

Block 4

**Environmental Psychology and
Sustainable Living**

UNIT 8 EFFECTS OF URBAN LIFE*

Structure

8.0 Introduction

8.1 Population Density

8.1.1 Concept of Population Density

8.1.2 Factors Affecting Population Density

8.1.2.1 Physical factors

8.1.2.2 Socio-economic factors

8.1.2.3 Demographic factors

8.1.2.4 Political factors

8.1.3 Effects of Population Density on Animals

8.2 Effects of Urban Life on City Dwellers

8.2.1 Housing and Slums

8.2.2 Overcrowding

8.2.3 Water supply, Drainage and Sanitation

8.2.4 Transportation and Traffic

8.2.5 Power shortage

8.2.6 Pollution

8.3 Growth of Slums and Rural to Urban Migration

8.3.1 Characteristics of Slums

8.3.2 Migration

8.4 Environmental Solutions to Urban Population and Sustainability of Cities

8.4.1 Environmental Solutions to Urban Problems

8.4.2 Sustainability of Cities

8.4.2.1 Rent Control Act (RCA), 1948

8.4.2.2 Urban Land Ceiling and Regulation Act (ULCRA), 1976

8.4.3 Programmes of Slum Clearance and Construction of New Houses

8.4.3.1 National Housing Bank

8.4.3.2 Rajiv Awas Yojana/ Slum Free India

8.4.3.3 Sponge Cities Mission

8.5 Summary

8.6 Key Words

8.7 Review Questions

8.8 References and Further Reading

8.9 Additional Online Resources

Learning Objectives:

After having read this unit, you will be able to:

- Explain the concept of population density

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- Identify the factors related to population density
- Describe the effects of urban life
- Explain the growth and development of slums
- Elucidate the various issues of urban migration, and
- Gain insight into the environmental solutions to urban population and sustainability of cities

8.0 INTRODUCTION

People of a country are the fundamental asset who generate and utilize its resources. They are at the core of the heart of a country without which it becomes a mere abundance of natural resources. Ultimately a country is known by its people. It is important to know the major enterprise of a country- the distribution of women and men in a country, how many children are born each year, how many people die and major causes of the same; whether they live in cities or villages, major professions, status of employment and literacy rate, overall status of education etc. The scope of the present Unit begins with a discussion on population density and the factors affecting population density. The Unit engages with the effects of urban life on the city dwellers. The growth and development of slums is also highlighted. The Unit also throws light on the environmental solutions for a sustainable city.

8.1 POPULATION DENSITY

The world at the beginning of 21st century recorded the presence of over 6 billion population. The population of the world is unevenly distributed. George B. Cressey (an American geographer) commented that “*Asia has many places where people are few and few place where people are very many*”. This is true about the pattern of population distribution worldwide. Patterns of population distribution and density help us to understand the demographic characteristics of any area. The term population distribution refers to the way people are spaced over the earth’s surface. Broadly, 90 percent of the world population lives in about 10 percent of its land area. The 10 most populous countries of the world contribute about 60 per cent of the world’s population. Of these 10 countries, are located in Asia (World Population Review 2021)

The size of a population for any species is not a static parameter. It keeps changing with time, depending on various factors including food availability, predation pressure and adverse weather. In fact, these changes in population density give us some idea of what is happening to the population – whether it is flourishing or declining. However, irrespective of the ultimate reasons, the density of a population in a given habitat during a given period fluctuates due to changes in four basic processes, two of which (natality and immigration) contribute to an increase in population density and rest two (mortality and emigration) contribute to a decrease.

- (i) *Natality* refers to the number of births during a given period in the population that are added to the initial density.
- (ii) *Immigration* is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

- (iii) *Mortality* is the number of deaths in the population during a given period.
- (iv) *Emigration* is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration.

8.1.1 Concept of Population Density

Each unit of land has limited capacity to support people living on it. Hence, it is necessary to understand the ratio between the numbers of people to the size of land. This ratio is the density of population. It is usually measured in persons per square kilometre. The formula for calculating population density is,

$$\text{Density of Population} = \text{Population/Area}$$

There are different methods to measure population density based on the kind of information:

1. Arithmetic density: The overall number of inhabitants/ land area (calculated in square miles or kilometres).
2. Agricultural Density: The overall agrarian population/area of productive farming land.
3. Physiological Density: The overall population/area of productive farming land.
4. Urban Density: Population peopling a metropolitan region overall area of metropolitan region.
5. Residential Density: Population inhabiting a metropolitan region/area of housing space.
6. Ecological Optimum: Population density which is backed by the natural reserves.

8.1.2 Factors Affecting Population Density

Populations are unevenly distributed across the world and much dependent on variation in physical environment. Hence, it is necessary for demographers to understand how and where populations are distributed. Present spatial distribution as well as its projections for the future is integral to a demographer's work. Through understanding of certain patterns, and the factors affecting population density and population size significantly, it is possible to make projections of the growth (or possible decline) in the global population, and its spatial distribution. It will then become possible for policymakers to frame appropriate policies and strategies to protect the environment, plan for sustainable development, and prepare for modifications that accompany changes in population characteristics. Adverse physical conditions and lack of sufficient livelihood opportunities are primarily responsible for discouraging inhabitation of certain areas. There are four broadly grouped factors affecting population density:

8.1.2.1 Physical Factors Humans makes the choice of moulding space according to their cultural values. There are variations in habitations in response to environmental stimuli. They relate to the natural environment through settlements, which are physical embodiments of an ideal environment.

Climate is one of the most important natural conditions. It determines the nature of the flora of the region and influences agriculture. Climate also determines the type of animals that are associated with the region. Humans seek favourable climatic conditions in the

places they want to settle in. The climatic belts are the principal areas of most of the human activity. It is evident from the world's population distribution that the highly populated countries are mostly located in the tropical regions. A warm, soothing and comfortable climate attracts people. Regions with such climates provide favourable conditions for a wide range of fauna to thrive, supporting the life systems in the place. Agriculture and animal husbandry make it possible to provide food for large populations. On the other hand, places with extreme climatic conditions are usually scarcely populated because it is difficult to sustain human life in such places. Countries in the temperate regions are also well populated. The regions are colder than the tropical regions but are hotter than the polar zones. The polar zones of the Arctic and Sub-Arctic regions remain the least populated of all. The extremely low temperature is not favourable for habitation. Vegetation is scarce. Comparatively long cold winters and very short summers make living difficult.

Terrain is another important physical factor that affects population density. Navigable areas are more populated than rough ones. Mountains are less preferred because of lack of arable land. In addition, the cost of transportation, construction and agriculture are considerably higher in such places. In general, high altitudes also impose a physiological load on humans' capacity to adapt. This is because of reduced atmospheric pressure and low oxygen content. Higher altitudes, therefore, do not favour population and growth. Low lying plains and coastal areas are more favoured areas for human settlement. The Himalayas are thinly populated, the Ganges valley is one of the densely populated areas of the world. Coastal regions have the advantage of ocean-going trade and transportation and thus, the major cities of the world are mostly located in the coastal areas.

Water is essential for human survival. The ancient civilizations of the world flourished near rivers and the coastal areas. The Nile, Amazon, and Ganges river systems supported rich civilizations on their banks. Adequate rainfall favours vegetation and agriculture which in turn, determine a place's suitability for habitation. Because of lack of water, vast expanses of deserts are uninhabited. For the same reason, there is less population on the rain-shadow side of a hill or mountain; however, the leeward side is often densely populated. Thus, population tends to be concentrated in the well-watered river valleys and coastal plains.

Soil quality influences the density and distribution of the population. A substantial percentage of populations earn their livelihood from agriculture which depends on the quality of the soil. Food crops are grown on the soil, thus, is one of the most important raw materials required by population. The alluvial regions, deltas and the coastal regions of India support high population densities. On the other hand, mountainous regions, where soil erosion is a problem, such as the Terai region of Uttarakhand, or the sandy soils of the desert of Rajasthan, cannot support dense populations. However, scientific agricultural practices, with the aid of technology, have succeeded in converting low-yield soils to better quality ones. In the past, degradation or overutilization of soil led to the disappearance of flourishing civilizations.

Vast reserves of *mineral resources* encouraged the establishment of industries, which attracted settlements. In India, the Chhotanagpur plateau is an area rich in mineral resources. The higher population densities in the Chhota Nagpur Plateau of Jharkhand and in the adjoining areas of Orissa are largely due to the availability of minerals.

Location of a place is another significant factor. Proximity to major towns and cities favours concentration of population. Generally, staying within the city limits increases living costs. The city's periphery or nearby towns provide affordable housing facilities. Cheap and reliable transportation provide convenient means of commuting.

Natural disasters also affect population density. Frequent storms, earthquakes, floods, wild fires discourage formation of settlements as people migrate to safer places. There are many examples of destruction of settlements due to the natural disasters. Malpa, a village in Pithoragarh District of Uttarakhand was wiped away on 18th August, 2018 because of a catastrophic landslide.

8.1.2.2 Socioeconomic Factors

The choice of settlement is generally based on natural processes. However, with time, humans have been able to adjust and control the natural processes to some extent. Thus, the factors influencing the choice of a place for settling no longer depends entirely on natural conditions. As needs changed with the evolution of human society, social and economic perspectives gained primacy.

Economic activity is an indicator of employment opportunities. People in the rural areas are largely dependent on agriculture for their livelihood. If the land fails to support the rural population economically, or urban areas come up with more lucrative opportunities, people may choose to migrate to cities. Concentration of population in urban areas is an outcome of diverse economic activities and livelihood options offered by the cities. Therefore, population density in the towns and cities tends to be higher than in rural areas, and will continue to rise day by day. Industries are a large job market, and have attracted cheap labour for several decades. Inevitably, cities provide diverse livelihood opportunities in both occupational and personal domains.

Industries, for example, coal mining industries, hydroelectric power stations etc. in largely uninhabited areas attract migrants to these places, resulting in increase in population as well as population density. An example in this category is Dubai (UAE) - due to varied job opportunities and tourism industry, a large migrant population have settled in a city that was otherwise unpopulated, making the place one of the fastest growing cities in the world.

Social Organization of newly migrated people encourages community growth, participation and cultural expansion. People moving out of their native places tend to settle in such a community where the language, culture, food habits etc. are alike.

8.1.2.3 Demographic Factors

The demographic factors are the characteristics of the population. These factors have considerable influence on population distribution and settlement patterns. These include fertility and mortality trends and migration. Fertility and mortality together influence the natural increase in a region. Variation in the differential growth rates lead to changes in population density and distribution.

Migration has deep influence on population distribution. The push factors, or negative circumstances, at the place of origin tend to motivate people to leave their native places to newer areas. Better opportunities in distant lands also encourage migration.

People may choose to move due to land scarcity, shortage of work in current place of residence, insufficient wages or salaries, inadequate medical facilities and education,

etc. Expectations of a better standard of living are often the main factors that drive rural to urban migration. The migration process allows redistribution of population, increasing the population density.

Natural increase is the net outcome of fertility and mortality in a region. If in a region, the fertility level is high, the population of that place tends to increase. In such situations, mortality brings stability because of deaths. Epidemics and disease have always significantly influenced mortality levels. In earlier times, high occurrence of disease resulted in more deaths. To offset the loss, a high level of fertility was maintained. With medical advances, many diseases could be cured and the death rate fell sharply. In effect, the population grew. However, this created the problems of high population density and pressure on limited resources. With the introduction of contraceptives and with several family planning options available, birth rate began to go down.

8.1.2.4 Political Factors

War, political disturbance, conflict, and weak administration negatively affect population distribution. War and political conflicts take a great toll on human lives. Death rates are high, and people are forced to move out in search of safety. Mortality rates peak and the out-migration dominates. Safer locations experience a sizeable population growth because of the in-flow of migrants. This is also the situation in regions near the political boundaries of countries that do not have peaceful relations. Even if there is no conflict, the fear of one compels people to move, making these areas the least populated ones.

Political unrest and discrimination are detrimental to population growth. Clashes between different political parties or people with different religious beliefs have often resulted in a reduction of population in the affected area. Before settling in a new place permanently, migrant population looks for a place that not only provides economic opportunities but also provides a safe and healthy environment for wholesome living. A politically unstable region is unable to provide both these conditions and hence it discourages not only the in-flow of migrant population but also the already residing population which might be forced to leave the region in search of peaceful locations for settlement. Discrimination faced by migrants because of race, language, food, culture etc., discourages in-migration. This has reduced the population growth on one hand and newer settlements on the other.

Policies encouraging migration have often led to population growth in the destination region. International labour movements take place where rules governing cross-border migration are lenient. Migration helps in the redistribution of population. Policies that promote reduction in fertility levels, banning of infanticide, etc. also influence the population growth in a place. For example, China's strict enforcement of one-child policy succeeded in curbing fertility levels and controlling population.

8.1.3 Effects of Population Density on Animals

The growth rate of a population at time is defined as the change in numbers per unit population at that time period. The rate usually changes with time as the population increases or decreases. The growth rate of animal populations is a function of the population density. In most mathematical models of populations whose changes resemble those of actual populations, the growth rate is a decreasing function of density, meaning that as the population increases the growth rate decreases and vice versa. Records of actual populations can be used to test the relation between growth rate and density by calculating correlation coefficients for these two characteristics. The methods

of doing this are described and the limitations on the data are explained. The records of 111 different populations representing 71 species were analyzed by these methods. Of the 71 species, 7 were eliminated from further analysis because their census records were not significantly different from a series of random numbers, 47 had correlation coefficients that were negative and significantly different from zero, 16 had coefficients not significantly different from zero (all but one of these estimated coefficients were negative), and one, the world's human population, had a positive coefficient significantly different from zero. There were no differences between taxonomic groups (insects other invertebrates, fish, birds, mammals). The primary conclusion is that in most animal species a population's growth rate is a decreasing function of density. This explains the relative stability of animal populations, which never continue to increase at rates their fertility would allow, and rarely decrease to extinction. Tentative conclusions are presented regarding the processes regulating population numbers. Populations of herbivorous insects at low and moderate levels are regulated by disease, parasites, and predators causing mortality that is an increasing function of density. Favourable conditions may allow an increase in insect numbers so rapid that the population temporarily escapes regulation by its enemies. Non-territorial species of vertebrates are normally controlled by predation and when that fails by competition; in both cases juvenile individuals are most affected. In territorial vertebrates competition for suitable territories determines the size of the breeding population. Populations of vertebrate species (excluding man) are in general regulated by the production of adult individuals being a decreasing function of population density.

Check Your Progress 1

1. Complete the following:
 - a) Arithmetic density is _____
 - b) Residential is _____
 - c) Physiological density is _____
 - d) Ecological optimum is _____
2. How does terrain and location of a place affect population density?

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3. What are the political factors affecting population density?

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4. How does population density affect animals?

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8.2 EFFECTS OF URBAN LIFE ON CITY DWELLERS

The effect of urban life in India has been marked by regional and interstate diversities, large scale rural to urban migration, insufficient infrastructural facilities, growth of slums and other allied problems. The environment - behaviour interaction has been explained by various theories and the effects are well explained by the theories as follows:

Adaptation level approaches hold that individual becomes familiarized to a positive level of ecological stimulation. The shared incidence of too much or too slight stimulation is an prominence of stimulation, excess or under load and stress.

Stimulation approaches theorizes the bodily setting as a basis of sensual material that is vital to our welfare; multifaceted sensual material that comes from structures, streets, other persons and so on.

Behaviour setting theory states that there are reliable agreed designs of conduct which is in dissimilar locations. In every similar state there are recurring designs of behaviour which are predictable.

Integral theories are efforts to look at the filled difficulty of ordinary person environment effects. This has two sub methods. Firstly, the interactionist method, which suggests that the person and the setting are divisible objects but one inspires the other, they are repeatedly engaged.

Some of the important effects of intensive urban growth in the Indian context are as follows:

8.2.1 Housing and Slums

There is acute shortage of housing in urban areas and much of the available accommodation is qualitatively sub-standard. This problem has tended to worsen over years owing to rapid increase in population, fast rate of urbanization and proportionately inadequate addition to the residential provisions. Rents are disproportionately high. Private developers and colonizers find little profit in building houses in cities for the poor and the lower middle class, and they concentrate in meeting the housing needs of the rich as it is gainful. With large scale migration to urban areas, many find slums as the only option left, despite all its disadvantages. Slums are characterised by sub-standard housing, overcrowding, lack of proper ventilation, sanitation, electric, roads, cooking arrangements and drinking water facilities. Basic hygiene seems drastically poor giving rise to diseases, environmental pollution, demoralisation and many social tensions.

The aim of the eleventh Sustainable Development Goals is to make “cities and human settlements inclusive, safe, resilient, and sustainable”. The first target of the goal aims at “access for all to adequate, safe and affordable housing and basic facilities and upgrade slums by 2030”. India’s slum population standing at nearly 35%, (World Bank Data, 2018). As per Census, 2011, percentage of slum dwellers to total population in the cities is highest in Jabalpur (44.71%), Greater Visakhapatnam (44.6%), Greater Mumbai (41.84%), Meerut (41.74%), and Raipur (39.58%).



Figure 8.1 View of Dharavi, one of Asia's largest slums located in Mumbai

Source: Dharavi India - Dharavi - Wikipedia

8.2.2 Over Crowding

In major cities in India like Bombay, Kolkata, Pune and Kanpur, 85% to 90% of the households live in one- or two- room set- ups (Handbook of Urban Statistics, 2019). In somehomes, five to six persons live in one room. Over-crowding encourages deviant behaviour, spreads diseases and hinders mental well- being. One effect of dense urban living is people's apathy and indifference. **Once** people adapt to poverty, attitudes and behaviours that initially developed in response to economic deprivation are passed on to subsequent generations through socialization.

Oscar Lewis' 'Culture of Poverty' (1966) was an attempt to develop a model of the behaviour of the poor in a variety of cultural settings. It is a distinct way of life that develops among the lowest stratum in capitalistic societies in response to economic deprivation and inequality. One of the crucial elements of the culture of poverty is that the slum dwellers are disengaged and not integrated to the major institutions of the society.

8.2.3 Water supply, Drainage and Sanitation:

Uninterrupted 24x7 water supply is a scarce scenario in India. Intermittent supply results in a vacuum being created in empty water lines which often suck in pollutants through leaking joints. Many small towns have no main water supply at all and are dependent on the wells. Drainage situation is equally bad. Because of the non-existence of a drainage system, large pools of stagnant water can be seen in the cities even during summer. There is total lack of motivation to tackle the basic sanitation needs of the cities. The spread of slums in congested urban areas and lack of civic sense among the dwellers further adds to the growing mound of filth and diseases. Attitudes towards cleanliness and community awareness about basic hygiene are extremely poor in most of the areas.

8.2.4 Transportation and Traffic:

Absence of planned and adequate arrangements for traffic and transport is another problem in urban areas in India. Majority of people use buses and tempos in comparison

to rail. The increasing number of two wheelers and four wheelers make the traffic problem worse. Moreover, the number of buses plying the metropolitan cities is not adequate and commuters have to spend long hours to travel. Such huge traffic and vehicles also aid to substantial rise in air pollution.

8.2.5 Power Shortage:

Insufficient power supply is another disadvantageous aspect of many urban areas in India. The use of electrical gadgets has increased in cities, and establishment of new industries and the expansion of the old ones has also increased dependence on electricity. Conflict over power supply between two states often creates severe power crisis for people in the city.

8.2.6 Pollution:

Several cities discharge 40 to 60 percent of their entire sewage and untreated industrial waste into the nearby rivers. Urban industry pollutes the atmosphere with smoke and toxic gases from chimneys. All these increase chances of diseases among the people living in the urban centres. According to UNICEF, lakhs of urban children die or suffer from diarrhoea, tetanus, measles etc. because of poor sanitary conditions and water contamination. Newer techniques for waste management, new technology for garbage-disposal and fundamental change in the municipal infrastructure and land-use planning are emergently needed.

All the above-mentioned urban problems indicate issues with migration and over-urbanization, industrial growth and lack of management, administrative issues and lack of proper timely urban planning. Systematic development of urban centres and creating job opportunities, regional planning along with city planning, encouraging industries to move to backward, less populated areas and adopting a pragmatic Housing Policy etc. are the need of the hour.

Check Your Progress 2

1. Define overcrowding.

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2. List some of the effects of intensive urban growth in the Indian context.

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8.3 GROWTH OF SLUMS AND RURAL TO URBAN MIGRATION

Slums are dilapidated and thickly populated or overcrowded areas with lack of adequate public utilities, yet their existence in the city does serve a purpose, especially for the urban poor and migrants coming for some job opportunities in the city. It is in slums

where economically backward people like industrial workers, casual labourers, hawkers, vegetable-sellers and several other unorganized sectors live over years and generations. These slums play a very vital role in orienting new migrants to the urban environment by providing social comfort and support and also integrate themselves with the mainstream of city life.

The figures relating to urban population living in slums are not accurately available, however, it is commonly accepted that nearly one-fifth of the total urban population in India lies in slums. The Task Force on Housing and Urban Development, appointed by the Planning Commission of India, estimated nearly 23 per cent or over 3 crore 60 lakh people are the urban slum-dwellers in India. The proportion of the slum-dwellers increase with the size of the urban population. Cities with less than one lakh population have 17.5% cities with the population between one lakh and ten lakhs have 21.5%, and cities having more than ten lakhs of population have 35.5% slum-dwellers in the total population. There are higher estimates in the metropolitan cities in India (NITI Aayog, 2021).

