Environmental engineering – pollution prevention

It therefore draws from all other engineering disciplines that are apt to bear on the desired objectives. Pursuit of pollution prevention and sustainability further implicate social, cultural and economic considerations. Generally, it includes supply of water, disposal and recycling of wastes, drainage of communities, control of water, soil, atmospheric pollution and environmental impacts of different activities carried out on earth. Nowadays, the causes of environmental problems are the increasing population and the greater consumption of natural resources.

Another cause is pollution, which includes air, land, water, marine and noise. Pollution is defined as the introduction of harmful contaminants that are outside the norm for a given ecosystem. These various types of pollutions are discussed in this research. In addition, radiation, natural calamities and drugs, narcotics and food additives are also included. Environmental engineering plays extremely important role because cleaner and healthier environment means healthier life with more quality.

Unhealthy environment leads to diseases, deaths, and generally low quality of life. Science and engineering really have tough task ahead of them to keep our environment clean and healthy in years to come because ecological problems are constantly growing, and what is even worse, they are all connected so loving one doesn’t count a lot on global scale. Take for instance problem of air and water pollution in Asia, water supply in Africa and you’ll see only few challenges that environmental engineering needs to overcome in years to come. I.

The Ecosystem An ecosystem is a community of organisms interacting with each other and with their environment such that energy is exchanged and system-level processes, such as the cycling of elements emerge. The ecosystem is a core concept in Biology and Ecology, serving as the level of biological organization in which organisms interact simultaneously with each there and with their environment. As such, ecosystems are a level above that of the ecological community (organisms of different species interacting with each other) but are at a level below, or equal to, biomass and the biosphere.

Essentially, biomass are regional ecosystems, and the biosphere is the largest of all possible ecosystems. Ecosystems include living organisms, the dead organic matter produced by them, the biotic environment within which the organisms live and exchange elements (soils, water, atmosphere), and the interactions between these components. Ecosystems embody the concept that living organisms continually interact with each other and with the environment to produce complex systems with emergent properties, such that “ the whole is greater than the sum of its parts” and “ everything is connected”.

In recent years, the impact of humans has caused a number of dramatic changes to a variety of ecosystems found on the Earth. Humans use and modify natural ecosystems through agriculture, forestry, recreation, arbitration, and industry. The most obvious impact of humans on ecosystems is the loss of biodiversity. The number of extinctions caused by unman domination of ecosystems has been steadily increasing since the start of the Industrial Revolution. The frequency of species extinctions is correlated to

the size of human population on the Earth which is directly related to resource consumption, land-use change, and environmental degradation.

Other human impacts to ecosystems include species invasions to new habitats, changes to the abundance and dominance of species in communities, modification of biochemical cycles, modification of hydrological cycling pollution, and climatic change. Ecosystem, basically, is of 2 types: aquatic and terrestrial. Sub ecosystem comes under them. Terrestrial-ecosystem is found in every place except water-bodies. It is classified broadly into following sub-parts: Forest- ecosystem – In this type of ecosystem we can see plenty of plants as well as numerous organisms.

So life’s density in it is quite high. Forest ecosystem is further divided into following forests: a. Tropical-evergreen – It receives rainfall at an average varying from inches 80-400 yearly. Vegetation is very dense having trees Of different lengths. B. Tropical-deciduous – Has dense shrubs and bushes as well as trees. C. Temperature-evergreen – Have fewer trees with leaves spiked for minimizing transpiration. D. Temperature- deciduous -? Found in regions where temperature is moist with enough rainfall. Desert-ecosystem – Is found in those regions which receives rainfall annually ; CACM. Almost 17% of planet’s land is occupied by it. Plants have leaves having spines for conserving water. To xeric conditions, animals found here are also adapted. Trees are very rare here. Grassland-ecosystem – We find it in regions both tropical and temperate of world. Comprises mainly grasses having trees and shrubs in small amount. It s of two types: Savanna, Prairies Mountain-ecosystem – Here wide variety of animals and plants are available. Higher

slopes have treeless vegetation and lower region is covered of coniferous-forest. Aquatic Ecosystem is situated inside water-bodies.

It is of 2 types: Marine- ecosystem – It covers about 71 percent of surface of Earth and has 97 percent Of Water Of planet. Its various divisions are: Oceanic, Inter-tidal, Salt-marshes, Estuaries, Coral-reefs Freshwater-ecosystem -? Covers only 0. Percent of surface of earth and 0. Percent of whole water. It is of 3 types: Lentil, Wetlands, Loti Two Major Components of Ecosystem The two major components of ecosystem are the biotic and biotic. Biotic consists of nonliving chemical and physical components such as water, air, nutrients in the soil or water and solar energy.

