



4th World Congress on

Climate Change and Global Warming

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Accepted Abstracts

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Climate change law education in post-Fukushima Japan and the progressive building of a cross-disciplinary anthropocene curriculum

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How can Environmental Law education engage with the proposed Age of Humankind? While much environmental law maintains a business as usual tone, how might we train the so-called Gaian generation of environmental learners? This paper is largely a speculative attempt to answer the question. Focusing on interdisciplinary pedagogical frameworks established for a mixed body of students in earth sciences, geo engineering and environmental humanities, it discusses the practical and theoretical conditions under which integrated syllabi and innovative pedagogies may contribute to the progressive development of climate change law education in Japan. It considers the potential of courses designed at the interface of Disaster STS (that investigates the relations between disasters, science production and policy outcomes), global environmental governance (that addresses the need for institutional science-policy interfaces) and critical environmental legal studies (that seek to move beyond the human/environment unproblematized distinction by combining law and environmental sciences in a way that belongs solely neither to law nor to ES). Such courses should allow students to explore, through case studies and role-play simulations, the relevance of emergent boundary organizations for dealing with climate change and their legitimacy regarding the development of negotiated rulemaking processes in environmental regulation. By emphasizing the pedagogical value of complementary fields such as disaster STS, global governance and critical environmental legal studies, this paper seeks to shed further light on the significance of climate change law education for the progressive building in post-Fukushima Japan of a cross-disciplinary anthropocene curriculum.

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Sustainable development in green energies and the environment

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The move towards a de-carbonized world, driven partly by climate science and partly by the business opportunities it offers, will need the promotion of environment friendly alternatives if an acceptable stabilization 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 article presents a comprehensive review of energy sources and the development of sustainable technologies to explore these energy sources. It also includes potential renewable energy technologies, efficient energy systems, energy savings techniques and other mitigation measures necessary to reduce climate changes. The article concludes with the technical status of the Ground Source Heat Pumps (GSHP) technologies. There is strong scientific evidence that the average temperature of the earth's surface is rising. This is a result of the increased concentration of carbon dioxide and other GHGs in the atmosphere as released by burning fossil fuels. This global warming will eventually lead to substantial changes in the world's climate, which will, in turn, have a major impact on human life and the built environment. Therefore, effort must be made to reduce fossil energy use and to promote green energy, particularly in the building sector. Energy use reductions can be achieved by minimizing the energy demand, rational energy use, recovering heat and the use of more green energy.

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Quantifying the impacts of built environment and surface properties on temperature extremes

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Urbanization has created an increase in Urban Heat Island (UHI) effect. UHI reflects an elevated temperature in cities as compared with nearby rural areas which is due to the change in landscape from grass covered and vegetative to concrete and asphalt with three-dimensional structures. Our on-site study revealed that mixed environments (grass, water and concrete) result in different temperature profiles within specific ranges. Grass shows the coolest environment, water is the most temperate and concrete has the highest peak temperatures during the day for the duration of the study. To further understand temperature extremes at fine temporal and spatial scales in complex urban settings and to minimize the thermal impact of structures on the surrounding environment, we plan on quantifying the impacts to build environment and surface properties on surrounding temperature through three specific tasks, downscaling satellite infrared radiation brightness temperatures to identify hot spots within urban environments and introduction of a localized offset table concept to quantify the impact of various surface type on thermal anomalies, understanding the behavior of common surface materials in the built environment in interaction with solar radiation and quantification of the vertical association between skin temperature and near surface air temperature for thermal mapping within urban microclimates and development of a conceptual framework for assessing environmental risk and vulnerability to temperature extremes by modeling the near surface air temperature profile of complex urban systems based on land surface properties and field measured data.

