Environmental Security:
The Challenge of Future

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Waste management is an essential public service in the fight to beat COVID-19.

—UN Environment Programme, March 20, 2020

Introduction

Traditionally, the concept of national security was always associated with protection of territorial integrity of country's borders against any external aggression. Post the Cold War, Human Development Report (HDR) 1994, introduced a new concept of human security, which was a historic departure from the traditional concept of national security.[1] In this concept, much greater stress has been laid on security of the people through sustainable human development programmes. National security, therefore, has two broad dimensions: traditional and non-traditional. All threats and challenges that impact "human security" are a part of non-traditional dimension of national security. Similarly, the Commission on Human Security (CHS), constituted in 2000, defines human security as protection of the vital core of all human lives in ways that enhance human freedoms and human fulfilment. It means protecting people from critical and pervasive threats and situations.[2] Based on the threats that influence

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"human security," HDR 1994 categorised seven main threats to human security: economic security; food security; health security; environmental security; personal security; community security; and political security.

United Nations Millennium Project (2002) defined environmental security as "the relative public safety from environmental dangers caused by natural or human processes due to ignorance, accident, mismanagement, or design and originating within or across national borders."[3]

Therefore, evidently environmental security is closely linked with environmental degradation, which affects wellness of human beings and all living and non-living organisms. The HDR 1994 briefly discusses a wide variety of environmental threats that occur primarily due to pollution of air, water and land, and their impact on countries, people and the ecosystem. All these threats manifest in the form of climate change, droughts, floods, which have a direct and/or indirect effect on human security.[4] Invariably, environmental degradation has a huge impact on non-traditional security, which affects human security in particular. Increase in sea level due to global warming, and internal displacement and mass migration of people due to cyclones, droughts or floods are cases in point. In addition, economic cost of natural disasters like hurricanes and tsunamis are too high: the total costs of Hurricane Katrina amounted to US$161 billion, which makes it the most expensive natural disaster to occur in the US as of January 2019,[5] and in 2019, besides the economic cost, the heaviest monsoon rains to lash India in 25 years had killed more than 1,600 people.[6]

The aim of this paper is to discuss fundamental issues like causes, categorisation and nature of environmental degradation. While it briefly gives a key insight into myriad threats, challenges, their impact on various facets of environment, its security, and the sources of conflicts in South Asian region (SAR), it also gives recommendations at various levels to mitigate the adverse impact of environmental degradation, including military's application to prepare for the emerging challenges.

The nature and character of environmental degradation differ between industrial and developing countries, but most of the effects are near similar with varying intensities, frequencies and impact. Therefore, of the varied definitions being propagated by different organisations and environmentalists, only important terms and organisations have been discussed briefly in the endnotes.[7]

Causes and Categorisation of Environmental Degradation

Humans and their activities or anthropological factors are a major source of environmental degradation, even though naturally induced factors also contribute to the degradation of the environment. In our environment, land, water and air are the primary sources of all living beings, as they provide food, fresh water, oxygen, and sustain other ecosystems and biodiversity. Although causes and categories of environmental degradation have been discussed separately, most of the factors are interdependent, intertwined and have a cross term effect on each other. Hence, there would be some repetition while discussing the causes and their impact.

The main causes of environmental degradation are: rapid increase in population leading to population pressure on resources; accelerated urbanisation which culminates in urban sprawl and slums; excessive pressure on land due to deforestation, intensive agriculture, mining, industrialisation; land, water and air pollution; use of fuels as source of energy; landfills, waste production; illegal dumping; agricultural pollution due to usage of outdated methods, and lack of awareness among the masses. While looking at two prominent factors alone—population and urbanisation—the urban population of the world has grown rapidly from 751 million in 1950 to 4.2 billion in 2018.[8] The Indian urban population increased rapidly from 25.6 per cent (217 million) of the total population in 1991 to 31.16 per cent in 2011 (377 million), an increase of 170 million (74 per cent) over two decades.[9] According to UN's 2018 Revision of the

World Urbanisation Prospects, the population size of India more than tripled since 1950 to 1.35 billion and the level of urbanisation nearly doubled, reaching 34 per cent in 2018 (page 37). India will contribute most to the urban increment with the addition of 416 million urban dwellers, nearly doubling the size of its urban population between 2018 and 2050.[10] As unplanned urbanisation is not safe, resilient and sustainable, it is bound to affect the environment in multiple ways.

Fundamentally, environmental degradation can be broadly categorised into four types, such as land degradation, water degradation, air degradation, and deforestation and biodiversity degradation. For ensuring a detailed discussion, air degradation has been further split into atmospheric degradation and environmental pollution. The effects due to nuclear tests and radiation have not been discussed.

Land Degradation: Land covers 29 per cent of the Earth's surface. The primary causes are deforestation, soil erosion, desertification, intensive agriculture, overgrazing, salination, forest fires, waterlogging, landfills, shifting agriculture in a few areas, excessive use of fertilisers and pesticides, and wastelands. While water and wind are the main contributory factors for rapid soil erosion, it also gets aggravated due to deforestation, overcultivation, overgrazing, and non-scientific farming practices. Desertification and land degradation would finally contribute to local warming due to absence of tree cover. Shifting cultivation or *jhum*, predominantly practised in the hilly areas of north-east of India, is an ancient agricultural practice where a farming community slashes secondary forests on a predetermined location, burns the slash and cultivates the land for a limited number of years.[11] As per UNEP 2019, 74 per cent of the poor are directly affected by land degradation globally. UN pronounced Sustainable Development Goals (SDG) 11 on "sustainable cities and communities," states, "The world's cities occupy just 3 per cent of the Earth's land, but account for 60-80 per cent of energy consumption and 75 per cent of carbon emissions."[12] It means that urban areas are major

contributors to global warming, scarcity of water, pollution and waste disposal.

Water Degradation: According to UNEP, oceans cover three-quarters of the earth's surface, contain 97 per cent of the earth's water, and represent 99 per cent of the living space on the planet by volume.[13] Water is the lifeline of all living beings, plants, marine life and biodiversity. More than 80 per cent of the world's wastewater is dumped—largely untreated—back into the environment, polluting rivers, lakes, and oceans.[14] According to the Composite Water Management Index (CWMI) report released by the NITI Aayog in 2018, 21 major cities (which includes Delhi, Bengaluru, Chennai, Hyderabad and others) are racing to reach zero groundwater levels by 2020, affecting access for 100 million people. India is suffering from the worst water crisis in its history and millions of lives and livelihoods are under threat. It is a matter of concern that 600 million people in India face high to extreme water stress in the country.[15] The causes of water degradation and pollution are: industrial waste, sewage and wastewater, mining activities, marine dumping, accidental oil leakage, burning of fossil fuels, chemical fertilisers and pesticides, global warming and emission of greenhouse gases, radioactive waste, leakage from the landfills, etc. As its degradation has a direct impact on population, urbanisation, marine life, hospitality and tourism industry, industrialisation and biodiversity, it is a major source of socio-economic security concern.

