Conflict-Solving Strategies in Heritage Studies

Climate Change: Challenges and Response as for Natural Heritage in Developing Countries

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Presented at International Academy Cottbus: Understanding Heritage (ISAC) 2015 30 November – 12 December 2015, BTU Cottbus-Senftenberg, Germany

1. Introduction

Climate change has enormous negative effect on Natural Heritage. Increase intensity and frequency of extreme weather events such as increase global temperature sea level rise over past decades and other negative impacts of climate change on natural heritage beats the alarm bell to announce world that ecosystem under threat. Climate change has a negative impact on terrestrial and marine ecosystems by altering the pattern of the ecosystem, causing widespread species extinction, migration and behavior changes. Global natural heritage already suffers from climate change, in developing countries situation of natural heritage is not better but worst due to human-induced pressures on environmental and absence of sustainable development. Paper will investigated the impact of Precipitation patterns, droughts, storminess, ocean temperature and acidification and sea level rise on natural heritage in Developing Countries and define climate change adaptation and mitigation strategies that mitigate climate change risks on natural heritage and involved in context of development plans in Developing Countries to conserve natural heritage. The impact of climate change on Natural Heritage in Developing Countries and the strategies to mitigate those effects has been investigated. Egypt, for example, as one of the developing countries, what the climate change impact on Egyptian natural heritage? And what the measures taken by Egypt to protect the natural heritage?

2. Climate Change Impact on Natural Heritage

Climate change affect terrestrial ecosystems and biodiversity such as plants and animals in a variety of ways through climate change risks such as melting glaciers, global warming, droughts and forest fires; raised temperatures led to rapid melting of glaciers and ice caps that reduce water availability; floods that threat species at Andean in Latin America and at Himalayas in Asia and push species to shift northward or to higher elevations where temperatures are more conducive to their survival but some invasive species will disturb native species or have negative effect on received habitats[1]. In the Huascaran National Park in Peru, glacier melting resulted in decreased quality and quantity of water and increased floods and landslides which push certain species to migration higher altitudes [2]. Some of the ecosystems try to adapt with climate change by change time of migration, blooming, and mating but this also confuse life cycle of wildlife, reduce growth and survival when migrants arrive at a location before or after food sources are present. Migration or extinct of some ecosystems will lead to food web disruptions [3]. In Africa the majority of African birds would will migrate large distances to reach suitable climates for survive [4]. 25–40% of animal species in national parks in sub-Saharan Africa expected to become endangered due to reduced habitat as a result of forest fires, desertification and other human-induced pressures [5]. Rate of Forest fires will increase due to raise temperatures and water shortage due to change precipitation patterns which led to reduce habitat and habitat fragmentation in most of developing countries in Africa, Asia and Latin America [6]. Raised temperature will increase spread of infectious diseases and reduce precipitation led to removing forest cover that cause desertification. Already African forest suffers from Drying and desertification in many areas particularly in the Sahel and Southern Africa, in Asia forest fires increase over the last 20 years due to higher temperatures [7], in Latin America forest fires and drought expected to destroy or severely damage 55% of the Amazon rainforest by the year 2030 result in deforestation and forest fragmentation.

Savannah and fire-prone brush will replace tropical forest in the Eastern Amazonia and parts of Mexico [8].

