case is largely unknown. Feasibly more than other animals-related impacts, weather change impacts on horse's diseases suffer from inherent problems of predictability and this is partly due to the nature of the disease (Anon, 2006). As noted in (Baylis & Githeko, 2006), climate change-driven changes in livestock production in Africa, if they occur, could have many indirect & unpredictable effects on infectious animal diseases on the continent. It appears, the combination of drought followed by high rainfall has led to widespread outbreaks of diseases such as RVF and bluetongue in the East Africa & African horse sickness in the Republic of the South Africa (Baylis & Githeko, 2006). It is likely that certain vector-borne disease outbreaks will become more common in areas of Africa; we are very limited in predicting when and where these may occur. In addition, it has been noted that there is a tendency to oversimplify the mechanisms by which weather change may act on disease transmission. Generally, many factors are at work, and thus considerable work is needed on disease dynamics & how they may adapt to a changing climate. These factors make assessing the impact of animal diseases in developing world's particularly inspiring (Kovats *et al.,* 2001).

Weather change effect on incidence of disease

It has been reported that the hot summer months lead to increased milk somatic cell counts and a higher incidence of clinical mastitis in dairy cattle. Reduction of thermal stress through air conditioning or shade management results in a lower frequency of clinical mastitis compared to cows exposed to the natural environment. Populations are associated with hot-humid conditions. Kumar *et al*. (2004) reported that hot-humid weather was found to increase tick infestation in cattle like, *B. microplus*, *H. bispinosa* and *H. anatolicum* which act as vectors of various protozoan diseases (Kumar *et al.,* 2004).

Environmental alteration impact on the hosts

Mammalian cell immunity may be suppressed following elevated exposure to UVB radiation, an expected consequence of stratospheric ozone depletion. Therefore, ozone-depleting greenhouse-gas emissions may affect some animal diseases, which are not studied in cattle. A more important act onmay be on genomic resistance to disease. Although animals often develop genetic immunity to diseases they are exposed to, they can be highly susceptible to "new" diseases. Weather change may cause significant changes in disease disposition, and disruption of local stability may lead to severe disease out-breaks in previously unexposed cattle populations (Baylis & Githeko, 2006).

Environmental change effect on feed resources of livestock

The most significant effects of weather change on cattle production is changes in forage re-sources (Abbett, 2009) as droughts and delays in the onset of rains lead to poor grass regeneration, water scarcity and heat stress on livestock. Again, droughts and delays in rainfall lead to increased livestock mortality, disease risk, and physical deterioration due to long distance travel for water and pasture.

Digambar, (2011) reported that due to severe drought, there is a direct impact on the growth of palatable grass species and low rainfall is reducing the regeneration of forage species in pastures and forest fodder resulting in loss of diversity and quality. Cattle feed this has led to a decline in the cattle population, which has further affected the production of milk, milk products and meat. Drought also affects livestock by drying up wetlands, pastures, water resources and streams and reducing the avail-ability of drinking water for horses and Changes in temperature, precipitation regimes and CO_2 levels will affect grassland productivity and species composition & dynamics, leading to alters in carnal diets and possibly deduced nutrient accessibility for the farm animals (Digambar, 2011).

Weather change effects on resources of water

De Wit & Stankiewicz, (2006) calculated that perennial drainage reductions will significantly affect access to current surface water across 26 percent of Africa by the end of this century. Morton, (2007) believed that weather change affects mostly developing countries, especially among the population referred to as subsistence or smallholder farmers. Furthermore, small farm sizes, low technology and low capital may increase the susceptibility of livestock production. Rivers, lakes and rainwater supplies are threatened by weather change, which reduces the accessibility of water for livestock production (Gammada *et al*., 2022).

Environmental change effects on milk production

Livestock and weather change have a close relationship. The spatial disposition and accessibility of pasture and water is highly dependent on rainfall patterns and availability (Akalilu *et al*., 2013). Changes in precipitation patterns and temperature ranges afect food availability, grazing limits, forage quality, weeds, and pest and disease prevalence. Thus, changes in weather factors such as the frequency and severity of ultimate events such as temperature, precipitation, and drought directly affect farm animal yields. Climatic factors or seasonal changes greatly affect animal behavior due to neuro-endocrine responses to climatic factors, thereby affecting animal production & health (Baumgard *et al*., 2012). Climate change is a major threat to the viability and sustainability of farm animal production systems in many areas of the nature (Gaughan *et al*., 2009). High-yielding animals are more affected by climatic factors, especially those grown in tropical conditions, due to high air temperature & relative humidity (Martello *et al*., 2010). Parons *et al*. (2001) argued that high temperatures can reduce feed intake, reduce milk production and lead to energy deficits that can reduce cow fertility, health and longevity. Modeling work using the Cornell Net Carbohydrate and Protein (CNCP) System Model (Chase, 2006) suggested that maintenance energy require-ments of a dairy cow weighing 636 kg at 33°C produces 37 kg of milk per day compared to the energy requirements at 17°C. For the same temperature increase, dry matter intake was predicted to decrease by 19% and milk by 33% (Thornton *et al*., 2008).