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Integrated impacts of climate and land use change on stream flow and water quality in the Songkhram River Basin, Thailand

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The livelihood of people in Songkhram River Basin (SRB) rely heavily on river water especially the fisheries. In recent past, SRB has experienced erratic variability in water quality afflicting the fish catch. Extensive land use changes in the recent past have raised concerns regarding its role in the water quality fluctuation in addition to the looming climate change effect. The current literature lacks a detailed model backed analysis on this matter, most importantly for the future. This study quantifies the future variation in the stream flow and water quality of the SRB using Soil and Water Assessment Tool (SWAT). The analysis is based on future climatic projections from three Regional Climate Models (RCMs) under two Regional Concentration Pathways (RCPs) scenarios. Two future scenarios generated from a dynamic land use change model (Dyna-CLUE) form the land use change scenarios. Results show climate change to be responsible (on an average) for 19.5% and 24% decrease in stream flow and 11.25% and 15.25% decrease in nitrate levels as projected by RCP 4.5 and 8.5 respectively. Land use change is found to be responsible (average) for 5.3% and 6.35% increase in stream flow and 11% and 11.6% decrease in nitrate levels under economic and conservation scenarios respectively. Thus, in conjunction, these two agents are seen to play against each other with a net effect of decrease in future stream flow (16%, average). Whereas, in case of nitrate levels the two works in tandem leading to amplified reduction (24.5%, average). Although land use is found to be the less afflicting agent, its role should not be overlooked land use may very well further exacerbate situation if there is unfavorable climatic variation than projected. The findings of this paper are useful for decision makers in the government bodies for planning/controlling the land use in the basin from the water quality conservation viewpoint.

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The 2015/16 El Niño business in Botswana: Water supply disruptions among small and medium enterprises in Gaborone

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Statement of the Problem: The 2015/2016 El Niño weather phenomenon has intensified the already existing drought associated with climate change in Botswana. Drought affects water resources, driving up water shortages for all use, including industrial use. Profound economic impacts are felt across sectors, particularly Small and Medium Enterprises (SMEs) due to their limited capacity to cope. Nevertheless, literature on the impacts of water shortages on SMEs is still lacking.

Objective: This study investigates the economic impacts of water supply disruption on SMEs in Gaborone and their responses during the 2015/2016 El Niño associated drought.

Methodology: A survey research design was used to assess 62 SMEs from the hospitality and hair salon sectors. In-depth interviews were held with resource managers in the water, environment and business sectors using a qualitative interview guide.

Results: Due to drought and poor management of water infrastructure, water shortage has affected business operations. Businesses experienced impacts including damage to inventories and assets, reduced productivity, increased cost of operation and suspension of business activities. As a result, businesses were unable to fulfill customer obligations that resulted in permanent loss of customers and they had to temporarily dismiss employees. Despite the fact that businesses employed a number of coping and adaptation strategies to stay in operation, some still felt they were at the risk of closing down.

Conclusion: Water supply disruption and its impact on business operations demonstrated that for businesses to stay in operation, proper water planning and management is of critical importance. Recommendations are made for enhanced strategies that will increase the resilience of SMEs to future hydrological and meteorological droughts.

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Human activities and global climate change: The role of traditional fuel wood use in rural and urban cities of Nigeria

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This paper analyzes the effects of fuel wood consumption in both urban and rural settings in Nigeria and how it brings about environmental degradation and contributes to global climate change. Demand for biomass, charcoal and other sources for energy in Nigeria is very high due to increase in population and industrial use and natural resources such as forest is on the decline due to deforestation. However, the rate of regeneration of the forest is very slow; this often creates wood fuel gap because wood is being harvested faster than it is being grown in these areas and the ability of forest to control land degradations such as erosion, leaching, soil desiccation to mention but a few. The study used pictorial and descriptive analysis as methodology for the study. However, data were sourced from National Bureau for Statistics (NBS), Central Bank of Nigeria (CBN) statistical bulletin and federal ministry of environment in Nigeria. The major finding shows that the consumption of traditional biomass surpasses all other forms of energy in Nigeria by more than 80%, being one of the major suppliers of energy resources at the global market. The study also found that there is no efficiency and sustainable biomass consumption in Nigeria, which has long run negative effects on the environment such as emission of greenhouse gasses, global warming that further culminate to global change. Hence, the study recommends among others that there is need for efficiency and sustainable use of these resources to guarantee the survival of the ecosystem.