Climate change impact on coastal areas include sea level rise, storm surge, heavy precipitation, raise water temperatures , ocean acidification and storms. Sea surface temperature has significantly warmed during the past 30 years along more than 70% of the world's coastlines, the average rate of temperature rise is 0.18°C per decade these values are larger than in the global ocean where the average of change is 0.11 °C per decade during the 1971–2010 period [9].Warming affects marine habitat such as mangroves and pressure species to migrate northward some of marine ecosystems cannot be tolerant with temperature will face extinction risk [10]. Increase water warming and ocean acidification due to rising concentration of carbon dioxide (CO2) in the atmosphere, increase CO2 uptake which increase acidic of water led to affect the health of many marine species and reduce the ability of shellfish to build the shells and corals to build skeletons that result in loss of critical habitat to marine ecosystem due to coral bleaching [11]. Greenhouse gases in the air emitted by pollution retain heat that cause global warming, global warming cause ice melting which discharge water into oceans and raise sea level. Global sea level rose at a mean rate of 1.7 mm/yr between 1900 and 2010 the rise rate rapidly increase and at a rate 3.2 mm/yr from 1993 to 2010, that's mean during the 20th century, global sea level rose by roughly 18 cm and projected to be 0.28 to 0.98 m by 2100 to play a role in submerge coastal wetlands and mangroves that represent habitat to a lot of species [12]. Already in Bangladesh sea level rise by 4-8 millimetres per year, scenarios predict raise sea level by 1 meter to submerge 20% of Bangladesh area, ecosystems would be lost such as The Sundarbans mangroves swamps that are part of the world natural heritage and Represent habitat to hundreds of species such as marine turtles, crocodiles and dolphins [13].

3. Climate change adaptation and mitigation Strategies

Reduce co2 emissions and prevent footprint of activities to mitigate the effect of global warming to reduce pollution stress on natural heritage, measure will be beneficial in countries that have high share of co2 emissions such as China .Maintain or restore habitat; maintain the environment in a fit condition for ecosystem by maintaining extent and diversity of habitat, landscape and species through strong adaptive conservation programmes building on mitigate climate change impacts on habitat, protect ecosystem health and restore floodplains, wetlands and peatland to mitigate risk of floods and forest fires [14]. Create protected areas including forests, wetlands, tropical and temperate grasslands and coastal habitats such as mangroves and sea-grass beds to preserve natural habitats which help in addressing the impacts of climate change, work as carbon sinks sequestering co2 from the atmosphere and play a role in avoid conversion to other land uses that damage the environment. 15% of the world's terrestrial carbon stock is stored in protected areas globally [15]. Connect Ecological sites along with expanding or creating protected areas; linkages between protected areas are important for conservation, Connect networks of protected areas can achieve objectives of conservation more than individual protected areas [16]. Connect protected areas by land and water enhance the resilience of plants and animals to adapt with weather extreme events, food or water shortage and allow migration of species northward to find tolerant climate zones. Management of nature conservation sites by integrate management of land, water and natural resources that promotes conservation and sustainable use of resources and deal with climate-induced problems such as forest fire, invasive species and food and water shortage by sustainable managing habitats that maintain nursery, feeding, and breeding grounds for fisheries, wildlife and other species. These approaches also maintain existing carbon stocks increase resilience, reduce the vulnerability of ecosystems to climate change risks and negative human footprint on environment, improve livelihood opportunities and provide health and recreational benefits. Involve stakeholders in management will strength adaptation and mitigation strategies and increase benefits [17], some examples about Sustainable management ; sustainable forest management through the

restoration of forest ecosystems and reestablishment of understory vegetation, water management for harvesting and conserving water, wild land fire management to combat factors that increase forest fires such as droughts and enhance the resilience of sensitive ecosystems to forest fires, Alien species management to control the spread of invasive species and Wildlife diseases management to identify risk factors associated with climate change and increased surveillance or preventative measures to enhance ecosystems health [18]. Improve Coastal management by enhance wetlands, mangroves and coral reefs to adapt with sea level rise and storm surge through soft measures (ecological engineering) such as reducing pollution, habitat fragmentation, reduce land and water degradation and restoring and creating buffer zones around protected areas. Hard engineering measures such as building a seawall, groynes and boulder barriers to mitigate flood but must be followed by studies analysing their effects on natural heritage to avoid maladaptation. High cost of hard engineering measures represent barrier to be applied in developing countries. Land use planning by use of the land and its natural resources in effective and efficient way to select the best land use options in order to enhance responses to climate change by avoid land use change in ecological areas and involve climate change adaption and mitigation in official plans, zoning, and development permits to preserve ecosystem and habitats. Enhance green urban environment, green urban environment contributing in improving air quality, mitigate climate change through absorbing co2 and enhance adaptation through manage flood water within floodplains, providing habitat for some ecosystem. Green roofs play a role in support nesting and migration of the birds, insects and airborne seeds which help biodiversity to adapt to climate change. Raise awareness of stakeholder about climate change risks on natural heritage and measures of mitigation and adaptation through held workshops, involve stakeholder in planning and implementation of adaption and mitigation process.

