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Scoping and Need Assessment (Academia and Research)

MAINSTREAMING CLIMATE CHANGE INTO HIGHER EDUCATION AND RESEARCH IN PAKISTAN

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GIZ PAKISTAN |

Table of Contents

Foreword

Educating future generations about the causes and effects of global climate change is imperative since implementing solutions depends on an informed public, for both societal and individual level actions. The quality of life of future generations is largely dependent on the quality of education that we impart to today's students. Educational methods are more effective when students are challenged to identify the cause and effect of a problem that they can relate to their life. Climate change is the most critical factor affecting sustainable and equitable development, increasing conflicts, and causing massive extinction of species. Addressing the climate change issue is an essential step toward achieving the Sustainable Development Goals (SDGs). As the impact of climate change is inseparable from our day-to-day life, now and in future, it is both a problem to be addressed and a problem that can be adopted for more effective teaching.

Ministry of climate change is fully cognizant of the importance of the role of higher education in addressing the new risks created and the previous exacerbated by climate change. Addressing these can provide the opportunity to recreate institutions of higher education for the future, equipping them to be safe and secure in the face of change, more actively engaged in solving real-world problems, and reorganized to better provide the education and research needed to create and maintain a sustainable society.

The National Climate Change Policy 2021 emphasizes the development of a knowledge-based management (KBM) system along with introducing curriculum on climate change and environmental planning to be introduced it into the formal education system at all levels, particularly into the higher education. It also stresses the need to fortify networking with strategic climate change research establishments to ensure benefits from international scientific advancements to address the future challenges.

Executive Summary

Universities globally are increasingly realizing their obligation to prepare students and society to contribute to climate change mitigation and adaptation actively. This realization has necessitated the higher education institutions (HEIs) to adopt a twin strategy, i. e. become carbon neutral and educate human resources to confront and adapt to the vulnerabilities of climate change. This role sees universities in developed countries adopting and promoting carbon-neutral goals and practices and developing curricula and pedagogical approaches to educate students on new methodologies and approaches related to climate impact assessment, mitigation, and adaptation. However, HEIs in the developing countries are far behind regarding the revision of curricula and mainstreaming of climate change in their curriculum guidelines; hence a daunting challenge for disseminating the current knowledge on climate change, and Pakistan is not an exception.

Pakistan is amongst the top 10 most vulnerable countries to climate change, and every sector is influenced by climate change to varying degrees. Considering the limited adaptive capacity of the already less-resourced country, Germany's Federal Ministry for Economic Cooperation and Development (BMZ), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, is supporting the Government of Pakistan to improve the conditions for climate adaptation and resilience as well as climate risk management. The project "*Strengthening Climate Adaptation and Resilience (SAR)*" was formally launched in December 2021 with financial assistance provided by BMZ. The SAR supports the entire planning cycle of climate change adaptation measures: from preparing climate risk assessments to piloting financing approaches and instruments. The focus of the project is to conduct sector-specific assessments to understand the vulnerability of the key sectors affected by climate change and to build the capacities of relevant actors in climate risk analysis and the proper interpretation and use of gender-sensitive climate risk data at the provincial level (Khyber Pakhtunkhwa and Punjab).

As a part of the SAR project, sector-specific assessments are being conducted. This scoping study was planned to fully understand the needs of academia and research institutes related to climate risk assessments and management in Pakistan. The goal of the scoping study was to assess the current state of climate change integration into the higher education system's curriculum and related capacities. The study also sought to identify gaps and provide recommendations to strengthen the capabilities of universities and their faculty in climate change.

Implementation of the scoping study was guided by a detailed research methodology that consisted of two main components:

- *Analysis of secondary data* comprised of current policies, guidelines, international commitments, and global and local practices for mainstreaming climate change into higher education systems. This analysis also helped identify research gaps and guidance to determine the parameters of training need assessment (TNA) at individual levels.
- *Key informant interviews (KIIs)* were conducted across universities and research institutes in Islamabad, Khyber Pakhtunkhwa (KP), and Punjab to analyze the present knowledge/ skills of academia and researchers in climate risk assessments and management and their needs for developing climate-sensitive curricula for HEIs. Results of the KIIs were validated through conducting *focus group discussions (FGDs)* with the relevant stakeholders in the KP and Punjab.

The study revealed that the climate change component was covered in the curricula of most universities under env. sciences, geography, env. engineering, agriculture, social sciences, env. science and applied hydrology, RS, and GIS. However, a significant number of the key informants (>40%) replied that no attempts were ever made to develop guidelines for teaching climate change in any degree program in their universities. This shortcoming was coupled with >40% of the respondent teaching climate change who were neither trained nor had prior experience teaching climate change modules. Surprisingly, only 15% of the experts expressed that they were fully equipped to teach climate change courses. At the same time, the remaining were either moderately prepared or not prepared for lecturing climate change courses. The nonexistence of a training program dedicated to the capacity building of the faculty engaged in teaching climate-related modules was another major challenge identified during the KIIs and FGDs. Inadequate training facilities and access to training material often led to poor delivery of concepts to students and caused disinterest among students. Limited technical backstopping and non-availability of the proper guidelines for universities and faculty (40%) make it difficult for universities and faculty to properly implement climate change education and related concepts into different degree programs as a cross-cutting issue. For this reason, several important degree programs, including public health, development studies, economics, social sciences, engineering, agricultural and biological sciences, offered at various universities did not have a single course on climate change in their curricula. The surveyed universities had minimal faculty members with expertise in climate change, whereby only six climate scientists were reported in the universities in KP and Punjab. The number of scientists working on climate risk analysis and climate impact assessments (agriculture and water) was not impressive.

