The SAGE International Encyclopedia of Travel and Tourism

Environmental Impacts of Travel

Travel has negative effects on the local environment, including air pollution, noise, land use, and water pollution. These effects have implications for human health and well-being. The emission of greenhouse gases by some transport modes also contributes to climate change, with possible impacts on the long-term sustainability of the planet. Technological progress has mitigated some of the environmental effects of travel, but the improvements have been offset by the continuous growth in travel demand. There is a need for governments to adopt policies to reduce car and air travel and promote modes of transportation with lower environmental impact.

Local Air Pollution

The transportation sector is one of the major sources of local air pollution because it relies on the burning of fossil fuels. Road traffic is responsible for a large proportion of the air pollution in urban areas, as most vehicles emit gases such as carbon monoxide (CO), nitrous oxides (NO_X), and sulfur oxides (SO_X). Road traffic also contributes to the formation of particulate matter (a compost of several solid and liquid substances) and volatile organic compounds (VOCs). NO_X and VOCs also contribute to the formation of ground-level ozone (O_3) or "smog." Buses cause air pollution because they tend to use diesel engines, which emit a large amount of NO_X, SO_X, and particulate matter. However, the emissions of pollutants per person traveling by bus tend to be smaller than the emissions per person travelling by car, assuming full occupancy of buses. Air travel also has substantial impacts on local air pollution, due to the emission of NO_X, CO, and VOCs, during airplane takeoff, cruising, and taxiing.

While the cases of cars and airplanes have attracted the most interest, other means of transport are also responsible for air pollution. Railway diesel locomotives emit a significant amount of CO, NO_X, SO_X, particulate matter, and VOCs. There is also growing evidence on the pollution created by ferryboats and cruise ships, which is linked to the combustion of fuels with high sulfur content and the emission of NO_X and particulate matter. The problem affects harbor cities, as ships at berth continue to run their engines to produce electrical power. Cruise ships also have incinerators to burn waste, which emit harmful gases.

Air pollution is linked with several health concerns, including respiratory problems, cancer, and cardiovascular disease. Children and older adults are particularly vulnerable to these effects. The people most exposed to air pollution are pedestrians, cyclists, open-air workers, and populations living near major transport infrastructure. Air pollution also has adverse effects on plants, damaging forests and crops, and on the built environment.

The effects of air pollution may be felt over a wide area. Pollutants may disperse across a region and even across national borders, causing tensions between countries. Atmospheric concentrations of NO_X and SO_X emitted by the different modes of transport and other polluting activities also contribute to the formation of acid rain, which has impacts on human and nonhuman life, and contributes to the decay of buildings.

Other Local Environmental Impacts

Noise is often the most tangible local environmental effect of transportation. Noise from motor vehicles and aircraft is a major concern for people living near busy roads, airports, and flight

paths. Railway traffic also creates noise, especially when trains have diesel engines. Noise is also a problem during the construction and maintenance of transport infrastructure. Exposure to noise has been linked to health effects such as hearing loss, cognitive performance, stress, and cardiovascular diseases, although the extent of these effects depend on the age and health status of the individuals affected.

Transportation infrastructure such as roads, railways, and airports also consumes land, reducing open space and agricultural areas, and in some cases changing hydrology. The presence of transport infrastructure and the level and speed of motorized traffic also disrupts local communities. This effect is known as "community severance" or "barrier effect" and is linked to losses in local walking mobility, with impacts on public health and social networks. Large infrastructure, such as major road junctions and elevated highways and railways, also has a visual impact that may interfere with people's perception and enjoyment of the surrounding environment. Structures supporting the travel and tourism industry, such as signs and billboards, may also affect pedestrians in urban areas and car drivers and passengers traveling on highways. The need to build footbridges and underpasses to cross railways and busy roads also tend to be perceived as ugly and dangerous environments. Finally, transport infrastructure and motorized traffic have a negative impact on nonhuman life, as they fragment natural habitats and disrupt ecosystems.

