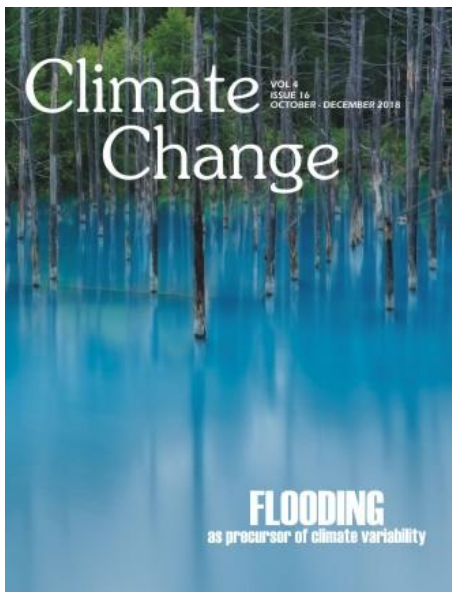


# Climate Change

## About the Cover



Pakistan is extremely vulnerable to climate induced hazards such as floods, droughts, storms, heat waves and extreme weather events. Flooding is the most devastating natural hazard of Pakistan. Since the inception, the country has faced with multiple flood events costing thousands of lives and billions of losses in infrastructure. The situation has gotten worse since the past decades as the events of floods have increased in the country particularly the enormous floods of 2010 which shook the economy and till now we have not been recovered yet. This paper utilizes primary and secondary sources in gathering the data regarding damages of floods incurred by the inhabitants of district Swat. A total of 86 respondents were interviewed using semi structured household questionnaire. The survey results showed that flooding is the main perceived climate change vulnerability in the area. Damages include human, livelihood and household losses. Most of the respondents believe the incidents of floods have increased since the past two decades. The study area is most vulnerable to the negative impacts of climate change. Climate variability and increasing extreme weathers events are resulting in livelihood insecurities among the local communities. Poor households with low resource base and adaptation capabilities are most vulnerable to the natural disasters. This research recommends that government should prioritize the effected livelihoods of the study area by extending their support to the affected communities. Intensive research is needed to investigate to a full extent the climate change vulnerabilities particularly extreme weather events in the area. Local communities should be equipped with climate change knowledge and extension of climate technologies to offset the vulnerabilities with effective climate adaptation plans. (Ref: Muhammad Suleman Bacha, Mohammad Nafees, Muhammad. Flooding as precursor of climate variability: causes and damages of 2010 flood event in District Swat, Pakistan. *Climate Change*, 2018, 4(16), 642-652).

## Climate Change & Disaster

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### **Flooding as precursor of climate variability: causes and damages of 2010 flood event in District Swat, Pakistan**

Muhammad Suleman Bacha, Mohammad Nafees, Muhammad

Pakistan is extremely vulnerable to climate induced hazards such as floods, droughts, storms, heat waves and extreme weather events. Flooding is the most devastating natural hazard of Pakistan. Since the inception, the country has faced with multiple flood events costing thousands of lives and billions of losses in infrastructure. The situation has gotten worse since the past decades as the events of floods have increased in the country particularly the enormous floods of 2010 which shook the economy and till now we have not been recovered yet. This paper utilizes primary and secondary sources in gathering the data regarding damages of floods incurred by the inhabitants of district Swat. A total of 86 respondents were interviewed using semi structured household questionnaire. The survey results showed that flooding is the main perceived climate change vulnerability in the area. Damages include human, livelihood and household losses. Most of the respondents believe the incidents of floods have increased since the past two decades. The study area is most vulnerable to the negative impacts of climate change. Climate variability and increasing extreme weathers events are resulting in livelihood insecurities among the local communities. Poor households with low resource base and adaptation capabilities are most vulnerable to the natural disasters. This research recommends that government should prioritize the effected livelihoods of the study area by extending their support to the affected communities. Intensive research is needed to investigate to a full extent the climate change vulnerabilities particularly extreme weather events in the area. Local communities should be equipped with climate change knowledge and extension of climate technologies to offset the vulnerabilities with effective climate adaptation plans.

