An Environmental Research Abstract

Headlines Himalaya

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For the 675th-676th issues of Headlines Himalaya, we reviewed researches from six sources and selected 14 researches from four countries. We selected two researches from Nepal and 12 researches from other Himalayan countries (India, China and Pakistan).

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MASS WASTING AND EROSION IN DIFFERENT MORPHOCLIMATIC ZONES OF THE MAKALU BARUN REGION, NEPAL HIMALAYA

Jan Kalvoda and Adam Emmer

Geografiska Annaler: Series A, Physical Geography 103: 1-29

Mountain regions of the world face unprecedented climate-induced changes and associated sustainable development challenges. Retreating glaciers, degrading permafrost and rapid mass movements on the one hand and glacier-related disasters, on the other hand, are the sentinels of these phenomena. In this study, we focus our attention on the Makalu Barun region in the Nepal Himalaya, and characterize four main morphoclimatic zones, building on repeated field surveys and interpretation of remote sensing imagery. We distinguish four distinct zones: (i) extreme glacial zone; (ii) glacial zone; (iii) periglacial zone; and (iv) seasonally cold/warm humid zone. While extreme glacial zone is stagnant in its area, remaining three zones have been experiencing area/location changes associated with changing climate, glacier extent and permafrost distribution. We describe dominant geomorphic processes and typical landforms of these zones in detail, highlighting the role of mass wasting processes and far-reaching process chains acting across distinct morphoclimatic zones. The study provides evidence of very dynamic landform evolution which indicates extreme geomorphological hazards in the Nepal Himalaya.

For Further Reading: https://doi.org/10.1080/04353676.2021.2000816

IMPACT OF DISTURBANCES ON SPECIES DIVERSITY AND REGENERATION OF NEPALESE SAL (*SHOREA ROBUSTA*) FORESTS MANAGED UNDER DIFFERENT MANAGEMENT REGIMES

Uttam Chapagain, Binod P. Chapagain, Sunil Nepal, and Michael Manthey

Earth 2: 826-844

Sal (*Shorea robusta*) forests, a dominant forest type in Nepal, experience different disturbance intensities depending on management regimes. This study compares the impact of disturbance on Nepalese Sal forests, which are managed on three major management regimes: protected area, state-managed forest, and buffer zone community forest. Using a systematic sampling approach, we sampled 20 plots, each covering 500 square meters, and nested plots within each main plot to measure pole and regeneration for each management regime. We

recorded forest characteristics including tree species, counts, diameter, height, crown cover, and disturbance indicators. We compared forest attributes such as diversity indices, species richness, and stand structure by management regime using analysis of variance and regression analysis. The forest management regimes were classified into three disturbance levels based on disturbance factor bundles, and the buffer zone community forest was found to have the highest disturbance while the protected forest had the lowest disturbance. Species richness, diversity, evenness, abundance, density and basal area were higher, but regeneration was lower in protected area and state-managed forest compared to the buffer zone community forests. This suggests positive impacts of moderate disturbance on regeneration. The management plan should prioritize the minimization of excessive disturbance to balance forest conservation and provide forest resources to local users.

For further reading: https://doi.org/10.3390/earth2040049

India-Himalaya

BULK PROCESSING OF MULTI-TEMPORAL MODIS DATA, STATISTICAL ANALYSES AND MACHINE LEARNING ALGORITHMS TO UNDERSTAND CLIMATE VARIABLES IN THE INDIAN HIMALAYAN REGION

Mohd Anul Haq, Prashant Baral, Shivaprakash Yaragal, and Biswajeet Pradhan

Sensors 21: 7416

Studies relating to trends of vegetation, snowfall and temperature in the north-western Himalayan region of India are generally focused on specific areas. Therefore, a proper understanding of regional changes in climate parameters over large time periods is generally absent, which increases the complexity of making appropriate conclusions related to climate change-induced effects in the Himalayan region. This study provides a broad overview of changes in patterns of vegetation, snow covers and temperature in Uttarakhand state of India through bulk processing of remotely sensed Moderate Resolution Imaging Spectroradiometer (MODIS) data, meteorological records and simulated global climate data. Additionally, regression using machine learning algorithms such as Support Vectors and Long Short-term Memory (LSTM) network is carried out to check the possibility of predicting these environmental variables. Results from 17 years of data show an increasing trend of snow-covered areas during pre-monsoon and decreasing vegetation covers during monsoon since 2001. Solar radiation and cloud cover largely control the lapse rate variations. Mean MODIS-derived land surface temperature (LST) observations are in close agreement with global climate data. Future studies focused on climate trends and environmental parameters in Uttarakhand could fairly rely upon the remotely sensed measurements and simulated climate data for the region.