Atmospheric Degradation

In simpler terms, it primarily refers to global warming/climate change, which results in disturbing the atmospheric equilibrium. It is perhaps the biggest challenge being faced by the world at large. According to report on the Protection of Atmosphere, "Atmospheric degradation means the alteration by humans, directly or indirectly, of atmospheric conditions having significant deleterious effects of such a nature as to endanger human life and health and the Earth's natural environment."[16]

Since it is argued that Climate Change is a function of human induced activities as well, its manifold increase since the Industrial Revolution (1750) that led to more heat retention and an increase in surface temperatures cannot be ignored. One of the primary causes of climate change in SAR has been the increased emission of Greenhouse Gases (GHGs) due to rapid industrialisation, urbanisation and other human activities that result in environmental pollution and increase in pollutants. According to the UNEP on Climate Change, a few startling data and facts are: one, from 1880 to 2012, average global temperature increased by 0.85°C; two, from 1901 to 2010, the global average sea level rose by 19 cm as oceans expanded and the Arctic Sea's ice extent has shrunk in every successive decade since 1979; three, global emissions of carbon dioxide (CO_2) have increased by almost 50 per cent since 1990; four, emissions grew more quickly between 2000 and 2010 than in each of the three previous decades; and five, GHG emissions have risen at a rate of 1.5 per cent per year in the last decade.

Climate change affects air and ocean temperatures, the length of seasons, sea levels, the pattern of ocean and wind currents, levels of precipitation, as well as other things. These changes also affect the habitats and behaviour of many different species.[17] Therefore, climate change, with its multiple adverse effects, has been the major player that has increasingly impacted rise in sea levels, food security, land and marine ecosystems, land degradation and induced desertification in many regions of the world.

Environmental Pollution: Environmental pollution refers to the degradation of quality and quantity of natural resources. Pollution is due to harmful substances, products or contaminants in the natural environment, which are detrimental to health of human beings and animals, and survival of natural ecosystems and the man-made environment. Environmental pollution is intense in the developing world, due to traditional sources of pollution such as unchecked industrial emissions, polluted water supply,

greenhouse emissions, pollution due to traffic congestion, insufficient waste management, poor sanitation, and exposure to indoor air pollution from biomass fuels. As per UNEP, energy consumption is the dominant contributor to climate change, accounting for around 60 per cent of total global greenhouse gas emissions. Air Pollution has emerged as the biggest challenge among the developing countries. According to Douglas Broom of World Economic Forum (2020), "Six of the world's 10 most polluted cities are in India; and air pollution kills 1.25 million people in India every year. New Delhi has the worst air pollution of any capital city."[18] India has not addressed air pollution seriously enough, as it acquires serious dimension from mid-October to mid-March every year.

Deforestation and Biodiversity Degradation: It refers to degradation of different varieties of species that inhabit the planet, including genes, species, communities, and their habitats. Biodiversity plays a significant role in maintaining equilibrium in the natural ecosystem, by protecting water sources, reducing environmental pollution, and stabilising climate in a region. Due to human activities of destroying the flora, fauna and habitat of all living beings, it has resulted in shrinking the space of wildlife sanctuaries, biodiversity parks or national parks. For the same reasons, there has been an increase in threatened/endangered species and/or extinction of species. According to UNEP report on Biodiversity (2018), of the 8,300 animal breeds known, 8 per cent are extinct and 22 per cent are at risk of extinction. It is feared that wild life species, with viruses and other pathogens have moved out of 'shrunken forests areas' into/closer to the habitats of mankind, resulting in Ebola, bird flu, swine flu, Severe Acute Respiratory System (SARS) and also probably the pandemic novel coronavirus COVID-19.[19] China was the epicentre of coronavirus—severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)—in late 2019, the root cause of the zoonotic virus, its spread and actions taken to forewarn the world are still under investigation. This notwithstanding, conservation of biodiversity ecosystem is vital to maintain equilibrium in the environment.

Analysis: Environmental Factors and their Impact: Due to near similar geophysical settings, climatic conditions and geographical features in the SAR, several issues pertaining to environmental degradation are common, with moderate changes. While causes have been discussed, the main areas of impact are: health of all living beings, plants, marine life and biodiversity; land degradation results in shrinking per capita cultivated land, and decrease in agricultural production; rise in the sea level leading to mass migration of people and their management; changes in the pattern of rainfall, floods, cyclones and droughts with varying frequency and intensity; prevalence of air and water-related diseases; vulnerability of agriculture, wetlands and ecosystems to desertification; and accelerated urbanisation and industrialisation results in pressure on land, agricultural products, deforestation and disturbance to the natural ecosystem. The changes in climatic conditions have long-term effects on global warming, changing rainfall patterns, increase in the frequency and intensity of cyclones or floods, rise in sea level, melting of glaciers, avalanches and landslides, which result in migration of people and affect overall well-being of a region and its people.

South Asian Region (SAR): Environmental Degradation

South Asian Region (SAR) is perhaps the most diversified regions of the world in terms of geophysical and hydro-meteorological settings, demography, climatic zones, environmental sites, and in socio-economic disparity. Geographically, it is a compact geo-ecological zone, with wide variety of terrains. Though one of the fastest growing regions "with 5.9 percent growth in 2019,"[20] the region has huge socio-economic disparity, poverty, deprivation, and environmental stress, which, put together, contribute to several mass movements , armed conflicts, and instability in the region. More than two-thirds of the world's poor people live in Asia, and nearly half of them are in Southern Asia.[21]

Demographically, South Asia is one of the largest regions in terms of population. As of March 2020, with 1.934 billion (24.89 per cent of the world's population),[22] the region holds only 3.5 per cent of the total land mass of the world. It is bound to have over-dependence primarily on land, water and air sources. It is home to a highly diversified demography in terms of religion, ethnic composition, tribal population, languages, dialects, social norms, and culture. It has a young population; median age 27.6 years,[23] with unemployment rate for the labour force in 2018 at 2.75 per cent.[24]

