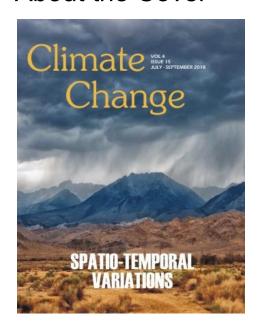# Climate Change

About the Cover

Wetlands are among the most important and productive ecosystems in the world. In addition to being rich in biodiversity, they are known to play a vital role in food production, water quality treatment and sustaining rural livelihoods. However, over the years, changes have been observed in wetland surface area. The absence of an effective monitoring system/ tool in Zimbabwe means that these changes have neither been quantified nor analysed. In addition, there is no comprehensive inventory on wetlands. Thus the study makes use of geographic information systems and remote sensing tools to establish and quantify the spatio-temporal changes in wetland area that have occurred over the period from 1984 to 2014 in the Masvingo district of Zimbabwe. Landsat satellite images for the years 1984, 1986, 1995, 2006 and 2014 together with climatic data for Masvingo district were used in the study. Multispectral index, modified normalized difference water index was used to separate wetlands from other features and area that they occupy was then dternined using the histogram function in ILWIS GIS. Furthermore, the spearman's rank-order correlation analysis was used to test for the nature of relationship between wetland areas with mean annual rainfall and mean maximum temperatures of the years understudy. The results show variability in wetland size over time but generally they show a declining trend. Mean maximum temperatures were also determined to have significantly changed, but the relationships between wetlands and climatic parameters were determined to be statistically not significant. Hence the research concludes that remote sensing can be used to accurately map and monitor wetlands and also that within the time scale under study climate change and variability alone cannot explain the changes in wetland area in Masvingo district (Ref: David Chikodzi, Linda Yeukai Mapfaka. Spatio-temporal variations of wetlands in Masvingo district of Zimbabwe and influences of climate change and variability. *Climate Change*, 2018, 4(15), 235-247).

Climate Change & Ecosystem

Spatio-temporal variations of wetlands in Masvingo district of Zimbabwe and influences of climate change and variability

David Chikodzi, Linda Yeukai Mapfaka

Wetlands are among the most important and productive ecosystems in the world. In addition to being rich in biodiversity, they are known to play a vital role in food production, water quality treatment and sustaining rural livelihoods. However, over the years, changes have been observed in wetland surface area. The absence of an effective monitoring system/ tool in Zimbabwe means that these changes have neither been quantified nor analysed. In addition, there is no comprehensive inventory on wetlands. Thus the study makes use of geographic information systems and remote sensing tools to establish and quantify the spatio-temporal changes in wetland area that have occurred over the period from 1984 to 2014 in the Masvingo district of Zimbabwe. Landsat satellite images for the years 1984, 1986, 1995, 2006 and 2014 together with climatic data for Masvingo district were used in the study. Multispectral index, modified normalized difference water index was used to separate wetlands from other features and area that they occupy was then dternined using the histogram function in ILWIS GIS. Furthermore, the spearman's rank-order correlation analysis was used to test for the nature of relationship between wetland areas with mean annual rainfall and mean maximum temperatures of the years understudy. The results show variability in wetland size over time but generally they show a declining trend. Mean maximum temperatures were also determined to have significantly changed, but the relationships between wetlands and climatic parameters were determined to be statistically not significant. Hence the research concludes that remote sensing can be used to accurately map and monitor wetlands and also that within the time scale under study climate change and variability alone cannot explain the changes in wetland area in Masvingo district.