For further reading: https://doi.org/10.3390/s21217416

LINKING GUT MICROBIOME WITH THE FEEDING BEHAVIOR OF THE ARUNACHAL MACAQUE (*MACACA MUNZALA*)

Avijit Ghosh, Mukesh Thakur, Lalit Kumar Sharma, and Kailash Chandra

Scientific Reports 11: 21926

Exploring the gut microbiome is an emerging tool for monitoring wildlife health and physiological conditions which often sustained under the variety of stresses and challenges. We analyzed gut microbiome of Arunachal macaque

(*Macaca munzala*) of two disjunct populations from Arunachal Pradesh, India, to validate whether the geography or the feeding habits plays a principal role in shaping the gut microbiome in natural populations. We observed geography has a mere effect but feeding habits (i.e. feeding upon the leftover food and crop-raiding) significantly influenced the gut microbiome composition. The phylum Proteobacteria found to be enriched in leftover feeding group while phylum Bacteroidetes was differentially abundant in crop-raiding group. We observed predominant phyla Firmicutes followed by Proteobacteria and Bacteroidetes with the dominant classes represented by the Clostridia. Interestingly, one individual with known diarrheal/metabolic disorder exhibited complete dominance of the order Bacillales and showed 100% sequence similarity with genus *Solibacillus*. We raise concern that shift in diet of macaques may compel them to expose for various human diseases as two macaques feeding upon the leftover food exhibited dysbiotic gut microbiome. The present study provides the pragmatic evidences of how the alteration of food resources can harm the physiological condition of the macaques in wild and raises alarm to the forest officials/managers in strategise planting of natural food resources and monitor anthropogenic activities in the distribution of Arunachal macaques.

For further reading: https://doi.org/10.1038/s41598-021-01316-0

LANDSCAPE TRANSFORMATIONS, MORPHOMETRY, AND TROPHIC STATUS OF ANCHAR WETLAND IN KASHMIR HIMALAYA: IMPLICATIONS FOR URBAN WETLAND MANAGEMENT

Shahid Ahmad Dar, Sami Ullah Bhat, and Irfan Rashid

Water, Air, and Soil Pollution 232: 462

This study examined the current trophic state based on integrated analysis of land use land cover changes (LULCCs), morphometry, bathymetry, and water quality of a semi-urban wetland. The analysis of satellite data indicated that the wetland has lost an area of ~93 ha from 1980 to 2017. During the same period, the urban area within the wetland increased from 0.04 to 13.5%. The natural area of the wetland was lost significantly because of land conversion practices largely related to encroachments, settlements, and unplanned developmental activities. The land cover changes assessed in the immediate vicinity of wetland indicated an increase in the built-up (223%) and roads (95%). Morphometric analysis revealed that the maximum length of the wetland decreased by 775 m, while width showed an insignificant decrease. The bathymetric analysis revealed that the depth of the wetland varied from 25 to 246 cm, with a mean depth of 101.6 cm. The Carlson's trophic state index (TSI) ranged between 71 and 80.4, indicating the hyper-eutrophic nature of the wetland. Comparison of water quality data of a wetland with the previous studies indicated a decrease of 29 cm in the maximum depth from 1980 to 2018. While NO_3^--N increased from 300 μg L^{-1} in 1980 to 367 μg L^{-1} in 2018, total phosphorus (TP) increased from 300 μg L^{-1} in 1980 to 923 μg L^{-1} in 2018, thereby indicating continuous nutrient enrichment of the wetland. Based on the data analysis, immediate policy interventions are required to safeguard and/or reclaim this culturally and ecologically important wetland in the Kashmir region.

