

PHILOSOPHY AND THE IMPACT OF CLIMATE CHANGE ON THE ENVIRONMENT

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Abstract

Man made global warming exists; this is due to unchecked actions of man in the society. The phenomenon of climatic regime on the earth surface is a dynamic process that evolved over millions of years. Research has it that Brundtland commission of 1987 discussed on the effect of mining and burning of fossil fuels, manufacture and release of toxic chemicals and pollutants into air and water; destruction of forests and soil erosion, with a clear warning for humanity to either change its development strategy or be prepared to face the consequences in near future. Unfortunately, the situation has further worsened due to unchecked population growth, consumption pattern, and use of fossil fuels and release of greenhouse gases, deforestation and pollution. There are incontrovertible evidences that temperatures today are more than 0.8 °C above pre-industrial levels and the sea level has been rising at 3mm per year. The world is currently witnessing frequent and severe natural disasters including droughts, floods, cyclones, fires and mudslides. So, the negative impact of climate change is enormous but these impacts can be remedied if man will accept to cooperate with nature.

Keywords: Philosophy, Climate Change, Environment, Nature, Global Warming

INTRODUCTION

Natural change in climatic regimes has impacted the evolutionary history of living species and the life on Earth has witnessed at least five periods during which huge numbers of living species vanished forever, primarily due to changes in climate and sea level. The first of these five extinction periods started around 485 million years ago when the sea level rose continuously due to very high temperatures and high atmospheric carbon dioxide leading to massive destruction of marine flora and fauna. The second one occurred after 120 million years (365 million years ago) when marine species vanished due to changes in sea level and loss of oxygen. The third extinction which happened some 251 million years ago is supposed to be the largest so far when more than 96% of all species disappeared. The fourth one, known as end Triassic extinction, occurred 205 million years ago due to intense volcanic activity and leading to loss of 76% living creature mostly marine. The last known extinction (that occurred some 65 million years ago) is the most interesting because it signaled the end of 75% to 80% of all species including dinosaurs, which had dominated the land for 140 million years. Probably

between 75% and 80% of all species disappeared during this time that occurred some 65 million years ago. Scientists in the University of Sheffield, UK, believe that the fourth extinction in the Late Triassic was the result of global warming (McElwain et al. 2009). Their argument is based on the stomata count of 18 different groups of fossil plants that existed between Triassic and Jurassic periods.

WHAT CLIMATE CHANGE ENTAILS

The term climate refers to prevailing outdoor environmental conditions including temperature, humidity, wind, precipitation, sea level, and other phenomena. Climate change refers to modifications in those outdoor conditions that occur over an extended period of time. The Intergovernmental Panel on Climate Change (IPCC) defined “climate change as any change in climate over a time period that alters the composition of the global atmosphere and this change might be due to natural climate variability or a result of human activity” (IPCC, 2007). According to the United Nations Framework Convention on Climate Change (UNFCCC) climate change refers to “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is in addition to natural climate variability observed over comparable time periods” (cf. USGCRP, 2009).

Human activities, most importantly the burning of fossil fuels, natural causes, industrialization, and changes in land use are modifying the concentrations of atmospheric constituents or properties of the surface that absorb or scatter radiant energy. Observations of key climatic variables provide a rich historical record of how the climate has changed in the past and serve as a basis for assessing potential future change.

However, measurements of global mean temperature indicate that the first decade of the 21st century was 0.8°C (1.4°F) warmer than the first decade of the 20th century. Associated with that temperature rise have been observations that heat waves have become longer and more extreme and that cold spells have become shorter and milder. For example, the Western Europe heat wave of 2003 was responsible for upwards of 70,000 deaths and was the warmest summer there in over 600 years (Robine et al., 2008). No single event like that can be reliably attributed to climate change, but it is consistent with expectations for the future. Within the United States, hot days, hot nights, and heat waves have become more frequent in recent decades and were the leading cause of weather-related morbidity and mortality during 1970–2004 (USGCRP, 2009).