*Climate Change*, 2018, 4(16), 642-652

## Climate Change & Sustainability

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### **Crop residues management in agro-environmental sustainability**

Jay Shankar Singh

The advance tools and technologies in agriculture sector of have played a significant role in enhancement of crop yields and food security to most of the countries. However, long term sustainability of current agricultural system is at risk because of soil health deterioration, over use of natural resources and erratic climate patterns due to global warming. In recent years, high crop yields due to improved tools and technologies have resulted in huge quantities of crop residues (CRs) production annually. Burning of CRs is now a common practice at filed conditions causing soil health deterioration, air pollution, loss of agriculturally important soil microbial biomass diversity, etc. Residue incorporation results more microbial activity than residue removal or burning. Paddy CRs decomposition in anaerobic flooded soil conditions substantially increases green house gases emissions particularly methane. Therefore, appropriate sustainable management of huge amount of crop residues produced every year is need of the hour and assumes a great significance to the major agricultural producing countries. Appropriate management planning and environmental education would reduce the CRs burning practices and the related environmental, social and economical loss. In this communication, current concerns and possible options related to efficient management of CRs has been discussed. At present most of the developing countries including India, has challenging tasks to ensure food and environmental security. Hence the CRs, either partly or entirely can be used for agriculture conservation to country's food security, agriculture and environmental sustainability.

*Climate Change*, 2018, 4(16), 653-660

## Climate Change & Food Security

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### **Measuring the productivity of food-grain crops in different climate change scenarios in India: An evidence from time series investigation**

Ajay Kumar Singh, Pritee Sharma

This study assess the impact of climate change on productivity of food-grain crops in India. It used Cobb-Douglas production function model to investigate the climate change impact on food-grain productivity in India using time series, 1980-2010. In this study, food-grain production/hectare land is used as a dependent variable that is regressed with different socio-economic and climatic variables. Thereupon, it estimates the expected productivity of food-grain crops in different climate change scenarios. Empirical result based on Newey-West Standard Errors model shows that increase in maximum and minimum temperature, and change in rainfall pattern have a negative and significant impact on productivity of rice, arhar, bajra, jowar, wheat, ragi, gram and barley crops. Estimates also indicates that productivity of aforesaid crops are likely to be declined significantly by 2025, 2040, 2050, 2075 and 2100 in different climate change scenarios in India. Thus, it would be very serious concern for Indian farmers and policy makers to mitigate the negative consequences of climate change in food-grain crop farming and to meet food security in India. It provides several viable policy proposals to mitigate the negative impact of climate change in food-grain crops farming and to achieve sustainable food security in India in near future.

*Climate Change*, 2018, 4(16), 661-673

## Climate Change & Policy/Law

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### **COP21 policies and abrupt climate change: Political Economy of Hawking's Irreversibility**

Jan-Erik Lane

Climate and earth scientists have convinced a large majority of people that climate change occurs today. And the new theory of abrupt climate change entails that huge feedback loops will change the Earth already within the next one or two decades. Yet, this information is only half the story, as the pragmatical side is also part of climate change: will the COP21 promise of global decarbonisation be fulfilled? It requires global coordination by states or government, which is very hard to achieve. The COP process by the UNFCCC and the IPCC never speaks about it. The aim of this paper is to emphasize that global decarbonisation can only be accomplished by global state coordination, which reduces the probability of COP21 success considerably.

*Climate Change*, 2018, 4(16), 674-683

## Climate Change & Ecosystem

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### **A one hundred-year study of the upper limit of tree growth (*Terminus aboreus*) in the Swedish Scandes illustrated and updated change in an historical perspective**

Leif Kullman, Lisa Oberg

Positional treeline change since the early 20th century and up to 2017 was assessed along three elevational transects on Mt. Getryggen in the southern Swedish Scandes. Baseline data, representing the year 1915, were compared with later intermittent records up to 2017. Concerned species were *Betula pubescens* ssp. *czerepanowii*, *Picea abies*, *Pinus sylvestris* and *Alnus incana*. These species responded with different degrees of continuous upshift and substantial inter-site variability. *Betula* displayed the largest advance, by 215 m. This maximum magnitude of change compares with data from widely different parts of the Swedish Scandes. This common performance indicates that regionally recorded summer warming by 1.5 °C is the ultimate cause. In a long-term historical perspective, most congenial conditions for birch and pine growth at high elevations prevailed around 10500 – 9400 cal. yr BP, when the local treelines reached 1355 and 1250 m a.s.l., respectively. The former elevation coincides with the upper limit of *Vaccinium myrtillus* and the low-alpine belt. With the exception for *Pinus*, recent treeline upshifts were accomplished predominantly by phenotypic responses of millennial-old krummholz specimens. Only occasionally, has treeline advance by *Betula* and *Picea* originated from seed regeneration during the past century. These circumstances may set the limit for further advance where and when the pool of high-altitude old-established krummholz specimens becomes depleted as existing krummholz individuals have already transformed to tree mode.

