

# Human Health, The Ecological Footprint and Climate Change

Ana Karen González-Álvarez, Luz Patricia Falcón-Reyes, Christian Starlight Franco-Trejo, Nubia Maricela Chávez-Lamas, Jesús Rivas-Gutiérrez\* and José Ricardo Gómez-Bañuelos

Universidad Autónoma de Zacatecas, México

\*Corresponding author: Jesús Rivas-Gutiérrez, Universidad Autónoma de Zacatecas, México

## ARTICLE INFO

**Received:** 📅 March 28, 2024

**Published:** 📅 April 05, 2024

**Citation:** Ana Karen González-Álvarez, Luz Patricia Falcón-Reyes, Christian Starlight Franco-Trejo, Nubia Maricela Chávez-Lamas, Jesús Rivas-Gutiérrez and José Ricardo Gómez-Bañuelos. Human Health, The Ecological Footprint and Climate Change. Biomed J Sci & Tech Res 56(1)-2024. BJSTR. MS.ID.008784.

## ABSTRACT

Environmental pollution, the type and way of life of modern societies, the growing need for greater comfort and electrical gadgets, the scarce environmental education of most populations, the lack of political will of governments and authorities and above all the preponderance of the economic interests of large commercial consortiums, have led the planet earth to an extreme and critical situation of overexploitation of its exhaustible and inexhaustible natural resources, a situation that has triggered what is currently called climate change and global warming. This environmental crisis has caused atypical alterations in the climate, unleashing floods, droughts, fires, melting of large ice masses, water and food shortages, migration of harmful fauna and the resurgence and appearance of new diseases, among many other things. If we do not take global actions to counteract and mitigate pollution, many species of flora and fauna will continue to disappear and societies will enter a situation of collapse that, in a short time, if things continue to increase, will not be reversible.

**Keywords:** Pollution; Climate Change; Global Warming

**Abbreviations:** GHG: Greenhouse Gases; CFC: Chlorofluocarbons; NOX: Nitrogen Oxides; CHS: Methane; CO2: Carbon Dioxide

## Introduction

Currently, worldwide, one of the many crises that humanity is experiencing is climate change and its local, regional and/or global consequences; Atypical situations of floods, droughts, fires, cyclones, hurricanes, storms, epidemics, migrations, pollution, heat waves, etc., overwhelm large and small natural areas and population centers without being seen on the horizon for when this situation could end, for example. On the contrary, it seems that it will get worse day by day. Under this circumstance, any alteration of the climate (hot or cold) out of the ordinary is socially included in the concept of climate change. Climate change is a stable and durable change in the distribution of weather patterns over short or long periods of time. It can be a change in average weather conditions or the distribution of events that may be extreme around that average; This change may be localized to a specific region or may encompass the entire world. This situation is generally associated with actions carried out by man, although historically, the planet has suffered a series of climatic changes due to

natural processes or cosmic phenomena. On the other hand, the term global warming is frequently used to refer to a type of climate change, especially in the field of politics and/or environmental education, a concept that in general terms refers to an increase in temperature due to actions made by human beings. Currently and thanks to the massification of the media and the accessibility and availability of all types of information, practically the vast majority of people in the world have heard or read about climate change and global warming and their consequences.

Books, newspapers, magazines, news, etc. are continually being published and disseminated. about the topic; Apparently the first person to refer to this term was Wallace S. Broecker in 1975, publishing an article called "Climate change: are we on the brink of a pronounced global warming.", in Science Magazine (S Broecker 2010). In academic journals, a clear difference is made between the concept of climate change and global warming, where global warming is conceptualized as an increase in the temperature of the planet's surface and the term

climate change is broader, as it includes global warming and all other aspects related to the climate that are influenced by the increase in greenhouse gases (GHG), such as abnormal climatic situations in time, form or place. Among this type of gases, we mainly have the following: Water Vapor, Carbon Dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrogen Oxides (NO<sub>x</sub>), Ozone (O<sub>3</sub>) and Chlorofluocarbons (CFC) (European Parliament, 2023 [1]). The evidence of these two situations, climate change and global warming, is based on observations of increases in air and water temperatures in the seas and oceans, the melting of ice and glaciers around the world and, as a consequence, rising sea and ocean levels worldwide. Among other evidence is the increase in temperature worldwide, evidently the last 14 years have been the hottest since 1850, the increase in temperature in the last 50 years is almost double that of the last 100 years, a consequence of Therefore, the average temperature increased by 0.74°C during the 20th century and one of the main culprits of this situation is the high concentrations of Carbon Dioxide (CO<sub>2</sub>) that are concentrated every day in the atmosphere of the entire planet, this gas is be one of the main GHGs, since it has increased from 278 ppm in the pre-industrial era to 397 ppm today (Global Climatic Change.com, s/f [2]).