On an urban scale, the heat-island effect contributes to local temperature increase. For example, the urban heat island around Phoenix, Arizona, raises minimum nighttime temperatures by as much as 12.6°F (7°C) (Brazel et al., 2000). When increased ozone events occur simultaneously with heat waves, mortality can rise by 175% (Filleul, 2006). As extremely hot days tend to be associated with high pressure and stagnant air-circulation patterns, ground-level ozone, PM_{2.5}, particulate sulfate, and organic carbon have been found to correlate strongly in summer months (NRC, 2008). The changes in climate, particularly increases in temperature have already affected a wide range of physical and biological systems in many aquatic, terrestrial and marine environments in various parts of

the world. The climate change will increase the risks of extinction of more vulnerable species and loss of biodiversity. The overall conclusion of the National Academies report *Advancing the Science of Climate Change* was that climate change “poses significant risks for and in many cases is already affecting a broad range of human and natural systems” (NRC, 2010). The US Global Change Research Program, which coordinates and integrates federal climate change research, found that;

Climate-related changes have already been observed globally and in the United States. These include increases in air and water temperatures, reduced frost days, increased frequency and intensity of heavy downpours, a rise in sea level, and reduced snow cover, glaciers, permafrost, and sea ice. A longer ice-free period on lakes and rivers, lengthening of the growing season, and increased water vapor in the atmosphere have also been observed. Over the past 30 years, temperatures have risen faster in winter than in any other season, with average winter temperatures in the Midwest and northern Great Plains increasing more than 7°F. Some of the changes have been faster than previous assessments had suggested (USGCRP, 2009).

These climate-related changes are expected to continue while new ones develop. Likely future changes for the United States and surrounding coastal waters include more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of these storms that make landfall), as well as drier conditions in the Southwest and Caribbean. These changes will affect human health, water supply, agriculture, coastal areas, and many other aspects of society and the natural environment.

CAUSES OF CLIMATE CHANGE

Nothing happens without a cause. Climate change occurs as a result of human actions in the society. Most of these actions are;

Mining/Manufacturing Activities: Mining is the act of extracting raw materials from the soil. Most of the materials extracted are Oil, Gold, Coal, Tin, Granite, lime stone, etc. the process by which this is been extracted pose so much to the lives of living things in the society. Billions of tons of CO₂ are released into the atmosphere every year as a result of coal, oil, and gas production. Human activity is producing greenhouse gas emissions at a record high, with no signs of slowing down. In order to maintain GDP at 8% per annum, China will have to generate more than 9200 TWh in 2030 and the current trends indicate that it has no other options but to burn coal to supply 70% of its energy needs. If the trends continue, China will continue to lead the world as the largest emitter of CO₂ and other global warming gases. In Port Harcourt of Nigeria some years ago, there was a record of black spot in the nose of the residence of that area and the rain of black particles. These are as a result of carbon emission through oil extraction.

Bush Burning: Bush burning as it is being studied not only poses health hazard to man alone but also affects the environment in general via the emission of the various pollutants. It is glaring that particulates, carbon monoxide, hydrocarbons, oxides of nitrogen and negligible percentage of oxides of Sulphur are the major pollutants of bush burning and they all have

various effects on man and his environment, like reduction of visibility by particulate matters, especially during periods of air stagnation and causing some respiratory diseases. Oxides of Sulphur and nitrogen are also hazardous as they cause respiratory disorders and irritants respectively. Apart from the soil destruction and desert encroachment caused by bush burning, it has also a marked increase in global warming due to the emission of NO₂, SO₂, SO₃, NO, CO and CO₂ gases which have tremendous effect on the ozone layer and also formation of acid rain which deteriorate plant life, damage calcium containing soils and also increase the acidity of surrounding lakes and river.

Deforestation: Deforestation results from the removal of trees without sufficient replacement, which leads to reduction in habitat, biodiversity as well as wood and quality of life. The use of the term “Deforestation” at times is associated with distortion of forestry issues. It is used to denote activities that use the forest, for instance, felling of wood for fuel, commercial logging and activities associated with temporary removal of forest cover such as slash and burn technique, which is a major component of shifting cultivation agricultural systems or clear cutting. It is equally used to describe clearing of forest for grazing or ranching. Deforestation has tremendously threatened depleted or endangered biodiversity of the forest ecosystem. Deforestation is one of the major causes of enhanced green house effect. Trees and other plants remove carbon in form of carbon dioxide from the atmosphere during the process of photosynthesis. Carbon dioxide is injurious to animals including man and as deforestation takes place, the few trees left cannot make use of the carbon dioxide, therefore, the excess carbon dioxide gets into the atmosphere causing global warming. Deforestation is estimated to contribute up to one third of all carbon dioxide. The water cycle is equally affected by deforestation as trees extract groundwater through their roots and release it into the atmosphere. When deforestation takes place, the region may not hold as much water which can lead to a much drier climate (Wikipedia,2008).