In India, the slums are usually classified into three categories:

- (1) The old building which have become decayed in course of time;
- (2) The slums which are characterised by poor and inadequate housing conditions, constructed legally around mills and factories,
- (3) The slums which are illegally come up in different parts of the city through unauthorised occupancy of open land.

8.3.1 Characteristics of Slums

The major characteristics of slums, common across cities, are enumerated below:

- 1) Dilapidated and poor houses in slums are made of scrap materials. These are often raised on unauthorised land.
- 2) High population density and housing leads to over-crowding and congestion
- 3) Lack of public facilities, such as, drainage, sanitation, water taps, electricity, health services etc.
- 4) The slum-dwellers are functionally integrated with the mainstream city life, but have high incidence of crime, juvenile delinquency, prostitution, drug use, beggary, illegitimacy, illicit etc. in most of the cases.
- 5) Slums have a culture of their own, as Lewis (1966) has referred to as the ‘culture of poverty’.
- 6) Largely slums are subject to neglect and apathy of the larger community. These areas are markedly considered inferior, making slums subject of social isolation. This compels the slum-dwellers to survive in such compromising conditions with almost no effort towards improvement.

8.3.2 Migration

Migration is a global phenomenon, with movements both within nations and internationally across borders. Migrants make up near about one-seventh of the world’s population. Population diversity in most developed countries can be attributed to

international migration, whereas in developing nations, it is mostly internal migration that contributes to this diversity. Migration to “global cities” – those that are advanced in terms of job opportunities, economic strength, political and cultural hubs of international significance – is increasing, with migrants.

Migration can be classified in several ways (UN DESA, 2016; McKinsey Global Institute, 2016):

- By political boundaries – Based on political limits and the boundaries crossed, such as districts, counties, state borders and international boundaries.

Internal migration – Migration occurring within a country by crossing political boundaries, either within a state or between states, it may be urban to rural, urban to urban, rural to rural, or rural to urban.

International migration – Migration occurring across country boundaries. Such migrants are known as immigrants (coming into a foreign country) and emigrants (leaving their own country). This also includes continent-to-continent migration.

- By movement patterns – Based on classifying people according to their social status, travel points and periodicity.
- Step migration – Migration initiating from a small settlement and moving to a larger one in the urban hierarchy over the years. (UN DESA, 2016; McKinsey Global Institute, 2016)

8.4 ENVIRONMENTAL SOLUTIONS TO URBAN POPULATION AND SUSTAINABILITY OF CITIES

It is often said that the battle for achieving the Sustainable Development Goals (SDGs) will be won or lost in cities, which is why SDG 11 – making cities inclusive, safe and sustainable – is so important. By 2050, more than two thirds of the world population are projected to live in urban areas, and most of this urban growth will take place in lower and lower-middle income countries. But densely built-up urban spaces tend to come with challenges of their own. Therefore, there is a need to start ensuring today that these urban areas will be inclusive, safe, sustainable and resilient.

8.4.1 Environmental Solutions to Urban Problems

People modify environment as per own requirement. Population and pollution related problems in cities toll huge number of environmental resources destroyed brutally. As discussed, development of slums, overcrowding, scarcity of pure water, inadequate sanitation facilities, crisis of uninterrupted power supply are consequences of mismanaged and unplanned use of resources. Different measures at the administrative level have already prevailed and various awareness programmes have also been organized over years. However, it is not only about the administrative policies and measures that can single handedly solve the issues, but it is at the hand of citizens who can change their attitude towards utilization of resources in more and more judicious way. Optimal utilization of both environmental resources may not wash out all problems but can show a path towards betterment. Celebration of environmental days, weeks are of no use until the behaviour changes. People need to be more cautious about waste management, rain water harvesting, proper use of tap water, following traffic

rules, regular pollution check etc. Various programmes have been organized by educational institutions where students voluntarily participate to generate mass awareness. Creating a better future for them is also the responsibility of adults. Therefore, irrespective of age and gender, people need to be more aware and follow prevailing rules; only then administrative efforts towards implementation of environmental laws and policies would succeed.

8.4.2 Sustainability of Cities

This section concerns the social legislation relating to urban land and housing that are essential for sustainability of cities. Measures are needed to combat crises and for sustainability of cities and also for sustainable development of a nation in changing environmental and demographic characteristics.

The Constitution gives the fundamental right of the freedom of movement to every citizen of India, but does not guarantee the right of housing to either the urban-dwellers or the village people. The Constitution says that the responsibility of urban development and related welfare programmes has been assigned to the State Governments. The social legislation governing rent and sale of land and houses include the following two important acts, namely, Rent Control Act (RCA), 1948, and Urban Land Ceiling and Regulation Act (ULCRA), 1976

8.4.2.1 The Rent Control Act, 1948

The Rent Control Act was enacted with a view to control and regulate the rent of the houses. It was first enacted in the then Bombay State, in 1948, and later on in several other states. The Rent Control Act also protects the tenants from the atrocities of the house-owner, especially in the sense that the owner of a house can neither force the tenant to vacate house, nor can he raise the rent of the house at his own will. Further, the Rent Control Act also imposes the responsibility of repairs of the house on the owner rather than on the tenant living in it. Systematic studies evaluating the impact of the Rent Control Act have revealed that the Act has not been able to bring about a solution to the problem of urban housing in the desired direction. Kiran Wadhava's (2002) study reveals that the said Act has hardly been able to make any noticeable progress in solving the problem of urban housing. In fact, there have been some latent consequences of this Act. The owners are now not eager to rent out the house, as it will never come back in their possession due to the conditions of the Rent Control Act. Similarly, now people do not like to build houses with a view to earn rent. These issues ultimately add to the scarcity of houses. It is also observed that the owners hardly show any interest to repair houses which have already been rented out, simply because all such expenses are finally going to be a burden on them alone, with faint possibility of raising the rent. Owing to such apathetic attitude of the owners towards timely repairs and renovations, a large number of buildings in cities have deteriorated and become dangerous for living.

The ill-effects of the Rent Control Act are not systematically recognised and in order to put a curb on such effects, the Ministry of Urban Development has taken some serious steps. In 1987, The National Commission on Urbanisation was appointed under the Ministry of Urban Development, Government of India. In the interim report, the National Commission on Urbanisation made several recommendations relating to the amendments in the terms and conditions of the existing Rent Control Act relating

- (1) the continuation of the protection of the interests of the existing tenants
- (2) the inclusion of the possibility of raising rent
- (3) the separation of the rules the regulations of renting houses for commercial purposes from houses to be rented for residential purposes
- (4) the provisions of providing incentives to build new houses, etc.

It is believed that the inclusion of these amendments will certainly lessen the adverse effects of the existing Rent Control Act.

8.4.2.2 Urban Land Ceiling and Regulation Act, 1976

The second important step relating to the management of following three fundamental objectives:

- a) Redistribution of land
- b) Prevention of speculation in land
- c) Regulation of construction on vacant land

Under the provisions of this Act, the excess land, i.e., land excluding the prescribed size of the available plot, can be procured by the local authorities or the State Government for wider public interests. Usually, the excess land under this Act is procured for the construction of houses for the urban poor and the low-income groups. Moreover, this Act imposes restrictions on the sale of excess land so as to curb speculation in urban land. Critics have pointed out that despite the existence of this Act, the prices of land in every city have reached far beyond the capacity of common-man. Moreover, the land procured for construction of houses for the urban poor and other public utilities is also negligible in size. In several cases, the owners of excess land have been successfully escaping the demands of the Land Ceiling Act through unjust practices.

8.4.3 Programmes of Slum Clearance and Construction of New Houses

In the face of rapid urban growth, a large section of urban population is living in slums and suffering from acute shortage of houses, water-supply, sanitation and other public facilities. These urban problems have assumed massive proportion, warranting social legislation and special attention in our national planning. Following from these efforts, one of the significant programmes is the slum clearance scheme and programme of construction of new houses for the urban poor and the low-income groups. Under this scheme, low-cost houses, equipped with water-closet, water-tap, sanitation and drainage facilities are made available to the poor people, who can afford to pay a token amount as rent from their small earnings. Moreover, under the scheme of slum clearance, an entire area inhabited by economically and socially weaker sections, is provided with these common utilities to be shared by all. These programmes under the slum clearance scheme are subsidised to provide assistance to the State Governments for construction of one crore and 40 lakh new houses at the rate of Rs. 5000 per house for the benefit of the urban poor and the low- and middle-income groups. In addition, the State Governments and the local bodies of the cities also provide necessary funds for execution of such projects. It should, however, be noted that the voluntary agencies have still lagged behind in taking up the activities of slum clearance and construction of

houses for the poor people (Press Information Bureau. Government of India, Ministry of Housing and Urban Poverty Alleviation, 2012).

The following schemes have been executed in several cities with financial and other support from the state governments and local bodies for the construction of new houses:

- a) In 1952, a scheme for the construction of houses for the industrial workers came into existence.
- b) A scheme was introduced in 1954 for the construction of houses for the low-income groups.
- c) Since the implementation of the Second Five Year Plan (1956), the scheme of slum clearance and improvement came into existence on a regular basis.
- d) The Life Insurance Corporation of India started giving loans since the Second Five Year Plan to the middle-income groups for the construction of houses.
- e) Since the Fifth Five Year Plan, the programme of building houses for the higher-income groups were taken on hand with the objective that profit earned through such projects will be diverted for the construction of houses for the urban poor and the low-income groups. Special instructions were issued to the Housing Urban Development Corporation (HUDCO) in this respect.

8.4.3.1 National Housing Bank

Systematic studies have revealed that most of the advantages of these schemes have been taken away by the middle- and high-income groups. The plight of the urban-poor has more or less remained the same. One of the greatest obstacles in effective implementation of the slum-clearance programme has been lack of adequate funds. The issue received significant attention in the Seventh Five Year Plan. It led to the establishment of a National Housing Bank (NHB) with an assistance of Rs. 100 crores from the Central government. It is proposed that the objectives of the National Housing Bank will be as follows:

- To provide a national body for financing the programmes only for the construction of houses
- To raise the sources for procuring finance for the construction of houses and make effective use of all such sources
- To raise financial institutions at local and regional levels for advancing loans for construction of houses and institutions giving loans for other purposes
- To establish meaningful links between financial institutions advancing loans for construction of houses and institutions giving loans for other purposes

8.4.3.2 Rajiv Awas Yojana/ Slum Free India

Rajiv Awas Yojana is being implemented by the Ministry of Ministry of Housing and Urban Poverty Alleviation in partnership with the communities, urban local bodies, state and central governments. It aims for a slum-free India where the slum dwellers will get the house ownership and have access basic amenities like water and electricity.

8.4.3.3 Sponge Cities Mission

With rapid urbanization, many cities in India witness floods and water logging during the monsoon months, for instance, Mumbai, Delhi, Gurgaon, Bangalore, to name a few. Thus, to manage urban flooding in metro cities, the cities will be designed (a

sponge city) in a way that will passively absorb and use the clean rainwater through ecologically friendly ways like, rain water harvesting, creating rooftop gardens, rain gardens, green space and blue spaces (ponds and lakes).

All these efforts are made with a hope that conditions of the slum-dwellers and the urban dwellers can be suitably improved so that they can also lead a fuller urban life and keeping in perspective the environmental, cultural, financial and administrative sustainability of the cities.

8.5 SUMMARY

To sum up what we have learnt in this unit, here is a quick recap:

- Urbanisation refers to a social process (United Nations, 1996). In demographic sense, it exhibits the proportion of the urban population to the total population of a society. In this sense, it also refers to a way of life typically associated with the city. The haphazard and steep rise in the population of big cities has led to the notion of over-urbanisation in India, which, in the societal context, may not be true.
- At present, less than one-third of the total population of India lives in towns and cities.
- The industrial-urban India has given birth to several environmental and social problems among which the problems of slums, crimes, housing, pollution and inadequate public utilities have become grave.
- In the absence of a national policy on urbanisation, the matters of urban planning and development remain largely confined to the efforts of the State Governments. The schemes of slum clearance and housing for the urban poor and the low-income groups are in a way addressed the solution of these problems.
- The five-year plans have also made significant efforts through making provisions of financial support to several programmes of urban renewal. Various government schemes like Rajiv Awas Yojana/ Slum Free India, Sponge Cities Mission, etc are aimed to ameliorate the quality of life of the city dwellers and to make the cities resilient and sustainable.

8.6 KEY WORDS

Population	: The way people are spaced over the earth's surface.
Population Density	: The ratio between the numbers of people to the size of land
Overcrowding	: When more people are located in a given space which is found to be not tolerable from a health perspective
Urbanization	: The process where cities are formed and witnesses' rapid growth because of the population shift from rural to urban areas
Slums	: Dilapidated and thickly populated or overcrowded areas with lack of adequate public utilities develop in cities due to rapid urbanisation

Migration : The movement of people both within a country and internationally across borders.

8.7 REVIEW QUESTIONS

1. What do you mean by population density? Enumerate the factors affecting population density.
2. What are the effects of growing population density in Indian context?
3. Discuss the impact of migration in development of urban slums.
4. How can the standard of living of slum dwellers be improved?
5. How is environmental management possible for sustainability of cities in India? Discuss in the light of legislative measures.

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8.9 ADDITIONAL ONLINE RESOURCES

- Slums in India. A Statistical Compendium (Government of India, Ministry of Housing and Urban Poverty Alleviation, National Building Organisation) untitled (nbo.nic.in)
- Oscar Lewis on *Culture of Poverty* (1966). Lewis (1966).pdf (wisc.edu)
- Housing Poverty in Urban India

- Addressing Slum Redevelopment Issues in India
<https://smartnet.niua.org/sites/default/files/resources/Dow-Slum-Redevelopment-India.pdf#:~:text=The%20slum%20redevelopment%20component%20of%20this%20scheme%20proposes,to%20as%20little>



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UNIT 9 ARCHITECTURE DESIGN AND ENGINEERING FOR HUMAN BEHAVIOUR*

Structure

- 9.0 Introduction
- 9.1 First Impression: History of the “Role of Entry” in Architecture
- 9.2 The Reflection of Tradition and Culture Through Entrances
- 9.3 The study of Meaning in Architecture Representational and Responsive Meaning
- 9.4 The effect of Architecture and design on patients of mental health
- 9.5 Architectural Design Process Based on Human Behaviour
- 9.6 Summary
- 9.7 Keywords
- 9.8 Review Questions
- 9.9 References and Further Reading
- 9.10 Additional Online Resources

Learning Objectives

After having read this unit, you will be able to:

- Appreciate the architectural forms to evaluate and analyse designs and the way they provide meaning and impact human minds
- Explain how entrances best function as a combination of aspects of history, architecture, and psychology
- Discuss the consequences of high rise or multistorey buildings on people
- Gain insight into designing spaces for patients with mental-health care facilities, and
- Analyse the different aspects of design that impact the mental and physical health of people

9.0 INTRODUCTION

Psychology is directly related to culture, art, and architecture. The appropriate use of these various artistic components, such as colour, space and size have the capacity to enlighten the atmosphere and influence people in a variety of ways. Humans are exposed to various architectural features in their living and work settings through spatial configuration, furniture, lighting, acoustics and views in our homes and offices. These architectural designs can inspire humans in negative and positive ways. Even though we may pay little attention to everyday and seemingly innocuous shifts in our exposure to our surroundings, these subtle shifts can have tremendous impact on our thoughts and behaviour.

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Architecture and design are as old as human civilization, and it is an activity which has had considerable impact on our tradition. The term design or its equivalent did not emerge in most European languages before the sixteenth century, but many people started designing artefacts and buildings long before the term “design” was institutionalised in education and professions. Architect, designers or builder roles evolved to become two separate occupations, leading to the need for a term to describe the occupation of drawing or planning, before construction. Since then, the term architect and design has become widely used both in the design profession and in everyday life. These terms are extensively used in many different professions and describes a broad range of activity. Architects and designers play a major role in interior design, industrial design, engineering design, graphic design, urban design, information system design, and interaction design of buildings, houses, and park etc. They have a strongly rooted connection between the meaning of plan and intention, where intention and plan both belong to the domain of design thinking. They are able to design buildings whose frameworks help to promote the creativity and reduce social and internal dissonance of people and try to increase its efficiency. Hence, the major roles of architects and designers correspond to transforming ideas and beliefs into a plan for implementation through concept, planning and analysis as well as execution, action and synthesis.

Architects believe that good designs are settings for human activities that help interactions among users, increase productivity, and raise their satisfaction, unlike weak design patterns which hinder users' performance, creativity, reduce satisfaction, and even undermine people's safety and security. Thus, architecture and the designing process is a challenge towards designers estimating whether a design will be good or poor before its realization. Research conducted over the past 40 years is applied to many buildings and classrooms to study its effect on creativity, efficiency, productivity, happiness and wellbeing etc (Ghaffarianhoseini et al., 2018). Such studies on architecture and designers come under the branch of architectural psychology, which comprises three major domains of study namely *built environment*, *spatial interaction* and *natural environment*.

Over the years, the field has evolved, and a variety of investigations have emerged which has emphasized that an architectural space should be clearly perceptible, as it is human tendency to pay attention toward special environmental and graphic features such as light, colour, and form (Rapoport, A., 2016). This is an important field of study as properly articulated architecture reflects the psychology of its designers, and reflect the human element. Architects and designers perceive their building designs based on the human psyche because building represent the physical illustration of what has been perceived by the human mind. The traditional and modern roots of architecture of any country or region can be traced back to the *individual expression of a particular designer*. Thus, art, artefacts, buildings and architecture offer a vehicle for conveying the deepest unconscious thoughts of human beings. The Unit will introduce to the effect of architecture and design on human behaviour.

9.1 FIRST IMPRESSION: HISTORY OF THE “ROLE OF ENTRY” IN ARCHITECTURE

The process of creating architectural space is synonymous to defining or enclosing built environment. The natural world and the human-made world (such as a building or

a temple etc.) expresses the basis of human arrival and departure. The “entrance” is the central point which is of immediate importance and intense scrutiny. It is the noticeable and critical part of the physical space and building which has an impact on the architectural composition of which it is simultaneously a functional, emotional, and aesthetic part.

Well-designed buildings with an impactful entrance can invite, orient visitors, restrict trespassers, prevent accidents, save energy, enhance positivity, represent owner’s value, offer a viewpoint, and present an artistic taste. But then again, a bad entrance can destroy many other aspects of the building. For example, careless designs such as repetition of the same entrance gives an impression of ordinary appearance. So, an architect must be aware of many things while designing an entrance. Some of the perspective to keep in mind while designing the entrances are mentioned below :

1. **Appearance** Appearance of the entry is important as it affects the whole design of the building and physical space. When a utilitarian function is considered, an everyday or ordinary entrance is created. However, temples and corporate buildings give importance to the entry point as it is the most attractive, and major feature of the building. It is the transfer point between the inside and outside. Thus, it is important to integrate the entry to the whole because overlooking a building’s structural or aesthetic integrity can create a banal or ordinary looking entrance which impacts the human use of that physical space and building.
2. **The Proportion and Scale Dimensions** Entrances define people’s impression and orientation towards the buildings. The entrance of the building should focus on the aesthetic, appeal, safety, cost, maintenance, and accessibility. So, the design of the entrance requires organisation of the above-mentioned conflicting interest. In terms of aesthetics scale of an entry point of the building, it can be an area of possible arguments, as it should be attractive but also for human usage. For example, a person looking at the building evaluates the size, requirements of doors, safety point and the aesthetic value. A person faraway from and perhaps unfamiliar with a building should also be able to identify its entrance and find it safe and attractive. Thus, many criteria such as safety, appeal, relative scale of people, number of people using the entrance, and the scale of the building are all important considerations point of an entrance. The relationships of scale to a building can make an entrance important and visible. A badly selected scale of an entrance disturbs the quality, appeal, and value of the entire building as well as the quantity of its use.
3. **Accessibility** The visibility and accessibility of an entrance impacts the user as it may distract them from the usefulness and impression of the building. The first impression and value of the building is recognised while entering the building. So, when we enter the building many parts such as plaza, stairs, organisation of sitting, bridge, or even pots/sculpture announce the accessibility of that building. For example, the waiting area or lounge area in the building within the view of the entrance function as a connecting space between the entrance and the building. The relative importance of these elements may vary

with different building types. So, a separate stair for people with disability before entering the building point towards the accessibility of the building. Good design of the entry sequence is crucial to solve various needs of the people, resulting in increasing the accessibility of various people using the building.

Thus, all of the above-mentioned points are considered by architects and designers who are aware of both aesthetic and functional considerations of the building. Building and its elements conveys meaning, both aesthetical and functional, so that a person can comprehend it while using the building. However, people do not realize while attributing meaning to the building elements, as that of the architect who creates misunderstanding regarding the building. Thus, it is very hard to design an entrance which satisfies, appeals and provides security as well. The important thing is how the meaning of the building itself can be expressed and easily understood by people using the physical space.

9.2 THE REFLECTION OF TRADITION AND CULTURE THROUGH ENTRANCES

Buildings and their elements express the traditions and culture of societies all over the world. But nothing is certain as change, as traditions and cultures are changing so is the architecture of that period. Thus, architecture becomes a gesture of a whole society. It is the duty of the designers to study the changes in the building of the past as well as the building of today to observe the changes in competence, impression and aesthetic value. Building reflects the *need, thoughts and the ideals* of people of their time, they reveal the *tradition, trends* and reflect upon the *characteristics of people* living in that physical space. Consequently, the study of many aspects of building such as that of the entrance, which is the first impression of the building is important as it reflects the art and culture which is intertwined in a complicated system of *symbolic implication*.

