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Sustainability of Environment by Conservation of Soil, Water and Air

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ABSTRACT: At the global scale sustainability and environmental management involves managing the oceans, freshwater systems, land and atmosphere, according to sustainability principles.[1][2]

Land use change is fundamental to the operations of the biosphere because alterations in the relative proportions of land dedicated to urbanisation, agriculture, forest, woodland, grassland and pasture have a marked effect on the global water, carbon and nitrogen biogeochemical cycles.[3] Management of the Earth's atmosphere involves assessment of all aspects of the carbon cycle to identify opportunities to address human-induced climate change and this has become a major focus of scientific research because of the potential catastrophic effects on biodiversity and human communities. Ocean circulation patterns have a strong influence on climate and weather and, in turn, the food supply of both humans and other organisms.

KEYWORDS: sustainability, environmental management, soil, water, air, atmosphere, biodiversity

INTRODUCTION

In March 2009, at a meeting of the Copenhagen Climate Council, 2,500 climate experts from 80 countries issued a keynote statement that there is now "no excuse" for failing to act on global warming and without strong carbon reduction targets "abrupt or irreversible" shifts in climate may occur that "will be very difficult for contemporary societies to cope with".[4][5] Management of the global atmosphere now involves assessment of all aspects of the carbon cycle to identify opportunities to address human-induced climate change and this has become a major focus of scientific research because of the potential catastrophic effects on biodiversity and human communities.[1]

Other human impacts on the atmosphere include the air pollution in cities, the pollutants including toxic chemicals like nitrogen oxides, sulphur oxides, volatile organic compounds and airborne particulate matter that produce photochemical smog and acid rain, and the chlorofluorocarbons that degrade the ozone layer. [2]Anthropogenic particulates such as sulfate aerosols in the atmosphere reduce the direct irradiance and reflectance (albedo) of the Earth's surface. Known as global dimming the decrease is estimated to have been about 4% between 1960 and 1990 although the trend has subsequently reversed. Global dimming may have disturbed the global water cycle by reducing evaporation and rainfall in some areas. It also creates a cooling effect and this may have partially [3]masked the effect of greenhouse gases on global warming.[6] Soil conservation is the prevention of loss of the topmost layer of the soil from erosion or prevention of reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination.[4,5]

Slash-and-burn and other unsustainable methods of subsistence farming are practiced in some lesser developed areas. A consequence of deforestation is typically large-scale erosion, loss of soil nutrients and sometimes total desertification. Techniques for improved soil conservation include crop rotation, cover crops, conservation tillage and planted windbreaks, affect both erosion and fertility.[7] When plants die, they decay and become part of the soil. Code 330 defines standard methods recommended by the U.S. Natural Resources Conservation Service. Farmers have practiced soil conservation for millennia.[8] In Europe, policies such as the Common Agricultural Policy are targeting the application of best management practices such as reduced tillage, winter cover crops,[1] plant residues and grass margins in order to better address soil conservation.[9] Political and economic action is further required to solve the erosion problem. A simple governance hurdle concerns how we value the land and this can be changed by cultural adaptation.[2] Soil carbon is a carbon sink, playing a role in climate change[10] mitigation.[3]

Soil-conservation farming involves no-till farming, "green manures" and other soil-enhancing practices which make it hard for the soils to be equalized. Such farming methods attempt to mimic the biology of barren lands.[11] They can revive damaged soil, minimize erosion, encourage plant growth, eliminate the use of nitrogen fertilizer or fungicide, produce above-average yields and protect crops during droughts or flooding.[12] The result is less labor and lower costs that increase farmers' profits. No-till farming and cover crops act as sinks for nitrogen and other nutrients. This increases the amount of soil organic matter.[8]

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Repeated plowing/tilling degrades soil, killing its beneficial fungi and earthworms. Once damaged, soil may take multiple seasons to fully recover, even in optimal circumstances.[8]

Critics argue that no-till and related methods are impractical and too expensive for many growers, partly because it requires new equipment. [13]They cite advantages for conventional tilling depending on the geography, crops and soil conditions. Some farmers claimed that no-till complicates pest control, delays planting and that post-harvest residues, especially for corn, are hard to manage.[8]