*Climate Change*, 2018, 4(16), 684-714

## Climate Change & Pollution

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### **The status of air pollution attributable to automobile emissions in Mysuru: Implications for urban transport planning**

Venkataramana GV, Azis Kemal Fauzie, Naveen S

This paper explains the interlinking impacts of population growth, urban land use, automobile transportation, and atmospheric air pollution in Mysuru, a fast growing city in south India. High growth in urbanization and industrialization has affected on tremendous change in land use pattern and increase in motor vehicle use that, in turn, threatens urban air quality and health status. Number of registered vehicles in Mysuru rises gradually at a rate of 20% per year. Highest proportion was found in the number of two-wheelers accounting for 81% of total vehicle population. However, air quality status of the city was found within the national standards, especially for SO<sub>2</sub> and NO<sub>2</sub>, while PM sometimes approached the limit. An updated estimation of automobile emission has been prepared according to the recent number of registered vehicles in the district from 2010 to 2015. Mysuru daily contributes about 2 Gg gas and particulate pollutants consisting of 1.98 Gg CO<sub>2</sub>, 37.3 Mg CO, 20.6 Mg NO<sub>x</sub>, 14.5 Mg HC, and 3.2 Mg PM, or total about 0.08% to the Indian road transport emissions in 2015.

*Climate Change*, 2018, 4(16), 715-722

## Climate Change & Policy/Law

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### **Brexit as critical juncture: factors for UK's environmental policy amendment?**

Cletus Famous Nwankwo

The United Kingdom (UK)'s political divorce of the European Union (EU), or 'Brexit' will have some implications for many policy areas because of the complex institutional web of the EU not least the fact that the EU's environmental policy is integrated into the UK's policy. Thus, disentangling and reconfiguring the UK's environmental policy seems necessary to circumvent environmental regulatory gaps. Scholars argue Brexit will provide the UK with the opportunity to amend its environmental policy not only to fill loopholes but also ensure that environmental protection is guaranteed. This paper highlights the factors that could influence the UK's environmental policy amendment because of Brexit. Gaps in the European Union Withdrawal Bill, trade deals, economic outlook and other circumstances are pivotal.

*Climate Change*, 2018, 4(16), 723-727

## Climate Change & Atmospheric Science

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### **Temporal analysis of drought in Mwingi sub-county of Kitui County in Kenya using the standardized precipitation index (SPI)**

Cassim JZ, Juma GS

This study attempts to temporally characterize drought using Standardized Precipitation Index (SPI) over Mwingi Sub-County of Kenya. Rainfall data spanning 1961-2011 over the area of study was used to determine SPI values using quantitative techniques in R programming. The SPI values were temporally characterized using series graphs and trend analysis carried out. In order to enhance understanding of vegetative characteristics over the area of study, Vegetation Cover Index data was used to generate 3 month VCI spatial characteristics. Results of this study revealed that Mwingi region has been experiencing increasing mild to moderate drought events with occasional severe cases being reported since 1961. No extreme drought event was recorded during this period. The study noted that the drought events were increasingly varying in intensity during the period of study. The study recommends correlation analysis between all climate variables and SPI values to give direction on how they relate to each other over time. However, no extreme drought event was recorded during this period. The study recommends correlation analysis between the SPI values and all climate variables over the area of study.

*Climate Change*, 2018, 4(16), 728-733

## Climate Change & Society

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### **Determinants of Access and Utilization of Climate Services among Vulnerable Communities: A Case Study of Isoko Communities in Delta State, Nigeria**

Onwumele Andrew

Changes in climate have caused impacts on natural and human systems. These impacts affect poor people's lives through impacts on livelihoods and destruction of homes. In Delta State, the impacts of climate change are real. Adaptation has been identified as the key to reducing the impacts of climate change. However, successful adaptation depends on use of climate services. While climate services are essential to adaptation, the services do not always reach the users who need it most. This paper analyses factors influencing access and utilization of climate services in Delta state, Nigeria. The paper utilized the survey research while data were analyzed using both descriptive and inferential statistics. Findings show low utilization of climate service. The determinants of access and utilization of climate services include income, educational attainments, access to ICT facilities, extension agents and the level of local climate variability. The paper calls for awareness creation on the importance of climate services.

*Climate Change*, 2018, 4(16), 734-742

## Climate Change & Atmospheric Science

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### **Assessment of intensity and distribution of aridity over Bangladesh using different climate indices with GIS**

Md. Ashraful Islam Chowdhury

Aridity is slowly lethal natural calamity for an agricultural county like Bangladesh. Due to aridity and scarcity of irrigational water the agricultural system of Bangladesh is being interrupted. De Martonne index (1923), Lang Rainfall factor (1915), Minar Moisture certainty, UNEP Arid Index (1997), Thornthwaite classification (1948), Pinna Combinative Index and Aridity index of Emberger (1932) were used to estimate the aridity of the whole country. Data from 34 meteorological station were used to reveals the aridity distribution and variation. A version of Arc GIS 10.1 was used for spatial distribution and map preparation. The study period was divided into two distinct time period of 1991-2000 and 2001-2010. The results showed that severity and distribution of aridity is in increasing pattern over the 20 years period. The lower values of all indices indicate the more arid region. The calculated values of all indices of 2010 is lower than the values of 1991, means aridity increases and disperse from 1991 to 2010. Only Embergeraridity index explore that the whole area is under humid climate because of temperature difference is very low. The most arid prone area is north-western and some of southern part of the country. Agriculture of those regions is highly affected by aridity and that contribute to country food security.