4. CC Impact on Natural Heritage in Egypt

Climate change threaten Egypt especially coastal zones and Nil delta due to sea level rise, Egypt has 1200 km long northern Mediterranean coast are exposed to sea level rise. Nile Delta is already subsiding at a rate of 3-5 mm per year [19], scenario projected loss of land estimated 704 kilometre square by 2025 due to sea level rise. Seawater acidification, water salinization and coastal erosion treat coastal habitat such as mangroves and coral reefs in red sea already coral reefs growth have decreased by 30% in 2013 and projected increase coral reef bleaching 80% by 2060 [20], also effect on coastal lakes Fisheries and push fish to migrate [21]. Sea-level rise might affect the ecosystem of the Northern Lakes such as Burullus lagoon and Manazala Lake in Nile Delta by saltwater intrusion hence altering its water quality. Changing temperatures will force ecosystems to shift. Plant species will dieback in some areas as temperatures rise and weed swamps will disappear due to increase water salinity [22]. Egypt taken measures to mitigate climate change risks such as reduce co2, afforestation, preserve protected areas , Enforcing environmental regulations and costal management; Egypt starts converting to clean and renewable energy to reduce co2 emission and afforestation using sewage water, Egypt has afforestation about 11 thousand acre to mitigate climate change impacts [23]. Expanding the marine protected areas, Egypt has thirty nature protected area estimated with more than 15% of the total area of Egypt such as Ras Mohamed Protected Area and Tyran as well as Sanafir in South Sinai Governorate that contain Coral reefs and Mangrove and Zaraniq and El Bardwaeel Marsh in the North Sinai Governorate that represent key points for migration and Wetland habitat for 270 species of birds [24]. Enforcing regulations such as law no 102 of 1983 for nature protectorates that define protected areas, preserve habitats and ecosystems [25], enhance coastal areas by implement soft and hard measures to adapt with sea level rise such as Abu Qir sea wall in Alex government [26].

5. Conclusions

- Climate change threaten several terrestrial and marine ecosystems and disturb ecological systems in Africa, Asia and Latin America.
- Desertification, drought and wildfires threat forest ecosystems, raise sea level and water acidity threat marine's ecosystems such as mangroves and coral reefs.
- Climate change risks push terrestrial ecosystem to migration or extinction.
- Climate change rates will accelerate in the future which increase risks on natural heritage.
- adaptation and mitigation climate change strategies divided in measures depend on maintain and restore habitat in direct way and other in indirect way such as land use management and green urban upgrading that also play a role in enhance development plans in developing countries.
- Developing countries should reduce human-induced pressures on the environment that increase vulnerability and doubled the impact of climate change on natural heritage.
- Risks on natural heritage will effect also economic activities such as fishing due to loss of habitats and social relations in community that depend on nature for livelihood.
- Egypt will suffer from climate change especially in coastal regions due to sea level rise and water acidity that will submerge habitats such as wetland and mangroves in coastal areas and cause coral reef bleaching in Red sea.
- Absence detailed studies about current and predicted impact of the climate change on ecosystem also absence clear adaptation and mitigation policies in ecosystem sector will increase natural heritage vulnerability in Egypt. Climate change not consider in urban development plan especially land use planning in the northern coast of Egypt that will effect on coastal natural heritage in Egypt. Egypt adaptation and mitigation projects insufficient comparing to enormous risk of climate change on natural heritage in Egypt.