Climate Change & Health Science

Review on the relationship of climate change and prevalence of animal diseases

Sena Zinabu, Abriham Kebede, Beshatu Ferede, Jiregna Dugassa

Climate change is a subset of the larger set of ecosystem change that is promoting the emergence and re emergence of animal diseases. It affects livestock health through several pathways. These includes effects on pathogens, such as higher temperatures affecting the rate of development of pathogens or parasites; effects on hosts, such as shifts in disease distribution that may affect susceptible animal populations; effects on vectors, such as changes in rainfall and temperature regimes that can affect both the distribution and the abundance of disease vectors; and effects on epidemiology, like altered transmission rates between hosts, food safety and animal production. Furthermore, Climate change influences the emergence and proliferation of disease hosts or vectors and pathogens and their breeding, development and disease transmission. Consequently, it affects distributions, host–parasite relationships and its assemblages to new areas. Indirectly the climate change can affect quantity and quality of fodder crops, animal production, severity and distribution of diseases in both domestic and wild animal that result in their migrations. Most developing countries are highly vulnerable to this climatic impact. From this developing countries Ethiopia is the one that faces recurrent drought due to climate change in its different parts that ends in economic crises. Even though this climatic change causes different economic impacts in the country, a few researches were conducted on it. Now climate models suggest that Ethiopia will see a further warming of 0.7°C and 2.3°C by the 2020s and between 1.4°C and 2.9°C by the 2050s. So that, it is important to create awareness for the society how climatic change can occurred and result in prevalence of infectious animal disease that end up with economic crises of the country.

Climate Change & Water Resources

GIS based approach for the identification of artificial recharge sites in Annavasal Block, Pudhukkottai district, Tamilnadu

Rajesh J, Lakshumanan C

The selection of sites for artificial recharge is a very important task for recharge studies in the over exploited hard rock terrain. Occurrence and movement of groundwater in the hard-rock terrain are controlled by secondary porosities developed through weathering and fracturing. Groundwater occurs in the weathered residuum under unconfined condition and circulates through fractures and fissures below. Here the high weathered thickness, high lineament density, almost flat or gentle slope and low drainage density areas are more suitable for effective recharge. The Remote Sensing and GIS based method of artificial recharge on the ground water aquifer is decided to be the most effective for the restoration of balance of the hydro geological system. The systematic planning of groundwater exploitation through modern approach is essential for management and sustainability. Remote Sensing (RS) Satellite data, Geographic Information Systems (GIS) and Survey of India (SoI) top sheets for mapping & integration of geology, drainage, lineament, hydrological soil groups, slope category and Land use /Land cover the thematic maps are assigned to a suitable ranks and weightage depending on the terrain condition for groundwater recharge. These thematic layers were integrated and reclassified into four categories for artificial recharge; good (27%), moderate (31%) and poor (51%).Later on, the final results

were compared with the groundwater level data from the bore wells collected by Groundwater Board, Tamilnadu, India. It was found that the integrated remote sensing and GIS techniques are the most suitable methods for delineating artificial recharge zones in hard rock terrain of Annavasal Block, Pudukkottai district, Tamilnadu.

Climate Change, 2018, 4(15), 282-298

Climate Change & Livestock

Impact of Climate Change on Smallholder Dairy Production and Coping Mechanism in Sub-Saharan Africa-Review

Gezu Tadesse, Moges Dereje

The current problems in the world are variation/declining of rainfall, shortage of feed and water, incidence of disease and rising of temperature, these are come about because of climate change. So, the objective of this review is to appraisal the impact of climate change on smallholder dairy production and coping mechanism in sub-Saharan Africa. Climate change is a long-term and significant change in the expected patterns of a specific region's average weather for an appropriately significant period of time caused by the accumulation of greenhouse gases (gases facilitate for climate change are CO_2, CH_4 and N_2O) in the atmosphere which leads to global warming. Africa has been identified as one of the parts of the world most vulnerable to the impacts of climate change. Though climate change affect livestock production directly and indirectly, can be mitigate through adaptation measures involve production and management system modifications, breeding strategies, institutional and policy changes, science and technology advances, and changing farmers' perception, manure management, shifting dietary and reducing enteric methane production.