Environmentally, the region has rich flora, fauna and habitat,[25] with a wide variety of species, on land and in marine life. Environmental degradation has been a matter of great concern to the region, for instance, South Asian countries account for only two percent of the world's forest area. The deforestation rate in the SAR is approximately 1.1 per cent annually, and about 88 per cent of the region's forest cover has been lost due to logging and other human activities.[26] Based on the key geographic, climatic, as well as geological features, the region is prone to environment related natural disasters like tsunamis, cyclones, intense rainfall, floods, droughts and landslides. Environmental factors including climate change (refer Figure 1) have been major drivers of such natural disasters. The disasters have been developing in the SAR, where the number of disasters per year has quadrupled over the past four decades (1970-2010).[27]

Environment, Development and Security

Since environmental degradation affects population at large and the natural biodiversity ecosystem, there is a clear linkage between environment, development and security. While economic development is vital for the growth of a country, it involves large-scale industrialisation, mining, urbanisation, infrastructure projects, deforestation, reduced availability of cultivable land, global warming due to increased use of energy and adverse effects on biodiversity ecosystem. Therefore, these actions also have an impact on

both traditional and non-traditional security threats. All these environmental stresses affect economic growth and stability, political stability, social cohesion and security situation within a country, as also in the neighbouring countries. We could witness, as proven historically, mass movements (driven by politico-social-environmental forces), armed conflicts, and insurgencies.

Depending upon the degree of threats and difficulties experienced in terms of survival needs of people and economic deprivation, there could be a surge in indoctrination, radicalisation, and recruitment of people for joining militancy. The Naxalite movement in central India was a result of abject poverty, exploitation, social discrimination, economic deprivation and consequences of deforestation, and landlessness. It affected the survival needs of the people from the natural sources: *jal*, *jangal*, *jamin aur khanij* (water, forest, land and minerals). Environment was also one of the prominent contributory factors that resulted in a full-blown insurgency by the Naxalites (Maoists), with incidents in 332 districts in 18 states during the peak period in 2009-11. However, as per MHA Annual Report 2018, these have reduced to about 60 districts across 8 states. To counter the threats posed by environmental degradation, India also has witnessed "save the environment" movements at various times. Therefore, a little emphasis on the subject is necessary.

Environmental Movements: There have been several environment related movements globally, as also in India. As a result of environment consciousness, India has seen the emergence of a large number of environmental/ecological movements after the mid-1970s, with a view to conserving the environment, promoting awareness among the people, demanding change in policies, and preventing development/ industrial projects that were detrimental to environmental, economic, social factors and the well-being of society at large. Within India, a few of the major environmental movements that have made an impact are: Bishnoi Movement in Rajasthan (the 1700s); Chipko Movement in Chamoli district, now in Uttarakhand (1973); Save Silent Valley

Movement in Palakkad district, Kerala (1978); Jungle Bachao Andholan in Singhbhum district, now in Jharkhand (1982); Appiko Movement in Uttara Kannada and Shimoga districts of Karnataka (1983); Narmada Bachao Andholan, Narmada River, which flows through the states of Gujarat, Madhya Pradesh and Maharashtra (1985); Tehri Dam Conflict, Bhagirathi River near Tehri in Uttarakhand (1990s);[28] and Siachen Swachh Abhiyan, Siachen Glacier by the Indian Army (1990s). People's movements, led by fair and visionary leaders, have proved to be an effective method to conserve our environment.

Environmental Conflicts at Global and Regional Levels

According to Salomé Bronkhorst and Urmilla Bob, researchers, the key points of conflict are in relation to climate change, conservation, water quality and availability, air quality and management aspects, and the new conflicts emerging due to migrations in receiving areas.[29] Based on their research, Thomas Bernauer et al. provide evidence that environmental scarcity has been a contributing factor in recent conflicts. Examples include violence in South Africa, the insurgency in Assam, the Zapatista rebellion in Chiapas, as well as conflicts in Sudan, the Middle East and Nigeria. They also identify three types of "environmental scarcities" that may result in a violent conflict: supply induced scarcity, demand induced scarcity, and structural scarcity caused by an unequal distribution of access to natural resources.[30]

According to UNEP Information Note 99-16, "growing trend in international and intranational conflict appears to be linked to deteriorating environmental conditions and resources. A vast majority of environmentally related conflicts occur in developing regions, which manifest in both direct and indirect forms. Conflicts over water resources appear to be a major source of direct international conflict. The most common environmental elements around which conflicts can erupt are water flow, diversion, salinisation, floods and pollution."[31] Water is perhaps the most critical environmental asset. Historically, it is known that there have been a number of intrastate and

interstate disputes over water like: "fundamental dispute over water in the Nile Basin among the upstream and downstream riparians; in 2011, acute water scarcity played a significant role in fuelling the political and security crisis in Yemen; Turkey, Syria and Iraq have had tension and conflict over the water of Euphrates-Tigris Basin; and periodically there have been violent protests over water in the Cauvery Basin between the states of Karnataka and Tamil Nadu in India."[32] According to Thomas Bernauer et al., "systematic empirical analyses suggest that transboundary waters are associated with low-level conflicts, but not with full-scale 'water wars.'"[33] Depending upon the severity of scarcity, even low-level conflicts can lead to limited wars.

It is evident that the cumulative effects of environmental degradation and stress are unimaginable, and these can well lead to conflicts within and outside the countries. Despite the fact that SAR has a legacy where histories, geographies, ethnic compositions, religions, languages and politics are closely interlinked, "economically, the region is the least integrated region in the world,"[34] with very low levels of intra-regional trade and investment.[35] It is primarily due to a history of distrust, dispute and the prevailing troublesome political relationship among a few countries. Degradation of land, water, air, biodiversity and environmental pollution and its adverse effects on the neighbouring countries lead to tensions and conflicts. These can result in a conflict situation. The probability and intensity of conflict would depend upon the severity of environmental degradation and its impact. A few cases are discussed briefly.

Being the most prominent country in the region, an emerging power, India's relations with most of its neighbouring countries are less than optimal. Therefore, interstate problems tend to get triggered even with trivial incidents. Periodically, tension builds up due to water scarcity and lack of transparency and hydro information over Indus Water System with Pakistan, and over Brahmaputra-Tsangpo river system with China. Regular communication and exchange of relevant information between countries is important to allay fears and apprehensions.