Over Population: population growth plays a key role in environmental sustainability. The increase in the number of persons within a geographical area has a lot negative impact. This ranges from deforestation, water pollution and air pollution

War: War is one of the major causes of climate change and environmental problems in the society. The World War 1, World War 11, the Vietnam war, the Rwandan war, the Kosovo war, the Gulf war and the attempted World War 111 (between USA and Iran) have left a negative imprint and major consequences in the lives of man and environment. During the war, a lot of chemicals are been used either to protect the environment and resources or for the destruction of enemies. During World War 1, about 125,000 tons of chemical agents were employed and 96,000 tons during the Vietnam conflict. Nerve gas also called organophosphorus anticholinesterases was used at lethal level against human being and destroyed a high number of nonhuman vertebrate and invertebrate populations.

The invention of mass destruction ushered in World War 2 which has created significant environmental destruction leading to climatic change. On top of loss in human lives, natural resources are usually the first to suffer, forest and wild animals are wiped out. During the Vietnam war, orange agent was one of the herbicides and defoliants used by the U.S military. An estimated 21,136,000 gal of Agent Orange were sprayed across South Vietnam exposing

4.8 million Vietnamese people to agent orange and resulting in instant deaths and disabilities of 400,000 people and 500,000 born with birth defects.

IMPACTS OF CLIMATE CHANGE

The increase in human activities and population growth has affected the lives of living organisms in the society. This effect has created a lot of negative and positive impacts, which includes;

Chronic Droughts: Chronic drought whether meteorological, hydrological, agricultural or environmental, has been a regular feature considered as a temporary aberration from normal climatic conditions. However, the current spates of frequent, severe and widespread droughts with devastating consequences have been reported in many regions. Persistent, higher than usual temperatures have attributed to the exacerbated retention of high moisture in the atmosphere, and high rainfall in certain areas, causing flash floods, erosion and mudslides. As a consequence, certain other areas suffer from less than normal rainfall or no rains at all. Also, the areas suffering from flash flood and soil erosion face drought as less moisture is retained.

Recent researches on the impact of atmosphere and ocean in altering the global weather and climate pattern indicate that sea surface temperatures in the central and eastern tropical Pacific Ocean are substantially higher than usual during El Nino event and substantially lower during La Nina. These temperature fluctuations are strongly linked to major climate fluctuations around the globe, and their impact lasts for more than 12 months (Rojas et al. 2014). For example, the strong El Nino event of 1997–1998 was followed by prolonged La Nina phase that lasted from mid-1998 to early 2001.

Climatic variations apart, there are many countries that have, over the years, overdrawn groundwater as well as surface water (river damming, etc.) for agriculture and industrial development. Such countries suffer most in the event of prolonged absence of or shortage of monsoon. One of the conspicuous examples is Australia that has suffered from millennium drought beginning 1995 and lasting until 2009. Catalonia region of Spain (about 70% of Spanish water is used for agriculture primarily due to poor irrigation system and water thirsty crop) was so badly affected by drought in 2008 that water was imported from France by ship. Populated and monsoon-dependent countries like India suffer from drought almost every year. Large-scale withdrawal of water for irrigation and human consumption in Haryana, Punjab, Rajasthan and Delhi between 2002 and 2008 has depleted groundwater to the extent of 108 cubic kilometres. Syria follows India in terms of groundwater loss. Between 2006 and 2011, Syria suffered worst drought and severe shortage of water in Tigris and Euphrates River basins.

Retreating Glaciers: a glacier is a large, long-lasting mass of ice that is formed on land by several years of ice accretion. Of the two main types of glaciers, the alpine glaciers are found in mountain terrain and the continental glaciers cover large areas of continents and are associated with ice ages. Glacier records are extremely useful in understanding climatic variability due to rapid changes in their mass and thus contribution to the rapid sea level rise.

