Phenomenon of 'green Sahara'

Neelam Pereira

The present-day Sahara Desert was previously a lush green region redundant with wildlife, savannah and swampland owing to a prehistoric climate change in the eastern Sahara, according to an in-depth archaeological study that highlights this theory[1]. Denoted as a flat, waterless area in Arabic, Sahara, deemed as the world's largest desert is a combination of immense flat, sandy or stony regions scattered with mountain ranges having base-rock protrusions or volcanic outcrops[2]. It swathes North Africa from the Atlantic coast to the Red Sea and came into being[3] around 2700 years ago, after a slow fade from green, according to a new study that clashes with the theory of abrupt desertification. The greening effect observed in parts of Africa was subsequent to a steady rainfall pattern arising from a warmer climate during the early and mid-Holocene period[4].

Recent research findings show that the drying Sahara evolved between 5600 and 2700 years ago, as a gradual response to decreasing tropical monsoon rainfall[5]. This led to an ecological succession, starting with tropical grassland trees and herbs followed by typical Sahel vegetation, eventually resulting in loss of grass cover and establishment of the oasis-bounded modern desert-plant community. A wide arrayed analysis of palaeo-environmental indicators extracted from the radiocarbon-dated sediment record of Lake Yoa in northern Chad corroborated the findings. The ecosystem of Lake Yoa experienced a more abrupt transition from freshwater to hypersaline conditions between 4200 and 3900 cal yrs BP, when its decreasing water balance stopped groundwater outflow and allowed salts to accumulate in the lake itself.

This new environmental reconstruction of the Sahara contrasts with the broadly recognized hypothesis that the 'green Sahara' which existed between 10,000 and ~6000 years ago, had ended abruptly. Hence, the drying of the Sahara can no longer be used as a case study of abrupt climate and ecological change. A number of studies on the green Sahara confirm that the change was definitely not abrupt, but occurred over a period of time. However, sizeable reports of abrupt climate change in the past continue to accentuate the significance of critical thresholds in the global climate system[6].

The impact of weather, oceans and vegetation on the Sahara was evaluated by Martin Claussen and co-workers at the Potsdam Institute for Climate Impact Research, in Germany. The results reflected that the vegetation in the Sahara reduced to a desert shrubland in an abrupt process spanning a few centuries. It was inferred that the change in the climate of Sahara was triggered by changes in the earth's orbit and its tilt, whereas the oceans added little to its desertification[7]. Though oceans are considered an important part in the scheme of climatic studies, vegetation was implemented as a main variable in a study by Elfatih Eltahir (Massachusetts Institute of Technology), to deduce factors that elicited climate change in the Sahara. Modelling based on the Holocene period showed that carbon dioxide remained a fixed parameter, while solar radiation and earth's orbit were dissimilar compared to the present-day conditions. These changes, though capable of receding the desert, could not account for the sudden evolution of the cultivable land to a waterless one[3].

While diverse studies on abrupt versus gradual 'greening' changes continue to emerge, the wildlife of the Sahara faces the axe of civilization. Large African mammals that thrived till the second half of the 19th century, have now become extinct, or are on the brink of extinction. It is speculated that some may be surviving further south, or in the parks of East Africa. However, the flora is at a better position with almost 3000 species of angiosperms, though some species may face danger due to man-made habitat destruction[8].

As the world pitches on slowing down the process of global warming, it becomes necessary to garner knowledge about changing climate, and its effects on Africa. While some views illustrate a greener Sahara with rainfall in the impoverished African regions, others paint a gloomy picture of droughts, diseases and natural disasters[4]. According to the climatologists at the Royal Meteorological Institute in the Netherlands, global warming could be a boon to the Sahara. They have predicted that changes such as heating and increase in greenhouse gases could significantly increase rainfall in Saharan Africa within a few decades, potentially ending the severe droughts that have devastated the region[9]. Claussen empathizes with the hypothesis of the green Sahara triggered by CO_2 emissions, with an estimated greening of 1/10th of the Sahara land per decade. However, he doubts that the factors attributed to climate change may not have the same effect on rainfall patterns, as it did in the mid-Holocene era. Besides, there are fears of over-grazing activities in the South Saharan region diminishing the positive effects of vegetation[4].

The unravelling of this mystery calls for more research in parts of Africa that are deemed to be recipients of the 'positive effects' of global warming. As Eltahir rightly believes, 'Looking at the past climate provides a reasonable way, perhaps the only way, to test models, which must be accurate if they're going to predict future climate changes'[3].

1. Markey, S., National Geographic News, 20 July 2006.
2. http://www.cru.uea.ac.uk/tiempo/newswatch/index.htm
3. Brehm, D., 2 April 2003; http://web.mit.edu/newsoffice/index.html
4. Hennig, R. C., http://www.afrol.com
5. Kröpelin, S. *et al.*, *Science*, 2008, **320**, 765–768.
6. Honecker, P., 12 May 2008; http://www.pressoffice.uni-koeln.de
7. http://www.climateark.org, 15 July 1999.
8. Le Houérou, H. N., *J. Arid Environ.*, 1997, **37**, 619–647.
9. Adam, D., 16 September 2005; http://www.guardian.co.uk/

Neelam Pereira (S. Ramaseshan Fellow), c/o D. Abhijit Mazumder, NCAOR, Headland Sada, Goa 403 804, India.
e-mail: neelam.pereira@gmail.com