Pakistan has been facing a series of threats due to environmental degradation and resultantly natural disasters, which have a direct impact on its economic growth and internal stability. Sualiha Nazar suggests that the Pakistani government must prioritise its response to climate change in order to mitigate environmental threats and prevent future calamities.[36]

Afghanistan remains vulnerable to climate change, and the changes in precipitation pattern have its effects on agriculture and biophysical resources. Due to the prolonged internal conflict, conservation of environment also suffers and adds to multiple effects of environmental hazards. Nepal too faces a number of environment related challenges, such as climate change, global warming, deforestation, land degradation, demographic changes and shrinking per capita cultivable land, soil erosion and environmental pollution.[37] Due to global warming and resultant changes in climatic conditions, Bhutan, though rich in biodiversity, may be vulnerable to glacier meltdown, floods, and landslides. Land degradation, biodiversity and habitat loss, high fuel-wood consumption, and human-wildlife conflicts are some of Bhutan's environmental challenges.[38]

Bangladesh is most vulnerable to climate change and global warming due to their geographic locations, large coastal plains and delta region with low elevation that extends deep into the hinterland, and high density of population along the coastal belts. With the rise in sea level or cyclones, these areas are highly prone to flooding and inundation, which may result in mass displacement of people within and outside the country, with attendant mass migration and friction at various levels. Migration also causes socio-economic dislocation, along with psychological trauma to the affected people with young children and elderly people. With global warming and rise in sea level, Sri Lanka and Maldives would remain vulnerable to cyclones, inundation, saltwater intrusion and water scarcity. It would also have an adverse impact on marine biodiversity and ecotourism.

Having discussed the primary causes of environmental degradation, acute scarcity of clean water, the main lifeline of all living beings, and

environmental pollution are the biggest challenges already facing India today. As environmental features have a transboundary character, thus, the impact of their degradation will evidently cut across political boundaries of nation states. Given the nature, frequency and varying intensities of environmental degradation in developing countries, it certainly has an adverse effect on "human security" in terms of health of human beings, and the natural ecosystems. The chain of events impact both internal politico-economic-social-security situation within a country and interstate relations. As such environmental problems become more severe, they, along with other factors, may trigger a conflict with neighbouring countries or the region. A few important environmental issues pertaining to sharing of waters of rivers, climate change and Siachen Glacier have been discussed briefly.

More than ten major rivers originate from the Tibetan Autonomous Region (TAR) of China. The waters from these rivers are not only the lifeline of people, but also serve huge areas with rich biodiversity ecosystems nestled in them. For instance, the River Brahmaputra, with a total length of 2,880 km, is known as the Yarlung Tsangpo in China, the Siang and the Brahmaputra in India and the Jamuna in Bangladesh.[39] Periodically, the issues regarding water diversion projects by China, Indus Water Treaty or river linking projects by India, non-sharing of hydel data by the upper riparian, and construction of hydel dams by both China and India along the Brahmaputra river raises apprehensions about availability of water among the local population in lower riparian states and countries. In the latter case, India is the lower riparian state. Therefore, if there is a serious shortage of water among the lower riparian, it would affect survival needs of all living beings, and could destroy the natural biodiversity ecosystem and deplete natural resources. Water scarcity and its pollution would be a major source of tension and conflict in the future. While India and Pakistan have been fighting over Kashmir, the two countries have cooperated successfully on sharing the water resources of the Indus.[40]

▪ The World Bank estimates that, if climate change continues unhindered, then average temperatures in India could reach as high as 29.1°C by the end of the century (up from 25.1°C currently). As India still overwhelmingly relies on coal for electricity, 68 per cent of India's emissions come from generating energy. In parts of Rajasthan, Gujarat, Tamil Nadu, Kerala and the North-East, average temperature over the last decade has risen by nearly 1°C compared to the historical average in the 1950-80 period. According to the Global Climate Risk Index (Germanwatch), India is the 14th most climate change-affected country in the world.[41] Rise in temperatures has an immediate and long-term effect on the environment, agricultural productivity, infrastructure development, and economic activities. Due to effects of the climate change, people in poor countries are facing reduction in the quality of life, who, if unable to adjust to the new challenges, are left with two main options: fight or flee.[42] In both conditions, it would result in a conflict in the future. From the map at Figure 1, it is evident that South Asia is the most vulnerable region in the world due to climate change.

Figure 1: South Asia is the Most Vulnerable Region in the World
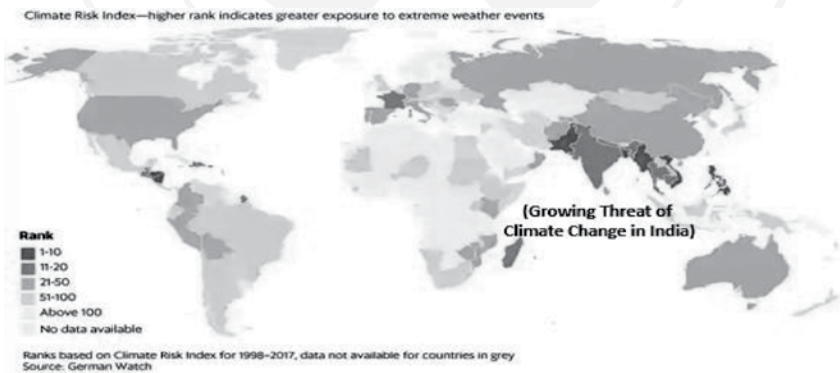
Source: Germanwatch, Global Climate Risk Index 2020, annotated by the Author, available at www.germanwatch.org/en.cri

▪ Environment gets affected by multiple factors. The effects of environment on the snow-clad Great Himalayan Ranges (GHR) and its offshoots must be studied with care both for conservation and for military operations. Siachen Glacier, the highest battlefield in the world, is also experiencing the hazards of environmental degradation due to large dumps of waste, garbage, packing materials and human excretion. Due to cumulative effects of global warming and accumulation of wastes, the fragile ecosystem is facing "glacier melting," which in turn will result in scarcity of water in the long run. As part of "Siachen Swachh Abhiyan," the Indian Army has institutionalised systems to conserve the natural ecosystem of the glacier. It has plans to dispose of about 100 tons of waste, including biodegradable and non-biodegradable, every year from the Siachen glacier, along with promoting awareness to identify and classify waste, instructing troops to reduce garbage and facilitate its disposal.[43] However, much more needs to be done by all countries to clean and conserve the GHR.

Out of the five conclusions drawn on environment and security in South Asia by Adil Najam, Pakistani academic and intellectual, the two prominent ones are: "first, the challenge of environment and security in South Asia is, at its core, not only a problem of resource endowments or geography but also a problem of institutions and governance; and second, while the prospects of interstate violence in South Asia over environmental issues are slim, the region's history of distrust and dispute suggests that environmental differences can add to existing tensions and apprehensions and perpetuate the general sense of insecurity that pervades interstate relations in the region."[44] Homer Dixon, a political scientist, argues that "environmental scarcity simultaneously increases economic deprivation and disrupts key social institutions, which in turn causes 'deprivation' conflicts such as civil strife and insurgency."[45] Two important deductions

are: first, if the South Asian countries focus themselves on good governance, take measures to minimise increase in global warming and ensure controlled urbanisation, environment related issues will also start getting addressed to a large extent; second, the environmental stresses need not necessarily result in an open conflict, but it will certainly induce avoidable tension, which could be one of the contributory factors for initiation of one.