Biotic factors may be grouped into the following main categories, which are climatic factors (sunlight, humidity, temperature, atmosphere, etc.), adapted factors (the nature and type of the soil, geology of the land, etc.) topographic factors (land use, etc.). Adapted factors are the physics-chemical properties of soil that limit the abundance and distribution of living organisms. Soil is a natural product of unconsolidated mineral and organic matter on Earth’s surface. It is the medium in w/c plant grows and the site of the decomposition of organic matter.

Soil serves as the habitat of animals and the anchoring medium of plants and source of their nutrients and water. Physical and chemical factors that influence living organisms in land (terrestrial) ecosystems and aquatic life zones include the following: Terrestrial Ecosystem Light penetration Aquatic Life Zone 1. Sunlight 2. Temperature 2. Water current 3. Precipitation 3. Dissolved nutrient concentrations . Wind (especially N and P) 5. Latitudes.

Suspended solids (distance from equator)5. Salinity (the amounts of various 6.

Altitude inorganic minerals or salts dissolved (distance above sea level) in a given volume of water) 7. Fire frequency 8. Soil Biotic is made up of biological components consisting of living and dead plants, animals and microorganisms. The Major Biological Components of Ecosystem a. Producers or authoress, also known as self-feeders, make their own food from compounds that are obtained from their environment. They are the source of all food in an ecosystem. On land most producers are green plants. In freshwater and marine ecosystems, algae and plants are the major producers near shorelines.

In Open Water, the dominant producers are phytoplankton (most of them microscopic) that float or drift in the water. Most producers capture sunlight to make carbohydrates (such as glucose) by photosynthesis. A few producers, mostly specialized bacteria, can convert simple compounds from their environment into more complex nutrient compounds without sunlight a process called chemosynthesis. B. Consumers or heterodox, also known as " other feeders", get their energy ND nutrients by feeding on other organisms or their remains.

Consumers are classified as: Primary consumers -? are those that eat producers (plants) as a source of food also known as herbivores. Secondary consumers or carnivores – eat other animals Omnivores – have mixed diet that include both plants and animals Decomposer – mostly certain types of bacteria and fungi are specialized consumers that recycle organic matter in

ecosystems; they do this by breaking down (biodegrading) dead organic material to get nutrients and releasing the resulting simpler inorganic compounds into the soil and water, here they can be taken up as nutrients by producers .

The Environment The word “ environment” is most commonly used describing “ natural” environment and means the sum of all living and non-living things that surround an organism, or group of organisms. Environment includes all elements, factors and conditions that have some impact on growth and development of certain organism. Environment includes both biotic and biotic factors that have influence on observed organism. Biotic factors such as light, temperature, water, atmospheric gases combine with biotic factors (all surrounding living species).

Environment often changes after some time and therefore many organisms have ability to adapt to these changes. However tolerance range is not the same with all species and exposure to environmental conditions at the limit Of a certain organism’s tolerance range represents environmental stress. Environmentalism is very important political and social movement with goal to protect nature environment by emphasizing importance of nature role in protection of the environment in combination with various actions and policies oriented to nature preservation.

Environmentalism is movement unconnected with environmental scientists and many of their goals. Some of these goals include reducing world consumption of fossil fuels, reducing and cleaning up all sorts of pollution (air, sea, river…) with future goal of zero pollution, emphasizing on clean,

alternative energy sources that have low carbon emissions, sustainable use of water, land, and other scarce resources, preservation of existing endangered species and protection of biodiversity. First goal reducing the world consumption of fossil fuels is very important to fight against climate change and global warming phenomenon.

Fossil (non-renewable) fuels are mainly responsible for global warming as during the combustion of fossil fuels carbon dioxide (one of the green house gases) gets released into the atmosphere. In fact reducing the emission of carbon dioxide is the most important thing if We Want to successfully fight global warming. Reducing and cleaning up pollution is also very important task. Every day we hear the news about tremendous pollution of our air, seas and rivers. Pollution creates unhealthy environment, and often causes many health problems and different diseases.

Third goal is very obvious. World deeds a lot of energy and if we want to reduce the use of fossil fuels then we should have some other alternative energy sources to satisfy world energetic needs. These alternative energy sources such as wind energy, solar power and hydro-energy, have all great potential, and are also ecologically acceptable. However their use is still negligent on global scale and fossil fuels are still dominant energy sources. Water is precious but also scarce resource that needs to be preserved for future generations.