During the third millennium in India, there was a great splendour of civilisation with signs of detailed and thoroughly maintained planning. The grid planning gave indication of a division into neighbourhood in accordance with the productive specialisation of the inhabitants, alongside the interpretation of the distance between home and workplace. *Planned functionalism* and *a sense of collective utility* defined the concept of the city. Unlike the modern multi-storey buildings in India, the houses in ancient times had only one story or two with open courtyards, windows and doors. The entrances were placed on streets that were considered least important, which resulted in uninterested walls lined along primary roads/streets creating *privacy* and *hidden entrances*.

Meaning was derived in a different way from the sacred monuments of Indian architecture, from that of the western world. The basic grid pattern combined with symbolic geometrical figures were the fundamental theme of Indian architecture which had facades along the main street and the buildings and were defined by big entrances. A *kudu* which is the horseshoe arch depicted in Figure 9.1 served as a frame for the entrance. The doors were sometimes rectangular, but most often they were enclosed in arches (see Figure 9.2). It became one of the most prevalent motifs in Indian architecture.

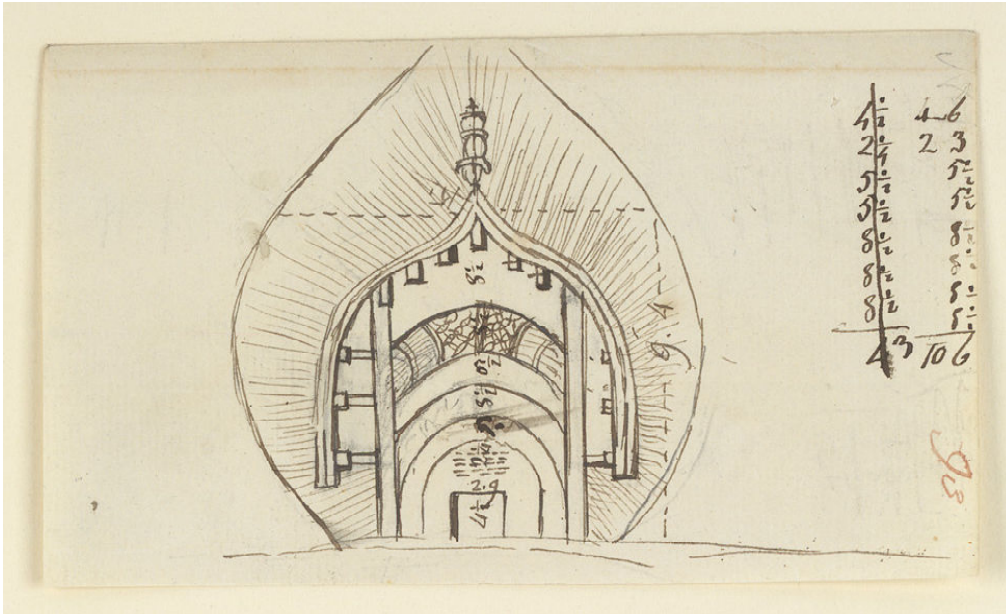


Figure 9.1 Entrance to Lomas Rishi cave, Barbara Hills, Gaya (Bihar)

Source: <http://www.bl.uk/onlinegallery/onlineex/apac/other/largeimage66562.html>



Figure 9.2 Nasik, Sangharama, Chitaya

Source: <http://archives.njit.edu/vol01/etd/1980s/1989/njit-etd1989-007/njit-etd1989-007.pdf>

Several famous stupas were built in the second and first century. They were of several types with different forms and sizes such as such as *stambas* (isolated pillars), *chaityas* (sanctuaries), and *Viharas* (monasteries). In order to protect and orient the stupa, it was surrounded by a *vedeka* (fence) with open *toranas* (gates) at the four main directions north, south, east, and west. The stupa at Sanchi (Figure 9.3) was originally surrounded by a railing with four gateways built of wood, but the railing was later replaced by a similar structure in stone. This was done to provide a suitable ground for religious ceremony where each gate consisted of two square vertical posts with built-in horizontal bars. The gates of stupas were carved in the form of female figures or animals (usually lions and elephants), which usually led to a focus on imagistic over-expressive function and a more static and pure forms of earlier carvings.



Figure 9.3 Sanchi Stupa

Source: <https://www.britannica.com/place/Great-Stupa-Buddhist-monument-Sanchi-India>

The Muslim conquerors occupied Northern India and Islamic architecture developed in that part during the 11th century. They built several mosques on Islamic tradition with tombs constructed in cubic and octagonal shapes, and palaces decorated with ceramic tiles inspired by Persian architecture. Taj mahal is an example of such a beautiful architecture where doorways developed from the original horseshoe arch frame to a pointed arch. The largest archway is in the centre and performed the important function of the building's main entrance.



Figure 9.4 Taj Mahal

Source: <https://edition.cnn.com/2017/10/18/asia/taj-mahal-india-cultural-wars/index.html>

Check your progress 1

1. How buildings reflect the human psyche or deepest unconscious thoughts?

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2. Elaborate the role of entrances in architecture?

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3. Take any sacred monument of Indian architecture and reflect on its characteristics and its impact on human mind.

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9.3 THE STUDY OF MEANING IN ARCHITECTURE- REPRESENTATIONAL AND RESPONSIVE MEANING

The architect tries to instil meaning not only through the building but also through different elements of the building and architectural symbols. The architect or designers try to serve two meaning through building that are *representational meaning* and *responsive meaning*. The representational meaning is anything that is *represented in human organism as a concept or an idea*. For example, a rectangular object is usually recognised as a door. The responsive meaning refers to the *internal responses to the already internal representations which can be affective, evaluative, or perspective in nature*. They are basically thoughts of contempt, disgust or love regarding the value of represented environment or ideas concerning what should be done about the environment. The responsive and representational meanings are related and usually the responsive meaning depends on the representational meaning. They both are useful in predicting human behaviour and the architectural form usually is helpful, as it suggests how people will react to their designs.

The architectural forms present themselves to viewers without acting as signs or any sort of symbols, which might suggest a meaning. But usually, people predict or recognise these forms on their past experiences and background, which will differ from that of the designer or architects. Thus, the architects and designers are careful as they create an impact through their design. While the architect may intend to evoke people's emotion or reaction through a big and attractive entrance building but some people might attend to other elements or features such as an outstanding shape and form or the colour and texture of the building instead. People can judge the characteristics of the building as well as reveal the architect's psychological make-up, or personality through the various elements in the building. In addition, the elements and features of the building reflect the attitude towards the societies as well. But the relationship works both ways as since society also reacts and shape the attitude of the architect and/or designer.

When representation is formed it could excite, please, or disgust the views. The responsive meaning is usually formed after viewing a form which produces an internal response concerning our representation. A colourful building has the ability to attract viewers and excite them, so that they enter the building, walk closer to the building, or walk through the building. The responsive meaning is the immediate reaction or emotions

that humans have towards the architectural form. When people first encounter an architectural form such as a water park, amusement park or eating joints with attractive symbols, they might be excited, happy and thrilled. After these emotions, then they bring values, criteria, or attitudes to bear on the representation. The reflections or perspective while they observe a building determine their own mind regarding if it is exciting, boring, pleasant, disgusting, ordinary or interesting. Lastly, after the representation has been perceived, and evaluated, the next behavioural response is to decide what action to take. This behavioural response is most significant to architects, as they foresee that their buildings will be used for the purpose they intended.

Architects are also concerned with the *expressive qualities* that an architectural form reflect. Expressive quality denotes “a property of shape evoking human response”. The human response towards an architectural form is usually to a totality, an experience of the whole. It is the direct experiences without being critical, judgemental and recording the visual shapes and visual organisations of architectural forms, without any biases. Gestalt psychologists have mentioned that expressive qualities relate to configurations in our experience. Architects and designers have the ability to change the expressive quality without changing the structure. For example, if two buildings of the same size, shape, material and structure are presented in front of viewers but one is black, and the other is white. Then in that case, the whole property of the object is affected by the colour change. Thus, the human response is altered by architects without changing the main structure. The different colours evoke different visual experiences, as they have very different expressive qualities. Unfortunately, nowadays the modern or multi-story, corporate building, parks, hospital, shelters, rehabilitation centres/building etc. has little or no meaning for people. Some buildings do not represent the activities and have no relation to their form, making it difficult to anticipate or even decipher the form's intent. This leads to isolation, powerlessness, and a sense of helplessness. Thus, a feeling of being connected can be employed by depicting forms and meaning through structure.

Modern architecture such as the high-rise buildings and multi-storey buildings have consequences, as they have a negative psychological impact on humans. They cause dissatisfaction, stress, behaviour problems, poor social relations, reduce helplessness and hinder child development. Gupta (2019) mentions some of the fears and anxiety provoking thoughts of residents living in high rise buildings:

1. The tragedy of people falling and jumping from the building which causes fear and nightmares.
2. The fear of being trapped inside the building during a dire such as an earthquake or a fire.
3. The fear of the building falling during an earthquake.
4. The fear of the building being attacked.
5. The feeling of having no privacy because of the sheer number of people living in the building, which means living amongst strangers which increases the fear of crime, less social support, and the absence of community in the midst of many.
6. The sheer number of people living in the building also increases the chances of becoming ill from a communicable disease generated by others. Air and touch borne flu, pandemic like COVID-19, chickenpox, etc. spread more easily when people share the same hallway, lift, stairs, door handles and elevator buttons.

Gupta (2009) posits that even though some of the fear and anxiety provoking thoughts can be realistic because so many people live together in the building, *but high-rise buildings have positive outcomes too*. Tall building has *smaller footprints* than low risings buildings and they *occupy less land area*, so residents have more space for parking, green space etc. Their usual *central location is an advantage* for those who desire it, and these buildings offer a great view to residents and relative *urban privacy*. Residents living in the upper reaches have *less noise pollution* from outside and *breather clearer air*. The high population density may promote better *social interaction* and the residents/neighbours offers greater choice of friends and acquaintances for social support. The outcome of living in such a building also depends on various reasons (such as location, neighbourhood, population density, and surrounding area) and non-building factors, including characteristics, features, qualities of the residents themselves, and the surrounding physical context (services and transportation facilities etc). These factors moderate the relation between living in high-rise and outcomes of living in low rise or a bungalow. For example: controlled and guarded entrance reduces crime and the fear of crime in the building as compared to the single-family resident. Thus, the high rise/multi-story buildings have both negative and positive effects, and this has been explained in Box 9.1.

Check your progress 2

1. What is the difference between representational and responsive meaning?
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2. What are the positive outcomes of living in a high-rise building/multi-storey building?
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3. How is the development of children affected by living in a high-rise building/multi-storey building?
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Box 9.1 Factors in high rise buildings that effect Human behaviour

The consequences of living in high-rise buildings are many which are caused both by the architectural design and moderated by non-architectural factors. ***High rise buildings influence resident's moods, thoughts thinking, and imagination, spatial cognition & perceptions order than the apparent size of their unit & their visual complexity.*** Very few studies have understood the experience of living in high rise dwelling, so some questions remain unanswered. The visual complexity and the view were the strongest predictor of

pleasure and arousal. But some questions remain unanswered such as- “Do the residents fear fires, earthquake or falling? Do people on floor, experience the many floors above them as a sort of psychological crushing burden?”

A lot of studies also suggest that many *senior citizens and young singles prefer high rise buildings*. A lot of joint families and family with children also prefer high rise building, but it depends upon the location, resident's lifestyle, the yard and gardens surrounds the buildings. However, the ecological constrains of crowding, the high-rise building, and unsafe streets, scarce open space all seem to conspire against the urban child's natural tendency to play with cheerful spontaneity. So, the *children's play time is severely affected* as parents in high rise buildings prefer keeping their children indoor due to the stranger living in the building, so it leads to a lot of fundamental and behavioural issues among children. Close protection inside their house or sending them floors away without supervision is a choice that the parents might have to make. This leads to either restricted play, being alone or being under-supervision outside their house. Thus, children in high rise building have lower levels of motor ability than children reared in single family dwellings. Children who resided in high-rise (versus non-high-rise buildings) were reported to demonstrate twice as many psychological, emotional and behavioural issues such, as anxiety, fear, bedwetting and temper tantrums. Similarly, studies mention that (Gifford, R., 2007; Saegert, S., 1979) children who lived in higher-storey verse lower storey buildings were having more behaviour and psychological issues such as hyperactivity and hostility. However, if the children have access to open spaces such as park, garden, play area then these problems may be improved.

Furthermore, high-rise buildings have *poor social relations* with other people in the building and relationship with neighbours in the buildings. They have more acquaintances but very few friends, so they meet a lot of people because of higher density but the friendship is more superficial. Additionally, a very interesting finding from Gupta (2109) mentioned that people living in lower floors have good friendship and relationship due to easier access to garden. They reported having three times as many friends in the building as did high-rise residents. So, people who lived in higher floors knew more of their neighbours, but women who lived in lower floors had closer relations with their neighbours. Also, high-rise residents experienced more freedom, privacy, independence, less social interaction and involvement than residents living on lower floors.

Another issue is the *increased anonymity* which accompanies the larger number of people in high rise buildings. The existence of shared public spaces in the building might hide criminal activities from the surveillance of most potential observers. Two potential moderators that lower the fear of crime rate in high rise buildings are when: 1. Residents assessed the local crime problems as more seriously, and 2. When it was unrelated to their own history of being crime victims.

Lastly, the topic of *suicide among high rise buildings leads to a lot of debates*. The substitution hypothesis holds that individuals who decide that they donot want to live find a way, regardless of the possible means. The substitution hypothesis emphasizes that if one means of suicide is removed or absent then

people will look for or will use another means to their end lives. The *substitution hypothesis* has been most frequently debated in the context of gun control issue but can also be applied to high-rise buildings, as media has reported suicide cases by jumping from tall buildings. A very controversial view also suggest that tall buildings do encourage or facilitate suicide among people due to the availability that would not have otherwise occurred.

Source: Gupta, S. K. (2019). Fusion Reviews on Human Living Beings in High-Rise/or Tall Residential Buildings-Social Economical & Psychological Parameters.

9.4 THE EFFECT OF ARCHITECTURE AND DESIGN ON PATIENTS OF MENTAL HEALTH

The external environment plays a crucial role for human growth and development as it determines the way people begin to understand and interact with the external world. Studies have mentioned that the physical environment has a direct effect on individual's psychological and physiological health. Thus, understanding the aspects of design and architecture are beneficial and detrimental to humans as it is crucial for mental well-being and physical health. These designs are important as it improves in reducing patients' levels of stress and enhancing their recovery.

Historically, in the 19th century in the United States, design and architecture once was thoughtfully considered as a means of promoting mental wellness and psychological well-being for people who were dealing with mental health issues. This idea was born out of the philosophy that changing the patients' external environment leads to better health and outcomes. Stressful environment such as places with loud noises, lack of privacy, lack of social support, confusing layout, and lack of daylight and no access to nature can have detrimental health outcomes. Whereas implementing and designing the physical space with sunlight, lesser noise, security, communal spaces, art spaces all have a positive impact on mental health. Moreover, the design and architecture of the physical space goes beyond the physical architecture and into the space which brings calmness and meets the needs of the people. The physical space and environment should bring into the equation the human interaction, so that it meets the human need of interpersonal interaction.

Dr. Thomas Story Kirkbride, American psychiatrist, was one of the first who was known for his influential idea that design and architecture can create a calm, stress relieving, and healing environment for those suffering from mental illnesses. The external environment such as proper light, nature, and purposeful work and social atmosphere instills hope of getting better and cured from the psychological disorder, which eventually leads to mental wellbeing. Dr Kirkbride created a model where he envisioned a therapeutic environment with garden, proper sunlight, grandiose architecture, fountains, and lush landscaping. The hospital was set on a large land on the outskirts of the city with land for farming with gardens with proper security. The symmetrical wings from the administrative building allows for an abundance of light from the large windows and proper air ventilation. The model achieved great success with a recovery rate of 70-75% but the Kirkbride plan failed due to overcrowding and financial problems. The Kirkbride institution eventually held triple the number of patients than it was originally designed for which led to decrease of adequate care, lack of privacy and overcrowding. Even though the Kirkbride model disintegrated due to financial reasons but the optimistic

and moral treatment with thoughtful architectural design cured a large number of patients. But in the 20th century, the shift towards the pessimistic custodial treatment model dismissed the idea that ‘insanity’ can be treated. Patients were held indefinitely in institutions which led to isolation, punishments, and often abandoned and neglected, and this resulted in a negative public perception of the asylums, and mental-health care in general. Thus, the transition from institutionalized care began to slowly shift towards deinstitutionalization with the development of psychiatric medicines as treatment for severe mental illnesses which was resulting in changing public perceptions of the asylum and mental health care. This idea was challenged by the Community Mental Health Centers Act of 1963 which led to the rise of community mental health care facilities, outpatient facilities, and informal support networks which believed that community care would be more compassionate, supportive, therapeutic, and cost-effective than hospital care. If adequate community care is provided to people such as access to outpatient treatment, support, and access to hospital care, unnecessary incarceration and stigmatization can be avoided. Thus, lessons from the past to be avoided, so that mental health care facility designs can be built accordingly to shift towards designing better spaces as a necessary aspect for effective care. As poorly designed spaces negatively impact mental health treatment.

Managing and eliminating stressors, which are linked to poor health outcomes, is the goal of supportive healthcare design. The presence of loud noises, loss of control, a lack of social support, confusing wayfinding, glaring lights, and lack of access to nature or other distractions in healthcare facilities results in stress for patients. Thus, the importance of design choices for employee is important, so that they feel comfortable and in control of work. A well-designed architectural building is beneficial to the clients they serve, as well to promote a less stressful work environment to prevent high staff turnover. Connellan et al., (2013) found common themes regarding the intersection of architecture, design, and positive mental health outcomes:

1. **Safety, security and privacy** A key finding in the literature is on the importance of security and safety implemented within the design of the facility and therapeutic space. Architectural design for safety involves easily observable patient living in a non-crowded space or living areas by staff member. An increase in population density in the facility or space has the tendency to increase the stress level and negatively correlates with perceived privacy and control. The feeling of losing control over the environment and increasing stress violence are factors associated with overcrowded in-patient ward. Thus, increased feelings of privacy and control over personal space and environment can be incorporated into the design. So, architects and designers should be mindful and maintain dialogue with patients and mental health professionals to indicate the use of the intended space, make areas distinct through colors, materials and better lighting, and lastly define a space that provides different tactile experiences and dedicated areas for social interactions.
2. **Noise and Environmental Stressors** Noise and unwanted sound in a mental health facility, hospital, etc. can act as an environmental stressor which has the potential to cause psychological harm. The architects and designers should be mindful of creating these spaces meant for recovery as excess of unwanted noise, both visual and auditory adds levels of stress and impacts sleep. Moreover, the built environment plays a major role as it becomes more demanding and plays a role in mental health, specially in urban areas. The

built environment in urban areas, as opposed to rural areas, is designed to elicit responses, and alter behavior (such as that of billboards and flashing lights for example), and that can create a feeling that one's actions are not determined by their own. Studies have argued that there is a strong relationship between the environment and the brain, where the actions and thoughts of individuals are not the result of cognitive planning, but rather automatic responses that are mainly triggered by the environment. Thus, this creates an onslaught of demands from the environment and the ability to inhibit those demands decreases, and people are less likely to be able to cope.

Golembiewski (2010) also forwarded the significance of architectural design in psychiatric care facilities and suggested that minor design choices can have a great consequence and lead to better health outcomes. Golembiewski (2010) suggested understanding the environment from a salutogenic perspective, that is when the internal and external environment remain predictable, comprehensible, manageable, and meaningful. Thus, using **Antonovsky's salutogenic theory** as a tool for the design choices of mental health care facilities can create a more calming, stress relieving and healing environment for patients. So, a sense of coherence can be used to alleviate mental health symptoms so that people feel in control of their environment and have the opportunity to grow and develop in that setting. Thus, in order to create a sense of coherence and be mindful of patients needs the architect or designers should consider the environment's aesthetics, order, safety needs, and spaces for visitors, and the opportunity for patients to have their personal belongings. This model helps to understand the relationship between the built environment and the patients need and it is transactional and not fixed.

3. **Space and layout** Just like finding one's way in life or direction, finding one's way through the physical environment or space is important for autonomy and the feeling of being self-reliant. Studies have argued that space differentiated by color and light are easily navigated with prominent landmarks, which leads to an improvement of the experience of healthcare environments. Color helps in navigation as it makes the space more friendly, calming, and welcoming. So, color design can be implanted as a means of promoting better wayfinding. However, understanding what sort of space design and layout that works for each population is important for maintaining a sense of autonomy, efficiency, and supportive health care facilities.
4. **Nature** Providing access to nature (garden, plants, flowers etc.) positively affects the mental and physical health of the client. There is a psychological and physiological need for nature, which results in lower levels of anxiety, blood pressure, and heart rate in the people. Nutsford et al. (2013) conducted a study which measured the proximity to urban green spaces and its effect on mental health, and concluded that there is a decrease in anxiety, panic and mood disorders with a decreased distance of usable green space.
5. **Light and Atmosphere** The impact of natural light and atmosphere has been studied in clinical studies and studies conducted on cancer patients. The study observed the impact on multisensory environment and patients' level of anxiety and stated that the room with natural lights, music, aromas, taste, and tactile sensations is thought to evoke a sense of rest and recuperation. There is still

scope and needs for more research on this area and how effective this type of environment would be for different populations, including those with dementia or individuals on the autism spectrum. To understand the affect of atmosphere, Radley and Taylor (2003) studied the effects of the physical setting, that is the hospital ward on patients' recovery through the medium of photography. They concluded that most of the patients captured their bed indicating it as a place of comfort and discomfort. The photography technique helped in visual communication for experiences that is challenging to verbalize. The technique was helpful for the patients, as the photographs with their visual commentary together became extremely significant. They not only described the object or spaces but their positive and negative associations in the hospital to explain their lived experiences of pain, discomfort, happiness, and sad moments.