Returning to the point regarding the consequences that human actions are having in the situation of climate change, we will say first of all that reference is made to the effects, processes or materials that are the result of human activities as opposed to those that have causes. natural without human influence, these actions are usually in the vicinity of urban centers and industrial hubs, where pollutants are concentrated in large volumes in the air, water and soil. Although apparently the use of water by human beings for their hygienic, food and health activities may seem to have no cause-effect relationship with climate change, analyzing this situation can provide evidence of a direct or indirect relationship, for example the generation of wastewater, which is thrown into rivers, lagoons, seas or oceans with fecal waste, food remains and a large amount of chemical products, generating various gases, including Methane (CH<sub>4</sub>), which is the gas most commonly is produced and is the result of the anaerobic putrefaction of plants, this gas is more powerful than itself Carbon Dioxide (CO<sub>2</sub>), but the difference is that in the atmosphere there is 220 times more Carbon Dioxide (CO<sub>2</sub>) than Methane (CH<sub>4</sub>) so the former contributes more significantly to the greenhouse effect (Global Climatic Change.com, s/f [2]). In addition to this situation, the conversion of forests into cropland and grasslands causes changes in the structure and composition of the soil, as well as causes longer periods of low rainfall or drought and reduction in the uptake of Carbon Dioxide (CO<sub>2</sub>).

Through the trees. Regarding industry, the effect and impact that it produces on the climate is more important due to the wide variety of materials and energies that can be thrown into the water, such as organic materials, heavy metals, radioactive substances and oils, among other things. causing an increase in pH and temperature and thereby negatively and fatally altering the habitat of the marine flora and fauna of these water cores. Among the most polluting indus-

tries are the petrochemical, energy, paper, steel and textile industries. Their degree of contamination in relation to climate change and global warming will depend on the type and quantity of fuel used for their refinery processes and the type of gas or gases. generated during the process, in addition to the dust expelled that also contributes to global warming. Light pollution is another type of pollution that indirectly generates global warming, due to the consumption of fuel to generate the required energy and which is generally fossil fuel (oil or coal) which, when burned, generally produces Carbon Dioxide (CO<sub>2</sub>), which is emitted. towards the atmosphere. The direct or indirect results of this human activity and the development of the industry have been called environmental footprint, carbon footprint, ecological footprint, water footprint or social footprint.

### Various Types of Footprint

Some marks left by human activity represent a global vision of the impact on the environment, while the carbon footprint focuses on climate change by quantifying GHG emissions. On the other hand, the water footprint analyzes and quantifies the use or misuse of water. The carbon footprint is the totality of GHGs emitted as a direct or indirect effect of an individual, organization, event or product; Its environmental impact is measured by carrying out an individual or group inventory of these emissions, following recognized international regulations; Through its analysis, organizations that work to control pollution can reduce pollution levels through a standardized calculation of emissions that take place during production processes.

### Differences Between Carbon Footprint and Ecological Footprint

The concept of carbon footprint could be understood in a way that is not strictly exact but quite clarifying, as a specific part of another more general concept such as the ecological footprint, this is defined as the area of ecologically productive territory (crops, pastures, forests or aquatic ecosystems) necessary to produce resources and to assimilate waste. However, the carbon footprint refers to all GHGs emitted directly and indirectly, that is, it introduces the impact of atmospheric pollution, since the ecological footprint does not take it into account; Although they are different concepts, the final objective of both is to achieve key indicators in the fight against climate change and for the design of sustainable development strategies (DELOS: Sustainable Local Development, 2010 [3]). Today, almost all the activities we carry out (mobility, food, transportation) and goods we own and use (consumer goods, home, office, school, etc.) involve consuming energy, which means contributing to GHG emissions. That is why the carbon footprint represents a basic indicator of control by organizations that call themselves socially responsible companies or industries and another element of information, knowledge and awareness for motivation among citizens to carry out better practices. friendly to the environment and social. Measuring the carbon footprint of a product identifies the sources of GHG emissions of a product, therefore, it allows defining better objectives, more effective polluting emissions