Water Pollution

The transportation sector is also responsible for water pollution. The dredging of waterways (removing sediment from the water bed) to facilitate the navigation of large ships has negative impacts on aquatic ecosystems. The evidence on the environmental impacts of cruise ships is also growing. According to the U.S. Bureau of Transportation Statistics, a cruise ship produces 10 gallons (38 liters) of sewage (from toilets), 47.6 gallons (180 liters) of grey water (from sinks, showers, and laundries), and 381 kilograms of solid waste per person per day. The discharge of these materials may destroy aquatic life, as it may contain harmful viruses and bacteria, and elements such as nitrogen and phosphorous, which support the growth of algae. Cruise ships also discharge fuel, oil, and chemical products, which deteriorate the aquatic ecosystem. There are also potential risks for human health, if the discharges are made close to the shore, or if humans consume contaminated seafood.

The environmental problems associated with cruise ships have worsened in recent years due the increase in the size of the ships and the continuous growth in cruise tourism. According to the Cruise Lines International Association, cruise passenger numbers have been growing at an average annual rate of 4.5% since 2007 and were expected to reach 21.7 million in 2014.

Land transportation may also create water pollution. Materials such as dirt, dust, engine oil, rubber, and metal washed off from roads and road construction sites by rainwater or melting snow may be carried to water bodies. There is also evidence of contamination of soil and water in areas near airports due to spillage of fuel, oil, and deicing fluid.

Global Impacts

Travel also leads to the emission of global greenhouse gases (GHGs), chemical compounds that absorb infrared radiation from the sun and trap heat in the atmosphere. The most abundant greenhouse gas is carbon dioxide, which is emitted by cars, buses, trains, ships, and airplanes. The increase in the concentration of greenhouse gases is linked to climate

changes, including global warming and increase in extreme weather conditions. These changes may lead to environmental changes such as the melting of the snow cover in arctic zones and the rise of sea levels around the globe, with potential devastating impacts in terms of human health, food security, water supply, and economic activity. Climate changes may affect the travel and tourism industries in many countries.

According to the Intergovernmental Panel on Climate Change, it is almost certain that human activities have been the main cause of the observed global warming since the mid-20th century. However, there is a high degree of uncertainty in the prediction of the impact of present human activity on future climate changes. For this reason, global warming has become a polarizing issue. The majority of the world's countries have committed to reduce their emissions of CO_2 by signing the Kyoto Protocol in 1997. However, the United States and Canada are not party to the protocol, despite being respectively the second and fourth country with the highest levels of CO_2 emissions per capita.

The effects of human activity on climate changes also have implications in terms of international justice. This is because developed countries are responsible for a disproportionate share of the emission of greenhouse gases, but the impacts of climate changes are likely to be particularly severe in developing countries, due to their geographic location and the lack of resources for adaptation.

According to the International Energy Agency, the transportation sector was responsible for 19.4% of global CO_2 emissions from fossil fuel combustion in 2011. The emissions of CO_2 from the sector grew 46% from 1991 to 2011. This increase was especially high in large, fast-growing economies. For example, in the period 1991–2001, emissions of CO_2 from the transportation sector grew 437% in China, 223% in Indonesia, 155% in Pakistan, 114% in Brazil, and 95% in India.

The growth in air travel during the last decades, fueled by trends such as globalization, economic growth, and the emergence of low-cost airlines, is responsible for some of increase in the emissions of CO_2 from the transportation sector. The growth in cruise ship holidays has also played an important role, as cruise ships emit more CO_2 emissions per passenger than any other travel mode. In addition, the degradation of marine environments contributes to the reduction in the absorption of CO_2. The growth in the motorization rate in developing countries also led to an increase of emissions in these countries.