Lastly, Connellan et al. (2013) mentioned that with architecture and design, the human need for *interactions and community* is significant for therapeutic process. Architecture on its own does not support or generate positive mental health outcomes but it is often in combination with a supportive social environment as well. Thus, people in the environment are just as important as the physical structures. Interestingly, recent research point towards the role of art therapy and open art studios (with studio space, setting and characteristics), as it helps in releasing stress and calming the patients. It provides energy from the people working in that space. More information on this is elaborated in Box 9.2.

Check your progress 3

1. Define Antonovsky's salutogenic theory.

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2. Write a short note on the effect of architecture on mental health patients.

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3. Mention any 3 themes of Connellan et al., (2013) which describes the intersection of architecture, design, and positive mental health outcomes.

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Box 9.2 Open Art studios and impact on mental health

Several studies on art projects in hospital environments have mentioned the positive impact on patients as it reduces stress levels, improves mood, accelerates recovery speeds, reduces need for medication, and improves communication (Staricoff, 2006). The positive impact of art on mental health patients led to the origin of open art studio approach. The act of making art together break down the inhibitions and barriers among people, allowing them to connect to each other on an empathetic basis. This physical space for an interpretive process enacts an art as therapy approach, where the process of drawing and flexible community-driven atmosphere is paramount to the therapeutic work. Moon (2016) stated that the core of the *open studio belief is the concept of relational aesthetics and developing interpersonal connections with people*.

This space is facilitated by an *art therapist* who is encouraging and helps in improving self-efficiency. The role of the therapist is to offer a chance so that the client feels understood through their artwork, and for the art therapist to be creator and collaborator. So that the clients can engage with the materials and processes within the studio.

The studio centres around the *idea of space* and how the clients and art therapist come together to engage in that physical environment. The open studio approach provides the space and conditions available for the artmaking process, so the *ambiance and functionality* of the studio space is very important. The studio should reflect creativity, flexibility, a non-judgement and autonomous environment and inspiration. Open art studios are usually placed in community-based settings such as rehabilitation centres, galleries, hospital, academic settings and educational settings.

An ideal studio space provides a *sense of flexibility* where people can come anytime and share the space, so there is *no sense of privacy*. These studios have grand spaces with ample lighting, storage and vast number of materials. But studios within a budget might have smaller spaces but these spaces reflect creativity and people make use of an unideal environment. Architects and designers use their artistic sensibilities to reimagine and reconceptualize workspaces to intentionally cultivate a therapeutic space. The architects and designers have the potential in converting a seemingly uncontrollable environment. By installing art in the room so that it forms a connection for the people using that space and those who visit it. Architects and designers have emphasized that even the creative presence matters more than the physical features, with imperfect environments maintaining the creative energy of the space. The type of spirit and energy in the space is more important as it impact people in different ways. Architect and designer should be mindful of the type of clients and neighbours using that space so that they feel connected to that space because they are the creators of that space.

9.5 ARCHITECTURAL DESIGN PROCESS BASED ON HUMAN BEHAVIOUR

As we have already discussed that humans spend large part of their lives at designed spaces whether for work, residential settings, commercial settings than natural settings,

which has an impact on their behaviour. The buildings regulate the course of our lives such as a comfortable space satisfies one's physical need and improves our mood. Thus, the structure of the building and its feature impact human mind. So, an architect uses this strategy to look whether the paths are already being formed by behaviour, and then enact them, rather than creating idealized path structure that ignores history, culture, tradition and human nature. This is called "pave the cow path", that is identifying the desired lines and then making paths and lastly formalising it so that it is easier for people to use it and follow it.

Architectural spaces, shapes and qualities inspire human experience and behaviour as they have the power to control the spaces of the built environment. Studies have mentioned that mostly people preferred positive spaces because it led to high level of social interaction than spaces that encourage movement rather than dwelling in it. Positive architectural space is designed to help and encourage a specific goal, experience and purpose. The space should be suitable for the people using it and should match the requirement of the user for the activity that they are using the physical space for. The architect should know the purpose, specifics, goal and the activities that might take place in that setting so that they can enhance it accordingly. For instance, the below Figures (9.4 and 9.5) are examples of positive and negative architectural spaces.

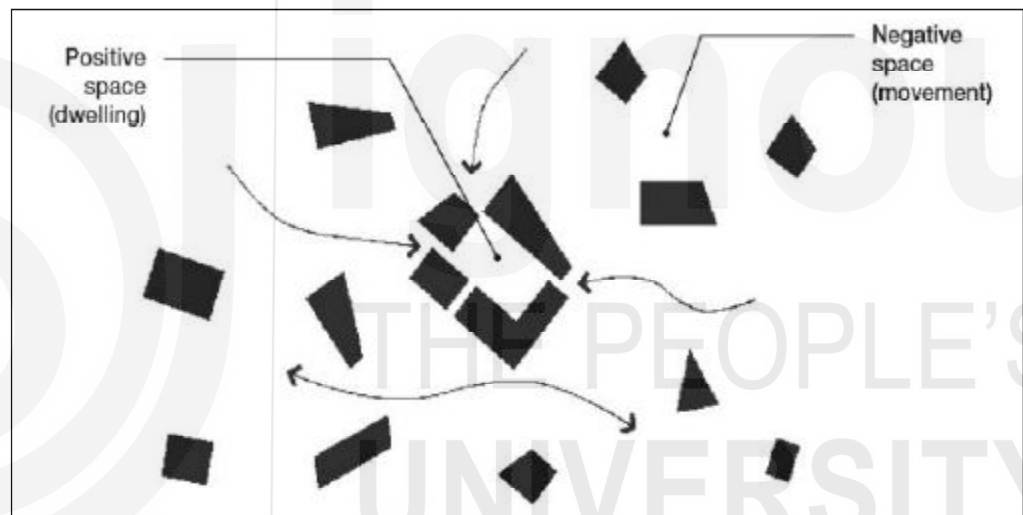


Figure 9.5 Depicts the positive and negative architectural spaces

Source: Ibrahim, A. M., & Mikhail, R. A. (2016). Architectural Design Process Based on Spatial Human Behavior Parameters through Computational Methodology. In *5th International Conference on Mediterranean Cultures in Art and Architecture, MCAA 2016, Science and Technology Theme* (pp. 0-15). Faculty of Fine Arts, Alexandria University.

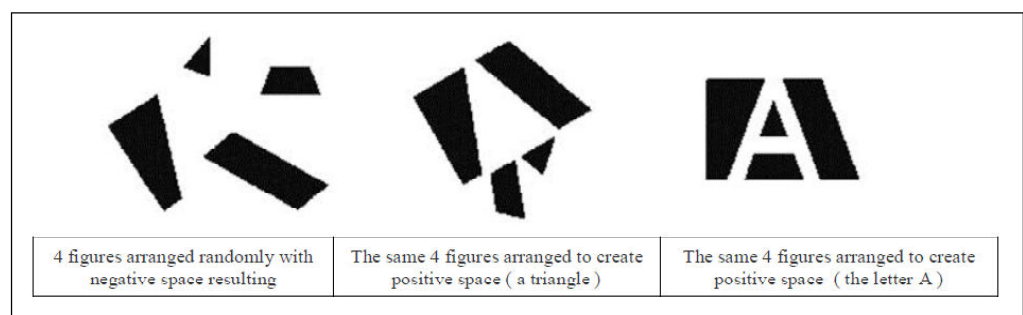


Figure 9.6 Depicts how 4 different shapes can be converted to create a positive and negative architectural space for the need of the users.

Source: Ibrahim, A. M., & Mikhail, R. A. (2016). Architectural Design Process Based on Spatial Human Behavior Parameters through Computational Methodology. In *5th International Conference on Mediterranean Cultures in Art and Architecture, MCAA 2016, Science and Technology Theme* (pp. 0-15). Faculty of Fine Arts, Alexandria University.

Designers and architect create more than a building as they promise to make the building attractive and functional so that they can change behaviour and attitude of people. Their behaviour and techniques of design range from high level aspirational strategies to specific tactics. They want to create a space which has the potential of involvement, interaction and knowledge sharing, basically which fulfils the basic human need. The sociological needs, psychological state and physiological determinants are three important criteria which affects one's attitude towards the surrounding environment and determine the human behaviour.

So, sociological human need that is the social interaction that can be improved among the users through designers' perception to the interior spaces they exist in. First, **maintaining privacy** by protecting the individual's physical, visual and sound transmission. So, for example in offices spaces using partitions, providing private spaces to people and planning according to space functions and human needs. Second, **interaction levels** affect privacy as people cross boundaries with others by coming in contact within their intimate and personal space. Thus, interpersonal cooperation is important which can be achieved by providing a space for interaction and achieving group task. This particular space can expand and provide various other purposes, such as a social space for different social activities. Third, **territoriality** is the control over space by an individual or a group. If privacy is achieved, then territoriality takes place. Lastly, **crowding** happens due to ineffective use of personal, social and territoriality, which reflects poor external social contact. People respond differently to crowding. So, if the activity is fun such as a concert, then crowding is considered attractive, but crowding can be irritating and frustrating if it appears in a confining way.

The architect also tries to understand the **psychological human response** to the environment which are complicated. It is divided into three psychological states that are **perception, cognition and spatial behaviour**. The perception is observers process towards their environment through different senses of vision, hearing, smell, taste, and touch, so that the observer can gain information about the place. Secondly, the cognition takes place after gaining this sensory information and then mentally processes the information which includes processes such as thinking activities, memorising or analysing the information. Lastly, the spatial behaviour means reaction and responses to the environment information depending on the perception and cognition. By using the secondary processes that involve motivation, effect and development and the psychological stages, the architect and designers create environmental stimulation. The environmental expectation with the gained experience and interaction with the environment are considered by the interior designers to create physical space. Sensation act as an integration point between the environment expectation and human perception of space.

Lastly, the physical needs of humans while planning the physical space are extremely important such as functionality, ergonomics, life safety, and health concerns. The designer must create his vision for the project while keeping in mind the activity taking place in the space and the reaction of the user as space is linked with behaviour patterns of the people. The functional efficiency occurs when interiors environment responds to the basic human functional needs such as vision, hearing, stability and mobility. These needs relate to the human body requirements while supporting the psychological needs in the interior space

planning, well-being and productivity. Various studies mention that productivity increases with environment improvement while following some specific environmental conditions that help in raising users' competence related to his/her needs:

1. Suitable lightings for the task being performed.
2. Facilities matching the need of the user's expectation and comprehension such as desk, table, lights, charging points, windows etc.
3. Proper human mobility and attention to the handicapped/disabled users which removes accessibility barriers.
4. Productivity range of motion that allow users to feel at ease and comfortable while using the physical space.
5. A suitable auditory environment that allows ease of communication, with limited noise annoyance and avoids distraction.

The **ergonomic design** helps the user in achieving his needs in the environment. Ergonomics strongly recognizes that the environment does influence and impact human behaviour, so they use this combination of data to create designs which are both humanistic and functional. This includes design aspects like space, furnishings, and environmental variables such as temperature, sound, humidity, and ventilation requirements to be sensibly endorsed to fulfil the purpose of the human body. The goal is to plan for the intended activities, furnishings, and finishes that are convenient to user expectations. Lastly, the **life safety and health** are another aspect is the priority of the architect and designers. They provide individual with an appropriate facility with an assurance of acceptable travel path to the user of that space, and a clear indication of a safe exit meaning. It is important to design the guiding mechanisms that are visible and clearly stated as people do not have the opportunity to decipher codes which may show safe passage at panic or emergency. It is necessary to control the visual environment as humans have a natural response towards danger sensing which transforms to fighting or escaping. So, the application of the design concept and the overall planning along with the user is important. Safety and health aspects are more effective in a space where the needs meet the desired activities and task, resulting in reducing the physical harm. Health aspects means to be aware of selection materials like paints, adhesives, smoke alarms that may cause headache. Some of the architects and designers cannot control these aspects because health and safety aspects are less noticeable to people than life safety. However, designers must be conscious of material selections as it impacts on occupant's health.

9.6 SUMMARY

To sum up what we have learnt in this unit, here is a quick recap:

- The physical environment and forms hold a lot of significant impact on physical health and mental health well-being.
- Entrances as an architectural element have played a crucial role in design development throughout history and in each religion the concept of entry design reflects its own meaning.

- Entrances are located according to local belief, superstition, purpose and they function not only as a passage but also as a gathering point for religious ceremonies.
- Architecture and design have power to confuse, frustrate, irritate and disorient humans.
- Better and positive architectural design with planning, natural light, calming atmosphere, a sense of control over surroundings, safety, and access to community can encourage healing and aid in recovery.
- Poor design has been shown to increase blood pressure, anxiety, and increased risk of infections, while exposure to views of nature and art is linked to positive outcomes, aids in stress easing, and reduction in stay at hospitals.
- Architects and designers can promote wellness by creating psychologically supportive environmental surroundings.
- When architects are designing spaces for mental health care facilities or people in general, it is important to have information regarding the requirements of the user, and research available that they can utilize to implement designs that are conducive for supportive environment.
- The architects are trying to incorporate the multisensory perspective into their work to promote the development of buildings and urban spaces according to the psychological, physiological and mental needs of the people, so that they can perform better socially, cognitively, and emotionally.
- A positive architectural design depends upon the degree to which it creates an interface between users and the environment, and a successful design and physical environment have been designed with the intention to fulfil human need and influence their behaviour in a variety of ways.

9.7 KEYWORDS

Architecture	: Refers to the various private, religious, public forms that are constructed and designed for optimization of people's ordinary and everyday life.
Cognition	: Refers to the mental processing for the primary sensory information.
Environmental Expectations	: It is developed over time out of interaction and experience with the environment.
Built Environment	: It refers to the man-made environment that provides physical space for human activity ranging from buildings, parks or green spaces to cities, corporate buildings, and neighbourhood.
Architectural Aesthetics	: It refers to the beauty of the space by using the design's main concepts such as shape, space, line, pattern, texture and colours and the design principles of need, purpose, balance and scale.
Behavioural aspects in Architecture	: It refers to the behavioural need of the users, their needs on a social and personal level as well.

Crowding	: Refers to the excess of undesired external contact.
Perception of Environment	: Refers to the process of becoming attentive to space by acquiring information through the sensations of hearing, sight, touch, smell, and taste.
Spatial Behaviour	: The reactions and responses by people to the environmental information gained through cognition and perception.

9.8 REVIEW QUESTIONS

1. Explain the relationship between architecture, culture and human behaviour.
2. Why study of architecture an important field of study?
3. Why are well designed entrances given importance in the study of architectural psychology?
4. Elaborate on the accessibility and appearance of the entry point of the school building while designing an entrance?
5. Write a short note on “*Buildings and their elements express the traditions and culture of societies all over the world*”.
6. Explain and give examples of the representational and responsive meaning from your surrounding.
7. Why is it important for buildings (for example: schools, hospitals, multi-storey building) to reflect meaning regarding the purpose of the building?
8. Mention the consequences of multi-storey or high-rise buildings.
9. Write a short note on the negative relationship between crime, poor relationship and obstacles in child’s play while living in a high-rise building.
10. “Changing the patients’ external environment leads to better health and outcomes”. Elaborate on the above-mentioned line.
11. Why meeting the needs of people using the space an important aspect while designing a space for patients with mental illness?
12. What are some of the major themes that the architects should be aware while building architectural form for mental health care facilities?

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9.10 ADDITIONAL ONLINE RESOURCES

- Places and Spaces and the Behaviour They Create
<https://www.youtube.com/watch?v=aNSNyJBK0VY>
- How Architecture Affects The Way You Feel || Environmental Psychology and Architecture
<https://www.youtube.com/watch?v=yWuqOliY1z4>
- How Architecture Impacts Our Mental Health

UNIT 10 GLOBAL WARMING AND CLIMATE CHANGE*

Structure

- 10.0 Introduction
- 10.1 Global warming and climate change
 - 10.1.1 Debates about global warming and climate change
 - 10.1.2 Climate change education for youth
 - 10.1.3 Education for Action
 - 10.1.4 Urban Cities and Climate change
- 10.2 Key factors for Sustainability
- 10.3 Carbon Footprint
- 10.6 Summary
- 10.7 Keywords
- 10.8 Review Questions
- 10.9 References and Further Reading
- 10.10 Additional Online Resources

Learning Objectives:

After having read this unit, you will be able to:

- Explain the long-term consequences of human activities on climate change and global warming
- Identify the causes and the impact of global warming and climate change on the ecosystem and human beings.
- Developing and advocating a sense of collective competence among children, youth and adult about climate change
- Address the issues of urban heat, water problem, carbon dioxide emission, sanitation and waste in urban cities, and
- Gain insight to achieve sustainability and appreciate the new techniques for green infrastructure and green spaces.

10.0 INTRODUCTION

The changes in Earth's weather patterns as a result of global warming can be noticed all over the globe. Many of these changes have never been seen or experienced before, are causing profound effects on humans. Global warming has a cyclical effect on our environment. As the Earth is warmed from the increasing presence of greenhouse gases in the atmosphere, this causes glaciers to melt which raises sea levels worldwide. Also, global warming causes the permafrost to melt, which releases vast stores of methane gas, thus further enhancing climate change. Human activities, especially the

burning of fossil fuels since the start of the Industrial Revolution have increased atmospheric carbon-dioxide concentrations. There are several “natural” causes of global warming, which humans are not directly responsible for, such as volcanic eruptions, forest fires, etc. which release large amounts of methane gas and carbon dioxide into the atmosphere every year. So, global warming is taking place, and unless we change our habits and our dependence on fossil fuels our planet will become permanently altered even further. The government, international/national organisations, state and local governments, large and small industry and businesses, non-governmental organisations, and individuals need to make concerted effort to educate the public, children and youth to combat the problem of global warming and climate change, as it can exacerbate the damage both to the natural world and to human communities. Thus, effective policies are essential if reduction of global warming is to be brought under control and reducing the carbon footprint and promoting environmental care. To arrive at global solutions, it is necessary to address human attitudes and behaviour towards environment. Hence, focusing on sustainability is the only way forward as it will help to meet the needs of the present without compromising the ability of the future generations to meet their own goals (United Nations, 1987). In this Unit, we will know the impact of human activities on climate change and global warming. The significance of advocacy of collective sense of competence among different communities is emphasized. Lastly, new techniques for green infrastructure and green spaces will also be highlighted.

10.1 GLOBAL WARMING AND CLIMATE CHANGE

Global warming and climate change refer to an increase in average global temperatures. These phenomena have been occurring since the beginning, as there have been periods of heating and cooling of Earth’s atmosphere. It can be described as a struggle between human progress (in the form of industrialization, population increase, and economic growth) and nature, which will not only affect the atmosphere and the sea but also the geology of the Earth. As predicted by the IPCC (Intergovernmental Panel on Climate Change), Earth’s mean temperature has already increased by 0.6°C in the 20th century (IPCC 2013). The emissions of carbon dioxide due to the excessive use of fossil energy will change the climate and will result in increased temperature up to 3°C . It might be accompanied by an increase of extreme climatic events, and alteration of global precipitation patterns. This will cause huge changes to the civilization, but the impact on the society is extremely uncertain.

The term global warming can be traced back to at least the mid-1970s and can be defined as an “increase in the temperature of the troposphere, which has occurred in the past as a result of natural processes but is now believed to be accelerating as a result of increased emissions of greenhouse gases associated with the burning of fossil fuels” (Schneider, 1989). Even though several greenhouse gases occur naturally but their atmospheric concentration has increased in the last few years. There are several reasons for the same some natural and some produced by the humans. Natural phenomenon that contributes for global warming are volcano, ocean current, earth’s orbital change and solar variations. The human causes are deforestation, increase on the use of fossil fuel, mining etc. Figure 10.1 mentions the framework regarding the causes and consequences of global warming.