reduction policies and better targeted cost savings initiatives, all of which are a consequence of better knowledge of the critical points for reducing emissions. In addition, the organization contributes to demonstrating to third parties its commitment to social and environmental responsibility, improving its reputation in the market (Spanish Association for Quality AEC, 2011 [4]).

## Impact of Man's Actions on the Environment

Measuring the impact of our society on the environment is a complex task due to the endless number of situations and variables it involves. It may therefore seem logical to us that, the greater our needs for goods and services, which grow day by day in the world, The greater the surface area that we will need to produce them and eliminate our waste will also be, and therefore, the impact of the processes and actions carried out to achieve this will also be greater; Countries with more industrialized societies have larger footprints than those of developing countries. Likewise, large cities with many inhabitants accustomed to lifestyles that are very demanding of goods and services will have larger ecological footprints than rural towns that have fewer inhabitants and that many times do not have the most basic services. In 2003, humanity needed about 14,100 million hectares, equivalent to 1.25 Planet Earths, to cover its needs, while in 1961 this value was about 4,500 million hectares, that is, half Planet Earth, which corresponds to a growth of about 310% between both dates (bibliography). The ecological footprint can also be calculated for each country based on its needs and the natural resources it has and based on this, we can know which countries have a deficit in their ecological footprint and those that still have natural credit; In general, industrialized countries such as the United States or European countries and those with high economic growth such as China or India have the highest carbon footprints, while developing countries such as those in South America or Africa, many of which They have a significant proportion of their population in poverty, they still have great natural credit; Mexico in particular has a significant deficit with respect to its ecological footprint, mainly due to the few actions to counteract the large quantities of fossil fuels used to supply energy for the needs of its population, the little political interest of first-level authorities.

And the lack of environmental education that exists. In many countries, large and firm steps have already been taken aimed at finally reducing national carbon footprints, this is undoubtedly one of the greatest challenges facing rulers and authorities today; To the extent that resources are used intelligently, the well-being and growth of societies can be guaranteed, otherwise the future will be uncertain. Currently in these countries there is great awareness of this problem, governments, civil societies, organized independent groups and international institutions have developed important information and warning campaigns about the consequences of poor management of natural resources, as well as the possible solutions (Secretary of the Environment and Natural Resources, 2013 [5]). Although there is a consensus that we must stop climate change and there are many initiatives in this regard, it is clear that we are not acting with the speed

and decisiveness that a problem like climate change and global warming requires; Most citizens consider it a serious problem that needs a solution, however, it remains at the bottom of the list of concerns when compared to those problems that people perceive as more immediate, for example: insecurity, poor education, bad health services, unemployment, poverty, inflation and lack of decent housing.

## Effects of Climate Change on Planet Earth

Whether in liquid, solid or gaseous state, water is vital for our planet, we depend on it to live and to sustain crops, animals and countless species that depend on freshwater ecosystems to live. The seas help regulate CO<sub>2</sub> levels and global temperature, while transporting nutrients and supporting marine ecosystems. As the climate changes, so will the fresh and salt water resources our community and economy depend on, and as it changes, so will our relationship with water. The seas, which cover 71% of our planet, now absorb so much human-produced CO<sub>2</sub> and solar energy that the chemistry and temperature of seawater endangers many organisms, changes in sea level alter coastlines and undermine buildings, which represents a risk to human life (National Geographic Spain, 2016 [6]). Currently the Earth receives more heat than it releases, the ocean stores 93% of that energy, which helps keep the planet habitable by moderating extreme temperatures. More CO<sub>2</sub> makes the oceans more acidic, affecting marine life; Increased rainfall and snowmelt will change ocean salinity, affecting currents and marine ecosystems, rising sea levels prompt reengineering of coastal infrastructure, and investments in roads and water diversion systems will need to be more effective to protect against storms and floods. The dynamic interactions of climate change with freshwater resources on Earth are critically linked to the availability of good quality water for human use. Today, at least half of the world's population depends on aquifers for safe drinking water.