Climate change modules being taught as part of degree programs across the universities were not updated; hence, the respondents recommended extensive curriculum revision and faculty training. Moreover, establishing a curriculum revision committee at the departmental level to update the curriculum after each academic year was recommended. Another important argument raised by the experts during the consultative session was that the curriculum should be need-based on national priorities and international commitments made by the Govt. of Pakistan from time to time.

A common understanding amongst the educationists, experts, and policy makers is growing for building environmental and climate literacy at various levels of the education system. This is particularly needed to prepare tomorrow's citizens and community members by helping them understand climate change impacts and systems thinking. Urban and municipal planners are now routinely including lessons in some required courses on weighing climate impact risks when undertaking community master plans, zoning ordinances, and others. Climate adaptation education cannot be limited to the STEM disciplines (science, technology, engineering, and math). There is a need to bring discussions about climate adaptation into core courses to make all students understand the issues and offer specialized courses in many disciplines to train experts on the topic. It is crucial to building the capacity to focus on social and behavioral disciplines, including emerging inter-disciplinary fields, such as ecological psychology and ecological economics. Incorporating new learning objectives into various programs will ensure that tomorrow's professionals and workforce understand the new climate reality that will impact their work.

For mainstreaming climate change, the following recommendations were made

- Development of standard strategy document/ manual or guidebook for federal and provincial higher education commissions and universities on steps and process of mainstreaming climate change into higher education and research system.
- Developing new course modules and capacity building on climate risk assessment and management considering the connections with important disciplines, including health, agriculture, food security, economics, communication, public policy, and governance. The modules may then be integrated into regular degree programs of select universities in KP, Punjab, and Islamabad.
- Enhancing the capacity of faculty/researchers by providing training through digital tools and platforms to be developed by the GCISC and HEC. GIZ can take the lead in implementing this crucial recommendation. Training of the trainers, especially on climate change modeling and risk assessment and management, is recommended.
- Access to modeling software and training on climate modeling should be ensured. GCISC's enriched inventory of modeling software could potentially provide this facility to academics/researchers across universities and research institutes.
- Strengthen collaboration and exchange between Pakistan and German universities and research institutions on climate change education and research, particularly in the lacking areas, e.g., climate modeling, simulation, macroeconomic modeling, climate policy, climate finance
- Climate change scientists in Pakistan cannot access and store climate data due to a lack of resources. Organizations such as GCISC and PMD have built such capacities; hence, they may provide server access to climate scientists.
- Higher Education Commission (HEC) should adopt a proactive approach to establishing interdisciplinary research centers well connected with academia and industry. These centers should conduct high-quality research in climate change adaptation, mitigation, climate risk assessment, and management, address the interdisciplinary issues and provide advisory services to the development and corporate sector. GIZ may take the lead to help build connections by developing forums for such linkages.
- Based on the strengthened interdisciplinary capacity on climate change and learning from the international best practices, GIZ may also support HEC and Pakistani universities to introduce interdisciplinary programs to match local and global demands.

1. Introduction

1.1. Background

Climate change has become a reality and the greatest challenge of the 21st century to the world. The vulnerability of the communities and systems has increased, threatening to undermine the gains the world has made in the form of socio-economic development, health, education, and wellbeing over the last few decades. Climate change is already exacerbating current inequalities by disproportionality, the most vulnerable populations (including rural areas, households with limited financial resources, minorities, women, children, and people with disabilities), and resource-poor countries.

As we observe more extreme and widespread changes in climate across the globe, this stability and all it affords human society is being threatened. This threat is serious, yet it offers exciting prospects to make our communities and the globe more dynamic and resilient. It provides enough food, wellbeing, energy, shelter, and mobility, with revamped systems equipped to thrive in a

changing climate. Nations are beginning to collectively embrace these opportunities, recognizing the risks while working to create more effective systems.

Like local governments and businesses, higher education institutions face clear and growing risks from climate disruptions. Still, at the same time, they also have their role to play by preparing the youth to tackle climate change crises. There is a great need for higher education institutions to transform and re-vision themselves as 21st-century community hubs with even closer ties with other stakeholders and as models of leading society into a new era of cooperation and creativity in the face of unprecedented change.