Recommendations

The recommendations are based on the environmental stresses, their impact, and the likely causes of conflicts at global and SAR levels, which have already been discussed in detail. Climate change, global warming and increase in seawater level impact the world at large; hence, it requires a global level response. The aim should be to analyse the holistic impact of climate change and other environmental factors on human security, biodiversity ecosystem and mass migration of people; and then formulate policies and suggest a plan of action to manage them. The global environmental conventions and summits like Stockholm 1972, Rio Summit 1992 and Rio+20 Summit, international/regional organisations like UNEP, IPCC, South Asian Forum for Environment (SAFE), and other agencies do lay down guidelines for protection of environment, prevention of conflicts, but their universal acceptance and implementation remains far from satisfactory. According to a Report of the International Institute for Sustainable Development (IISD), in order to enforce globally accepted environmental conventions to minimise environmental stresses, certain countries may impose trade embargoes, non-grant of subsidies, tariff discrimination, the suspension of aid, and prevent capital flows.[46] Therefore, the world bodies must look at measures to promote environmental sustainability and prevent conflicts. Environmental security is the main link between humans, and natural resources cum

biodiversity. Any degradation in the environment would influence all living beings. The environmental security is a dynamic concept, as it affects individuals, society, states, and global community. With ever increasing environmental degradation, it has an impact on political stability, economic development, social cohesion, and peace, both at national and international levels. Environmental factors affect national security primarily on two counts: one, it effects human security and economic growth; two, as a potential source of conflict.

India is working with multiple UN, global, Asian, and South Asian organisations to strengthen cooperation in mitigating environmental stresses and to improve the response mechanism. The signing of the SAARC Agreement on Rapid Response to Natural Disasters in November 2011, ratified in May 2016, was a welcome initiative. Sadly, according to a report published by South Asia Forum on Preparedness for Regional Disaster Response, "… *yet, there have not been any tangible steps to operationalise it.*"[47] When environmental stresses are combined with politico-socio-economic-security stresses, they have the potential of triggering conflicts within and among nation states. This actually means that considering the hazards of environmental degradation, it requires an integrated approach to natural resource management and conflict resolution, knowledge-based partnership, information management and cooperation at global, regional and at subregional (Indian subcontinent) level. It should follow a decentralised format to analyse its overall impact, to put in place the mitigation measures and share relevant information, data and experience.

To minimise the effects of various forms of environmental degradation including climate change, global warming and energy dependence, strategy and action plans are required for: capacity and capability building; management of resources and promoting awareness; and encourage new technologies to innovate energy efficient systems and simultaneously aim to reduce carbon emissions. As establishment of major industries and

infrastructural projects degrade the environment and natural resources, they should be responsible and accountable to the local population to improve their quality of life. A proactive disaster diplomacy would help to keep a check on various agencies including non-state actors indulging in environmental terrorism (destruction, or the threat of destruction of the environment by states, groups, or individuals). Regional organisations must work together to respond to all forms of disasters. In India, National Disaster Management Authority (NDMA) is the apex body which lays down the policies, plans and guidelines for disaster management. It would be useful to hold regional and subregional level multinational disaster management exercises and formal discussions, based on probability of environment related disasters.

Military Application

The Indian Armed Forces are operating in varied climatic conditions, and terrains like glaciers, mountains, riverine regions, jungles, deserts, semi-deserts, salt marshes, coastal belts, and island territories, which are prone to environmental degradation. Although armed forces would give always highest priority to their operations, they should be aware of the hazards of environmental degradation and its impact on human security. Given the trend of environmental conflicts the world over, as discussed, it further reinforces the point that environmental stresses and their impact should form an essential part of the national security and military strategy. At national level, a holistic appreciation of impact of environmental degradation on national security is carried out and the essential elements should form part of it. The armed forces must incorporate the actionable points in the military security doctrine/strategy. Further, it would be required to analyse the actions by the militaries at both strategic and tactical levels. Simultaneously, greater focus should be at the tactical level, as troops get more affected by changes in the terrain and weather at the grass-roots levels.

The second edition of Joint Doctrine of the Indian Armed Forces (JDAIF)–2017 has acknowledged that the environment has emerged as a critical area of the security paradigm.[48] JDIAF also highlights that environmental degradation issues like climate change, ecosystem disruption, energy issues, population issues, food-related problems, economic issues of unsustainable modes of production, and civil strife related to environment, can lead to a conflict between countries. As the armed forces are one of the biggest consumers of energy by way of fuel for vehicles, aircraft, ships, and weapon systems, they should also minimise emission of GHGs and pollution. In India, the annual global solar radiation is about 5 kWh/sq. m per day with about 2,300-3,200 sunshine hours per year.[49] The new technologies should look at innovative means to install systems that are energy efficient and minimise GHG emissions. Given the pan-India presence of armed forces, they must exploit non-conventional energy sources as alternate sources of power like solar, wind, hybrid of solar and wind, etc. In order to exploit renewable energy, they should install mega solar energy projects in areas with large number of solar radiation days such as in Ladakh, Rajasthan, Gujarat, Central India, or hybrid solar-cum-wind projects in other suitable areas in southern peninsula and Gujarat.[50]

The IPCC in its Assessment Report 5 predicts an increase in the sea levels that would pose a significant threat to naval establishments located in Mumbai, Vishakhapatnam and Kolkata. Military infrastructure in these bases could be inundated.[51] Climate change should not be considered as an environmental issue, but as a threat multiplier that effects national security. It affects environment in several ways: extremes of temperatures, changes in frequency and intensity of precipitation and snowfall, ozone layer depletion, heat waves, and growth of trees and shrubs. Besides weather related disasters like cyclones, floods, avalanches, landslides and droughts, climatic changes would affect military operations at all levels due to changes in orientation of terrains, cover available, degree of

difficulty in movement of troops due to marshes, increased water channels, desertification or greening of deserts, avalanches, flooding and landslides. "Higher temperatures sensitive weapons, equipment and armament" of all three services should be temperature hardened or measures taken to preserve their operational capabilities. Karwar Seabird, the Naval Base of India has been designed to be Smart Green Naval Base to combat the rising sea levels.[52]