With a projection of urban growth that increases demand, the future use of the liquid would have to be carefully managed. Climate change is causing the snow cover in the northern hemisphere to probably reduce by 10 to 30%, thereby reducing the reserve of fresh water and forcing crucial planning and comprehensive water management, those who manage the necessary water will need a flexible combination of strategies, including collecting rainwater, recycling the liquid, improving storage systems and diversifying crops. Fresh water that was once frozen in the Arctic, Greenland, Antarctica, and alpine regions is melting and spilling into the world's seas, rivers, and soils (bibliography); As more ice melts, the rivers and basins will fill first. As the ice decreases, so will the meltwater and available fresh water. If the problem is not stopped, restrictions on water use are expected. When the permafrost melts, the ground changes, in the north people rethink their roads and buildings and move to less vulnerable areas, as global temperatures rise the sea ice in the Arctic and Antarctic will continue to shrink and thin, less ice means less energy reflected (and more absorbed) by the seas.

Climate change will also affect agriculture, just as it can benefit some plants by prolonging growing seasons and increasing CO<sub>2</sub>, however, other effects such as more pests, droughts and floods, would be less benign; Using a climate simulation model known as HadGEM2, researchers from the International Food Policy Research Institute (IFPRI) predict by 2050 changes in the land suitable for four basic foods (corn, potatoes, rice and wheat), which in some cases will force farmers plant new products. Some cropland may benefit from warming, but others will not, climate itself, yields, political changes, global demand and agricultural practices will influence the fortunes of farms (International Food Policy Research Institute IFPRI, 2009 [7]). Regarding heat, the planet will feel different in 2100, when average temperatures have risen several degrees, all environments inhabited by humans will be affected, urban, suburban, rural, mountains, plains, coasts, forests, most of them.

Of the developing world changes geographically and populations will modify their way and lifestyle. For that year, in warm climates we will have a huge increase in the use of air conditioners, and as a consequence, supplying energy for these and other climate devices will be contributing to global warming due to a greater need for energy production; The average annual air temperature in a city can be 2 to 6°C warmer than usual at that time, in rural areas the temperature during the day will be higher and between 2 and 5°C at night. Green roofs filled with vegetables can mitigate this urban heat island effect, by lowering the temperature by more than 3° C on the hottest days and plants also help control excess rainwater (Sustainability for all, 2018 [8]). Although temperature settings varied by region, many farmers opted to raise more heat-tolerant animals, meaning more sheep, pigs and goats replacing cattle and poultry; Crop yields like soybeans could increase as CO<sub>2</sub> levels rise, but many crops will be at risk from droughts and extreme weather; Communities adapted to fires could proliferate in landscapes at risk, surrounded by firebreak rings, where flammable vegetation has been removed; these enclaves protected by citizens educated in fire safety, help safeguard homes and health. Forest fires are predicted to increase by more than 60% in some mid- and high-latitudes. Heat- and drought-resistant seeds can help plants produce and survive despite extreme weather just as diversifying livestock and crops increases income opportunities for farmers while reducing their risks, e.g.

It has been shown that when Jersey cows are exposed to heat stress, they have smaller declines in milk production than Holstein cows; Smart sheds, fans and sprinklers also help production. Reflective cooling roofs can block up to 65% of solar radiation, urban forestry also helps, strategically planting shade trees can lower the surface temperature on walls and buildings by more than 12°C, reflective and permeable pavements lower surface temperatures in summer, which can reach 42°C. Ensuring the recovery and care of coastal mangroves and mountainside forests seeks to prevent storm surges, landslides and flooding during future storms. Since 1980, weather records show

an increase in climate-related disasters. Climate change partly affects the weather, but experts warn that it cannot be blamed for every extreme event. Climate change may not be the cause of a particular storm, but rising sea levels could worsen its consequences. Sea level by 2050 is predicted to rise between 28 and 53 cm. and to prepare, coastal cities must implement coastal protection measures, as well as a system of retaining walls, flat spaces and retractable barriers for better protection against storms (Climate Change, Survival Guide: How to live with it? 2016 [9]).