II.DISCUSSION

Ocean circulation patterns have a strong influence on climate and weather and, in turn, the food supply of both humans and other organisms. Scientists have warned of the possibility, under the influence of climate change, of a sudden alteration in circulation patterns of ocean currents that could drastically alter the climate in some regions of the globe.[7] Major human environmental impacts occur in the more habitable regions of the ocean fringes[14] – the estuaries, coastline and bays. Eight point five of the world's population – about 600 million people – live in low-lying areas vulnerable to sea level rise. Trends of concern that require management include: over-fishing (beyond sustainable levels);[8] coral bleaching due to ocean warming, and ocean acidification due to increasing levels of dissolved carbon dioxide;[9] and sea level rise due to climate change.[15] Because of their vastness oceans also act as a convenient dumping ground for human waste.[10] Remedial strategies include: more careful waste management, statutory control of overfishing by adoption of sustainable fishing practices and the use of environmentally sensitive and sustainable aquaculture and fish farming, reduction of fossil fuel emissions and restoration of coastal and other marine habitats.[11] Water conservation includes all the policies, strategies and activities to sustainably manage the natural resource of fresh water, to protect the hydrosphere[16], and to meet the current and future human demand (thus avoiding water scarcity). Population, household size and growth and affluence all affect how much water is used. Factors such as climate change have increased pressures on natural water resources especially in manufacturing and agricultural irrigation.[1] Many countries have already implemented policies aimed at water conservation, with much success.[2] The key activities to conserve water are as follows: any beneficial reduction in water loss, use and waste of resources,[3] avoiding any damage to water quality; and improving water management practices that reduce the use or enhance the beneficial use of water.[4][5] Technology solutions exist for households, commercial and agricultural applications.[17] Water conservation programs involved in social solutions are typically initiated at the local level, by either municipal water utilities or regional governments. The key activities to conserve water are as follows:

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One of the strategies in water conservation is rain water harvesting.[8] Digging ponds, lakes, canals, expanding the water reservoir, and installing rain water catching ducts and filtration systems on homes are different methods of harvesting rain water.[18] Many people in many countries keep clean containers so they can boil it and drink it, which is useful to supply water to the needy.[8] Harvested and filtered rain water can be used for toilets, home gardening, lawn irrigation, and small scale agriculture.[8]

Another strategy in water conservation is protecting groundwater resources. When precipitation occurs, some infiltrates the soil and goes underground.[9] Water in this saturation zone is called groundwater.[9] Contamination of groundwater causes the groundwater water supply to not be able to be used as a resource of fresh drinking water and the natural regeneration of contaminated groundwater can take years to replenish.[10] Some examples of potential sources of groundwater contamination include storage tanks, septic systems, uncontrolled hazardous [19] waste, landfills, atmospheric contaminants, chemicals, and road salts.[10] Contamination of groundwater decreases the replenishment of available freshwater[20] so taking preventative measures by protecting groundwater resources from contamination is an important aspect of water conservation.[8]

An additional strategy to water conservation is practicing sustainable methods of utilizing groundwater resources.[8] Groundwater flows due to gravity and eventually discharges into streams.[9] Excess pumping of groundwater leads to a decrease in groundwater levels and if continued it can exhaust the resource.[8] Ground and surface waters are connected and overuse of groundwater can reduce and, in extreme examples, diminish the water supply of lakes, rivers, and streams.[10] In coastal regions, over pumping groundwater can increase saltwater intrusion which results in the contamination of groundwater water supply.[10] Sustainable use of groundwater is essential in water conservation.[21]

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A fundamental component to water conservation strategy is communication and education outreach of different water programs.[11] Developing communication that educates science to land managers, policy makers, farmers, and the general public is another important strategy utilized in water conservation.[11] Communication of the science of how water systems work is an important aspect when creating a management plan to conserve that system and is often used for ensuring the right management plan to be put into action.[11]

The conservation of water is extremely important in order to preserve wildlife habitats. There are many organisms in temperate regions who are affected by shortages in water.[12] Additionally, many freshwater organisms are increasingly feeling the impacts of water pollution as it disrupts the ecosystem.[12]

"World Water Day" is celebrated on 22 March.[13]