Given our boundary and territorial disputes with two of our adversaries, predominantly in geologically and environmentally sensitive areas in the mountainous and other terrains, the armed forces must specifically study the impact on military operations due to changes in climate and varied terrains like: potential avalanche, crevasses, landslide prone areas in mountains; alternate routes, helipads; shifting sand dunes in deserts; effects of canals in greening of deserts; changes in the courses of rivers, *nullahs*, and capacity of water bodies; and vegetation cover. For instance, GHR and its offshoots are an area of great interest to the army. It has been observed that due to warmer winters and their impact, there has been much greater avalanche activity in terms of frequency and intensity. Therefore, impact of each such environmental stress must be studied and exact areas identified on the ground and dovetailed into military plans. Map of GHR refers.[53] Due to territorial disputes and operational necessity, Indian Army specialises in mountain warfare. Therefore, environmental conservation is even more important in our mountainous terrains in particular. In addition, there is a need to identify strengths and vulnerabilities, structural changes required, and how the emerging technologies can be employed to gather information about environmental stresses, their impact, and leverage optimum operational effectiveness. Technologies should aim at providing early warning about the impending weather changes and natural disasters.
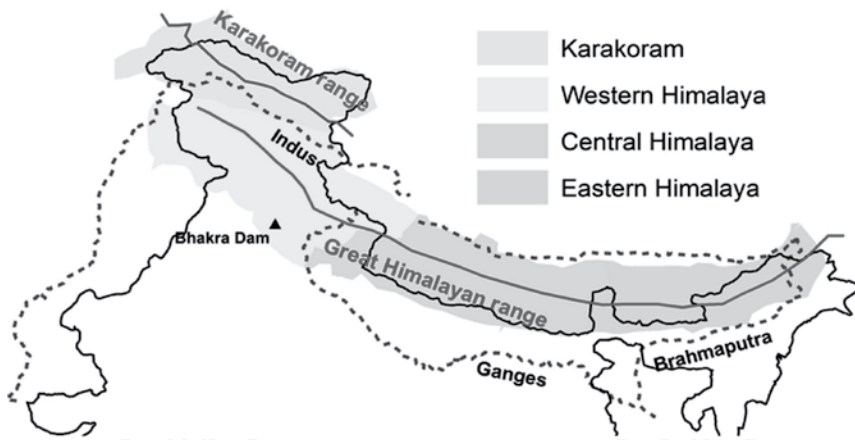
In the long-term perspective, it would be expedient to review our doctrines, strategy, warfighting concepts, tactics and training philosophy to meet the emerging challenges. At the strategic level, armed forces must plan for: actions required to be taken when directed to intervene in Aid to Civil Authorities and Humanitarian Assistance and Disaster Relief (HADR); assisting in mass migration or refugee management; civic action programmes to support the population; to combat non-state actors or terrorists; early warning forecasts, providing soft skills, physical assistance to conserve environment; collection of data and sharing with all stakeholders; work in conjunction with other legitimate environmental organisations; and provide continuous feedback and recommendations to the government for further courses of action.

While the leaders and commanders must be sensitive to the larger issue of environmental sustainability, environmental assets can be used as "weapons of war" like flooding an area of choosing [water stored in upstream reservoirs/dams is actual potential energy (PE), (PE equals mgh, where m is the mass, g is the acceleration due to gravity, and h is the height), which can be released at the most suitable time to exploit

water's kinetic energy (KE) potential (KE equals $1/2\ mv^2$)]; triggering avalanches and slides; creation of rains by cloud seeding or by using silver iodide and other chemicals into clouds; and creating or dispersing fog conditions. To quote a few examples, historically, "water had become a strategic target in both the Korean and Vietnam wars. In 1950-1951, the US attacked North Korean dams along the Yalu River; North Korea released floods from the Hwachon Dam to damage US floating bridges downstream; in 1963-1964, several hundred people were killed in fighting between Ethiopia and Somalia on a dispute over critical water sources in the Ogaden desert."[54] Similarly, during a conflict, such like hydropower plants and strategic assets could be the targets of physical or cyberattacks to leverage an advantage. On the Indian subcontinent, the Battle of Asal Uttar was one of the largest tank battles fought during the Indo-Pakistan War of 1965. To state briefly, the Indian Army lured the Pakistani tanks inside the "horseshoe trap" in the sugar fields of Khem Kharan Sector, which were flooded a night before. Next morning, over 100 Pakistani tanks (mostly M47 and M48 Patton tanks) were destroyed as they could not move because of the soft soil and muddy slush. It was one of the main turning points of the war.[55]

While undertaking secondary obligations like aid to Civil Authorities and HADR, Indian Armed Forces should be fully aware of the hazards of environmental degradation and the preparations required to be fully effective. Broadly, these include: organisational structure with command & control and communications network, casualty evacuation and medical aid, transportation of relief material, establishment of relief camps, construction and repair of roads and bridges, maintenance of essential services and evacuation of people to safer areas. While undertaking HADR duties, army should also be prepared to operate in contaminated environments. Hence, they need to formulate doctrines and SOPs, and ensure specialised equipment, protection gear and training.

The first of their kind in the world, Indian Army's Ecological Task Force (ETF) battalions have fought against deforestation and ecological degradation since 1982, and have achieved phenomenal results. They have been rightly nicknamed, "Green Warriors."[56] These warriors have remained dedicated to greening arid deserts and barren mountains, exploiting renewable energy and pursuing water harvesting. Indian Army (Kargil Division) was awarded the BNHS National Green Governance Award by the Prime Minister of India on November 10, 2005 for its unique socio-economic-strategic-ecological initiative called "Operation Green Curtain."[57] The vision of a "Clean Siachen-Green Siachen" is another recent initiative of the army. As part of green initiative, Indian Navy also launched its first warship running entirely on bio-fuel at 2016 International Fleet Review.[58] On balance, it must be appreciated that Indian Armed Forces, as a single entity, have made sterling contribution to conservation of flora, fauna and habitat, and to mitigation of the hazards of environmental degradation.

It requires political will to conserve the environment, minimise effects of climate change and manage natural resources for sustainable development. It must be understood that technical ingenuity and capacity building should form part of strategy for effective management of environmental stresses and conservation of natural resources, to prevent conflicts. The national environmental policy should be reviewed periodically, to minimise the effects of environmental degradation. As South Asia is one of the worst affected regions due to environmental degradation and natural disasters, the whole region must work together as one entity to conserve the environment, build capacities and resilience to minimise environmental stresses. The earlier the better.

 "… the world will need to pick up the pace and put greater efforts in finding better solutions to pollution, climate change and biodiversity loss in order to truly transform societies and economies."