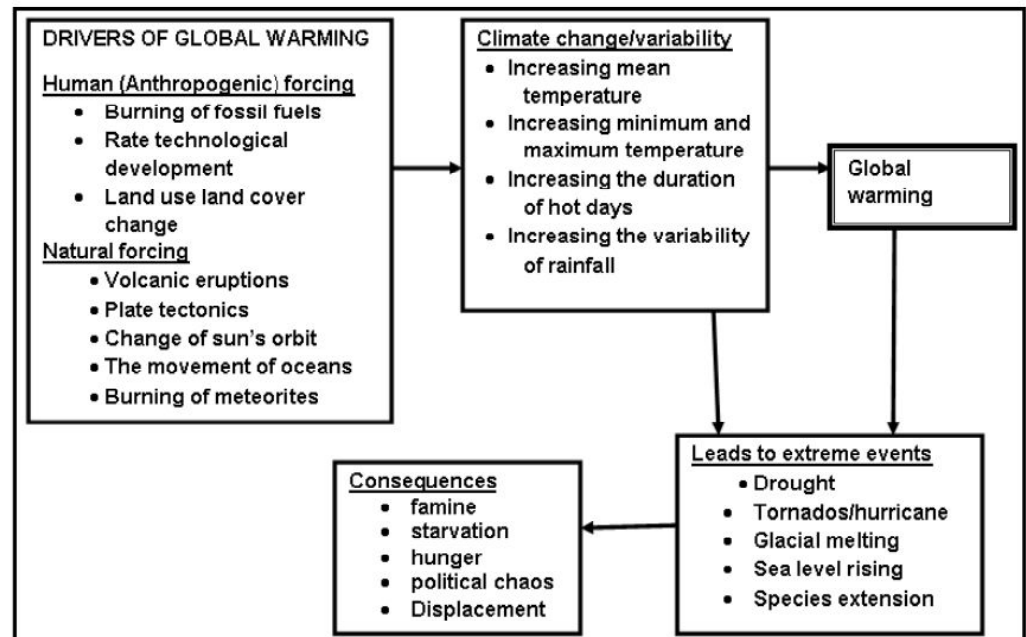


Figure 10.1 The Causes and Consequences of Global Warming

Source: Berlie, A. B. (2018). Global warming: A review of the debates on the causes, consequences and politics of global response. *Ghana Journal of Geography*, 10(1), 144-164.

The recent human-caused-emission of greenhouse gases are the highest in the history, which will have a widespread impact on the human and natural environment. The UNFCCC defines greenhouse gases as “those gaseous elements of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.” Anthropogenic emissions create four principal greenhouse gases that are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and the halocarbons (a group of gases containing fluorine, chlorine and bromine), which accumulate in the atmosphere, causing concentrations to increase with time. The atmospheric concentrations of all these gases have significantly increased since the beginning of the Industrial Revolution in 1750 and their concentrations have increased to an extraordinary level in at least the last 800,000 years.

Weldon (2011) articulated the theory of global warming by stating that humans are burning too much fossil fuel which is producing vast amount of carbon dioxide into the atmosphere. The carbon dioxide and many other atmospheric gases (some natural and some man-made) act like a one-way heat filter which allows sunlight to pass freely from outer space into our atmosphere but prevents heat from the planet from re-radiating freely into space. Thus, without the heat-filtering processes of these gases, the Earth’s average temperature would be approximately 30-degree cooler. Scientists believe that global warming will change the environment in several ways:

1. Cold seasons (or Winter seasons) might become shorter and warm ones to become longer.
2. Northern latitudes are likely to have wetter autumns and winters, and drier springs and summers.
3. More rainfalls are predicted in the tropics, and sub-tropical areas could become drier.
4. A shift in the climate zones around the world which might bring a change in the frequency and intensity of floods, droughts, typhoons, tornados and hurricanes in many areas.
5. Rise in seas levels might cause more hardship and losses.

10.1.1 Debates about Global Warming and Climate Change

Due to the lack of scientific evidence, many people did not believe that global warming was taking place. Today, global warming is an issue that does not involve much controversy in terms of its existence. However, the argument over the causes, impact, and responsibility of global warming is a topic of conversation and research. The most reliable data to prove that global warming is taking place was found deep inside the glaciers, in form of ice core samples. Scientists could drill out core samples from glaciers and determine the greenhouse gas concentrations in Earth's atmosphere from 400,000 years in the past (Caire, 2007). Their data reveal that the level of carbon dioxide has been steadily rising for the last 15,000 years, and most dramatically since the Industrial Revolution first began pumping large quantities of carbon dioxide into the atmosphere (Caire, 2007).

Willi Dansgaard, Claude Lorius, and Hans Oeschger are three scientists who have documented more than 150,000 years of global climate change by analysing glacial ice core samples and were awarded the *Tyler Prize for Environmental Achievement* in 1996. They mentioned that analysing the ice was like sticking a thermometer backwards in time as the composition of ice itself tells us about the temperature and atmospheric conditions at the time the ice was formed. The idea of examining Earth's climate history from ice core samples was first proposed in the early 1950's which was followed by the first deep ice core drilling project which took place in 1966 in Greenland. Drilling and analysing the ice core sample is a complex process which involves a lot of planning, people and preparation time. Data from ice core samples is still being collected and analysed in Greenland and Antarctica by a group of multinational scientists. Evidence from these ice core samples also show a linear trend in increased greenhouse gas emissions which parallels the worldwide population growth. If population growth is a contributing factor for the rise in greenhouse gases emission, then humans are partially responsible for global warming. This is until scientists can better understand Earth's natural changes in its climate cycle, thus, till then, it will be unclear to what degree human action has accelerated global warming.

Scientists have mentioned that Earth naturally goes through cycles of warming and cooling, correlated by carbon dioxide (CO₂) levels rising and falling. Thus, there have been a steady 20 percent rise and fall of CO₂ over time from a mean of 240 parts per million (ppm). But in the present times, all indicators are going off the scale as the current greenhouse gases concentrations are higher than at any time in the last 400,000 years, according to data accumulated from the Vostok ice core in Antarctica (Caire, 2007). Furthermore, recent data has shown that carbon dioxide emissions have risen 30% since 1900, which is a 10% increase over Earth's natural variations in the levels of carbon dioxide. Possibly even more shocking is that until 1999, two gigatons of carbon dioxide have been released into the atmosphere annually. Furthermore, since 2000, six gigatons have been added to the atmosphere. Thus, according to that there is a three-fold increase in carbon dioxide emissions from 1999 to 2000, which might result in destructive consequences in the form of recent extreme weather patterns (Tol et al., 2000). Some of the consequences that we are already witnessing due to global warming are ice melting at the earth's pole, sea level rise has become faster over the years, and precipitation has increased across the globe. Some of the species such as butterflies, foxes, plants have moved farther from the north to higher cooler areas due to the warm weather.

Climate change is primarily a scientific topic which poses a high-risk to humans and social systems, and probably one of the most controversial one because of its inherent scientific uncertainty (Björnberg, et al., 2017). The theory of climate change assumes that an increase in global mean temperature (defined as global warming) may influence the climatic conditions of the world. Climate change is more than global warming because the rise in average temperature is only one indicator of broader changes such as extreme temperatures, drought, flooding, storms, rising sea levels, impacts on food production, and infectious diseases. Even though, people often use the term climate change instead of global warming due to the rise of earth's average temperature. But climate change is different in different areas as it is not merely an increase in temperature but also includes the frequency and severity of droughts, floods, hurricanes and blizzards. It is a broader term in the sense that it includes weather changes and outcomes to be promoted as resulting from humanity's impact upon the global climate. So, climate change is more than just the changes in the weather. It is defined IPCC AR4, (2007) by "any change in climate over time, whether due to natural variability or as a result of human activity." Climate change has also been defined as "any natural or stimulated changes in climate, either globally or in a particular area" (Parmesan & Yohe, 2003). According to the United Nations Framework Convention on Climate Change [UNFCCC], climate change is defined as "a change of climate which is attributed directly or indirectly to human activity that alters the structure of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

Changes in climate refer to changes in means and inconsistency for example on the temperature, rainfall, and wind which can happen over the course of months to millions of years. So, change in climate refers to changes in *atmosphere* (gaseous envelope surrounding the earth), *hydrosphere* (water on the surface of the earth), *cryosphere* (snow, ice, and permafrost on and beneath the surface of the earth and ocean), *land surface*, and *biosphere* (ecosystems and organisms living in the atmosphere, land, and oceans). Nevertheless, the recent and accelerating warming of the earth's climate is largely attributable to human activity, and its influence are mediated by psychological and social processes, and it can be restricted by human activity. According to the World Health Organization, climate change is estimated to cause over 150,000 deaths annually, and is likely to cause, as it is predicted, approximately 250,000 additional deaths per year between 2030 and 2050 from malnutrition, malaria, diarrhoea, and heat stress. If global warming and climate change continues at its current pace, the following effects could occur later this century (Figure 10.2 also elaborates on the impact of global warming).

1. Sea levels are estimated to rise between 7 and 23 inches (18 and 59 centimetres) by the end of the century and the prolonged melting at the poles could add between 4 and 8 inches (10 to 20 centimetres).
2. Hurricanes and other storms are likely to become stronger.
3. Species that depend on one another might not be able to survive or may get disturbed. For example, plants could bloom earlier than their pollinating insects become active.
4. Floods and droughts will become more common. Rainfall in Ethiopia, where droughts are already common, could decline by 10 percent over the next 50 years.

5. Less fresh water will be available. For example: If Quelccaya ice cap in Peru continues to melt at its current rate, it will be gone by 2100, leaving thousands of people who rely on it for drinking water and electricity without a source of either.
6. Chances of becoming ill will increase as some diseases might spread, such as malaria carried by mosquitoes.
7. Ecosystems will get affected. As some species will move farther north and others species might not be able to move so they could become extinct.

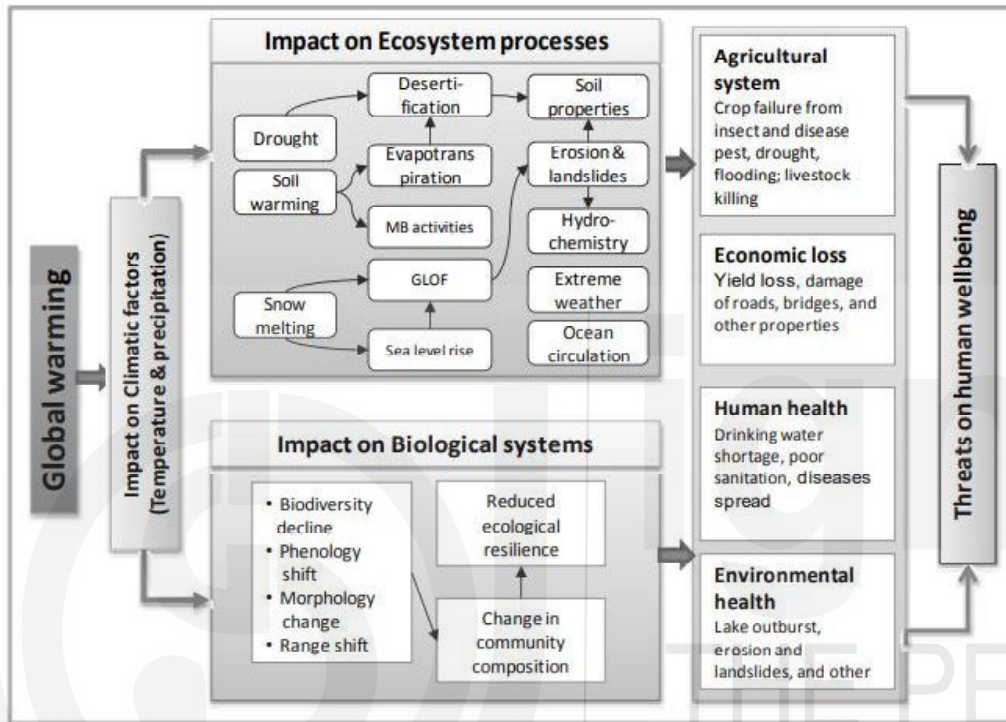


Figure 10.2 Impact of global warming and climate change on the ecosystem and human being.

Source: Chaudhary & Aryal(2009)

Figure 10.2 explains that climate change and global warming have long term consequences. They are a result of several changes in human activities that accelerated with industrialization in the 19th Century and increased exponentially since. The environmental psychologist and scholars expanded their research on environmental degradation in 1980s to adapt and confront climate change and global warming impacts on ecosystem and humans. Thus, several themes in environmental psychology have emerged that are relevant to climate change and global warming such as:

- 1) A concern in how environmental psychology can inform and aid public policy.
- 2) Attention to technology and digital means both as a contributor to environmental problems and to improve sustainability.
- 3) A tendency to value and benefit from multi-disciplinary associations and theories from other fields.
- 4) Expansion of interests to include multiple levels of analyses from small scale studies of individuals and small groups to larger scale issues of sustainability, issues facing nonhuman biological world, and large scale ecological problems such as the impending world water crises, food crisis etc.

Furthermore, experts from different fields of psychology and other disciplines can contribute to finding solutions to many problems associated with climate change. This includes talking about issues such as:

1. Coping with perceived threats of climate change to trauma stemming from experience of climate-related weather disasters.
2. Experts in community, business, and organizational behaviour can address changes necessary at the systemic and human behavioural levels as businesses and non-profit organizations adapt to a changing environment.
3. To provide an understanding of how people across the lifespan can adapt to climate change.
4. To design effective methods to integrate an environmental focus into psychology and other curricula.
5. Experts in international and peace psychology can intervene as intergroup conflicts develop due to decreasing resources and forced migrations associated with a changing climate.

Moreover, youth should also be engaged in climate change education. They should also be at the forefront of this change as they are vulnerable and will bear the impacts of climate change over their lifetime. The next section elaborates on educating youth and children on global warming and climate change.

Check your progress 1

1. Write a short note on climate change and global warming?
.....
.....
2. What are the impact and consequences of climate change and global warming on Earth?
.....
.....
3. How is global warming measured through ice-core samples?
.....
.....
4. Mention the themes that emerged in environmental psychology have emerged that are relevant to climate change and global warming?
.....
.....

10.1.2 Climate Change Education for Youth

Recent studies have mentioned that children are under-informed and poorly trained regarding topics such as climate change and global warming (Mah et al., 2020). Thus, advocating children and youth from a young age will help children develop a sense of

collective competence through the promotion of youth engagement. Involving youth in research is a critical component as their efforts will enhance the quality of data that is used to inform climate change policies and plans. Furthermore, it will empower children to take actions that relate to their future lives.

The literature on youth climate change education primarily investigates the impact of educational programming on youths' knowledge. The scholars believe that making sense of climate change is the crucial and the first step to changing behaviour. However, the knowledge regarding climate change does not necessarily translate into personal connection or action. It is important to connect the cause and consequences with the personal lives of people so that they understand the impact. Thus, facilitating youths' understanding of the connections between climate change concepts and issues beyond the classroom is necessary for attitude and behaviour change. So, for example, if students are encouraged to think about topics such as climate change in relation with their own lives their concern for the environment grows. Therefore, increased knowledge and connection to climate change can lead to youths' increased enthusiasm and eagerness to engage in pro-environmental behaviours as well as motivate students to act towards change. There are several benefits to youth from engaging creatively and meaningfully with topics such as climate change:

1. It improves their reasoning and discussion skills. Discussion among students from different cultural background and values lead to different viewpoints which might provide richer and more productive climate change discussions.
2. It increases students' engagement in topics related to sustainability such as climate change, global warming, deforestation etc, which further stimulates creatively, increases engagement and diverse problem-solving.
3. Sustainability-oriented education aims to cultivate youths' 'future's thinking,' by promoting learners to consider the multiple outcomes of their own decisions and actions, and to visualize and reflect upon the potential elements that make up their own future lives.
4. It inspires students and children that they have the power to save the environment, and thus this gives them the power to modify their future.

10.1.3 Education for Action

Educational programs that move from transmissive learning to transformational learning involve youth in various forms of climate change action related to their education. These sorts of programs can typically happen outside the formal classroom or informal settings. Climate change-related educational initiatives seek to engage the 'whole person' by emphasizing knowledge, values, and action that have been advocated under a variety of terms, including environmental education for empowerment and education for sustainability. The goals of action based educational initiatives are that "youth are considered agents of change within their families and communities". They are environmentally empowered and are confident in their own abilities to make a difference in the world by making lifestyle choices and influencing other. They act as catalyst of change in their families and communities and influence others with their engagement with the environment. Thus, involving youth and children in climate change education might make them feel capable of taking action to minimize harm and believe in the transformation of their environments. A conceptual model is presented in Figure 10.3 that explains how children and youth engagement with climate change.

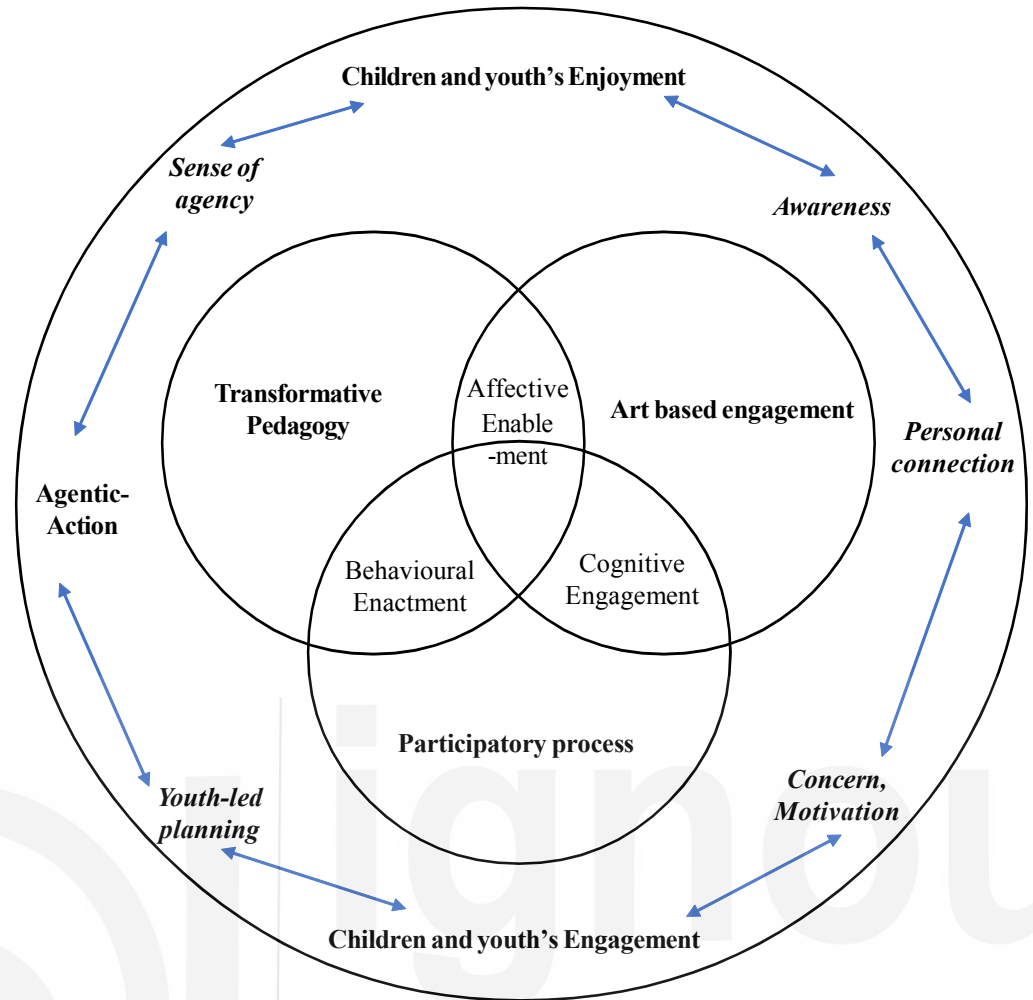


Figure 10.3 Conceptual model of children's and youth engagement in climate change.

Source: Trott, C. D. (2019). Reshaping our world: Collaborating with children for community-based climate change action. *Action Research*, 17(1), 42-62.

Trott (2019) introduced **transformative, arts-based, and participatory approaches** as potential avenues for facilitating children's constructive climate change engagement. The educational approaches and literature focus on effective instructional strategies to strengthen children and youth's learning. Children and youth learn about climate change but very rarely they are given opportunities to act on this information. Thus, to go beyond scientific facts, alternative educational paradigms have arisen that move "from transmissive towards transformative learning" which emphasize the social, ethical, and political dimensions of climate change, while encouraging diverse participation and social change action.

The art-based methods have been used as a medium through which to foster the civic participation of children and young people in their communities. Art is usually a technique to raise awareness of social issues, resist and rewrite dominant cultural narratives, and facilitate social change action. Even though art-based methods are limited but they engage young children and youth in creative, participatory processes (e.g., visual art; video production; performance), which can eventually serve to empower their agency and to raise awareness of climate change with decision-makers and advocate changes on behalf of their communities. Art encourages meaning-making and self-expression around issues of identity, community, and place so this medium helps to identify place-based sustainable solutions important to children and their local communities.

Action based methods is acting on learned concepts which can be an empowering experience for children and youth. So, children engaging with the community to address a local issue or the simple act of imagining preferable futures for their community. To facilitate children's and youth's constructive climate change engagement, participatory methods are best as they help them to bring out their potential and empower them. This method helps to shift the power from adults to children and youth, and they act as key stakeholders and raise their voices. The adults, policy makers help children and youth to come together as they investigate a problematic situation in order to improve conditions and they voice and control things that will ultimately impact them.

10.1.4 Urban Cities and Climate Change

Cities are vulnerable to climate change, but they are also uniquely positioned to lead the way in both mitigating and adapting to it. Urban cities and population have a responsibility to transition toward a more sustainable future as they are a source of most of the world's greenhouse gas emissions. Cities are currently home to over half of the global population. In developed regions that figure is even larger, with nearly 80 percent of population residing in cities which makes it more important to adopt sustainable development plans to be able to keep city growth within ecological limits. Temperature in the urban cities rises and it tends to become hotter than their surrounding suburbs and rural areas because of heat absorption and retention. This happens because of the impervious surfaces (such as concrete, and dense populations), the reduced amount of vegetation and impermeable surfaces. This results in what is known as the '**urban heat island**' effect, which is a warming effect in the atmosphere surrounding urbanized areas. Urban heat island causes the temperature to increase, resulting in frequent heat waves and making the cities more vulnerable to climate change. Thus, people should obtain better knowledge about the degree to which the urban heat island is influencing their city, which might help city planners in responding more appropriately to the situation.