III.RESULTS

Water covers 71% of the Earth's surface.[22] Of this, 97.5% is the salty water of the oceans and only 2.5% freshwater, most of which is locked up in the Antarctic ice sheet. The remaining freshwater is found in lakes, rivers, wetlands, the soil, aquifers and atmosphere[23]. All life depends on the solar-powered global water cycle, the evaporation from oceans and land to form water vapour that later condenses from clouds as rain, which then becomes the renewable part of the freshwater supply.[12] Awareness of the global importance of preserving water for ecosystem services has only recently emerged as: during the 20th century[24], more than half the world's wetlands have been lost along with their valuable environmental services. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystems[13] making them the world's most vulnerable [25] habitats.[14] Increasing urbanization pollutes clean water supplies and much of the world still does not have access to clean, safe water.[12] In the industrial world demand management has slowed absolute usage rates but increasingly water is being transported over vast distances from water-rich natural areas to population-dense urban areas and energy-hungry desalination is becoming more widely used.[26] Greater emphasis is now being placed on the improved management of blue (harvestable) and green (soil water available for plant use) water, and this applies at all scales of water management.[13] Loss of biodiversity originates largely from the habitat loss and fragmentation produced by artificial land development, forestry and agriculture as natural capital is progressively converted to man-made capital. [27]Land-use change is fundamental to the operations of the biosphere because alterations in the relative proportions of land dedicated to urbanisation, agriculture, forest, woodland, grassland and pasture have a marked effect on the global water, carbon and nitrogen biogeochemical cycles[28] and this can negatively impact both natural and human systems.[3] At the local human scale major sustainability benefits accrue from the pursuit of green cities and sustainable parks and gardens.[15][16]

Implications

Since the Neolithic Revolution, human consumption has reduced the world's forest cover by about 47%. Present-day forests occupy about a quarter of the world's ice-free land with about half of these occurring in the tropics.[17] In temperate and boreal regions forest area is gradually increasing (with the exception of Siberia),[29] but deforestation in the tropics is of major concern.[18]

Forests moderate the local climate and the global water cycle through their light reflectance (albedo) and evapotranspiration. [29]They also conserve biodiversity, protect water quality, preserve soil and soil quality, provide fuel and pharmaceuticals, and purify the air. These free ecosystem services are not given a market value under most current economic systems, and so forest conservation has little appeal when compared with the economic benefits of logging and clearance which, through soil degradation and organic decomposition returns carbon dioxide to the atmosphere.[19] The United Nations Food and Agriculture Organization (FAO) estimates that about 90% of the carbon stored in land vegetation is locked up in trees and that they sequester about 50% more carbon than is present in the atmosphere. Changes in land use currently contribute about 20% of total global carbon emissions (heavily logged Indonesia and Brazil are a major source of emissions).[19] Climate change can be mitigated by sequestering carbon in reafforestation schemes, plantations and timber products. Also wood biomass can be utilized as a renewable carbon-neutral fuel. The FAO has suggested that, over the period 2005–2050,[30] effective use of tree planting could absorb about 10–20% of man-made emissions – so monitoring the condition of the world's forests must be part of a global strategy to mitigate emissions and protect ecosystem services.[20] However, climate change may preempt this FAO scenario as a study by the International Union of Forest Research Organizations[31] in 2009 concluded that the stress of a 2.5 °C (36.5 °F) temperature rise above pre-industrial levels could result in the release of vast amounts of carbon[21] so the potential of forests to act as carbon "sinks" is "at risk of being lost entirely".[22]

Feeding more than seven billion human bodies takes a heavy toll on the Earth's resources. This begins with the appropriation of about 38% of the Earth's land surface[23] and about 20% of its net primary productivity.[24] Added to

this are the resource-hungry activities of industrial agribusiness – everything from the crop need for irrigation water, [32] synthetic fertilizers and pesticides to the resource costs of food packaging, transport (now a major part of global trade) and retail. Food is essential to life. But the list of environmental costs of food production is a long one: topsoil depletion, erosion and conversion to desert from constant tillage of annual crops; [33]overgrazing; salinization; sodification; waterlogging; high levels of fossil fuel use; reliance on inorganic fertilisers and synthetic organic pesticides; reductions in genetic diversity by the mass use of monocultures;[34] water resource depletion; pollution of waterbodies by run-off and groundwater contamination; social problems including the decline of family farms and weakening of rural communities.[25]

All of these environmental problems associated with industrial agriculture and agribusiness are now being addressed through such movements as sustainable agriculture, organic farming and more sustainable business practices.[26] Wind power is the use of wind energy to generate useful work. Historically, wind power was used by sails, windmills and windpumps, but today it is mostly used to generate electricity.[35] This article only deals with wind power for electricity generation. Today, wind power is almost completely generated with wind turbines, generally grouped into wind farms and connected to the electrical grid.[36]