As humans continue to impact the Earth through the burning of fossil fuels and other activities, predicting future requires understanding of past climate variability. Glaciers around the world, including those in the Himalaya, are a unique laboratory for helping unlock the secrets of our complex climate system. Similarly, the Glacial National Park of the USA, encompassing 4000 km², had nearly 150 glaciers in the mid-nineteenth century. However, only 25 remain now facing further challenges from global warming impacts that threaten to engulf all of them by 2025 lest the climatic situation improves (Key et al. 2002). Data of the snout positions of a few of the thousand's glaciers in Himalayan region highlights the worse that they have been in a general state of decline over at least the past 150 years. It also suggests that the rate of retreat has been increasing in the past decade and the melting glaciers are filling Himalayan Mountain lakes and river systems too quickly, threatening millions of lives with unpredictable and colossal floods and landslides. If the glacial retreat continues over the long term (several decades), as is expected in a greenhouse-gas-warmed climate, the amount of water melted will decrease and the flow of rivers in southern Asia will become less reliable and eventually diminish causing potential widespread water shortages leading to disastrous consequences.

Acidification of Oceans: There are three principal ways in which oceans affect the climate.

- i. Transfer of huge amount of water vapour between sea and air;
- ii. Transport of considerable amount of heat from tropics to the poles;
- iii. Being huge reservoir of CO₂ (50 times more than atmosphere), they maintain Earth's heat balance. The oceans absorb 22 million tons of CO₂ per day, thus proving valuable service to the survival of mankind (Feely et al. 2006). There is no other mechanism to absorb CO₂ at this rate, and this invaluable service of oceans has a high ecological cost. Since the beginning of the Industrial Revolution, the ocean has become 30% more acidic and the speed of this change is unparalleled in known human history. Carbonic acid formed by dissolution of CO₂ in water decreases the availability of carbonate making it difficult for marine organisms including corals, mussels, snails, and sea urchins to construct their hard parts out of calcium carbonate minerals. Decreased calcification in marine organisms makes them vulnerable to extrinsic factors such as erosion and pollution. In a few invertebrates and fish, CO₂ accumulation and lowered pH may result in acidosis, a build-up of carbonic acid in body fluids, leading to lowered immune response, metabolic depression and asphyxiation. Ocean acidification may also affect marine food webs and lead to significant changes in commercial fish stocks, threatening food security for millions of people thereby adversely impacting a multi-billion-dollar industry. Similarly, coral reefs generate billions of dollars annually in tourism, which may be at risk as reef area diminishes and corals become more prone to diseases. In addition, reefs will provide shorelines that are more vulnerable to erosion and flooding.

Death of Habitats and Species: Each of the biological species on this planet is a storehouse of matchless substances for the sustenance of the planet. Of the fourteen biomes, the two most species rich biomes are the tropical forests and the coral reefs. The former contains at least half of the world's species but are under serious threats, largely from conversion to other land uses for human use, while the latter are experiencing increasing levels of pollution and

over exploitation. A whole range of plant-derived dietary supplements, Phyto-chemicals and pro-vitamins that assist in maintaining good health and combating disease are now being prescribed as food supplements by experts and pharmaceutical companies.

In addition to human use, many plants and plant products are also used for treatment of captive animals in zoos and circuses. Because of the major contributions that these plants make in terms of health support, financial income, cultural identity and livelihood security, these plants have become the cornerstone of both human and veterinary medical systems worldwide. It is estimated that 484 animal and 654 plant species have already been driven to extinction during the past four centuries and almost 1400 tropical plants and 500 marine organisms which yield chemicals for cure of cancer will soon be driven to extinction before their potential can be assessed or tapped (Srivastav and Srivastav 2015). Unconfirmed statistics indicate that worldwide between 35,000 and 70,000 plant species are used as medicines and food supplements of which 9000 are threatened (McNeely and Mainka 2006). Europe alone shares around 25% of world trade in medicinal plants, and the demand is growing.

Commercial and non-commercial trade in wild animals and their parts and products for food, therapeutic and other uses not only affect animal populations and their habitat but also the local and indigenous communities who rely on locally obtained medicines for their own basic needs. For example, population of Hose's langur endemic to Borneo in Indonesia has sharply declined because of its hunting for bezoar stones used in traditional medicines. Similarly, populations of Saiga antelope for horn; seals for genitalia; pangolin for scales; bear for salts derived from gallbladders, musk deer for musk; rhinoceros for horn and tiger for bone are on decline. Every component of tiger's body including hair, skin, meat, testes, tail, stomach, nose, whiskers and bones holds some therapeutic value in treating a litany of ailments and nearly twenty million freshwater turtles and tortoises are consumed annually by consumers in China, Lao PDR, Cambodia, Vietnam, Malaysia, Thailand, India, Nepal, Bangladesh and Sri Lanka. With the present rate of human population growth and consumption, the coming decades are expected to witness biological holocaust.