For further reading: https://doi.org/10.1007/s11270-021-05416-5

ASSESSING THE STATUS OF GLACIERS IN UPPER JHELUM BASIN OF KASHMIR HIMALAYAS USING MULTI-TEMPORAL SATELLITE DATA

Syed Towseef Ahmad, Rayees Ahmed, Gowhar Farooq Wani, Parmanand Sharma, Pervez Ahmed, Riyaz Ahmad Mir, and Jobair B. Alam

Earth Systems and Environment 5: 1-15

Climate change, a global challenge of our time has severely impacted mountain glaciers. This study presents a detailed and an updated glacier inventory of 2020 for the Upper Jhelum Basin (UJB), Kashmir Himalayas using Sentinel-2 data and documents 308 glaciers. The glaciers range in size from 0.01 to 10.51 km^2 and cover an area of 102.1 km^2. All glaciers are located in the elevation zone between 3500 and 5000 masl. About 86% of glaciers are small in size (< 0.5 km^2) and constitute 38.7% of total ice cover. However, glaciers with size greater than 0.5 km^2 are only 14% but constitute a major proportion 61.3% of glacier area. Majority of small glaciers are a result of defragmentation of larger ones, hence more vulnerable to melting. Multi-date satellite images were used to assess glacier fluctuations of selected glaciers (≥ 0.3) for the period 1990–2020. The total glacier area has reduced from 85.25 to 68.17 km^2 (20%) at the rate of 0.56 km^2 a^{-1}. Glaciers in the lower elevation zone (3800–4200 masl) have lost about 35% of their area at the rate of 0.22 km^2 a^{-1}. The analysis of meteorological data using Thel–Sen method and Mann–Kendall test before examining its impact on glacier mass loss reveals that a persistent warming trend in mean annual temperatures is observed over the region. This is strictly under the influence of global climate change having a potential to cause enhanced shrinking and thinning of glaciers in the study region.

For further reading: https://doi.org/10.1007/s41748-021-00273-y

China Himalaya

SIMULATING THE RESPONSE OF THE SURFACE URBAN HEAT ENVIRONMENT TO LAND USE AND LAND COVER CHANGES: A CASE STUDY OF WUHAN, CHINA

Meiling Gao, Zhenhong Li, Zhenyu Tan, Qi Liu, and Huanfeng Shen

Remote Sensing 13: 4495

With the rapid process of urbanization, the urban heat island (UHI), the phenomenon where urban regions become hotter than their surroundings, is increasingly aggravated. The UHI is affected by multiple factors overall. However, it is difficult to dissociate the effect of one aspect by widely used approaches such as the remote-sensing-based method. To qualify the response of surface UHI to the land use and land cover (LULC) changes, this study took the numerical land model named u-HRLDAS (urbanized high-resolution land data assimilation system) as the modeling tool to investigate the effect of LULC changes on the UHI from 1980 to 2013 in Wuhan city, China. Firstly, the simulation accuracy of the model was improved, and the summer urban heat environment was simulated for the summer of 2013. Secondly, taking the simulation in 2013 as the control case (CNTL), the LULC in 1980, 1990, and 2000 were replaced by the LULC while the other conditions kept the same as the CNTL to explore the effect of LULC on UHI. The results indicate that the proper configuration of the modeling setup and accurate surface input data are considered important for the simulated results of the u-HRLDAS. The response intensity of UHI to LULC changes after 2000 was stronger than that of before 2000. From the spatial perspective, the part that had the strongest response intensity of land surface temperature to LULC changes was the region between the third ring road and the inner ring road of Wuhan. This study can provide a reference for cognizing the urban heat environment and guide policy making for urban development.

For further reading: https://doi.org/10.3390/rs13224495

ASSESSMENT OF WATER POLLUTION IN THE TIBETAN PLATEAU WITH CONTRIBUTIONS FROM AGRICULTURAL AND ECONOMIC SECTORS: A CASE STUDY OF LHASA RIVER BASIN

Dan Li, Peipei Tian, Donguo Shao, Tiesong Hu, Hongying Luo, Bin Dong, Shahbaz Khan, Yuanlai Cui, and Yufeng Luo

Environmental Science and Pollution Research 28: 1-15

The freshwater environment of watersheds in the Tibetan Plateau is bound with the safety of the Asian Water Tower. In this study, nitrogen (N) and phosphorus (P) loads delivered to freshwater and the associated gray water footprint (GWF) in the agriculture, tourism, domestic life, and industrial sectors were estimated to assess the seasonal and annual characteristics of the water pollution levels (WPLs) in the Lhasa River Basin from 2006 to 2018, and WPL calculations were compared with actual water quality measurements from 2017 to 2018. We found that more than 90% of the GWF came from anthropogenic sources. From the perspective of the whole basin, domestic life was the largest contributor to both N-related GWFs (52%) and P-related GWFs (50%), followed by agriculture for N-related GWFs (32%) and tourism industry for P-related GWFs (30%). The N emissions into the freshwater environment exceeded the maximum assimilation capacity of the watersheds in individual years at both seasonal and annual scales, while P emissions were completely within the pollution assimilative capacity. Besides, we found the serious N pollution near irrigation areas at the seasonal scale (WPL = 2.7 and TN = 1.11 mg/L). The prosperity of tourism has led to a tenfold increase in N-related GWFs and a fivefold increase in P-related GWFs for the tourism industry near the Lhasa city. The strict top-down unified management for ecological environmental protection in plateaus may be an effective method.