Climate Change, 2018, 4(15), 299-313

Climate Change & Pollution

Non-point source pollution in China, policies and best management practices: Lessons for Uganda

Natamba Leo, Zhang Weihua, Shiqiang Wei, Jinshong Zhang, Zhao Xiulin

Non-Point Source Pollution (NPSP) is a serious environmental threat for water ecosystems in China. It is created primarily by overuse of agrochemicals. Uganda, which is still far behind in developing its agricultural, industrial and mining sectors, is facing the same problem. This paper looked at various policies in place to control NPSP in China and Uganda. Lessons for both countries, particularly Uganda, whose environment is not very polluted, have been drawn and the gaps highlighted for policy makers to address. Despite the commitment of the Chinese government in tackling this problem, NPSP is still a serious environmental problem. In conclusion, there is need for both countries to involve the public in NPSP awareness campaigns, and policy formulation and implementation. Where possible, collaboration between the two partner states should be enhanced.

Climate Change, 2018, 4(15), 314-322

Climate Change & Agriculture (Book)

BUILDING CLIMATE SMART FARMERS (A Guidebook for Doubling Income of Farmers in Arena of Climate Change)

Kirit N Shelat, Odemari Mbuya

Climate-smart crop production contributes to food security and this can be accomplished by addressing different aspects of current and projected climate change impacts through adaptation and mitigation actions. Agriculture provides opportunities for adapting to, and mitigating, climate change effects.

Climate Change, 2018, 4(15), 323-624

Climate Change & Education

An empirical assessment of public understanding of climate change in Benin City, Nigeria

Eghosa Igun, Jomata Lucky Igben

Despite the increasing availability of scientific information about climate change and global warming, there exists a state of confused or lack of understanding of global warming among the public. Nevertheless, there has been little empirical research done to assess public understanding, trust and engagement; hence, this study aims to provide data about public levels of understanding, trust, concern and response to climate change. Data were obtained from 120 respondents chosen through a self-selected sampling technique, and administration of closed-ended questionnaire based on the Fifth Assessment Report of the Inter-governmental Panel for Climate Change (IPCC). Data obtained were analyzed using charts and scatterplots. The result shows that there is considerable understanding of and concern for climate change and a limited level of trust in its occurrence; hence, the unwillingness to act. This study recommends that climate scientists should pay greater attention to their approach in communicating climate change messages to the public.

Climate Change & Forestry

Exploring forest aboveground biomass estimation using landsat, forest inventory and analysis data base

Seyed Omid Reza Shobairi, Vladimir Andreevich Usoltsev, Viktor Petrovich Chasovskikh, Mingyang LI

This paper, aims to calculate the various remote sensing based models namely multiple linear regression (MLR), k-Nearest Neighbor (k-NN), bagging (Bagging) and random forest (RF); that were established using 9 vegetation index and three terrain variables. Five indicators of correlation coefficient (COR), mean absolute error (MAE), root mean squared error (RMSE), relative absolute error (%RAE), root relative squared error (%RMSE) were figured out to evaluate the performance of the four models using ten-fold cross validation method. Then the model with the best performance was applied to predict the dynamics of forest aboveground biomass during 1993 to 2013. Results show that among the four models, the prediction accuracy of random forest is the highest, followed by k-NN method, while the accuracy of MLP is the lowest. The terrain factors including elevation and slope, soil conditions (e.g. brightness, wetness), vegetation growth conditions (e.g. vertical vegetation index, effective leaf area index) are the enforcing factors impacting regional forest aboveground biomass. During 1993 to 2013, the unit forest biomass in study area decreased from 34.68 Mg/ha in 1993 to 32.59 Mg/ha in 2003, then increased to 44.65 Mg/ha in 2013. The spatial distribution pattern of forest aboveground biomass had experienced a change from high aggregation to fragmentation from 1993 to 2013. The spatial hot/cold spots analysis predicted that the cold spots with most gentle changes of forest aboveground biomass during research period were mainly distributed in the northern rocky mountains with inconvenient traffic conditions, high forest cover and less human disturbance, while the hot spots with most dramatic changes located in the southern Guan River valley with good traffic conditions, high population density and gentle slope.