Sustainable use of water, land and other resources is therefore vital to enable future life of our planet. The number of endangered species is lately increasing rapidly and many species have become extinct in the last 50

years or so. Preservation of endangered species is important to save number of ecosystems and to protect biodiversity of our planet. Biodiversity is very important in enabling the life on earth since all species are connected in perfectly balanced circle, each with their very own role.

Humans are not owners of this circle but only one small part that needs even the smallest parts of this circle for its proper functioning. However we seem to be forgetting this more often than not. In an environment, organisms do interact with each other. These interactions can have positive, negative, or neutral impacts on the species involved. KINDS OF ORGANISM INTERACTIONS 1 . Predation ; situation in w/c an organism of one species (the predator) captures and feeds on parts or all of an organism of another species (the prey); an example is the wolf(predator) and the rabbit (prey) 2.

Competition – a kind of interaction in w/c two organisms strive to obtain the same limited resource and in the process both organisms are harmed to some extent (population growth rates are reduced); examples include oak Reese and maple trees competing for light in a forest, wading birds foraging for food in a marsh a. Introspection competition – competition w/c is between members of the same species b. Interspecies competition -? competition among organisms of different species 3. Symbiotic relationships a. Symbiosis – is a close, long lasting, physical relationship between two different species of organisms. ?? the two organisms are usually in physical contact and at least one of the organisms derives some sort of benefit from this contact b. Parasitism – is a relationship in w/c one organism, known as he parasite, lives in or on another Organism, known as the host, from w/c it derives nourishment. 1), Catastrophe – those that live on the surface of their host 2).

Indoctrinate – those that live inside the bodies of their hosts c. Commercialism – relationship in w/c one organism benefits while the other is not affected.

Ex Remove fish attached to shark d. Naturalism – symbiotic relationships that are actually beneficial to both species of organisms involved; examples include humans and house pets and insect pollination of flowers e. Nationalism – One species harms another (typically by releasing a OIC substance), but is not affected itself; example: Elephant (plants that produce substances harmful to other plants): rye and wheat suppress weeds when used as cover crops, broccoli residue suppresses growth of other vegetables in the same plant family II.

Air Pollution Air pollution can be defined as dirty air which damages human health, plant and animal life or property. The World Health Organization defines air pollution as “ substances put into the air by the activity of mankind into concentration sufficient to cause harmful effects to health, property, crop yield or to interfere with the enjoyment of property. Reducing air pollution exposure is largely a technical issue. Technologies to reduce pollution at its source are plentiful, as are technologies that reduce pollution by filtering it away from the emission source.

Getting these technologies applied in practice requires government or corporate policies that guide technical decision making in the right direction. Sophisticated modeling in combination with monitoring has made it possible to start producing detailed estimates and maps of air pollution levels in key urban areas, thus providing a powerful tool for assessing current health

impacts and estimated changes in the health impacts brought about by defined air pollution interventions. The composition of “ unpolluted” air is unknown to us.

Humans have lived on the planet thousands of years and influenced the composition of the air through their many activities before it was possible to measure the constituents of the air. Air is a complex mixture made up of many chemical components. The primary components of air are nitrogen (NO), oxygen (02), and water vapor (H2O). About 99 percent of air is nitrogen (78%) and oxygen (210/6). The remaining percent includes trace quantities of substances such as arbor dioxide (CA), methane (CHI), hydrogen (H2O), argon (Ar) and helium (He).

In theory, the air has always been polluted to some degree. The pollutants we usually refer to when We talk about air pollution are those generated as a result of human activity. An air pollutant can be considered as a substance in the air that, in high enough concentrations, produces a detrimental environmental effect. These effects can be either health effects or welfare effects. An environmental effect is defined as a measurable or perceivable detrimental change resulting from contact with an air pollutant. Human activities have had a detrimental effect on the makeup of air.

Activities such as driving cars and trucks, burning of coal, oil and other fossil fuels, and manufacturing chemicals have changed the composition of air by introducing many pollutants. There are hundreds of pollutants in the ambient air. Ambient air is the air to which the general public has access, I. E. Any unconfined portion of the atmosphere. The two basic physical forms of air

pollutants are particulate matter and gases. Particulate matter includes small solid and liquid particles such as dust, smoke, sand, pollen, mist, and fly ash.

Gases include substances such as carbon monoxide (CO), sulfur dioxide (SIS), nitrogen oxides (NON), and volatile organic compounds (Voss). Pollutants can also be classified as either primary pollutants or secondary pollutants. A primary pollutant is one that is emitted into the atmosphere directly from the source of the pollutant and retains the same chemical form. An example of a primary pollutant is the ash produced by the burning of solid waste. A secondary pollutant is one that is formed by atmospheric reactions of precursor or primary emissions.