Furthermore, climate change might increase the **risks to health** directly from increased injuries and mortality from extreme weather events such as water-borne diseases after flooding, hurricanes, extreme rainfall events. Moreover, the food-borne diseases due to the contact of food to higher temperatures causing bacterial growth, increased mortality from more intense and more frequent heat waves worsened by the urban heat island effect and forced migrations as city dwellers seek shelter from increased conflict over resources. Moreover, respiratory diseases and illnesses from **poor air quality** and **increased allergies** related to changes in temperature, precipitation, and the build-up of smog from commercial and industrial practices. Thus, doctors, physicians and members of the healthcare system should be aware of the increased risks to human health in cities and predict climate change related consequences. They can incorporate this information into healthcare systems to reduce serious health impacts and make recommendations for better understanding of the possible health risks in their area.

City infrastructure should be assessed for increased extreme weather events such as storms, flooding, hurricanes, and high winds. The increased frequency of these events will have direct impacts on availability of food and water, human health, and facility operations. Drought conditions aggravated by climate change will exert added stress on cities, especially those who import their water or depend on remote sources to meet their demands. Moreover, as urbanization continues, difficult decisions in urban planning and development will be driven by **resource availability and demand for**

basic resources. Therefore, healthcare system must adapt by anticipating needs and adopting practices that incorporate changing environmental conditions and the associated increased risks. Even though its difficult to anticipate a natural hazard but when disasters occur in the human-built environment that the consequences can be drastic. However, as **urbanization and the built environment** continues to expand, **vulnerability and risk exposure** will increase in urban areas. The combination of larger and denser populations with increased infrastructure such as buildings and roads mean that when a disaster does strike in cities it has a greater capacity to cause more damage, putting important facilities out of operation. Therefore, it is crucial to human health and well-being that disaster reduction plans include the management of these negative consequences of climate change. To address these problems, three pillars of sustainability has been illustrated in Figure 10.4. Adapted from Wilkson and Yeneken (2000), this venn diagram highlights the importance of not just the environment, but also the economy and society. Each of the pillar is desirable to achieve sustainability.

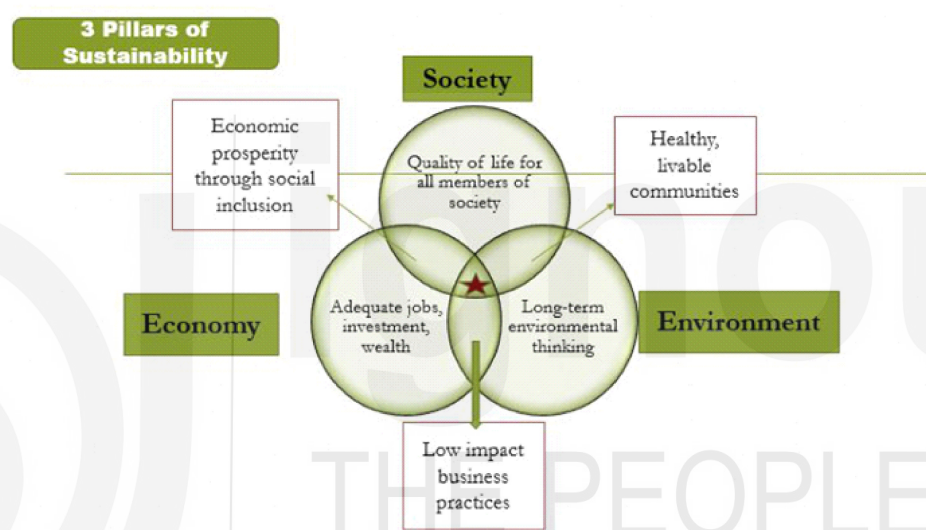


Figure 10.4 Three Pillars of Sustainability

Source: Sanabria, J. L. (2017). A Literature Review of Climate Change and Urban Sustainability.

10.2 KEY FACTORS FOR SUSTAINABILITY

Climate change and increased climate variability will have many negative consequences in the urban environment, but **city's management plays a big role in determining its ability to respond to climate change.** Thus, it is important to address **water and energy related supplies** because without them the cities are forced to import it from different parts of the world which increase carbon footprint. So, to do that:

1. There is a need for the support of water conservation policy and regulations at all levels to enforce behavioural changes.
2. Sustainable water management can be organized at the city level around three major water uses that are drinking water, wastewater, and stormwater systems.
3. Conservation programs must be put in place at local and state level to assign more accountability.
4. Other mitigation efforts in cities might also include water reclamation and recycling or increasing the efficiency of water supply.

Another development priority for cities can be to focus on the **public transportation sector**. Cities make for the most efficient transportation centres because denser populations allow for closer proximity of housing, retail space and employment, reducing travelling distances and supporting alternative travel options. People living in cities can benefit from public transportation in ways that those in rural areas cannot because the necessary infrastructure is already in place. Public transport is a more sustainable means of transportation due to its ability to reduce greenhouse gas emissions, carbon footprint through the conservation of energy. Another alternative transportation options are walking or bicycling for better physical health, for people who don't want to own their own private vehicle and due to the increasing fuel prices and various other reasons. Accessibility to alternative transportation not only improves public health, but can also address air pollution, increase housing values, contribute to a sense of place and community, promote economic development in the area, and save household money. It can be difficult to persuade people to change their attitude and behavioural patterns towards public transportation over personal automobiles. However, incentives and rewards can be put in place to further develop the transportation sector in a city, which in turn will encourage this behavioural change. For instance, carpooling and sharing platforms reduce greenhouse gas emissions and reduce the cost of travelling as compared to a personal vehicle.

Urban waste management is another area which can help protect people and environment from the negative effects associated with waste. Discarded materials that do not seem harmful can potentially become hazardous if not managed properly. So, to run efficiently and sustainably, few steps in the cycle that are: waste generation, collection and disposal must be addressed. People need to focus on effectively managing waste and reducing overall outputs of trash so that it will lead to fewer trips to the landfill and help in saving fuel and emissions. **Prevention is better so less trash generation means less energy expenditures** towards waste collection, transport, and distribution. So, some points to keep in mind for waste management are:

1. The state and government agencies need to enforce regulations for guiding waste management and educating people about the proper waste management.
2. The government needs to analyse the city's waste consumption pattern and invest their money in more sustainable materials sourced from less carbon intensive companies and processes.
3. Small businesses, store owners, and individuals can all make commitments in reducing their dependence on material goods, reducing their demand for them, and making informed consumer decisions.

The key to good urban waste management is providing waste collection services in a consistent and ethical way. Thus, the government and local agencies need to be tasked with providing services for waste collection and recycling. Moreover, focusing on green infrastructure that is planting more trees, has been gaining a lot of importance since the last few decades. More information is provided in Box 10.1 regarding green infrastructure in cities and corporates.

Check your progress 2

1. How involving youth in climate change can lead to transformation of environment?

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2. What is Urban heat island effect?

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.....

3. How government and citizens make a sustainable environment for urban cities?

.....

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Box 1

Green Infrastructure

Source: Cameron, R. W., Blanuša, T., Taylor, J. E., Salisbury, A., Halstead, A. J., Henricot, B., & Thompson, K. (2012). The domestic garden—Its contribution to urban green infrastructure. *Urban forestry & urban greening*, 11(2), 129-137.

Green infrastructure been gaining a lot of attention in recent years for its integration of creative thinking, art and design. Urban areas often lack horizontal space for vegetation, so they can be innovative by incorporating green spaces. Thus, green infrastructure allows a city to address this issue with sustainable urban landscape and other deviceful green practices. They can be used to improve community resiliency, reduce pollution and runoff, and cut back on energy and water supply, all while maintaining the original functionality of the walls, buildings, roofs, etc. Green roofs provide new innovative uses and functionality to spaces that would otherwise go unused. They also increase biodiversity in urban settings by creating habitats for birds and insects and are an excellent way to apply technologies to grow food in urban settings, creating a sustainable and local source of food. Vertical gardens, or green walls, act similarly to green roofs having many of the same benefits, but they can be located both outdoors and indoors. For example: Implementing green roofs on buildings (houses or corporate buildings) is one way to reduce the urban heat island effect of the local area because the vegetation has an evaporative cooling effect. These green spaces improve the mental health of people as they provide many psychological benefits such as boost morale, improve connection with space, better physical health etc.

Another sustainable landscape is permeable pavement or porous pavement that act as a pavement for Vertical gardens, or green walls, act similarly to green roofs having many of the same benefits, but they can be located both outdoors and indoors. It allows stormwater to re-enter the soil rather than being carried around as overflow which could possibly cause flooding and pollution in urban areas. Permeable pavement helps to manage this issue and allows for improved soil moisture and the natural filtering of water through the soil. Permeable pavement also reduces costs that would otherwise have to be spent on flood damages.

(Picture 1: Vertical Garden on left; Source: <https://www.udesign.es/best-biggest-vertical-gardens-world/>)

(Picture 2: Green Roof on right; Source: https://www.construction21.org/articles/h/all-you-need-to-know-about-green-roof-construction.html?__cf_chl_tk=wEuLget6ezrVj7dy5fy0P38YaaW15FHjnUBWFuAGadE-1653142597-0-gaNycGzNBz0)



10.3 CARBON FOOTPRINT

The word carbon footprint can simply be understood as the amount of carbon dioxide emitted to the atmosphere by the anthropogenic activities. The carbon footprint has its origins in the ‘ecological footprint’ introduced by Wackernagel and Rees in 1996. An ecological footprint refers to the biologically productive area on earth that is necessary to maintain a person’s standard of living.

On the other hand, the carbon footprint measures the land area needed to compensate carbon dioxide emissions and equivalents provoked by human activities. It is a measure of the total amount of carbon dioxide and methane emissions of a defined population, system or activity, considering all relevant sources, sinks and storage within the spatial and temporal boundary of the population, system or activity of interest calculated as carbon dioxide equivalent using the relevant 100-year global warming potential (Wright L. et al., 2011). It can be measured by the total amount of greenhouse gas emissions that are directly or indirectly caused by an activity or accumulated over the life stages of a product.

Carbon footprint provides a concrete tool for the control of the gasification of our planet. Main sources of greenhouse gas emissions can be identified, and high emissive areas can be reduced when striving for a lower-emission policy. By this means, governmental institutions and companies can use this method to assess a product’s impact on the environmental. This method provides companies, organisation and universities to investigate their processes and allow businesses to make more efficient decisions. Environmental considerations while developing their business have shown encouraging effects not only on a reductive cost base but also on their Corporate Social Responsibility image, which eventually results in a competitive advantage. Reducing carbon emissions has become a new lifestyle trend that has led to more use of renewable energy. A carbon footprint represents a more substantial tool for the civil society to be aware of individual climate actions. Nowadays, numerous online platforms for calculating individual carbon footprints are also being offered. The main aim of a Carbon footprint’s calculation is to assess all greenhouse gases emissions of a product’s development including all its steps from the manufacturing of raw materials to production processes, logistic distributions, packaging, retail, consumption and recycling or disposal.

Many companies also provide carbon labels. They provide additional information for consumers, but carbon labels are still rare. Carbon labels are designed to help consumers making more climate-friendly purchase choices. Within this eco-label category, the carbon label (CL), also called carbon footprint label or CO₂ label, has become an important and communicative tool for the attempt to reduce greenhouse gas emissions. It is aimed to visibly transmit the CO₂ or CO₂-e emissions over a product's life cycle to the consumers, giving better choice criteria in their purchase decisions by confronting them with their own environmental consumption impact and generating an improved environmental behaviour.

Companies have started to apply carbon labels as a way to demonstrate their environmental responsibility and to highlight their products. The label trend can also convince other firms to start cutting their emissions causing in cost-reduction, improved image and reputation. Although carbon labels also exist for companies reporting emissions from their own production processes, labels for product packages are more common since they enclose emissions from a wider supply-chain range. Both companies and consumers can be influenced by carbon labels towards a reductive carbon behaviour. Increased information interest from the consumer side has given a further reason for the carbon labelling of products. Additionally, labels should include transparency, trustworthiness, completeness, clarity, availability and producer incentive.

10.6 SUMMARY

To sum up what we have learnt in this unit, here is a quick recap.

- Several changes in human activities that accelerated with industrialization in the 19th Century and increased exponentially since. Greenhouse gases such as sulphur dioxide, nitrogen dioxide, and carbon dioxide have been recognized as the prime cause of global climate change.
- Youth needs to be engaged in global warming and climate change education as they are at the forefront of this change, and they will bear the long-term impacts.
- The management of waste plastics is a major environmental issue which has led to deterioration in the environment. Climate change might increase the risks to health by causing water borne diseases and respiratory diseases.
- People must be aware about the harmful effects of waste in the environment, and they should focus on effectively managing the waste in the environment.
- Waste management is different in different countries due to various factors such as technology and population etc.

10.7 KEYWORDS

Global Warming : The phenomenon of increasing average air temperatures near the surface of Earth over the past one to two centuries

Climate Change : Long-term shift in weather and temperature patterns.

Urban Heat Island Effect : It occurs when cities replace natural land cover with

dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat.

- Carbon Footprint** : Total amount of greenhouse gases generated by humans or that come from the production, use and end-of-life of a product or service.
- Waste Management** : It is the management of waste by introducing integrated waste management facilities, which supports the treatment of multiple wastes at single facility, with time and cost effectiveness.
- Green Infrastructure** : It means planting trees and restoring wetlands for solving the climatic challenges by building with nature, which also results in cleaner air and better quality of life.
- Sustainability** : An integrated approach that takes into consideration environmental concerns along with economic and societal development.

10.8 REVIEW QUESTIONS

1. Explain global warming and climate change.
2. How can experts from different fields of psychology and other disciplines contribute to solutions to the many problems associated with climate change?
3. What are the benefits of engaging meaningfully with topics such as climate change?
4. Elaborate on urban waste management.
5. How can state and local government respond to climate change?
6. What is green infrastructure? Think about some points of incorporating green infrastructure in your house or school and turning it into a green space.
7. “Carbon footprint provides a concrete tool for the control of the gasification of our planet”. Discuss.
8. Explain the 3 pillars that are desirable to achieve sustainability.
9. Discuss transformative, arts-based, and participatory approaches which will help children engage in climate change.

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10.10 ADDITIONAL ONLINE RESOURCES

1. What is a CARBON FOOTPRINT? How to calculate and reduce it? | Climate change
https://www.youtube.com/watch?v=bYb7YLSXvzg&ab_channel=SustainabilityIllustrated
2. See what three degrees of global warming looks like | The Economist
https://www.youtube.com/watch?v=uynhvHZUOOo&ab_channel=TheEconomist
3. What's the real carbon footprint of your food? | FT Food Revolution
https://www.youtube.com/watch?v=JCohzl9oVNE&ab_channel=FinancialTimes
4. How to reduce your food's carbon footprint | Your Planet
https://www.youtube.com/watch?v=BJnUTcKj1As&ab_channel=ABCScience
5. 3 thoughtful ways to conserve water | Lana Mazahreh
https://www.youtube.com/watch?v=nLB8A—QdHc&ab_channel=TED
6. One Earth - Environmental Short Film
https://www.youtube.com/watch?v=QQYgCxu988s&ab_channel=RomainPennes

UNIT 11 CLIMATE CHANGE AND PRO-ENVIRONMENTAL BEHAVIOUR*

Structure

- 11.0 Introduction
- 11.1 Climate change and its Impact on Mental Health
- 11.2 Climate Change Adaptation
- 11.3 Environment Concern and Pro-environmental Behaviour
 - 11.3.1 Model by Kollmuss and Agyeman
 - 11.3.2 Theory of Planned Behaviour
- 11.4 Waste Management
- 11.5 Environmental Policies in India
 - 11.5.1 Swachh Bharat Abhiyaan
- 11.6 Summary
- 11.7 Keywords
- 11.8 Review Questions
- 11.9 References and Further Reading
- 11.10 Additional Online Resources

Learning Objectives

After having read this unit, you will be able to:

- Explain the climate change effects on mental health in a variety of direct, indirect, and overarching pathways.
- Summarize the mental health implications of climate change
- Discuss the complex connection between the development of environmental awareness and climate friendly behaviour.
- Describe the relationship between environmental attitudes and environmental behaviour.
- Identify the harmful effects of increasing use of plastic and the need to treat the used plastics and waste in sense of resources, and
- Appreciate the different sustainable waste management approaches.

11.0 INTRODUCTION

Climate change is recognized as one of the top threats to global health in the 21st century. The impact of climate change on mental health results in stress for individuals and communities. The physical, social and mental health consequences of the climatic events are well documented in literature, ranging from stress and distress symptoms to clinical disorders, including depression, anxiety, and post-traumatic stress disorder.

Marginalised groups and individuals with pre-existing mental illness may be particularly vulnerable to the threat of climate change, as it can cause significant psychological and emotional distress. The messages in the media, and information given by scholars, researchers and government, regarding important topics of global warming and climate change also influences people's perception regarding them. Therefore, to reduce the physical, mental, societal risks and projected consequences of climate change, the attribution and exposure of information regarding climate change needs to be changed. Climate change might be seen as compelling and overwhelming; however, the response is denial and avoidance. A lack of understanding regarding climate change and its implications for human health can result in behaviour's marked by indifference and continuation of actions that worsen climate change. So, adaptation measures focusing on the psychosocial impacts of climate change should be considered.

The next sections of the Unit will help to understand, explain, and predict behaviour's that benefit the natural environment. But each person has his/her reasons why they behave the way they do. The human behaviour to the environment is also influenced by external factors (that means the environment of an individual) and internal factors (physical and mental aspects of an individual). Moreover, the demand for materials such as clothes, plastic, and technological devices/equipment's etc. are increasing, which causes environmental damage as it generates waste (such as textile waste and E-waste etc), along with the material extraction, processing transport and waste management associated with it. So, this Unit explores the different domains of environmental behaviour such as reduction, reuse and recycling, as well as waste management strategy. Lastly, the Unit talks about some of the Indian government policies and projects that promote sustainability, sanitisation and waste reduction behaviours to ensure good public health and environmental outcomes for its citizens.

11.1 CLIMATE CHANGE AND ITS IMPACT ON MENTAL HEALTH

The global climate change problem presents serious problem on the mental and physical health of people. Some people are more vulnerable to the potential impact and risk of climate change on mental health. There are communities and people that are more vulnerable to such events than other communities and people; these include vulnerable groups like children, refugees, and indigenous groups, marginalized sections of society, older adults, the chronically ill, people with disability, pregnant and postpartum women, people with mental illness, and those with lower socioeconomic status. Thus, climate change and mental health is one of the most nascent topics within the climate change and global warming health research, as very few studies discuss the risks and impacts of a changing climate on psychosocial health (Middleton et al., 2020; Burke et al., 2018; Dollard and Katasek, 2010).

The more temperature shifts from optimum levels, the more there will be groups that cannot cope, and such extreme weather conditions can lead to Post-Traumatic Stress Disorder (PTSD), Major Depressive Disorder (MDD), anxiety, depression, complicated grief, survivor guilt, vicarious trauma, recovery fatigue, substance abuse, and suicidal ideation. Incremental climate changes, such as rising temperatures, rising sea levels, and drought, can change natural settings, disrupt food and water resources, change agricultural conditions, change land use and habitation, weaken infrastructure and result in monetary problems, and personal and social relationship stress, increase

risks of violence and aggression, and displacement of entire communities. Thus, when people are exposed to climate change they experience constant uncertainty, anxiety, loss, disruption, displacement, and fear even before a disaster has even occurred. Climate change negatively impact mental health and wellbeing with unequal distribution within and among communities.

The primary threats of a changing climate and global warming can also incite hopelessness, powerlessness and helplessness as actions to address the constant problem of climate change seem vague or insignificant in comparison to the scale and magnitude of the threats (Littlemore, 2019). However, there is a silver lining as well as these same disastrous circumstances may also result in resilience, altruism, sympathy, optimism, and foster a sense of meaning and personal growth as people come together to rebuild, and console amongst the confusion, chaos and loss of a changing climate. A striking example is the traditional native populations or farmers (Albrecht, 2019). Different studies have considered the effect of climate change on native communities and highlighted aspects of weakness and resilience. Among these populations, the older adults are a clear example of difficulty in re-adaptation.

Furthermore, climate change augments existing inequalities, rendering those most marginalized at greater danger to the health consequences of a changing climate. Climate change is a social determinant for mental health specially for marginalized group with pre-existing mental health conditions. Moreover, studies have shown negative impact on refugees and migrants ethnic minorities, the homeless or vulnerable populations such as the developing countries like India, China, and Brazil (Cianconi et al., 2020; Michael et al., 2012). Women, refugees, migrants and families from low socioeconomic status, living in poverty, with scarce economic and social resources, reduction of social support with traumatic experiences (death or life risk, serious injury or sexual assault) and stressors might have more chances of developing new mental disorders. After climate disasters, children typically show more severe disturbances than adults, with more severity and prevalence regarding the onset of PTSD, anxiety, and depression (Galea et al., 2005). The lack of attention to the topic of climate change and mental health is often due to the challenges of attribution. Attribution in this case is the scientific association between greenhouse gas emissions and meteorological change on the one hand, and between climate change-related meteorological change and mental health effects on the other. Climate change leads to extreme weather which further leads to frequent, intense, and complex weather events. But many of these studies tend not to connect extreme weather to a changing climate. Similarly, within the disaster mental health literature, the links between extreme weather events and mental health effects are well established. However, studies focus on mental health outcomes of specific hazard events which positions each hazard as an isolated incident rather than connecting it to the problem or the impact of climate change. Thus, the risk of overlooking or minimizing the role of climate change within these hazardous events is major cause that creates a sensitive culture of emergency response that inhibits appropriate and effective adaptation planning and preparation for complex emergencies that a changing climate can create.