## Main Effects of High Co<sub>2</sub> Concentrations on Human Health

Climate change is not only bad for the health of the planet, but also for that of people, the effects vary according to age, gender, geography and socioeconomic level; A recent international study in the Lancet Magazine says that many more people than previously thought will be exposed to extreme climate events over the next century, a potentially catastrophic risk to human health that could undo 50 years of global health gains. Climate change and global warming can affect people's well-being in a less direct way, through exposure to air pollution, waterborne diseases, famine and malnutrition among other factors (Close, J. et al. [10]). CO<sub>2</sub> is naturally present in the atmosphere at levels of approximately 0.035%, this gas is not irritating to the skin, but contact with liquid CO<sub>2</sub> can cause frostbite, symptoms of frostbite include numbness, burning and itching in the affected area; symptoms of more severe frostbite that include a burning sensation and stiffness of the affected area, the skin may turn yellow or serous white with the presence of blisters, tissue death and gangrene, much more severe cases may also develop. Short-term exposure to CO<sub>2</sub> gas at levels below 2% (20,000 ppm) has not been reported to cause harmful effects; Higher concentrations may impair respiratory function and cause excitement followed by central nervous system depression. High concentrations of CO<sub>2</sub> can displace oxygen in the air, resulting in lower oxygen concentrations for respiration, therefore, the effects of oxygen deficiency can be combined with the effects of CO<sub>2</sub> toxicity.

Volunteers exposed to 3.3% or 5.4% CO<sub>2</sub> for 15 minutes experienced increased depth of breathing, at 7.5%, a feeling of inability to breathe (dyspnea), increased pulse rate, headache, dizziness, sweating, fatigue, disorientation and distortion developed visual. Twenty minutes of exposure to 6.5 or 7.5% decreased mental performance; Irritability and discomfort were reported with exposures to 6.5% for approximately 70 minutes. Exposure to 6% for several minutes, or 30% for 20-30 seconds, affected the heart, as evidenced by altered electrocardiograms. Workers briefly exposed to very high concentrations showed retinal damage and/or light sensitivity (photophobia), abnormal eye movements, constriction of visual fields, and enlarged blind spots. Exposures up to 3.0% for more than 15 hours, for six days, resulted in decreased night vision and color sensitivity. Exposure to 10% for 1.5 minutes caused eye blinking, excitement and increased muscle activity and contraction, concentrations greater than

10% caused difficulty breathing, poor hearing, nausea, vomiting, sensation of strangulation, sweating, stupor for several minutes with loss of consciousness at 15 minutes, 30% exposures quickly resulted in unconsciousness and seizures (Vidaurre Valdez G [11]). The consequences caused in some African countries by climate change and being prone to flooding have caused malaria and intestinal infections, which will probably increase as temperatures and sea levels rise, meanwhile, public health experts in All sides are calling for broader improvements that will help people stay healthy despite floods, droughts and heat waves, greater access to clean water, sanitation systems, vaccines and child health care.

Power outages during extreme weather events could paralyze hospitals and transportation systems when they need them most; The decrease in crops would cause malnutrition, famine and rise in food prices. More CO<sub>2</sub> in the air could make staple crops like barley and soybeans less nutritious. Occupational hazards such as the risk of heat stroke will increase, especially among farmers and construction workers. Schedules could be changed to dawn or dusk, when that there are more disease-carrying insects; Hotter days, more rain, and higher humidity will produce more ticks, which spread infectious diseases like Lyme Disease. Psychological trauma due to floods, droughts and heat waves can lead to mental health problems such as anxiety, depression and suicide, more heat means longer allergy seasons and more respiratory illnesses, more rain will increase mold, mildew and pollutants indoor air, dengue, transmitted by mosquitoes, has increased 30 times in the last 50 years, three quarters of those infected so far live in the Asia-Pacific region. The elderly and poor children, especially those with malaria, malnutrition and diarrhea, tend to be more vulnerable to heat-related diseases, drought and chronic water shortages harm more rural areas and 150 million people, if localities do not adapt soon, by 2050 that number could approach 1 billion; Soil degradation, freshwater scarcity, population pressure and other factors related to climate change are potential causes of conflict. Rising sea levels threaten the supply of fresh water for people living in low-lying areas; more severe storms can cause drainage systems in cities to overflow; Extreme weather tends to affect older, sedentary people more than younger, more mobile people (National Geographic Magazine, 2016 [9]).