Environmental degradation and growing pollution are already threatening biodiversity and ecosystem stability, and many Asian and African nations are currently at a stage when their physical and biological systems may not be able to meet even their basic needs (potable water, fodder, energy, shelter and food) of the growing population. Increasing frequency of landslides, floods, droughts, soil loss and other human incited natural disasters continues to compound the miseries of poor communities' particularly marginal and poor farmers as well as the landless labourers.

Naturally and human-induced factors have contributed significantly to the degradation of coastal and marine ecosystems, most of which are irreversible. The biggest damage to these ecosystems has been caused by silt brought down by soil erosion due to the deforestation and poorly planned developmental activities, encroachment, excess sedimentation due to poor land use practices, industrial effluents, urban sewage, over fishing, clear felling in coastal forests and mining of coral rocks for building material, and extraction of coral sands for cement production. Clearance of land for farming and other uses has also resulted in

sedimentation and siltation, impacting especially on mangrove and reef areas. Many industries including petrochemical, cement, shrimp farming, tanneries, slaughterhouses and other chemical processes contribute solid waste and wastewaters to the environment, often without adequate treatment. A large number of coastal cities and towns have become vulnerable to hazards and perturbations that have become frequent and more intense. For example, cyclonic winds and storm surges cause inundation of low-lying areas of coastal region, drowning human beings and livestock, eroding beaches and embankments and destruction of vegetation, reducing soil fertility and polluting drinking water, extensive damage to infrastructure, dwellings, communication systems. Heavy and prolonged rains due to cyclones repeatedly cause river floods and submergence of low-line areas leading to loss of life and property.

Climate change is also known to have some beneficial effects on the human system (IPCC, 2001). The positive impacts of climate change include: i) an increase in the potential yields of some crops in some of the regions in Mid-altitudes for increases in temperatures of less than a few 0C; ii) a potential increase in global supply of timber from well managed forests; iii) an increase in the availability of water in some water-scarce regions in some parts of Southeast Asia; iv) A decrease in the winter-mortality in mid- and high altitudes; and v) reduced demand for energy due to higher winter temperatures.

POSSIBLE SOLUTIONS

Use of Energy from Waste: In today's world of technology, nothing is worthless not even waste that we produce. As the organic waste decomposes, the aerobic bacteria remove oxygen and the anaerobic bacteria react with the waste to produce acetate which is then converted into carbon dioxide and methane. The USA is one of the few countries where food is wasted in huge quantity. In 2013, the cumulative organic waste was 250 million tons. More than 600 landfill projects are currently in operation covering almost all states generating 15 billion kilowatt-hours enough to power roughly one million homes for a year. Another area of generating power is by using the property of some materials whereby heating part of an object made of that material drives electrons from hot part to cold part creating a current. Tapping this heat, converting it directly into electricity is being explored by scientists. Strontium titanium oxide is one such material that can be used when heated between 700 and 750 °C. Heat generated from heavy machineries such as boilers, diesel engines and thermal power plants normally goes waste and increases the temperature of the surrounding environment. A new technology called Organic Rankine Cycle can convert this waste heat from all kinds of heavy machinery into electricity. This technology can be easily integrated into the existing industrial process.

Reduction in Mining Activities: The major cause of environmental change is the increase in mining activities. The power of sunlight captured millions of years ago by plants and animals and buried in huge deposits is now being burned as coal, petroleum and natural gas. Englishmen started using coal for fuel as early as ninth century which was subsequently banned during the reign of King Edward I (1272–1307). Richard II (1377–1399) revoked the ban and introduced taxation. This was succeeded by strict regulatory measures for use of

coal by Henry V (1413–1422). The only way of maintaining sanity in the environment is by going back to the norm of King Edward I.

Environmental Law: there is need to enact law that will govern the activities of human beings on earth. This law will prohibit the use of chemicals in fishing, pollution, hunting and cutting of trees. With this, our environment will be protected and public health will be improved. To achieve this, there is need for government intervention.