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Physical and mathematical basis for decision making using weather and climate information for the energy sector

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Decision Making (DM) problem is of great practical value in many areas of human activities. Most widely used DM methods are based on probabilistic approaches. Well-known Bayesian theorem for conditional Probability Density Function (PDF) is a background for such techniques. It is due to some uncertainty in many parameters entered in any model described functioning of many real systems or objects. Uncertainty in our knowledge might be expressed in alternative form. I offer to employ appropriate confidential intervals for model parameters instead of relevant PDF. Thus one can formulate a prior uncertainty in model parameters by means of a set of linear constraints. Related cost or goal function should be defined at corresponding set of parameters. That leads us to statement of problem in terms of operational research or mathematical linear programming. It is more convenient to formulate such optimization problem for discrete or Boolean variables. Review of relevant problem statements and numerical techniques will be presented as well as several examples. The house heating and air condition optimal strategies responded to different IPCC climate change scenarios for some domains of Russia are considered. Evolving of climate and energy costs should be taken into account in building construction design. Optimal relationship between future expenses for house heating and costs of new house constructions including material costs and its amounts is a subject of discussion. In both considered tasks DM might be performed by means of the discrete optimization algorithms. If the DM variables are all required to be integers, then the problem is called an Integer Programming (IP). The 0-1 IP is the special case of integer programming where variables are required to be 0 or 1 (rather than arbitrary integers). The IP is a most convenient form for decision maker use. The 1 value means that a given scenarios is accepted, the 0 value means that a given scenarios is rejected. To illustrate suggested approach the branch and bound technique was implemented to surface air temperature Ensemble Predictions System (EPS) for northern parts of Russia. Aim of this illustrative research was to link the EPS output facility to requirements of particular forecast users.

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Climate change adaptation: Education to action!

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The only choice left for Nepal to combat climate change is to increase the capacity of the people to adapt to the changed situation and to increase their resilience. The Centre for Environment Education Nepal (CEEN), with funding from Helvetas Nepal, launched a four-year project in selected 13 rural schools and communities of mid-eastern hills. The project aimed at educating students to take active roles in improving the adaptive capacity of the community and act on climate change awareness and adaptation and sensitizing local farmers at risk to become aware of climate risks and opportunities, plan and adopt measures to increase their adaptive capacity against climate vulnerability and hazards. The students were expected to become keen observers of local problems and issues, analyzers of situations and risks; designers and implementers of projects; participants in community decision-making and development; communicators of risks, their causes and management options; mobilisers of resources and people; constructors of social networks. The teachers from these selected schools were trained to encourage the students to investigate and explore the past environmental condition with that of the present, thereby enabling them to perceive the possible future trends on rainfall patterns, water sources, flowering time, sowing and harvesting time, appearance and disappearance of birds, plants, flowers, along with incidents of different hazards like hailstorms, floods, landslides, epidemics, etc. with children asking their parents, grandparents and elder members in the community about changes taken place over the last 30-40 years. In the meantime, the selected community members (normally members of Community Learning Centers and Community Awareness Centers (CLC/CAC) and other existing institutions) from the school vicinity were selected for sensitization and adaptation planning. Effort was made to select the farmers who were the members of these grass root institutions who also had their children at the local school.

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The impacts of climate change on wheat domestication and epigenetic changes

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Statement of the Problem: Climate is the most important element for agricultural products. Climate change can produce physiological tensions and stresses, genetic and epigenetic changes in plants. Our researches showed that wheat has been adapted to colder and severe winds climatic conditions approximately around 12,500 years ago (Younger Dryas event). As cold conditions caused the desired genetic variation in wheat, warmer climatic conditions is effective in reduction of fertility, changes in size, crop seed shape and quality and achievement of consistency with current climatic conditions for cereals in low and middle latitudes. Moreover, the probability of the pests and fungus outbreak will be increased for cereals.

Methodology & Theoretical Orientation: The effects of climate changes on different species of wheat were investigated in various periods as well. We used to sediment core analyses for detection of cereal pollens also data on archaeological excavations were used for analysis changes in grains and seeds.

Findings: The climatic conditions in the Younger Dryas period caused the most epigenetic changes in wheat that cultivated by inhabitants of the Fertile Crescent. Climate change makes genetic and epigenetic changes in plants.