*Climate Change*, 2018, 4(16), 743-749

## Climate Change & Engineering

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### **Best practice - introduction to energy efficiency in greenhouses**

Abdeen Mustafa Omer

The move towards a de-carbonised world, driven partly by climate science and partly by the business opportunities it offers, will need the promotion of environmentally friendly alternatives, if an acceptable stabilisation level of atmospheric carbon dioxide is to be achieved. This requires the harnessing and use of natural resources that produce no air pollution or greenhouse gases and provides comfortable coexistence of human, livestock, and plants. This study reviews the energy-using technologies based on natural resources, which are available to and applicable in the farming industry. Among these are greenhouses, which are necessary for the growth of some plants (i.e., vegetables, flowers, etc.) in severe climates. However, greenhouses require some air conditioning process to control their temperature and relative humidity to suit specific plants. To achieve this, a novel air humidifier and/or dehumidifier systems using mop fans had been designed and employed in an experimental greenhouse to evaluate its performance under a controlled environment. This device helped to reduce the energy consumption of the greenhouse whilst providing a pleasant environment for the plants inside the greenhouse. The system was designed taking into account the meteorological conditions, which affect the environment inside the greenhouse. The performance of the system was monitored over a period of time by measuring the temperature and relative humidity of the greenhouse. Results of the monitoring have shown that the system was able to provide comfortable conditions (temperatures

of 16-26°C and relative humidity of 65%) suitable for the plants grown in the experimental greenhouse. It also enabled the minimisation of temperature variation and, hence, avoided the hazard of any sudden climatic change inside the greenhouse.

*Climate Change*, 2018, 4(16), 750-780

## Climate Change & Greenhouse Gas

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### **Prediction of methane (CH<sub>4</sub>) emission based on paddy harvest area in Lampung Province, Indonesia**

Tumiar K Manik, Onny Chrisna P Pradana, Warsono

Major contribution of greenhouse gas (GHG) emissions from agriculture sector comes from paddy cultivation system; flooded paddy field is the source of methane emissions. Several researches related to greenhouse gas emissions from agriculture (paddy field) by direct measurements have been done in plot scale. This research aimed to predict methane annual emissions from paddy field in regional scale (province) based on paddy harvest areas. Methods that used in this research were IPCC model to estimate the emission and time series method (ARIMA) to forecast the emission in next five years. The result of this research showed: (1) methane emissions from paddy field are predicted to decline in the next five years, the number will be 232.703 Gg (2013); 229.113 Gg (2014); 225.877 Gg (2015); 222.961 (2016) and 220.333 (2017) for methane emissions; (2) comparing the result from other country with similar area, it could be concluded that IPCC model could be applied to estimate methane emissions in Lampung; and (3) the amount of methane annual emissions from paddy field was effected by annual cultivated area/harvested area and cultivation period.

*Climate Change*, 2018, 4(16), 781-788

## Climate Change & Society

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### **The influence of climate change on migration drivers: a qualitative analysis**

Magreth S Bushesha

This paper takes forward the knowledge frontiers regarding the influence of climate change on migration by answering the question why people do out-migrate in the semi arid areas of Tanzania. The paper explores ways in which climate change influences migration decisions among communities in very specific local scales with reference to Shinyanga District. The study is descriptive in nature. Data was collected through interviewing key informants, household survey, field observation and documentary review. Perceptions indicate that climate change manifests through erratic rains hence unpredictable seasonality; decreased storm size, reduced wet season, and prolonged dry season. Temperature is on a rising trend, and wind speed is on the increasing side. Frequent crop failure, reduced water resources, degraded soils, reduced fish resources, outbreak of non-common pests and diseases, disappearance of some animal and tree species and reduced pasture all negatively impact the agricultural economic system, in turn, this compromises the community's social system. Search for more fertile land, pasture, waged labour in nearby villages and search for jobs in towns are some of the identified reasons for outmigration in response to the challenges posed by climate change on the agricultural economic system. The paper informs policy on the urgency of proper action against climate change and related stresses in the country. Food relief programmes and transformation of the agricultural economic system are highly recommended to support adaptation to climate change in the study area. The study also recommends facilitation of research work which thrusts to excavate the social, economic and environmental implications of climate change forced migration in destinations.

*Climate Change*, 2018, 4(16), 789-803

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