—**UN Environment Programme 2019**

Notes

1. United Nations Development Programme (UNDP) (1994), *Human Development Report 1994* (New York: Oxford University Press, 1994).

2. Commission on Human Security (2003), *Human Security Now*, New York. https://reliefweb.int/sites/reliefweb.int/files/resources/91BAEEDBA50C6907C1256D1900 6A9353-chs-security-may03.pdf. Accessed on March 29, 2020.

3. UN Millennium Project (2002), "Definitions of Environmental Security," Environmental Security Study. http://107.22.164.43/millennium/es-2def.html. Accessed on April 29, 2020.

4. Commission on Human Security 2003, pp. 28-30.

5. Jennifer Rudden (2019), "Most Expensive Natural Disasters in the U.S. as of 2019," August 9. https://www.statista.com/statistics/744015/most-expensive-natural-disasters-usa/. Accessed on March 29, 2020.

6. "Over 1,600 Dead in India's Heaviest Monsoon in 25 Years: Report," All India Reuters. October 1, 2019. https://www.ndtv.com/india-news/over-1-600-dead-in-indias-heaviest-monsoon-in-25-years

7. According to *HDR 1994*, environmental degradation is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems and the extinction of wildlife. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable.

    The Convention on Biological Diversity defines biodiversity as the "variability among living organisms from all sources." Biodiversity includes all living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems. On the other hand, ecosystem refers to the larger environment of both living organisms and non-living things that interact with each other and enjoy a relationship of coexistence.

    Earth's surface emits infrared radiation, most of which is absorbed and re-emitted by the greenhouse gas (GHG) molecules and clouds. The primary greenhouse gases in earth's atmosphere are water vapour, carbon dioxide, methane, nitrous oxide, and ozone. Much of this thermal radiation emitted by the land and ocean is absorbed by the atmosphere, including clouds, and re-radiated back to earth. This is called the greenhouse effect. Due to this effect, the earth's surface remains warm. (IPCC. https://wg1.ipcc.ch/publications/wg1-ar4/faq/wg1_faq-1.3.html)

8. United nations Department of Economic and Social Affairs (UNDESA) (2018), "2018 Revision of the World Urbanization Prospects," Population Division of the United Nations Department of Economic and Social Affairs. https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html. Accessed on March 29, 2020.

9. The Census of India 2001 and Census 2011, Government of India. http:censusindia.gov.in/2011/CensusData2011.html. Accessed on March 29, 2020.

10. UNDESA (2018), "World Urbanization Prospects: The 2018 Revision," Population Division, United Nations, p. 43.

11. Sanjay Choudhury, "Jhum," *Geography and You*, vol. 10, issue 59, March-April 2010. https://www.geographyandyou.com/jhum/. Accessed on March 29, 2020.

12. UNDP (United Nations Development Programme) (n.d.), "Sustainable Development Goals: Goal Number 11," UN. https://www.undp.org/content/undp/en/home/sustainable-development-goals.html. Accessed on March 29, 2020.

13. UNEP (United Nations Environment Programme) (2018), "Sustainable Goal Number 14." https://www.unenvironment.org/about-un-environment. Accessed on March 29, 2020.

14. Melissa Denchak, "Water Pollution: Everything You Need to Know," National Resources Defence Council (NRDC), May 14. https://www.nrdc.org/water-pollution-everything-you-need-know. Accessed on March 29, 2020; See also, "UNEP Sustainable Goal No. 11."

15. NITI Aayog (2018), "NITI Aayog Annual Report: 2018-19," Government of India. https://niti.gov.in/sites/default/files/2019-11/AnnualReport2019.pdf. Accessed on March 29, 2020.

16. UN (2015), Protection of the Atmosphere," Report of the International Law Commission, July 6–August 7. https://legal.un.org/ilc/reports/2015/english/chp5.pdf. Accessed on March 29, 2020.

17. Hector Perera (2012), "What is the difference between biodiversity and ecosystem and do they affect the human lives?" *LankaWeb*, September 29. http://www.lankaweb.com/news/items/2012/09/29/what-is-the-difference-between-biodiversity-and-ecosystem-and-do-they-affect-the-human-lives/. Accessed on March 29, 2020.

18. Douglas Broom (2020), "6 of the world's 10 most polluted cities are in India," World Economic Forum, March 5. https://www.weforum.org/agenda/2020/03/6-of-the-world-s-10-most-polluted-cities-are-in-india/. Accessed on March 29, 2020.

19. *The Hindu* (2020), "Safe Forests, Safe People: On Diseases of Animal Origin," April 3. https://www.thehindu.com/opinion/editorial/safe-forests-safe-people-the-hindu-editorial-on-diseases-of-animal-origin/article31242337.ece. Accessed on March 29, 2020.

20. World Bank (2020), "Overview: The World Bank in South Asia." https://www.worldbank.org/en/region/sar/overview. Accessed on March 29, 2020.

21. Kafle, S. K. (2017), "Disaster Risk Management Systems in South Asia: Natural Hazards, Vulnerability, Disaster Risk and Legislative and Institutional Frameworks," *Journal of Geography and Natural Disasters*, vol. 7, issue 3.

22. Worldometers (2020), "Southern Asia Population," United Nations Population Division, Population as on March 28, 2020. https://www.worldometers.info/world-population/southern-asia-population/. Accessed on March 29, 2020.

23. Ibid.

24. World Bank (2020), "South Asia Unemployment Rate 1991-2020," Macrotrends. https://www.macrotrends.net/countries/SAS/south-asia/unemployment-rate. Accessed on March 29, 2020.

25. Hasnat, G. N. et al. (2018), "Major Environmental Issues and Problems of South Asia, Particularly Bangladesh," in C. M. Hussain (ed.), *Handbook of Environmental Materials*

Management. Singapore: Springer International Publishing. According to Hasnat et al., "SAR provides shelter for approximately 15.5% flora and 12% fauna of the world. The floral diversity comprises 39,875 species of flowering plants, 66 conifers and cycads, and 764 ferns. Faunal diversity is wide-ranging with 933 species of mammals, 4494 birds, 923 reptiles, 332 amphibians, and 342 freshwater fishes."

26. Cal Poly Pomona (2012), BioTrek, "Disaster Risk Management in South Asia: A Regional Overview," (Washington, D.C.: The World Bank: GFDRR, 2012), p. 19.

27. Ibid., p. 14.

28. Priyanka Sunil (n.d.), "7 Major Environmental Movements in India," ClearIAS. https://www.clearias.com/environmental-movements-in-india/. Accessed on March 29, 2020.