## What Has Been Done to Control Climate Change

In this sense, education through the processes of environmentalization of curricula in Higher Education Institutions will play a transcendental role in the control of climate change; This process implies thinking that you have to work on education to benefit the environment, nor that this situation and crisis is just a matter of money, rather it involves thinking and executing education to change people, their culture, their way of life. seeing reality, implies a comprehensive education that contributes to improving the quality of life of people and their environment, an education that focuses on the subject and not on the environment, in this case educational institutions at all

levels, but in particular higher-level education in general can be an important vehicle to promote the sustainable development of modern societies. Unless we start with ourselves by changing things as basic as daily habits, routine actions or the small decisions that we often make in our home, in our consumption habits, in our work, in our rest time, in Our educational centers will never be able to globally change the world in which we live and day and day it will deteriorate until its recovery is no longer possible. The above is not an easy undertaking, situations such as the inertia produced by years of irrational consumerism, of buying, using and throwing away and the need for an environmental mentality, make great political will necessary to really change people. Although there are no magic formulas to achieve these aspirations, operational methodological strategies can be proposed in the short and medium term to progressively get closer to ways of life that are more respectful of the environment that surrounds us.

Starting from the idea that environmental education is institutionalized in schools, these institutions would assume greater responsibility in the dissemination of universal values consistent with the environment, decisions should not only be incorporated through their environmental programs but also These institutions must be designed to transmit their message in their architecture, in the rational use of their resources, in administrative planning, in the management and maintenance of green areas and the adaptation of rest areas. Higher Education Institutions must play a much more active role in the transition process towards sustainable societies, due to the weight they have in professional training, research and the dissemination of culture, we are witnessing a rapid growth of young people who access higher education systems, this fact in itself turns these schools into privileged settings for the construction of increasingly sustainable social and economic models, work must be done to rescue the critical spirit to visualize in its proper dimension the environmental and climatic issue, to be able to face the problems of development and sustainability from interdisciplinarity, promote new political structures that have as their objective the environmental crisis, climate change and global warming, among other endless social situations, promote research on technologies appropriate to the territorial conditions of the context and coordinate networking efforts and develop sustainability strategies to face the current crisis (Bravo Mercado M T [12]).

## References

1. (2023) Climate Change: greenhouse gases that cause global warming European Parliament.
2. Climate change global.com, (s/f). Reporting on global warming since (1997).
3. DELOS: Sustainable Local Development (2010) Usefulness of the ecological and carbon footprint in the field of corporate social responsibility. 3(8).
4. (2011) Spanish Association for quality AEC. The carbon footprint. National Quality Information Center.
5. Secretary of the Environment and Natural Resources. (2013) Ecological Footprint: Data and Faces, SEMARNAT/Federal Government, Mexico, D. F.

6. (2016) National Geographic Magazine. Climate Change, Survival Guide: How to live with it? 16(5): 78-89.
7. International Food Policy Research Institute IFPRI, (2009) Climate change. The impact on agriculture and the costs of adaptation, Washington, D.C.
8. (2018) Sustainability for all What will the world be like in a hundred years? climate change in the year 2100.
9. (2016) National Geographic Magazine. Climate Change, Survival Guide: How to live with it? 16(5): 78-89.
10. Close J, Caballero (2015) Climate change, health and opportunity for sustainable development, World Bank IBRD-IDA.
11. Vidaurri Valdez G (2014) Carbon dioxide-criminology.
12. Bravo Mercado M T (2012) UNAM and its curricular greening processes. Mexican Journal of Educational Research 17(55): 9-1146.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2024.56.008784

Jesús Rivas-Gutiérrez. Biomed J Sci & Tech Res



This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: <https://biomedres.us/submit-manuscript.php>



#### Assets of Publishing with us

- Global archiving of articles
- *Immediate*, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles

<https://biomedres.us/>