The situation is especially alarming as worldwide travel demand continues to increase. In fact, tourism is one of the fastest growing industries in the world. According to the World Tourism Organization, international tourist arrivals rose from 277 million in 1980 to 1 billion in 2013 and are expected to rise to 1.8 billion by 2030. This trend is one of the main reasons for the expected rise in the global emissions for the transportation sector, which, according to the International Transportation Forum, was expected to grow 40% from 2007 to 2030.

The consumption of energy by the transportation sector is also becoming a pressing issue, as the majority of trips by motorized means of transport require nonrenewable sources of energy. According to the International Energy Agency, the road sector accounted for around 14.3% of the global consumption of energy in 2011. The sector consumption of energy per capita has grown 22.7% from 1991 to 2011. The use of energy by the aviation industry represented 11% of the global consumption of energy in 2011, but is expected to triple until 2050.

Technological Change

Technological progress is often seen as a solution to reduce the environmental impact of the transportation sector. Solutions such as improvements in airframe and engines and the use of fuel combustor technology, low-sulfur fuels, and noise abatement systems have reduced the impact of aviation. Automobile manufacturers have also been able to introduce less polluting vehicles using technologies such as three-way catalytic converters, exhaust gas recirculation systems, and secondary air injection systems. The use of quieter engines also reduces the emission of noise.

A number of alternative automotive fuels have also been introduced, such as electricity, hydrogen, and biogas fuels. An increase in the use of natural gas by buses can lead to a considerable reduction of the emissions of CO and CO_2 in urban areas. However, there are concerns that the use of these sources of energy may simply shift the pollution to other places. For example, in the case of electric vehicles, pollution may increase in the areas near the power plants.

Public Policies

Many researchers believe that technological progress alone is insufficient to achieve a substantial reduction in the environmental impacts of travel, given the growth in travel demand. For this reason, national and local governments around the world have started to implement policies to change people's travel behavior and regulate the environmental impacts of travel.

The definition of standards for air pollution is a common example. These standards can refer to the emissions of new vehicles produced by manufacturers. Standards can also be relative to the concentrations of pollutants in the atmosphere. These are set at a national level (e.g., the National Ambient Air Quality Standards, defined by the U.S. Environmental Protection Agency) or international level (e.g., the standards defined by the European Union's Directive on Ambient Air Quality and Cleaner Air). Similar standards exist for the emission of noise by new vehicles and measured levels of noise in specific areas.

An alternative is to promote the use of travel modes with lower environmental effects. In the case of short-distance travel, the aim is to achieve a shift from private vehicles to public transit or to active modes (walking and cycling). For example, the promotion of walking and cycling tours and the provision of shared cycle schemes in cities may contribute to the decrease of usage of cars or buses by tourists. For medium and long distances, the aim is to achieve a shift from air travel or cruise ships to railways. In recent years, the development of high-speed railways has provided a competitive alternative for air travel in several countries.

Some of the policies aimed at modal shift are regulatory, such as restrictions on the ownership of private vehicles or on the circulation of motorized traffic in certain areas or at certain times. Other policies are economic, such as taxes on the modes of transport or types of vehicles with highest environmental impact and subsidies on the modes or vehicles with the lowest impacts. The policies may have unintended economic effects in both cases. For example, the imposition of restrictions or taxes on transport services with a small demand may decrease their profitability and lead to their closure. This may decrease the accessibility of isolated places which were dependent on those services, with possible impacts on the local tourism industry and in other economic sectors. The dissemination of information about the environmental impacts of different modes of transportation is an alternative to regulatory and

economic policies.

Efforts to achieve modal shift should be complemented with other strategies. Policies may focus on the reduction the amount of travel. For example, the promotion of information communication technology may contribute to a reduction of the number of work and shopping trips. Land use policies at the urban and regional level are also important in order to ensure that roads, railways, airports, and flight paths are located away from residential or environmentally sensitive areas.

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See alsoClimate Change; Cruise Lines; Cruise Lines International Association; Cruise Tourism; Environmental Impacts of Tourism; Environmental Policies; Externalities; Sustainable Tourism

Further Readings

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