The wind supplied over 2000 TWh of electricity, which was over 7% of world electricity[1]:58 and about 2% of world energy.[2][3] With about 100 GW added , mostly in China and the United States, global installed wind power capacity exceeded 800 GW.[4][3][5] To help meet the Paris Agreement goals to limit climate change, analysts say it should expand much faster - by over 1% of electricity generation per year.[6]

Wind power is considered a sustainable, renewable energy source, and has a much smaller impact on the environment compared to burning fossil fuels. Wind power is variable, so it needs energy storage or other dispatchable generation energy sources to attain a reliable supply of electricity. Land-based (onshore) wind farms have a greater visual impact on the landscape than most other power stations per energy produced.[7][8] Wind farms sited offshore have less visual impact and have higher capacity factors, although they are generally more expensive.[4] Offshore wind power currently has a share of about 10% of new installations.[9] Through wind resource assessment, it is possible to estimate wind power potential globally, by country or region, or for a specific site[30]. The Global Wind Atlas provided by the Technical University of Denmark in partnership with the World Bank provides a global assessment of wind power potential.[13][15][16] Unlike 'static' wind resource atlases which average estimates of wind speed and power density across multiple years, tools such as Renewables.ninja provide time-varying simulations of wind speed and power output from different wind turbine models at an hourly resolution.[17] More detailed, site-specific assessments of wind resource potential can be obtained from specialist commercial providers, and many of the larger wind developers have in-house modeling capabilities.[31]

The total amount of economically extractable power available from the wind is considerably more than present human power use from all sources.[18] The strength of wind varies, and an average value for a given location does not alone indicate the amount of energy a wind turbine could produce there.[32]

To assess prospective wind power sites, a probability distribution function is often fit to the observed wind speed data.[19] Different locations will have different wind speed distributions. The Weibull model closely mirrors the actual distribution of hourly/ten-minute wind speeds at many locations. The Weibull factor is often close to 2 and therefore a Rayleigh distribution can be used as a less accurate, but simpler model.[20]

IV.CONCLUSIONS

Although biodiversity loss can be monitored simply as loss of species, effective conservation demands the protection of species within their natural habitats and ecosystems. Following human migration and population growth, species extinctions have progressively increased to a rate unprecedented since the Cretaceous–Paleogene extinction event[33]. Known as the Holocene extinction event this current human-induced extinction of species ranks as one of the world's six mass extinction events. Some scientific estimates indicate that up to half of presently existing species may become extinct by 2100.[27][28] Current extinction rates are 100 to 1000 times their prehuman levels with more than 10% birds and mammals threatened, about 8% of plants, 5% of fish and more than 20% of freshwater species.[29]

The 2008 IUCN Red List warns that long-term droughts and extreme weather put additional stress on key habitats and, for example, lists 1,226 bird species as threatened with extinction, which is one eighth of all bird species.[30][31] The Red List Index also identifies 44 tree species in Central Asia as under threat of extinction due to over-exploitation and human development and threatening the region's forests which are home to more than 300 wild ancestors of modern domesticated[34]

In many parts of the industrial world land clearing for agriculture has diminished and here the greatest threat to biodiversity, after climate change, has become the destructive effect of invasive species.[33] Increasingly efficient global

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transport has facilitated the spread of organisms across the planet. The potential danger of this aspect of globalization is starkly illustrated through the spread of human diseases like HIV AIDS, mad cow disease, bird flu and swine flu, but invasive plants and animals are also having a devastating impact on native biodiversity. Non-indigenous organisms can quickly occupy disturbed land and natural areas where, in the absence of their natural predators, they are able to thrive.[34] At the global scale this issue is being addressed through the Global Invasive Species Information Network but there is improved international biosecurity legislation to minimise the transmission of pathogens and invasive organisms. Also, through CITES legislation there is control the trade in rare and threatened species. Increasingly at the local level public awareness programs are alerting communities, gardeners, the nursery industry, collectors, and the pet and aquarium industries, to the harmful effects of potentially invasive species.[35] The environmental sustainability problem has proven difficult to solve. The modern environmental movement has attempted to solve the problem in a large variety of ways. But little progress has been made, as shown by severe ecological footprint overshoot and lack of sufficient progress on the climate change problem. Something within the human system in preventing change to a sustainable mode of behavior. That system trait is systemic change resistance. Change resistance is also known as organizational resistance, barriers to change, or policy resistance.[36]

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