Secondary pollutants undergo a chemical hanger once they reach the atmosphere. An example Of a secondary pollutant is ozone created from organic vapors given off at a gasoline station. The organic vapors react with sunlight in the atmosphere to produce the ozone, the primary component of smog. Control of secondary pollutants is generally more problematic than that of primary pollutants, because mitigation of secondary pollutants requires the identification of the precursor compounds and their sources as well as an understanding of the specific chemical reactions that result in the formation of the secondary pollutants.

Sources of Pollutants in the Ambient Air A source of air pollution is any activity that causes pollutants to be emitted into the air. There have always been natural sources of air pollution, also known as boogieing sources. For example, volcanoes have spewed particulate matter and gases into our

atmosphere for millions of years. Lightning strikes have caused forest fires, with their resulting contribution of gases and particles. These natural pollutants can be problematic at times, but generally are not as much of a problem as are human-generated pollutants or anthropogenic so races.

Human-generated SOUrces Of air pollution or anthropogenic sources are categorized in two WAP: mobile and stationary sources. Mobile sources of air pollution include most forms of transportation such as automobiles, trucks, and airplanes. Stationary sources of air pollution consist of non-moving sources such as power plants and industrial facilities. Stationary sources are classified as point source or area source. A point source refers to a source at a fixed point, such as a smokestack or storage tank, that emits air pollutants.

An area source refers to a series of small sources that together can affect air quality in a region. For example, a community of homes using woodsiest for heating would be considered as an area source, even though each individual home is contributing small amounts of various pollutants. “ Mobile sources” is a term used to describe a wide variety of vehicles, engines, and equipment that generate air pollution and that move, or can be moved, from place to place. Mobile sources are classified as on-road and inroad sources. “ On-road” or highway sources include vehicles used on roads for transportation of passengers or freight. Inroad” sources include gasoline and diesel powered vehicles, engines, and equipment used for instruction, agriculture, transportation, recreation, and many other purposes. These sources emit both criteria pollutants and other hazardous air pollutants. Mobile sources pollute the air through combustion and fuel evaporation. Combustion is the process of burning. Motor vehicles and equipment typically burn fuel in an

engine to create power. Gasoline and diesel fuels are mixtures of hydrocarbons, which are compounds that contain hydrogen and carbon atoms.

In “ perfect” combustion, oxygen in the air would combine with all the hydrogen in the fuel to form water and with all the carbon in the fuel to form arbor dioxide. Nitrogen in the air would remain unaffected. In reality, the combustion process is not “ perfect,” and engines emit several types of pollutants as combustion byproducts. Evaporation is the process by which a substance is converted from a liquid into a vapor. “ Evaporative emissions” occur when a liquid fuel evaporates and fuel molecules escape into the atmosphere.

A considerable amount of hydrocarbon pollution results from evaporative emissions that occur when gasoline leaks or spills, or when gasoline gets hot and evaporates from the fuel tank or engine. Perfect Combustion Fuel (hydrocarbons) + Air (oxygen and nitrogen) Carbon dioxide (CA) + water (H2O) + unaffected nitrogen Typical Engine Combustion Fuel + Air Unburned Hydrocarbons + Nitrogen Oxides (Knox) + Carbon monoxide (CO) Carbon dioxide + water Stationary sources are non-moving sources, fixed-site producers Of pollution such as power plants, chemical plants, oil refineries, manufacturing facilities, and other industrial facilities.

Stationary sources emit both criteria pollutants and hazardous air pollutants (HAPS). Air pollution from stationary sources is produced by two primary activities. These activities are stationary combustion f fuel such as coal and oil at power generating facilities, and the pollutant losses from industrial

processes. Industrial processes include refineries, chemical manufacturing facilities, and smelters. Stationary sources have many possible emission points.

An emission point is the specific place or piece of equipment from which a pollutant is emitted. Air pollutants can be emitted from smokestacks, storage tanks, equipment leaks, process wastewater handling/treatment area, loading and unloading facilities, and process vents. A process vent is basically an opening where substances mostly in gaseous form) are “ vented” into the atmosphere. Common process vents in a chemical plant are distillation columns and oxidation vents.

Emissions from storage tanks are due to pollutants that can leak through the roofs, and can leak through tank openings when liquids expand or cool because of outdoor temperature changes. Also, air pollutants can escape during the filling and emptying of a storage tank. Air pollution produced from wastewater occurs when wastewater containing volatile chemicals comes in contact with the air. Volatile means that it can be evaporated, or pass from a liquid state to a gaseous state.