29. Salomé Bronkhorst & Urmilla Bob (2010), "Environmental conflicts: Key issues and management implications," ACCORD, October 26. https://www.accord.org.za/ajcr-issues/environmental-conflicts/. Accessed on March 29, 2020.

30. Thomas Bernauer, Tobias Böhmelt and Vally Koubi (2012), "Environmental changes and violent conflict," IOP, January 17. https://iopscience.iop.org/article/1088/1748-9326/7/1/015601. Accessed on March 29, 2020.

31. UNEP (n.d.), "New UNEP Report Provides an Overview of Environmental Conditions, Resources, and Conflict." https://na.unep.net/siouxfalls/publications/Conflicts.pdf. Accessed on March 29, 2020.

32. Adelphi (2017), "Editor's Pick: 10 Violent Water Conflicts," Reliefweb, September 4. https://reliefweb.int/report/world/editor-s-pick-10-violent-water-conflicts. Accessed on March 29, 2020.

33. Thomas Bernauer, Tobias Böhmelt and Vally Koubi (2012).

34. Moeed Yusuf (ed.) (2014), *Insurgency and Counterinsurgency in South Asia: Through a Peacebuilding Lens* (Washington: United States Institute of Peace (USIP) Press), p. 1.

35. Rohan Sandhu and Waheguru Pal Singh Sidhu (2014), "Reinvigorating SAARC: India's Opportunities and Challenges," Brookings Report, November 20. Available at: https://www.brookings.edu/research/reinvigorating-saarc-indias-opportunities-and-challenges-2/. Accessed on March 29, 2020.

36. Sualiha Nazar (2016), "Pakistan's Big Threat Isn't Terrorism—It's Climate Change," *Foreign Policy*, The South Asia Channel, March 4. Available at: https://foreignpolicy.com/2016/03/04/pakistans-big-threat-isnt-terrorism-its-climate-change/. Accessed on March 29, 2020.

37. Jugal Bhurtel Saleem Ali (2009), "The Green Roots of Red Rebellion: Environmental Degradation and the Rise of the Maoist Movement in Nepal," ResearchGate.

38. Sonam Pelden (2011), "Report Underlines Climate Threats," *Bhutan Observer Online*, September 5, 2011.

39. Mirza Zulfiqur Rahman (2016), "China and India's race to dam the Brahmaputra river puts the Himalayas at risk," *The Conversation*, September 26.

40. Buhaug et al. (2008), *Implications of Climate Change for Armed Conflict, Social Dimension of Climate Change*, The World Bank, February 25.

41. Vishnu Padmanabhan et al. (2019), "The growing threat of climate change in India," *Live Mint*, July 21. https://www.livemint.com/news/india/the-growing-threat-of-climate-change-in-india-html. Accessed on March 29, 2020.

42. Buhaug et al. (2008), *Implications of Climate Change for Armed Conflict, Social Dimension of Climate Change*.

43. Shaurya Gurung (2019), "Army removes 130 tonnes of solid waste from Siachen glacier to protect its eco-system," *The Economic Times*, September 24. https://economictimes.indiatimes.com/news/defence/army-removes-130-tonnes-of-solid-waste-from-siachen-glacier-to-protect-its-eco-system. Accessed on March 29, 2020.

44. Adil Najam (2003), "The Human Dimensions of Environmental Insecurity : Some Insights From South Asia," *Environmental Change Security Project Report*, vol. 9, issue 9, pp. 59-73. https://www.wilsoncenter.org/sites/default/files/media/documents/publication/najam.pdf. Accessed on March 29, 2020.

45. Homer-Dixon, T. (1991), "On the Threshold: Environmental Changes as Causes of Acute Conflict," *International Security*, vol. 16, no. 2, pp. 76-116.

46. IISD (1992), "Trade and Sustainable Development," *Report of the International Institute for Sustainable Development* (IISD). https://www.iisd.org/sites/default/files/publications/trade_and_sd.pdf. Accessed on March 29, 2020.

47. IFRC (2020), *South Asia Forum on Preparedness for Regional Disaster Response*, February, IFRC. https://media.ifrc.org/ifrc/2020/02/06/south-asia-forum-preparedness-regional-disaster-response/. Accessed on March 29, 2020.

48. IDSA (2017), "Joint Doctrine of the Indian Armed Forces (JDAIF)–2017." https://www.ids.nic.in/IDSAdmin/upload_images/doctrine/JointDoctrineIndianArmedForces2017.pdf. Accessed on March 29, 2020.

49. Department of Telecommunication (2008), "Hybrid Wind/Solar Power for Rural Telephony Green Solutions to Power Problems," First Report of the Committee on Non-conventional Energy to Power Rural Telephony, Government of India. http://usof.gov.in/usof-cms/miscellaneous/Renewable%20Energy%20Committee%20Report.pdf. Accessed on March 29, 2020.

50. Ibid.

51. IPCC (2018), *Climate Change 2014 Synthesis Report.* https:ipcc.ch/site/assets/uploads/2018/5 pdf. Accessed on March 29, 2020.

52. https://economictimes.indiatimes.com/news/defence/international-fleet-review-2016-navy-to-showcase-warship-running-on-biofuel-at-vizag/articleshow/

53. Neha Jain (2018), "Warmer winters in the Himalayas are triggering avalanches," Mongabay, April 24, https://india.mongabay.com/2018/04/warmer-winters-in-the-himalayas-triggering-avalanches/. Accessed on March 29, 2020.

54. Wessels (2017), "Water Wars," Wessels Living History Farm. https://livinghistoryfarm.org/farminginthe50s/water_10.html. Accessed on March 29, 2020.

55. Peter Wilson (2003), *Wars, proxy-wars and terrorism: post independent India*. New Delhi: Mittal Publications; see also, Zaloga (1999), *The M47 and M48 Patton tanks*. Osprey Publishing, 1999.

56. Sanchari Pal (2017), "These Army Battalions Have Been Greening Once-Barren Landscapes for Over a Decade," *The Better India*, October 6. https://www.thebetterindia.com/117047/ecological-task-force-indian-army-ecological-restoration-afforestation-conservation/. Accessed on March 29, 2020.

57. V. K. Ahluwalia and Narjit Singh (2019), *Surprise, Strategy and Vijay: 20 Years of Kargil and Beyond*, (New Delhi: Pentagon Press, 2019), p. 158.

58. M. Pabbi (2018), "IFR 2016: Navy to showcase warship running on biofuel at Vizag," *The Economic Times*, July 14. https://ecotimes.indiatimes.com/news/defence/international-fleet-review-2016. Accessed on March 29, 2020.