For further readings: https://doi.org/10.1007/s11356-021-17249-0

HYDROCHEMICAL CHARACTERISTICS OF GROUNDWATER AT THE EPICENTER OF THE 2021 BIRU M6.1 EARTHQUAKE IN CENTRAL TIBET

Pengtao Yang, Xiaolong Sun, Dongying Liu, Zhongtai He, and Yongsheng Li

Water 13*:* 3111

Groundwater is undoubtedly important for water security and eco-environmental protection, especially in areas that experience earthquakes. Analyzing the characteristics and variation of groundwater after an earthquake is significant to obtain a better understanding of the seismic risk and rational management of groundwater resources. This study investigated the hydrogeochemical characteristics of groundwater at the epicenter of the 2021 Biru M6.1 earthquake in central Tibet, southwest China, using 23 water samples. The results showed that: (1) the hydrochemical type, hydrogen and oxygen isotope ratios, and SiO_2 concentrations of three hot spring water samples in the study area were significantly different from those of samples taken elsewhere, indicating that the hot spring water originates from deeper geothermal reservoirs and has undergone more distant migration and longer fractionation processes; (2) the geochemical characteristics of groundwater from some sampling sites in the epicentral area were apparently distinct from those of other shallow groundwater or surface water samples, suggesting that the groundwater environment in the epicentral area has been affected by the earthquake. Along with the macroscopic groundwater responses in the epicentral area after the earthquake, we investigated the influencing mechanisms of the earthquake on the regional groundwater environment. We conclude that a shorter distance from the epicenter to the seismogenic fault leads to a greater possibility of the generation of new fractures, which then induce macroscopic responses and chemical characteristic variations for groundwater.

For further reading: https://doi.org/10.3390/w13213111

SIMULATION OF POTENTIAL SUITABLE DISTRIBUTION OF ORIGINAL SPECIES OF FRITILLARIAE CIRRHOSAE BULBUS IN CHINA UNDER CLIMATE CHANGE SCENARIOS

Lei Liu, Yuanyuan Zhang, Yi Huang, Jindong Zhang, Qiuyu Mou, Jianyue Qiu, Rulin Wang, Yujie Li, and Dequan Zhang

Environmental Science and Pollution Research 28: 1-14

Fritillariae Cirrhosae Bulbus (FCB) is a famous traditional Chinese medicine, mainly used for relieving cough and resolving phlegm. According to Chinese Pharmacopoeia (2020), the medicine comes from dried bulbs of five species and one variety in *Fritillaria*. Due to climate change and human disturbance, the wild resources have become critically endangered in recent years. Following three climate change scenarios (SSP1-2.6, SSP2-4.5, and SSP5-8.5) under 2050s and 2070s, geographic information technology (GIS) and maximum entropy model (MaxEnt) were used to simulate the ecological suitability of FCB, a third-grade rare and endangered medicinal plant species. The results showed that the key environmental variables affecting the distribution of FCB were altitude, human activity intensity, and mean temperature of coldest quarter. Under current climate situation, the highly suitable areas were mainly located in the east of Qinghai Tibet Plateau, including Western Sichuan, Southeastern Tibet, Southern Gansu, Northwestern Yunnan, and Eastern Qinghai, with a total area of 31.47×10^4 km^2, the area within the nature reserve was 7.13×10^4 km^2, indicating that there was a large protection gap. Under the future climate change scenarios, the areas of the highly and poorly suitable areas of FCB showed a decreasing trend, while the areas of the moderately and total suitable areas showed an increasing trend. The geometric center of the total suitable area of the medicine will move to the northwest. The results could provide a strategic guidance for protection, development and utilization of FCB though its prediction of potential distribution based on the key variables of climate change.