Recent studies show that people often go through **ecoanxiety**, which is an experience where they feel loss, helplessness, powerlessness, and frustration caused by their inability to cope with climate change (Hickman, 2020). People with ecoanxiety may also experience feelings of uncertainty, unpredictability and anticipation of the unknown regarding climate change. This leads to a psychological distance, a perception of distance, when a climatic event occurs as near or far, at a temporal, spatial, and social

level. In response to growing stress and ecoanxiety related to the changing climatic conditions and various type of biosphere concern, clinical psychologists and therapists are establishing a new field of treatment, termed “**ecopsychology**” (Frumkin, 2012). It is important that social workers, doctors, therapists and people in medical field to impart children, adults and patients to accept their own helplessness and powerlessness. For example, when it starts raining, some patients have episodes of anxiety, stress and feeling of sadness because they think of the past flooding with fear of losing the house or maybe a death of a loved one due to the flood. Thus, **ecological grief** is recorded, which refers to the grief and anxiety related to trauma they have experienced due to the climatic condition (Cunsolo and Landman, 2017). These new terms are emerging from recent observations due to the risk, impact and power that climate change has on mental health and on wellbeing of people. It will certainly take time and further studies in order to identify these new diseases and disorders. The *DSM-5* and *ICD-10* offer no specific references to mental disorders related to climate change. The chapter “*Other conditions that may be a focus of clinical attention*” in the *DSM-5* contains the section “*Economic Problems*” where the following conditions are listed: lack of adequate food or safe drinking water, extreme poverty, low income, insufficient social insurance, or welfare support (Cianconi et al., 2020). In the section “*Problems Related to other Psychosocial, Personal and Environmental Circumstances*” the following conditions are listed: exposure to disaster, war, or other hostilities.

Acting on the health consequences of climate change requires actions rooted in both mitigation and adaptation at all levels from global, national, state to local, and from all sectors and individuals. Climate change mitigation refers to primary efforts to reduce greenhouse gas emissions and enhance carbon sinks to slow the speed, scale, and magnitude of climate change.

Key climate change mitigation priorities include:

1. Reducing energy demand (through reduced consumption and increased energy efficiency),
2. A swift and equitable transition from fossil fuels to renewable energy.
3. Reducing emissions from agriculture and forestry, and
4. Strengthening land-based climate mitigation measures, for example, agriculture and forestry. They include supply-side interventions in forests and other ecosystems (to protect, manage, and restore), agriculture (to reduce emissions and enhance carbon sequestration), and bioenergy (to reduce fossil fuel emissions and sequester carbon), as well as demand-side interventions on food waste, diets, and resource use.

11.2 CLIMATE CHANGE ADAPTATION

Climate change adaptation refers to interventions that respond to the effects of climate change by **adjusting, moderating, and coping with the risks and impacts** of climate change. Adaptation is ultimately affected by the capacity to adjust, which is the willingness to respond to climate change mediated by individual and collective agency. Adaptive capacity is determined by things like governance, economics, infrastructure, technology, community, information and skills, institutions, and equity. Some of the intervention examples are:

1. Observation, surveillance and monitoring of disease burdens related to climate change and health,
2. Educating people (e.g., public health promotion of the risks of vector-borne illness),
3. Capacity building (e.g., physical and psychological first aid, and surge capacities at hospitals and health care facilities),
4. Preparing and planning for extreme weather events, and
5. Relocating entire communities to geographic areas where sea-level rise and frequent extreme weather events are less likely to occur.

There is a need to address the negative impact of climate change on mental health as very few policies address the future risks and impacts of climate change. Coordinated and collaborative efforts to address the mental health implications of climate change not only require policy frameworks but also concrete actions on behalf of mental health practitioners. Some actions may include:

1. Communicating about climate change and mental health in a way that helps people understand that it is pertinent and salient to them,
2. Support for greenhouse gas reductions in health care facilities,
3. Engagement in efforts to reduce the environmental footprint of the health care sector; and,
4. Engaging in adaptation measures like preparing for and responding to extreme events.

Furthermore, **behavioural, psychological engagement and coping strategies** can be further propagated by mental health therapist and advocates so that people can psychologically adapt to the grave threat posed by climate change. Coping strategies to manage the negative and sad feelings and thoughts that arise from the traumatic experiences of climate change so that people can face up to, and come to terms with, these threats and consequences rather than avoiding the problem of climate change.

Active hope advocated by Macy and Johnstone (2012) is a psychological adaption strategy where people transition from a passive state (where waiting for someone else to take-on the task of addressing the climate change problem) to a process of climate change mitigation and adaptation behaviours (Johnstone, 2014). The key point here is that hope alone cannot provide sufficient safeguard from the escalating negative risks of climate change. This “active” process occurs when the reality of the problem is **recognized and acknowledged**, as is the magnitude of the problem, **intentions to address the problem are set**, and **engaged actions** take place. While these three steps may oversimplify the complexity of working in the face of bureaucracy, climate denialism, or downright avoidance and ignorance of the magnitude of the problem area, but these three steps are indeed the important points of transformation (Hrynkow, 2013). However, these important points need to be endorsed by global political will and policy commitments to tackle the problem at the appropriate scale and speed. With that public awareness of the severity, extent, consequences and

range of health impacts need to be projected to pressure the governments and communities to act.

Adaptation measure comes in various forms that focus on the psychosocial impacts of climate change come in a variety of forms, such as policies, practices, behavioural interventions, community-based interventions, specific training, and pharmacotherapeutics. Some general approaches to address climate change-related mental health problems or illnesses include: primary care interventions, individual and group-based therapy, cognitive based interventions (including cognitive-based therapy, cognitive restructuring, and stress inoculation training), and crisis/trauma counselling. Engaging with art, literature, and spirituality may help in building resilience. Additionally, some adaptation mechanisms that ought to be considered to support people with mental health problems in a changing climate are:

1. Policy responses: Improving access, advocating for mental health and funding to mental health care.
2. Surveillance and monitoring: Administering epidemiological surveys after extreme weather events, and monitoring emergency department visits during heat waves, droughts, floods, hurricanes, earthquake etc and following extreme weather events.
3. Practice: Introducing interventions of a stepped-care approach to mental health that is often used in disaster mental health to support different levels of interventions depending on the timing of the disaster and the level of distress
4. Preparation and response: Climate change adaptation and resilience planning in the mental health system.
5. Community-based interventions: Climate change resilience plans that address physical psychological and social wellbeing; and,
6. Special training for care providers and first responders: e.g., Psychological First Aid.

Other new approaches to addressing mental health and wellbeing in a changing climate include **experiencing and preserving nature**. Studies suggest that environmental preservation provides people with a sense of ownership and personal investment which can help people overcome feelings of hopelessness, anxiety, and Eco-paralysis (Yaqoob, 2019). If people feel a deep personal connection to places such as forest, wilderness, and other species, then threats to these others are much more likely to be viewed as personal issues (Pyle, 2013). Other research on the restorative benefits of natural environments and settings has found that biodiversity in natural environments is important for human mental and physical health and wellbeing and it has a particularly positive effect on mood, attention and cognition (Mantler and Logan, 2015). For example: A common practice in Japan to reduce stress and anxiety is the practice of *shinrin-yoku*, otherwise referred to as forest bathing. A framework showing the mental health consequences of climate change and how these consequences are mediated by the social and ecological determinants of health, response interventions, and factors that influence psychosocial adaptation is shown in Figure 11.1.

Factors that Influence the Psychosocial Health Impacts of Climate Change

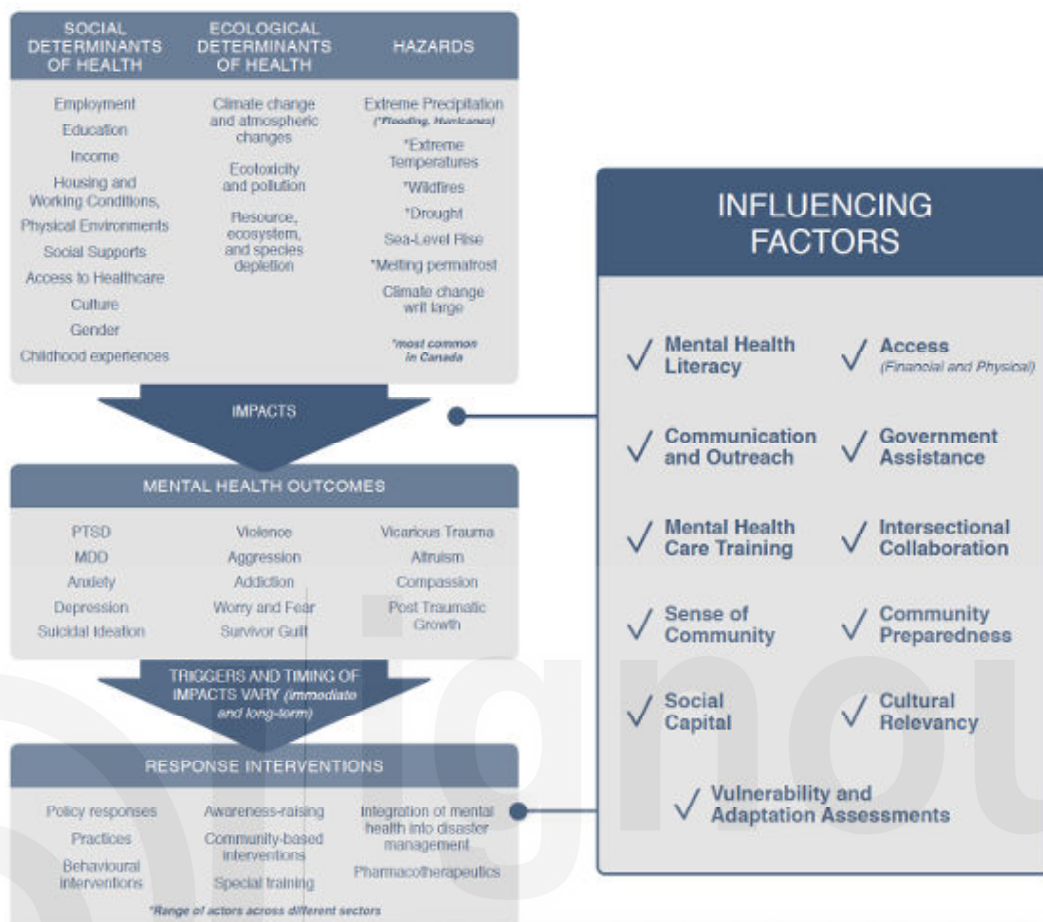


Figure 11.1 Factors that influence the Psychosocial health impacts of Climate change

Source: Hayes, K. (2019). *Responding to a changing climate: An investigation of the psychosocial consequences of climate change and community-based mental health responses in High River* (Doctoral dissertation, University of Toronto (Canada)).

Check Your Progress 1

1. How does climate change impact mental health?

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2. Define the terms ecoanxiety, ecological grief, ecopsychology.

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3. List some adaptive mechanisms that maybe considered to support people with mental health problems in a changing climate.

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11.3 ENVIRONMENTAL CONCERN AND PRO-ENVIRONMENTAL BEHAVIOUR

Environmental psychology tries to understand the human interaction with the environment. There is a need to understand the complex connection between the development of **environmental awareness and climate friendly behaviour** in order to promote pro-environmental actions. But still, there is no precise answer. The term '**pro-environmental behaviour**' refers to the conscientious willingness and action to minimize negative impacts for our natural environment.

Another term that has also been use is "**environmental concern**" (EC) that refers to broad range of attitudes towards the natural environment. The environmental concern not only consists of attitudes towards the environment and environmental problems, but also how people perceive their own level of environmental behaviour, and/or the behaviour of others. Long-established theories have been claiming a simple behaviour pattern to the principle 'the more you know the more you do' as seen in Figure 11.2. The model by Kollmuss and Agyeman (2002) was based on a linear progression of environmental knowledge leading to an environmental attitude, which lead to pro-environmental behaviour (Kollmuss&Agyeman, 2002). These models from the early 1970s were soon heavily criticized, as research showed that increases in knowledge and perception did not lead to pro-environmental behaviour. Changing behaviour is a more difficult and complicated process, and different research have tried to explore in more depth about the relevant behavioural shifting factors. They focus and deal with the wide variety of interaction patterns between the environment and human which has been explained further in this Unit.

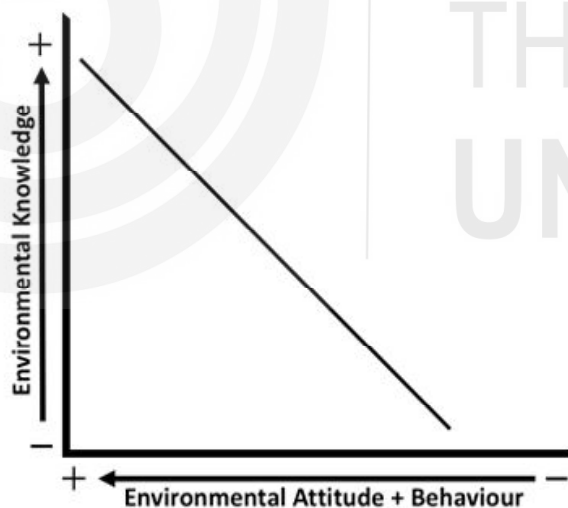


Figure 11.2 Graph of linear progression of environmental knowledge leading to an environmental attitude.

Source: Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental education research*, 8(3), 239-260.

11.3.1 Model by Kollmuss and Agyeman

There have been several attempts to develop a **complete and meaningful framework of factors influencing environmental behaviour**. However, it is a debatable topic and researchers have concluded that combining all potential factors is impossible to bring together into one framework. However, model explaining the summary of influential

environmental behaviour factors was developed by Kollmuss and Agyeman (2002) (refer Figure 11.3).

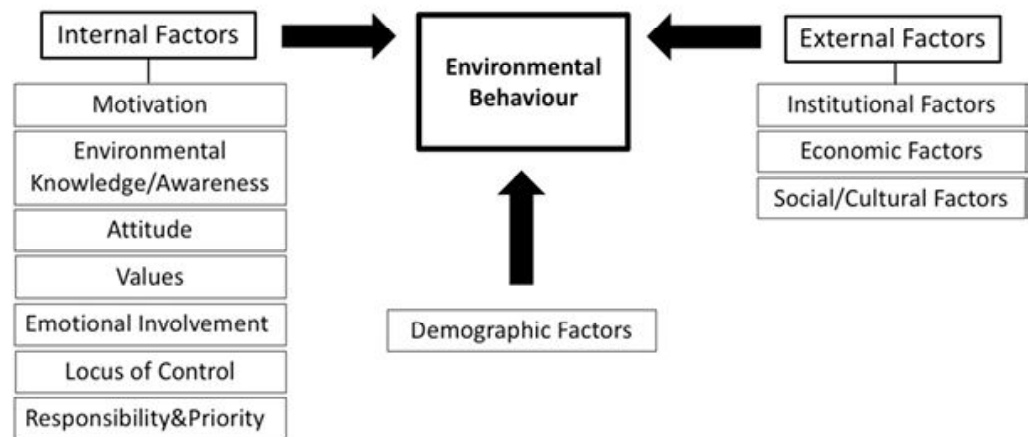


Figure 11.3 Model by Kollmuss, A., & Agyeman, J. (2002).

Source: Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behaviour? *Environmental Education Research*, 8(3), 239-260.

In the Figure 11.3, the internal factors constitute **motivation** which is the most important driver for behaviour. Motives can be divided into **primary and selective motives**. In an environmental context, primary motives are usually oppressed by secondary motives. An example of a secondary motive is that a person could prefer driving the car than taking public transportation because the benefit perceived of travelling alone in their own private vehicle is more relaxed (selective) than becoming climate-friendly (primary). Secondly, researchers have noted that **environmental knowledge and awareness** is not a guarantee for pro-environmental behaviour. However, it is assumed that in order to act consciously, people need to have a basic understanding. Thirdly, **attitudes** are characterized by positive or negative thoughts towards something. However, positive attitudes towards our environment are found to have only small impacts on behaviour as it is expected that a positive attitude might only turn into positive actions if the cost of lifestyle change is low. Moreover, **values**, are closely linked to attitudes and are mostly responsible for our intrinsic motivation. People usually adapt, modify or change their values from their immediate surrounding due to their experiences. So, pro-environmental discussions with family and friends might form pro-environmental behaviour, sensitivity and subsequently, environmental awareness. Furthermore, **emotional environmental involvement** refers to the emotional link between a person and the environment. Greater emotional involvement is supposed to lead to pro-environmental actions. Additionally, **the locus of control** is the conviction of a person to what extent his or her actions can bring a change. People with a stronger external locus of control in comparison to their internal locus of control are less confident about their own change potential and expect others to deal with it. Lastly, **responsibilities and priorities** are evaluated based on attitudes, values and control beliefs. If environmental implications are in line with these factors, pro-environmental behaviours are more likely to be considered.

The **external factors** such as the **institutional factors** are responsible for providing a suitable infrastructure for a positive behavioural adaptation. If an environmentally aware person is not given the chance and tools to act accordingly to their attitude, then pro-environmental behaviour will most unlikely to happen. For example, if there are no trash cans in the park and streets, then it is likely that people will litter in the park or

streets. Secondly, **economic factors** have a strong influence as lower priced alternatives are mostly preferred but when some companies started the pay-per-bag policy, then it resulted in waste reduction behaviour. Lastly, **social and cultural factors** also play an important role in environmental behaviour. It is suggested that in countries where natural resources are rare and the population is dense, people tend to act more climate friendly.

Lastly, **demographic variables** such as age, income, gender play a role in determining the environmental behaviour as higher education is believed to foster pro-environmental behaviour.

Check Your Progress 2

1. Define the terms: environmental concern and pro-environmental behaviour.

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2. Explain the basic premise of Kollmuss and Agyeman's model on environmental behaviour.

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11.3.2 Theory of Planned Behaviour

Another theory that predicts pro-environmental behaviour is **theory of planned behaviour**. Many researchers have tried to explain the gap between attitude and behaviour, but the theory of planned action offered by **Ajzen and Fishbein (1980)** argues that attitudes do not determine behaviour directly, rather they influence behavioural intentions which then helps to shape our actions. Intentions are not only influenced by attitudes but also by social/normative pressure. Thus, the ultimate determinants for any behaviour are the behavioural beliefs concerning its consequences and normative beliefs concerning the prescriptions of others (Ajzen & Fishbein, 1980).

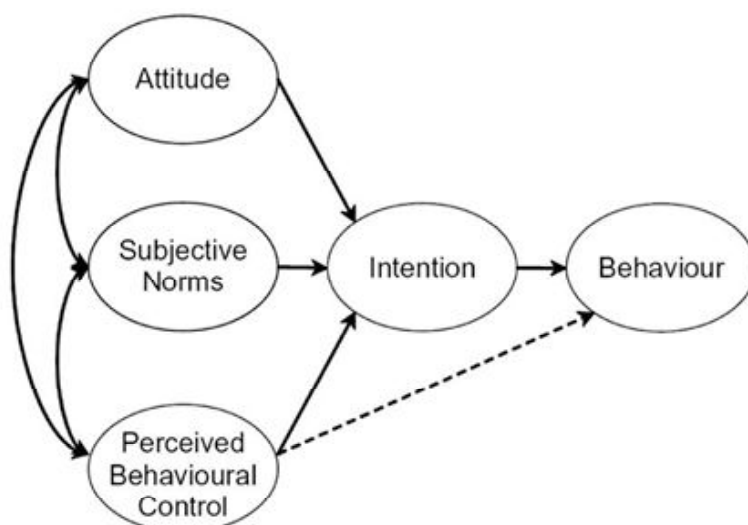


Figure 11.4 Theory of Planned Behaviour

Source: Ajzen, 1991

As shown in the Figure 11.4 intentions are shaped by three determinants that are attitudes, subjective norms, and perceived behavioural control (Conner & Abraham, 2001). Attitude refers to the degree to which a person has a favourable or unfavourable assessment of the behaviour. They give an indication of how to frame the decisional problem, the relevant behavioural alternatives and personally relevant consequences associated with these alternatives. Furthermore, subjective norms are beliefs regarding whether significant others think an individual should engage in the behaviour or not. People can be influenced by their emotions and by their values. These emotions are considered functional as they might discourage similar behaviour in the future. Moreover, motivation is an important fact in the theory of planned behaviour, and it is situated within the perceived behavioural control (PBC). This determinant refers to the perception of the acceptance or difficulty of performing the behaviour (Ajzen, 1991). The PBC has shown that people's behaviour is strongly influenced by their confidence and belief to implement it (Ajzen, 1991). PBC has an impact on the intent to act as effort expended to successfully perform an intention is likely to increase with greater PBC. Furthermore, PBC may reflect the actual control of an individual.