Climate change effect on the production of egg and meat

The thermoregulation features of poultry are somewhat different from those of mammals because of their higher metabolic rate due to more intensive heat generation and lower heat dissipation capacity produced by their feathers & lack of sweat glands. Above 30°C, food and energy intake reduces to such an extent that animals are no longer able to compensate for it, production declines rapidly, and mortality increases. A lot of studies have reported that high enveloping temperatures decrease nutrient digestibility in poultry, which may be due to decreased activity of chymotrypsin, trypsin, and amylase. Consequently, low and most inadequate nutrient supply reduces egg production, egg mass & egg-shell quality in layers, and growth rate of broilers (Amundson *et al*., 2006).

Climate change effects on the reproduction of the farm animal

A lot of studies reported that high enveloping temperatures decrease nutrient digestibility in poultry, which may be due to decreased activity of renin, chymotrypsin, & amylase. Consequently, low and most inadequate nutrient supply limits egg production, egg mass and eggshell quality in layers, and growth rate of broilers (Madan, 2007). It is reported that the length and intensity of the estrous period is reduced, so lower conception rates occur. Therefore, heat stress may reduce fertility in summer dairy cows by poor expression of behavioral signs of oestrus due to less estradiol secretion from dominant follicles. In this situation, the calving interval is longer. Appropriately, the lifetime production of dairy animals decreases. Heat stress during pregnancy slows fetal growth due to reduced blood supply to the uterus, which causes placental insufficiency to supply maternal nutrients, resulting in reduced fetal growth and calf size. Even fetal death occurs in cows exposed to heat stress. Heat stress also reduces seminal volume and sperm concentration. It has been reported that ejaculate volume, sperm concentration and sperm motility of bulls are lower in summer than winter season (Samal, 2013).

CONCLUSION AND RECOMMENDATIONS:

Weather change has an adverse impact on cattle health and productivity in several ways. It can affect cattle health through many factors, including the extent and plentiful of vectors and wildlife reservoirs, and the survival of pathogens in the environment. This can increase livestock diseases and some diseases are particularly sensitive to weather change. Indeed a better understanding of the effects of weather change on animal health is important and good for recommendations on how to reduce its potential effects. Unfortunately, the determinants of resilience and adaptation that moderate this effect are already poorly understood. For example, adaptive capacity can be enhanced in the broader context of developing appropriate policy measures and institutional support to help livestock owners deal with all livestock health problems. Indeed, the development of an effective and sustainable animal health service, with associated surveillance and emergency preparedness measures and sustainable animal disease control and prevention programs, is the most important and most necessary adaptation strategy. This will protect the livestock population from the threats of weather change and weather variability. Again, the impact of weather change on livestock production and productivity is complex. Weather change can affect animal production and welfare, particularly due to increased air temperatures. However, knowledge of animal responses to heat stress during warmer months in different areas of the nature, as well as during extreme heat events, can be used to assess the effects of global change. However, farmers are not sufficiently aware of the effects of global changes on their operations, resulting in deterioration in the quality and quantity of the natural pastures that most livestock owners rely on to feed their animals. Apart from that, the available water sources are not reliable, as they sometimes dry up due to high temperatures and lack of rainfall. They lost their lives due to excessive heat, water, food and unknown diseases. Therefore, the following recommendations are forwarded for future action.

The awareness of livestock owners and professional on weather change must be raised through training.

1) Selection of representative climatic stations should be considered for livestock enterprises, especially in arid & semi-arid regions.
2) Recording of additional inputs of pasture and cattle production should be implemented, especially in climatically favorable areas.
3) Successful adaptations can be shown to be a better way to deal with the negative consequences of weather change and associated drivers of disease.
4) Future needs assessment of weather change impact should be done, then it should be included in curriculum by concerned policy makers for veterinarians, animal production, & related professionals.

ACKNOWLEDGEMENTS:

The current work was completed by collaborating with all authors and thanks to the co-authors for their encouragement and writing support in the supervision of successful research studies.

CONFLICTS OF INTEREST:

The author's declare there are no potential conflicting of interest to publish it.

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Citation: Harun MH, Shafi KM, Dey SKC, Hossen MM, Rahman M, Ahmad T, Bekere HY, Hussen HD, and Yusuf MA. (2022). Consequence of environmental change on the animal's health and productivity: a brief review. *Int. J. Agric. Vet. Sci.*, **4**(4), 75-85. https://doi.org/10.34104/ijavs.022.075085