For further reading: https://doi.org/10.1007/s11356-021-17338-0

Pakistan- Himalaya

ASSESSMENT OF WATER QUALITY BY BIOINDICATION OF ALGAE AND CYANOBACTERIA IN THE PESHAWAR VALLEY, PAKISTAN

Izaz Khuram, Nadeem Ahmad, Cüneyt Nadir Solak, and Sophia Barinova

Turkish Journal of Fisheries and Aquatic Sciences 22: 19805

In purpose to assess the water quality in Peshawar Valley, the diversity of algae and cyanobacteria were studied in 41 sites during 2018-2019. A total of 361 species indicators of 7 Phyla were revealed. Algae and cyanobacteria in the studied sites preferred benthic and plankton-benthic lifestyle and mesotrophic waters. Indicators characterized water as moderate in temperature, medium oxygenated, low alkaline, and low saline. Algae and cyanobacteria inhabited medium-polluted and good water quality of Classes 2-3. The statistical maps were constructed for the first time to visualize the spatial distribution of diverse environmental and biological water quality variables and their relationship. The statistical maps and CCA revealed Water Temperature, Electrical Conductivity, Salinity, and Total Dissolved Solids as significant factors influenced freshwater algal and cyanobacteria communities. Statistical maps reflected an increase of dissolved substances from the foothills to the Kabul and Indus rivers' confluence. Acidification was revealed in the northeast of the valley. The bioindication results allowed us to propose that the algae and cyanobacteria communities were influenced by nutrient runoff from the surrounding foothills, agriculture, domestic and industrial effluents. The bioindication method combined with statistics can be recommended as a productive instrument for future water quality monitoring in the Peshawar Valley.

For further reading: http://doi.org/10.4194/TRJFAS19805

BIODIVERSITY AND ECOLOGICAL INTERACTIONS OF EARTHWORM SPECIES FROM POONCH DIVISION PAKISTAN

Muhammad Umar Khan, Saiqa Andleeb, Muhammad Fiaz Khan, and Rozina Ghulam Mustafa

Tropical Ecology 62: 1-12

Current research represents the biodiversity and ecological interactions of earthworms in Poonch division, Pakistan which is unexplored till now. Earthworms were sampled randomly from 18 study sites during the study duration from April to October 2019 by using digging and hand sorting methods. Eleven earthworm species belonging to eight genera and three families were identified. The values of overall Shannon diversity indices indicate that *Eisenia fetida* (H = 0.14) was predominantly found in all habitats, while *Drawida nepalensis* (H = 0.05) has least abundance in the study area, likewise overall percent abundance of earthworms was highest in municipal dumped areas (27.4%) and lowest in near water entities (12.4%). Our investigations revealed that different abiotic parameters like soil temperature, pH, moisture contents, soil texture, organic matter content, available phosphorous, potassium and nitrogen in soil affect earthworm's diversity, distribution and abundance. It was also observed that earthworm population density was higher in localities with good canopy cover along with gardens because of the greater accumulation of organic matter. The present investigation provide a base line data in context of biodiversity and ecological interactions of earthworms with associated vegetation, soil macro fauna and other abiotic parameters, however a multidimensional research approach is needed to understand the complicacy of this association and its potential beneficial or harmful effects on functional ecosystem and agricultural land management.

For further reading: https://doi.org/10.1007/s42965-021-00196-9

PRECIPITATION CHANGES AND THEIR RELATIONSHIPS WITH VEGETATION RESPONSES DURING 1982–2015 IN KUNHAR RIVER BASIN, PAKISTAN

Shan-e-hyder Soomro, Caihong Hu, Shengqi Jian, Qiang Wu, Muhammad Waseem Boota, and Mairaj Hyder Alias Aamir Soomro

Water Supply 21: 3657–3671

Precipitation is a major determinant of vegetation growth. The impact of precipitation variability is more pronounced in ecosystems where sensitive vegetation is apparent. Therefore, understanding the relationship between precipitation and vegetation is vital to guide appropriate measures towards fragile biomes. We investigated the trends and correlations between precipitation and normalized difference vegetation index (NDVI) for 1982–2015 over the Kunhar River basin, Pakistan, using satellite-derived NDVI and globally available interpolated precipitation datasets. Subsequently, we attempt to identify vegetation types that are influenced by precipitation changes. Results show a general decreasing trend in vegetation activity as we go from southern to northern portions of the basin. This decrease is also accompanied by the similarly decreasing precipitation trend in the same direction. The similarity of spatial patterns between the two variables can indicate that, in general, precipitation is playing a guiding role in determining vegetation distribution in the basin. Our lagged correlation analysis revealed that strong precipitation–vegetation correlations ($r > 0.75$) are rare in the basin. Agricultural and forested areas show moderate correlations ($0.5 < r < 0.75$) when NDVI is correlated with the previous month's precipitation values (lag1). In simultaneous month correlation (lag0) and the rest of the lagged correlations (lag2 and lag3), a weak association between precipitation and NDVI is observed. The moderate and weak correlations