Conclusion & Significance: Wheat can reduce the transpiration surface area by forming small cells against dry conditions. Climate change during the Younger Dryas period has been effective on domestication and increasing the power adaptation of wheat in different geographical areas. However before that, wheat was cultivated for a long time but, it did not have the properties of domesticated wheat. Cold and dry climatic conditions in Younger Dryas (12,500 years ago) and dry climate in 5000-6000 years ago causes increase in the resistance of wheat and created more morphological and epigenetic changes. Wheat is sensitive to high temperature, but the sensitivity depends on several factors such as variety, ambient temperature in which corn growth and its growth stages. The warmer climatic conditions are effective in reduction of fertility, changes in size, crop seed shape and quality. With the transferring of agricultural belts to high latitudes, although, there will be a desirable temperature conditions to grow wheat, factors including high humidity, poor soil organic matter and low thickness of the soil are the most important issues that restrict the wheat cultivation. Moreover, the probability of the pests and fungus outbreak will be increased for cereals.

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Carbon stocks in tropical high-land ecosystems in the Santuario de Fauna y Flora de Iguaque, Colombia

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The high-land ecosystems are a great carbon (C) sinks, mainly in soils. The objective of this study was to estimate the C storage in the most dominant Land Uses (LU) (dense grasslands in firm lands with no trees -G, open shrub lands -OS, dense shrub lands -DS, high dense forest in firm land -F) of the Santuario de Fauna y Flora de Iguaque (SFFI), Boyacá, Colombia. A temporal sampling plot of 10*25 m² in OS, DS and F was established and diameter at the breast height (dbh) and total height were measured in all trees with dbh>10 cm and the total and stipitate height of *Espeletia* spp. It was estimated the above ground and below ground biomass using allometric models. The Soil Organic Carbon (SOC) was estimated at a depth of 0-30 cm. The greatest C contents were found in F, being higher than the rest of LU (59.0 t/ha). The shrub lands with different tree density presented similarities in the C in total biomass (28.7 vs. 25.3 for dense and open, respectively). The G, dominated by *Espeletia* spp., presented the lowest C (5.3 t/ha). The C stock was similar between LU (83-139 t/ha), mainly caused by a high spatial variability. The results show a high C stock, mainly in SOC, in these ecosystems, that indicates the relevance of conserving these ecosystems for removing this greenhouse gas from the atmosphere.

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A system for safe, sustainable and eco-friendly waste water treatment to create soil, grass and water (EWT)

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Human activity has had a negative impact on the environment because it has caused deforestation, ocean acidification and the extinction of important biodiversity. Current sanitation methods convert pollution to disaster; they lead to major problems faced by society today, such as water pollution, water scarcity, loss of soil fertility, global warming, poor economy, poor health and loss of life. These methods decompose (break-up) valuable organic elements, found in the so called waste, into foul gases and acids, even now. The gases badly pollute the air and acids badly pollute the land and sub soil water. Based on intensive field research, field experiments and application of fundamental science, a system for treatment, using waste water, unutilized solar energy, building debris as resources to produce soil with vegetation (say grass) and clean water. Community waste water includes sullage, kitchen sink food waste pulverized waste water, wash water, bath water, sewage, polluted rivers, lakes and sea, etc. It is about 99% water and 1% organic matter primarily made up of natural elements such as carbon, oxygen, hydrogen, nitrogen, sulfur and other trace elements found in all healthy biology, these are nutrients and in EWT are converted to healthy vegetation such as grass. Clean highly aerated water is filtered out, wherein there is no odor, no mosquitoes, no color. The system is occupationally safe and eco-friendly. EWT helps recycling of material and energy enhancement of environment, energy conservation, enhancement of air, soil, water, plants and animals feeding on these plants, bio-energy generation, reduction in global warming and climate change, development of havens for wildlife including flora and fauna, enhanced quantity, quality and distribution of rainfall, enhanced dissolved oxygen in water, watershed development, enhanced aquaculture and fisheries development, flood control. EWT is at least 10 times economical, efficient, safer, sustainable and ecological compared to alternatives.