Increase in Plant Plantation: everyone is encouraged to plant at least one tree every year. This will help to reduce climate problems experienced in the society, tree absorb CO₂ and release oxygen to the air. Every year, trees absorb carbon dioxide equal to driving car 26, 000 miles. It purifies the air by absorbing pollutant gases, such as nitrogen oxide, ozone, ammonia and Sulphur dioxide. So, tree plantation is necessary because the average temperature in population dense areas grow by 1.4F every year.

Adoption of New Technological Innovation: The desire of man to change the world through conversion of matter into new, different and useful forms has led us to the golden age for materials. New alloys and composite materials with new ideas are emerging in the market. These 'smart' materials are energy efficient and high performers, e.g.

Perovskite: It is a crystal that can be used for enhancing the performance of LED bulbs.

Iron Pyrite: Nano particles from this material can help in recharging batteries much faster.

Graphene: It is also known as wonder material, is a two-dimensional carbon material that is extremely light, strong, and transparent and works as a semiconductor. Not in commercial use as yet but it has great potential to revolutionize computer chips, efficient solar cells and water purification membrane.

Carbon Fibre Composites: It is made from a thin filament of carbon woven into a cloth and cut and pressed into any shape, and the fibres are bound together with a plastic resin, cured by heat and pressure. The molecular structure of carbon compounds produces strong chemical bonds much like those of diamonds. The resulting structure is stronger than steel (but 50% lighter) and longer lasting and does not corrode. Carbon fibre is already in wide use by aircraft industry, and all state-of-the-art aircraft such as Boeing 787, Airbus A 380 are made with carbon fibre. These aircraft are fuel efficient and low in emission.

Neutrino: Neutrinos are extremely important for future energy for three reasons:

They are abundant, have feeble mass (the mass of a neutrino is of the order of 1×10^{-37} kg) and have no charge. They can, therefore, travel through human bodies, rocks, planets and stars without any interaction, thereby unravel scientific mysteries and help in medical science and communication. Neutrinos are the second most widely occurring particle after photons and are so abundant that nearly 100 trillion of them pass through us every second unnoticed. Since neutrinos can pass right through the Earth, they may revolutionize the communication system that currently uses satellites and cables (which also means transmission losses). Besides, neutrinos may also help in detecting minerals and oil deposits deep inside the Earth and ocean as well as detect geological defects.

Hybrid Cars: A hybrid car is eco-friendly, fuel efficient (30% more efficient) and less carbon (30% less carbon)-emitting vehicle that uses energy from petrol/diesel and electric motor.

Introduction of Environmental Studies into Academic Programs: the fight against environmental degradation and climate change can only be achieved if there is a modification of the academic curriculum of both the primary, secondary and tertiary institutions. The amendment or modification will give credence into the inculcation of environmental studies as a program in the schools. The pupils and students have to learn from their tender age the effects and consequences of all the environmental factors or challenges.

Media Broadcasting: the media has a role to play in ensuring that the climate condition of the people is improved. This is because media as an instrument of mass communication are the avenues through which information is communicated to the general public at the same time. The media messages are so influential that they in turn influence in the thoughts of the receivers. If media broadcasting is carried out in different languages as an advert or as a news update in radio or television, there will be a wider knowledge of climate condition in the society.

CONCLUSION

Climate change is like no other environmental problem that humanity has ever faced. Ross Garnaut, in his exhaustive review of the climate change problem for the Australian Government, called it a 'diabolical policy problem' (Garnaut 2008) and concluded his report with the statement: 'On a balance of probabilities, the failure of our generation would lead to consequences that would haunt humanity until the end of time' (Garnaut 2008). Nicholas Stern, who carried out the first comprehensive economic analysis of the climate change problem, said that 'this (climate change) is an externality like none other. The risks, scales and uncertainties are enormous... There is a big probability of a devastating outcome' (Stern 2009).

However, with the above assertions it is pertinent to note that the fight against climate change is a collective action which must start at the national level. Climate change involves a complex global set of both causal practices and felt impacts, and as such requires coherent global action or, at a minimum, coordination across some critical mass of global players. Without such coordination, there is substantial incentive for every player to seek to impose the burdens of mitigate on others, while seeking to take as free a ride as possible on their efforts. Enough players doing this will of course result in little in the way of effective action.

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