over the basin might indicate that precipitation is not the only factor influencing vegetation growth in the Kunhar River basin. Other climatic and biogeographic factors such as temperature, solar radiation, topography and soil characteristics also play additional roles in vegetation activities. The results can provide a technical basis and valuable reference to ecological management strategies in the Kunhar River basin for concerned decision-makers and stakeholders.

For further reading: https://doi.org/10.2166/ws.2021.129

ASSESSING THE CONTRIBUTION OF CITRUS ORCHARDS IN CLIMATE CHANGE MITIGATION THROUGH CARBON SEQUESTRATION IN SARGODHA DISTRICT, PAKISTAN

Ghulam Yasin, Muhammad Farrakh Nawaz, Muhammad Zubair, Ihsan Qadir, Aansa Rukya Saleem, Muhammad Ijaz, Sadaf Gul, Muhammad Amjad Bashir, Abdur Rehim, Shafeeq Ur Rahman, and Zhenjie Du

Sustainability 13: 12412

Adopting agroforestry practices in many developing countries is essential to combat climate change and diversify farm incomes. This study investigated the above and below-ground biomass and soil carbon of a citrus-based intercropping system in six sites (subdivisions: Bhalwal, Kot Momin, Sahiwal, Sargodha, Shahpur and Silanwali) of District Sargodha, Southeast Pakistan. Tree biomass production and carbon were assessed by allometric equations through a non-destructive approach whereas, soil carbon was estimated at 0–15 cm and 15–30 cm depths. Above and below-ground biomass differed significantly, and the maximum mean values (16.61 Mg ha^{-1} & 4.82 Mg ha^{-1}) were computed in Shahpur due to greater tree basal diameter. Tree carbon stock fluctuated from 6.98 Mg C ha^{-1} to 10.28 Mg C ha^{-1} among selected study sites. The surface soil (0–15 cm) had greater bulk density, organic carbon, and soil carbon stock than the subsoil (15–30 cm) in the whole study area. The total carbon stock of the ecosystem ranged from 25.07 Mg C ha^{-1} to 34.50 Mg C ha^{-1} across all study sites, respectively. The above findings enable us to better understand and predict the carbon storage potential of fruit-based agroforestry systems like citrus. Moreover, measuring carbon with simple techniques can produce trustworthy outcomes that enhance the participation of underdeveloped nations in several payment initiatives such as REDD+.

For further reading: https://doi.org/10.3390/su132212412

Highlight of the Issue

Are there any new hopes from COP 26 in climate change mitigation?

UN Climate Change Conference of Parties (COP26) took place in Glasgow from October 31 to November 12, 2021, making lots of important progresses to address the climate crisis. Summit received a commitment from developed countries in doubling the adaptation finance from 2019 levels, by 2025. The Glasgow Leaders' Declaration on Forests and Land Use that was targeted to halt and reverse forest loss and land degradation by 2030 was signed by the 120 countries. Importantly, over 100 countries signed the Global Methane Pledge to commit to collectively reduce global methane emission by 30% by 2030. Glasgow summit also served as a launchpad for new sectors alliances and financing with the goal of altering the economy at the scale required to achieve a net-zero future. Despite Glasgow Climate Pact agreement at COP 26, the question of feasibility of the global commitment still remains. For instance, the surety of this agreement to keep global warming to 1.5°C above pre-industrial levels, is still a question. United Nations Secretary-General António Guterres wrapped up the conference with the message,

"It is an important step but is not enough. Our fragile planet is hanging by a thread. We are still knocking on the door of climate catastrophe. It is time to go into emergency mode — or our chance of reaching net-zero will itself be zero."

https://unfccc.int/sites/default/files/resource/cma2021_L16_adv.pdf

https://www.unep.org/news-and-stories/story/cop26-ends-agreement-falls-short-climate-action

https://enb.iisd.org/Glasgow-Climate-Change-Conference-COP26