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Quantifying the nexus between Trump's climate change agenda and the sub-Saharan rural livelihood

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The Donald Trump's environmental policy runs contrary to that of Barack Obama. While Trump's predecessor had advocated a reduction of carbon through renewable energy, Trump has advocated for an increment of fossil fuel while scrapping the environmental regulations as an agendum to boasting the American economy. Trump further veers from Barack Obama's climate change agenda when he opposed the Paris Climate Change Agreement. Some notable American economic analysts have forecasted that Trump's decision will likely drive the American economy in the short and medium term. While the American economy is forecasted to head in a positive direction, the sub-Saharan African livelihood is being threatened in the short, medium and long term. It has been proven empirically that the sub-Saharan region will be the most adversely impacted upon by the climate change variation. In an attempt to explore the nexus between Trump's climate change agenda and the sub-Saharan rural livelihood, a textual analysis of the United Nations framework convention on climate change (UNFCCC) - 2015 Paris Agreement; variety of policy documents on climate change and a series of scholarly publications on climate change were reviewed. Based on the current climatic change variation, the study emphasized the unquantifiable, worrisome and looming consequence the climate change impact would have on livelihood in the sub-Saharan Africa in the near future. In consonance to these worrisome consequences, this paper advocates a proactive-integrated water resource management approach across rural communities within the sub-Saharan region of Africa. It also advocates the interactive participation among climate change stakeholders wherein cutting edge innovations discovered by researchers and scientist will be meticulously infused into the policy documents and thereon be executed as an agendum to sustaining the future livelihood among rural populace in the sub-Saharan Africa.

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Resilience to climate change in Pakistan

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Pakistan is one of the country's most affected and highly vulnerable due to climate change induced disasters. According to the global climate risk index (2017), Pakistan ranks 7th amongst the countries most adversely affected by climate change. The major climate change threats to Pakistan are increasing extreme weather events, causing the rapid recession of the glaciers and intense floods. The purpose of this paper is to address population based responses to a major climate induced natural hazards in Pakistan. The areas most affected by the 2010 floods, when studied 7 years later, offer an opportunity to examine some major responses which can fall both under adaption and resilience behavior. This study utilizes climate change environmental hazard data from the meteorological department, flood data from the national disaster management agency, to assess the relative risks of flooding being faced by people living in different geographies in Pakistan. The Pakistan Social and Living Standard Measurement (PSLM) survey 2014-15 and the census 2017 data is used to assess major changes that demonstrate resilience/vulnerability to the floods at the individual, household and community levels. Differences in responses ranging from livelihood patterns, migration or its proxies and investments in the next generation will be among the responses which will be examined as a reflection of long term adaptive behavior.

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Impact and social vulnerability among farmers to climate change: Evidence from coastal Odisha, India

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The study attempts to understand the rationale behind why (or how) different groups of farmers within a community are disproportionately vulnerable (or impacted) by climatic change and variability. Primary data were collected using structured household interview schedule from a random sample of 310 males headed farm households across four categories of farmers such as marginal (≤ 2.50 acres of land), small (2.51-5.00), medium (5.01-10.00) and large (>10.00) in Chamakhandi and Mandipalli villages of Gajam district, Odisha. Indexing approach and focused group discussions are applied to understand the social vulnerability of different farm groups which comprises of geographical, economic and social factors respectively. The impact assessment results suggested that the productions of cereal crops (paddy and wheat), pulses crops (green gram and black gram) and oilseeds across different groups of farmers have been negatively affected due to climate change and variability in Mandiapalli village, whereas it has the similar impact except for the production of black gram and oilseeds in case of the marginal farmers in Chamakhandi village. Whereas, the medium and large farmers, on the average, confronted the greater reduction in cereal and pulses incomes compared to the marginal and small farmers in both study areas. In sharp contrast to these findings, the marginal and small farmers are socially more vulnerable to climate change than the medium and large farmers. This is attributed to the fact that the marginal and small farmers performed are abysmally on the geographical indicator (educational level), economic indicators (diversified sources of income, access to formal credit, percent of households having debt, changing paddy crop varieties, using early-maturing varieties of paddy and crop insurance) and social indicators (membership in community-level decision-making, farmer-based organization and political organization) as compared to the medium and large farmers.

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