References

1. Christopher B. Field et al. (2008) ECOLOGICAL IMPACTS OF CLIMATE CHANGE. United States: The National Academies.
2. World Heritage Centre (2006) PREDICTING AND MANAGING THE EFFECTS OF CLIMATE CHANGE ON WORLD HERITAGE. 30th session of the World Heritage conference. Vilnius, 2006.
3. US Environmental Protection Agency, Climate Impacts on Ecosystems. Available at: http://www3.epa.gov/climatechange/impacts/ecosystems.html [Accessed September 2015].
4. Jean Pierre al. (2014) Ch4: Terrestrial and inland water systems in: Climate Change 2014: Impacts, Adaptation, and Vulnerability, The Intergovernmental Panel on Climate Change (IPCC).
5. United Nations Framework Convention on Climate Change (2007) IMPACTS, VULNERABILITIES AND ADAPTATION IN DEVELOPING COUNTRIES. UNFCCC.
6. William F. Laurance(2010) Habitat destruction: death by a thousand cuts. Oxford University Press.
7. Fulco Ludwig et al. (2007) Climate change impacts on Developing Countries. European Parliament's Committee on the Environment and Wageningen University and Research Centre.
8. Michael Case. Climate Change Impacts in the Amazon.Climate Change Programme (WWF).
9. Jean Pierre al. (2014) Ch5: Coastal Systems and Low-Lying Areas in: Climate Change 2014: Impacts, Adaptation, and Vulnerability, the Intergovernmental Panel on Climate Change (IPCC).
10. San Francisco State University (2015) Climate change could cause cold-blooded animals' thermal tolerance to shrink. Science Daily.
11. US Environmental Protection Agency, Climate Impacts on Coastal Areas. Available at: http://www3.epa.gov/climatechange/impacts/coasts.html [Accessed September 2015].

12. Jean Pierre al. (2014) Ch5: Coastal Systems and Low-Lying Areas in: Climate Change 2014: Impacts, Adaptation, and Vulnerability, the Intergovernmental Panel on Climate Change (IPCC).
13. Sonja Butzengeiger and Britta Horstmann (2004) Sea-Level Rise in Bangladesh and the Netherlands. Germanwatch.
14. EU Ad Hoc Expert Working Group on Biodiversity and Climate Change (July 2009) Towards a Strategy on Climate Change, Ecosystem Services and Biodiversity. EIONET workshop on adaptation in Copenhagen 30 June – 1 July 2009.
15. Nigel Dudley al. (2010) Protected areas helping people cope with climate change. The World Bank.
16. Working Group for the Canadian Parks Council (2013) CANADIAN PARKS AND PROTECTED AREAS: Helping Canada weather climate change. Canadian Parks Council.
17. Naumann al. (November 2011) Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe. Oxford University.
18. Edgar Kaeslin al. (2012) Wildlife in a changing climate. Rome. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO).
19. Shardul Agrawala al. (2013) DEVELOPMENT AND CLIMATE CHANGE IN EGYPT: FOCUS ON COASTAL RESOURCES AND THE NILE. Organisation for Economic Co-operation and Development.
20. Joel Smith al. (2013) Potential Impacts of Climate Change on the Egyptian Economy 2013. United Nations Development Programme.
21. The Egyptian cabinet information and decision support center (2011) Egypt's National Strategy for Adaptation to Climate Change and Disaster Risk Reduction.
22. Akram ElGanzori (2012) TOWARDS A CLIMATE CHANGE ADAPTATION STRATEGY FOR THE WATER SECTOR IN EGYPT.
23. El-Sayed Kalifa and Ahmed A. El-Settawy. Waste Water Reuse for Afforestation in Egypt.
24. Ministry of Environment (MOE), Natural Protectorates Description. Available at: http://www.eeaa.gov.eg/en-us/topics/nature/protectorates/protectoratesdescription.aspx [Accessed September 2015].
25. Ministry of Environment (MOE). Law No 102 of 1983 for Nature Protectorates. Available at: http://www.eeaa.gov.eg/en-us/laws/otherlaws.aspx [Accessed September 2015].
26. The Egyptian Cabinet's Information and Decision Support Center [IDSC](May 2011) National Adaptation Strategy for Climate Change and Disaster Risk Reduction for the Resulting (AR).