However, several authors (Ajzen & Fishbein, 1973; Kollmuss & Agyeman, 2002) have commented that the theory of planned behaviour (TPB) is not complete and fails to adequately consider other determinants. In addition, the TPB model identifies beliefs that are underlying attitudes (the behavioural beliefs) and argues that attitudes can be seen as an evaluative summary based upon these beliefs (White, Terry, Troup, & Rempel, 2007, Petty & Krosnick, 2014). As a result, single attitude scores cannot adequately represent all these beliefs and thus cannot predict behaviour accurately (Ajzen & Fishbein, 1973) (Box 11.1 explains the discrepancy between attitude and behaviour) For these reasons, belief-based determinants and other determinants might influence the intention to act.

Check Your Progress 3

1. Elaborate on the discrepancy between environmental attitude and the corresponding actions.

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2. Explain the internal and external factors with examples that affect the environmental behaviours.

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3. Explain the theory of planned behaviour with the help of a diagram.

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Box 11.1 Environmental Attitude vs. Environmental Behaviour

Source: Trivedi, R., Patel, J., & Savalia, J. (2015). “Pro-environmental behavior and willingness to pay for environmentally friendly products in emerging market: An empirical analysis”. *Marketing Intelligence & Planning*, 33(1), 67-89.

Behaviour is not directly determined by attitudes but influenced by intentions which do affect our behaviour. Although humans want to consciously change their behaviour, but they mostly lack discipline to repetitively practice the new behaviour pattern in order to form a new habit.

To explain this gap between attitude and behaviour Rajecki (1982) determined four exemplary reasons for the discrepancy between environmental attitude and the corresponding actions:

- (1) **Direct vs. indirect experience:** Direct experience means that whether the effect is seen immediately and has a stronger impact on a person's behaviour than an indirect experience. An improving environmental change cannot be experienced instantly during a pro-environmental action which widens the gap between attitude and behaviour.
- (2) **Normative influence:** Environmental behaviour is also formed by social norms and customs. For individuals who are part of a culture where they live an unsustainable lifestyle might result and contribute negatively to the environment.
- (3) **Temporal discrepancy:** Attitudes might change over time so when the collection of behaviour data and attitude data lie far apart in time, results can become inconsistent.
- (4) **Attitude-behaviour measurement:** Often the measured attitude is broader in scope than measured actions, which leads to larger discrepancies in results. Research is most attitudinally based which pushes behaviour in the background and leads to deviation.

The gap between a positive environmental attitude and a translation into actual behaviour can be filled with right information, research, accessibility and effectiveness. The information must be properly received, processed and believed. For example: People make their choice based on individual necessities instead of collective needs. So, a person might choose to visit his family through a plane or personal automobile than a train. So, there is a stronger desire to visit family in the shortest span of time than act on the need to be climate friendly. Thus, environmentally conscious behaviour does not become a social standard with which individuals can identify, until and unless their attitudes translate into actions.

11.4 WASTE MANAGEMENT

There are a lot of materials in the environment which exceed the balance of their production and destruction which eventually leads to the deterioration in the environment. Plastic is one such material and it poses a big threat to the environment. A huge amount of plastic is produced and dumped into the environment which does not degrade naturally. Plastic has secured a firm place in the consumer market over its substitutes. Urbanization and the increasing consumption of plastics have resulted in a

rapid increase in the production of plastic waste, making it a major element of the solid waste stream. Plastic waste is the third major component of municipal waste incities after food and paper waste (UNEP, 2009).

Plastics have two main impacts on the environment which include those connected with the raw materials or production processes and those connected with plastic littering and wastes. There has been a remarkably increase in plastic usage globally during the last decade, putting pressure on the source of raw materials and the environment. Recently, the magnitude of plastic use presents a major challenge to city authorities as they are responsible for solid waste management and sanitation.

At present, the management of waste plastics is a major environmental issue. Numerous strategies have been implemented for the handling of plastic waste which includes recycling, depositing in landfill, incineration, microbial degradation and conversion into useful materials. However, **recycling of plastic** is a costly and tedious practice because of the collection, organizing and handling of waste plastics. Some environmental scholar's belief that reuses of plastic (especially shopping bags) at the point of generation is one promising way to delay the release of plastic as waste to disposal sites or the environment. Other point is the use of utilizing different packaging materials to prevent the increased use of plastic materials. Packaging waste is very visible across globe as almost 70% of primary packaging is used for food and drink purposes, which is often discarded in a dirty state and contaminated by residues of the original contents. As the consumption of plastics is increasing day by day, there is a need to treat the used plastics in sense of resources.

Plastics packaging normally considered as litter because of the lightweight nature of both rigid and flexible plastics. Thus, reusing and recycling this plastic can be helpful. Recycling is defined as the process of systematically collecting, sorting, decontaminating and returning of waste materials to commerce as commodities for use or exchange (Pohlen and Farris, 1992). Waste management varies in different countries as it is affected by several factors such as population, technology and population. Compared to developing countries, the developed countries have advanced and rich practical experience with advanced technology. Some countries follow a four-tiered hierarchical waste management strategy like the United States that is mentioned in Figure 11.5.

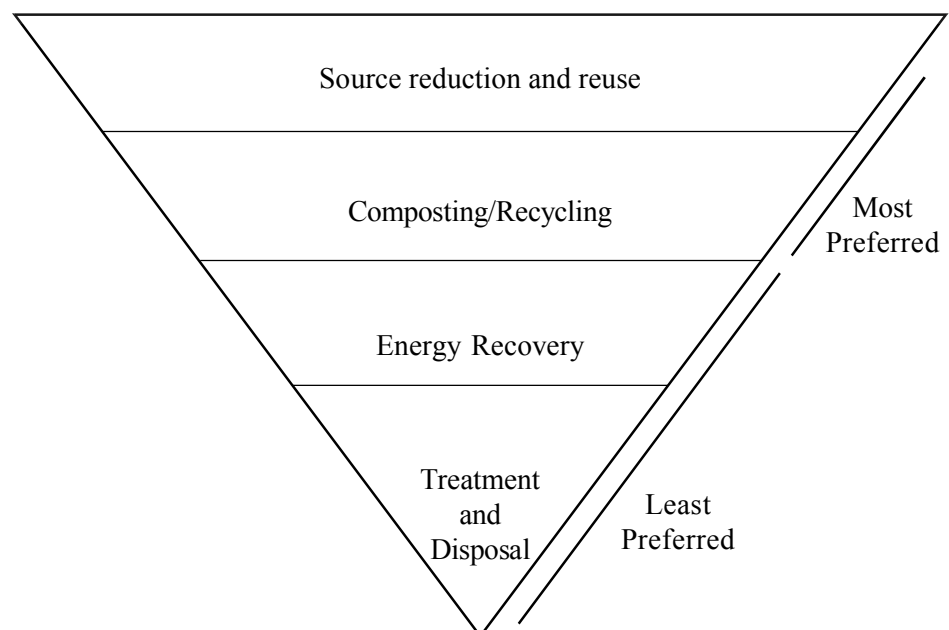


Figure 11.5 Waste Management Strategy (United State)

Other countries like the Europe follow the waste management strategy as mentioned in the Figure 11.6.

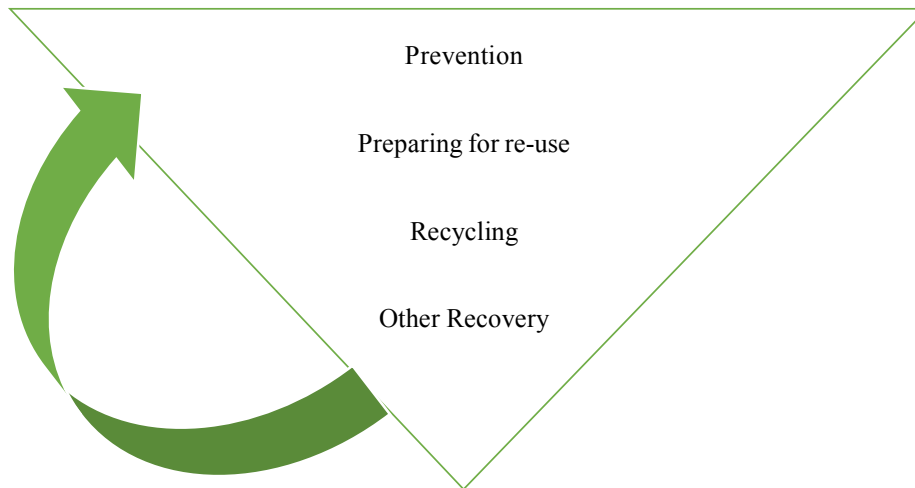


Figure 11.6 Waste Management Strategy (Europe)

With the expansion of cities and growth of human population, the availability of land for waste disposal is decreasing. Serious problem including groundwater contamination, soil and air pollution have caused uncontrolled and unplanned dumping of waste on land in various areas of the world. Thus, sustainable waste management approaches are needed.

Sustainable waste management refers to manipulating the value of material resources as much as possible by handling waste materials from source to disposal. It is vital for conservation of natural resources but also for reducing greenhouse gases and protecting the natural ecosystem. The waste hierarchy proposed by Ad Lansink in 1979 known as the **Lansink's ladder** includes the following components:

1. **Reduce or prevent waste** arising waste minimization initiatives to help business and households reduce waste generated.
2. **Reuse waste:** reuse waste and thus avoid energy consuming reprocessing.
3. **Recycle:** reprocess waste for further use.
4. **Energy Recovery:** generating energy from waste by using a range of technologies.
5. **Disposal:** put waste in landfill site.

The **3R principle** (reduce, reuse and recycle) practise maximizes use of resource but also contributes to reduction of greenhouse gas emission, minimizing environmental load from landfill and incineration, resulting in improving economy and social wellbeing etc. The 3 Rs are essential as they help to transition from the **linear economy to a circular economy**. Thus, it is not only about saving resources but also about sustainable development of human society and planet. A **circular economy** relies on three principles that are:

1. Design out waste and pollution
2. Keep products, components, and materials at their highest value and in use
3. Regenerate natural systems

In circular economy the materials flows are divided into two types that are biological and technical. In biological flow, consumption occurs, and renewable energy are regenerated and in technical cycle, technical materials are recovered and mostly restored. Figure 11.7 below shows the linear economy, where little attention is given to the social cost of waste. In circular economy, materials are reused wherever possible.

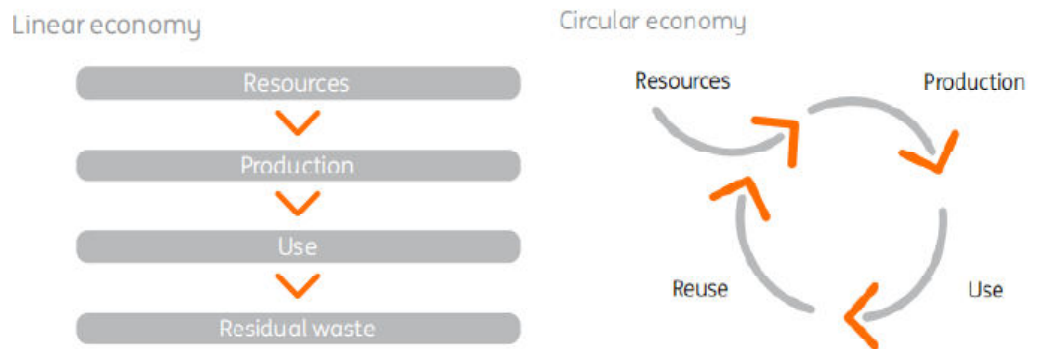


Figure 11.7 Linear and Circular Economy

Source: Goyal, S., Esposito, M., & Kapoor, A. (2018). Circular economy business models in developing economies: lessons from India on reduce, recycle, and reuse paradigms. *Thunderbird International Business Review*, 60(5), 729-740.

11.5 ENVIRONMENTAL POLICIES IN INDIA

India has also several policies over the years. Table 11.1 mentions the sanitisation policies in India. *Public health* and *sanitation* are the subjects under the *State List* of the Seventh Schedule of the Indian Constitution. However, the Central Government in India frames policies and guidelines for sanitation and provides financial as well as capacity-building support. In rural India, the accountability for provision of sanitation facilities predominantly rests with local governments particularly the Gram Panchayat, to the extent that the State Government transfers functions, funds, and functionaries to the local government. In India, with around one-third of the total population living in the urban areas (World Bank Data, 2020), it is one of the fastest urbanising nations facing several issues in urban sanitation infrastructure and management. Though urban sanitation has made considerable progress, yet several city administrations are still grappling with the enormous challenge of providing improved and adequate sanitation facilities to its citizens.

Table 1: Sanitisation Policies in India

Source: Bharat, Girija; Dkhar, Nathaniel B and Abraham, Mary. 2020. Aligning India's Sanitation Policies with the Sustainable Development Goals (SDGs), TERI Discussion Paper

Policy	Year	Description
Integrates low-cost sanitation scheme (ILCS) for urban areas	1980-81	Aimed to convert/construct low-cost sanitation units through sanitary two-pit pour-flush latrines with superstructures and appropriate variations depending on local conditions.
National Water Policy	1987	Recognised the need for and laid targets on the provision of sanitation services in both rural and urban areas.
The 74th Constitutional Amendment Act (CAA)	1993	The Act enabled the State Governments to pass their respective legislation. This, in turn, shared the responsibilities of water supply and sanitation services to the ULBs through decentralisation and ensuring people's participation.
The Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act	1993	The Act prohibited the construction of dry latrines and employment of manual scavengers.

Policy	Year	Description
National Health Policy	2000	Recognised the relationship of unsafe drinking water and unhygienic sanitation in urban settings.
The Valmiki Ambedkar Awas Yojana (VAMBAY)	2001	It included sanitation for urban poor and slum dwellers.
Jawaharlal Nehru National Urban Renewal Mission (JnNURM)	2005	Provision of sanitation infrastructure
Nirmal Shahar Puraskar	2010	It encouraged all cities to strive for 100% access to sanitation facilities and 100% safe disposal of all city generated waste.
Rajiv Awas Yojana (RAY)	2011	It brought all existing slums, notified or non-notified within the formal system and enabled them to avail the basic amenities including sanitation.
Prohibition of Employment as Manual Scavengers and their Rehabilitation Act	2013	Responsibility on ULBs to prohibit manual scavenging and provide sanitation infrastructure
Swachh Bharat Mission	2014	For creating ODF areas and achieving 100% scientific management of municipal solid waste in all statutory towns in the country.
Atal Mission for Rejuvenation and Urban Transformation (AMRUT)	2015	Aimed to provide basic services (e.g., water supply, sewerage, and urban transport) to households and build amenities in cities which will improve the quality of life for all, especially the poor and the disadvantaged.
Swachh Survekshan (Box-1)	2014 - 2019	Aimed to inculcate competition among urban areas for enhancing the performance of cities on sanitation and cleanliness.
National Policy on Faecal Sludge and Septage Management (FSSM)	2017	Aimed to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all ULBs for ensuring safe and sustainable sanitation for every household, street, town, and city.
SMART City	2015	Have the objective of promoting sustainable and inclusive cities that provide core infrastructure (including adequate water and sanitation) and give a decent quality of life to its citizens, a clean and sustainable environment, and application of smart solutions.
National Urban Sanitation Policy (NUSP)	2008	Aimed to transform all urban areas into a community-driven, totally sanitised, healthy, and liveable cities and towns ensuring and sustaining good public health and environmental outcomes for all citizens.
Service Level Benchmark (SLB)	2008	The SLB included 28 performance indicators in the domain of water supply, waste water management, solid waste management, and storm water management for assessment and accountability of service levels in the ULBs.

11.5.1 Swachh Bharat Abhiyaan

One of the most ambitious projects that has been successful in bringing difference at facility and infrastructure level is Swachh Bharat Abhiyaan. Swachh Bharat Mission i.e., Clean India Mission, a national level initiative started by the Government of India in 2014 is a major step towards the protection of environment. India's honourable Prime Minister, Shri Narendra Modi ideated and initiated the Swachh Bharat Abhiyan (SBA) on 2 October 2014 on the birth anniversary of Mahatma Gandhi at Rajghat, New Delhi. This programme aims at contributing towards universal cleanliness, sanitation and hygienic India. This movement has well-defined guidelines and has two sub-missions—the Swachh Bharat Mission (Gramin/Rural) and the Swachh Bharat Mission.

The objectives of urban Swachh Bharat Abhiyaan are:

- The elimination of open defecation.
- Eradication of manual scavenging; modern and scientific municipal solid waste management.
- Bringing positive behavioural changes regarding healthy sanitation practices.
- Generating awareness about sanitation and its linkage with public health and capacity augmentation for urban local bodies (ULBs) to create an enabling environment for private sector participation in capital expenditure and operation and maintenance expenditure.

But all the objectives of this programme can be achieved only if people are aware of this mission and have correct attitude towards basic sanitation and waste management. Cleanliness can be seen as a key to preventing diseases. An unclean environment can lead to spread of many diseases. Thus, SBA aims at preventive healthcare as it helps us maintain a clean environment and has the potential to support essential components of primary health by sustaining basic sanitation and preventing epidemics.

Check Your Progress 4

1. What is the 3 R principle.

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2. What steps need to be taken for Waste Management in Indian Cities.

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11.6 SUMMARY

To sum up what we have learnt in this unit, here is a quick recap:

- There is a need to better understand climate change-related hazards within the context of mental health.
- Rising temperatures, heat waves, floods, tornadoes, hurricanes, droughts, fires, loss of forest, and glaciers, along with disappearance of rivers and desertification, can directly and indirectly cause human pathologies that are physical and mental.
- Climatic events are usually disregarded in studies on mental health of exposed populations (e.g., ocean acidification, acid rain, superfog, glacier melting, biomass extinction), and they could also have a broader impact on mental health.
- Mental health outcomes of climate change range from minimal stress and distress symptoms to clinical disorders, ranging from depression, anxiety, PTSD and sleep disturbances
- The disposal of waste must be done for a better impact on environment; there

is an urgent need for efficient disposal and proper management of waste in various states.

- A significant investment in cleanliness, hygiene training, maintenance and human resources are linked to the policies introduced in India specially seen through the Swachh Bharat Abhiyaan/Mission.
- Transformative action should be taken where inequities are addressed, action is demonstrated, and communities are mobilized so that people can address the negative impact and risk of climate change on mental health.

11.7 KEYWORDS

Adaptation	: Refers to events that emphasize coping from threats of climate change.
Mental Health	: Conceptualized as existing on a continuum between mental illness and wellbeing, and includes states of mental wellbeing, experiencing mental problems (like worry, grief, stress related to climate change), and mental illness like depression and anxiety.
Psychosocial Health	: Is the interplay between social and psychological conditions that shape wellbeing.
Mitigation	: Refers to actions to reduce the effects of climate change and global warming, for example reducing Greenhouse gas emissions.
Ecoanxiety	: Refers to the anxiety that people face from constantly being surrounded by the risk and problems associated with a changing climate.
Ecological grief (eco-grief)	: The feeling of sadness and distress related to ecological loss or anticipated losses related to climate change.
Eco-paralysis	: The complex feelings of not being able to take effective action to significantly alleviate the climate change risks.
Pro-environmental Behaviours	: The potential actions aimed at avoiding harm to the environment and focusing on safeguarding the environment.
Circular Economy	: The recirculation of wastes through different recycling (3R principle) and recovery techniques.
Sanitisation	: Includes the effective management (collection, treatment and disposal/recovery, reuse or recycling) of human waste, solid waste (including biodegradable and non-biodegradable refuse/trash/rubbish), wastewater, sewage effluents, industrial wastes, and hazardous (such as hospital, chemical, radioactive, plastic or other dangerous) wastes.

11.8 REVIEW QUESTIONS

1. How does increased knowledge and connection to climate change lead to pro-environmental behaviours?
2. Discuss the different factors impacting the environmental behaviour.
3. How theory of planned behaviour predicts pro-environmental behaviour?
4. Write a note on recycling of plastic.
5. Mention some of the Indian sanitisation policies in India.
6. Explain the risks and impact of climate change on mental health.
7. What are the key mitigation strategies that people need to adopt for climate change?
8. What is climate change adaptation?
9. Explain the theory of planned action.
10. Discuss the adaptive strategies and the action people can take to address the negative impact of climate change on mental health.
11. Write a short note on 1) active hope 2) Swachh Bharat Abhiyaan
12. What are the adaptation mechanisms that ought to be considered to support people with mental health in a changing climate?
13. Explain the reasons for the discrepancy between environmental attitude and the corresponding actions?
14. Explain the waste hierarchy as proposed by Ad Lansink.

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11.10 ADDITIONAL ONLINE RESOURCES

- How Climate Change Impacts Your Mental Health | APA
https://www.youtube.com/watch?v=xhN4afWdX4Q&ab_channel=AmericanPsychiatricAssociation
- The Attitude-Behavior-Gap in sustainability | Why we want to act more sustainable but we aren't
https://www.youtube.com/watch?v=3YK8L0IP3Go&ab_channel=GREENMINIMALISTLIFE
- Relevant Environmental Attitudes and Behaviour
https://www.youtube.com/watch?v=1RjS_U-pfqA&ab_channel=ArnoldFonollera
- How Singapore fixed its big trash problem | CNBC Reports
https://www.youtube.com/watch?v=r-q5V6LDxEY&ab_channel=CNBCInternational
- How We Can Keep Plastics Out of Our Ocean | National Geographic
https://www.youtube.com/watch?v=HQTUWK7CM-Y&ab_channel=NationalGeographic
- Waste generation and management- Sustainability | ACCIONA
https://www.youtube.com/watch?v=DmFGsxLcT6k&ab_channel=ACCIONA