More importantly, higher education institutions are also seen as playing a vital role in educating future environmental auditors, economists, community organizers, corporate managers, engineers, practitioners, technical professionals, policymakers, and, most significantly, the community about actions to be taken to mitigate and adapt to climate change, while simultaneously propagating social and governance measures. Over time, the cumulative build-up of societal awareness progressively infuses and impacts the stakeholders' practices, including community leaders and local and national governments, on how to better manage climate change mitigation and adaptation in their diverse spheres of influence, including through daily behaviors, advocacy, and professional careers. Although considerable progress has been made by the higher education institutions around the globe for the inclusion of climate change in their teaching schemes. However, such efforts are critically lacking in the developing counties, which are already resource deficient and have limited or no capacity to mitigate and adapt against the vulnerabilities of climate change. Therefore, it becomes imperative for higher education institutions, academia, and researchers to uplift the declining state of climate education in the developing world.

1.2. Objectives

As per the commitments of the national and sub-national governments in Pakistan to building the capacity of the higher education system in Pakistan on climate change, this scoping study aims to.

- Assess the current state of integration of climate change into the curriculum of the higher education system and related capacities.
- Provide recommendations to strengthen the capacities of universities and their faculty on climate change.

2. Methodology

The above-detailed objectives were addressed by conducting an in-depth analysis of existing literature and collecting primary data from the key informants in academia, research institutes, and planning departments at the provincial level. The secondary data consisting of current policies, guidelines, international commitments, and global and local practices for mainstreaming climate change into higher education systems were made part of analyses (reports/peer-reviewed articles analyzed during this scoping study are listed in the references of this report). This literature could also give sufficient guidance to determine the parameters of training need assessment (TNA) at individual levels.

In addition to secondary data analysis, key informant interviews (KIIs) were conducted across universities and research centers in Islamabad, Khyber Pakhtunkhwa, and Punjab, with the primary goal of analyzing the present knowledge/ skills and gaps concerning climate change education in Pakistan (interview protocol is provided at appendix V). The findings were further verified by direct observations and reviewing relevant documents. The data collected during the

interviews were validated through focus group discussions with the relevant stakeholders in Punjab and KP.

3. Findings- Desk review/ GAP analysis

3.1. Global approaches and models for integrating climate change in higher education

Analysis of the international reports, university curricula, peer-reviewed, and grey literature revealed that most the universities, particularly in the developed world, realized the importance of mainstreaming climate change into their curricula and have either updated or doing so to meet the global challenges. Additionally, numerous universities from industrialized countries have initiated interdisciplinary courses and programs covering the cross-cutting issue of climate change concepts and its interaction with various disciplines ranging from business practices to ecosystem management, from community planning to law, and from architecture to health care.
A common understanding amongst the educationists, experts, and policy makers is growing for building environmental and climate literacy at various levels of the education system. This is particularly needed to prepare the citizens and community members of tomorrow by helping them understand climate change impacts and systems thinking. Urban and municipal planners are now routinely including lessons in some required courses on weighing climate impact risks when undertaking community master plans, zoning ordinances, and others. Climate adaptation education cannot be limited to the STEM disciplines (science, technology, engineering, and math). There is a need to bring discussions about climate adaptation into core courses to make all students understand the issues, in addition to offering specialized courses in many disciplines to train experts on the topic. It is crucial to build the capacity to focus on social and behavioral disciplines, including emerging inter-disciplinary fields, such as ecological psychology and ecological economics. Incorporating new learning objectives into various programs will be necessary to ensure that tomorrow's professionals and workforce understand the new climate reality that will impact their work.
The global approaches for integrating climate change into higher education curricula can be broadly grouped into four categories; 1. Introducing specialized interdisciplinary or transdisciplinary degree programs encompassing the interaction of climate change with other disciplines, 2. Mainstreaming climate change into existing university degree programs by submitting new teaching modules with a particular focus on climate change and related issues, 3. Focusing on university-wide digital platforms and online education modes for climate change among students and faculty, and 4. Concentrate on providing access to trans-university integrated initiatives. The paragraphs below discuss all these four categories with examples from different universities across the globe.

Focused degree programs

Climate Change is a growing issue for policy makers at international, national, and sub-national levels as well as for the experts in public, private and non-profit making organizations. Confronting climate change demands an interdisciplinary approach to provide a more holistic view of climate change issues and debates. To fill the marker demand on interdisciplinary issues around climate change and to teach about the complex problems and solutions to climate change, universities worldwide are introducing innovative interdisciplinary-focused programs. These programs may range from offering a degree program in one specific domain. For instance, Bard college in the United States is offering "*Bard MBA degree*" with a focus on sustainability to an interdisciplinary degree program on climate change combining teaching modules from relevant departments.

Similarly, Leads University in the United Kingdom offered a "*Master in Climate Change and Environmental Policy*" by combining the modules from the School of Geography, the School of Politics and International Studies, Business School, and the School of Media and Communication. University of Hamburg, Germany, offers a master's degree in "*Integrated Climate System Sciences*" with a choice of three study tracks: Physics of the Climate System, Biogeochemistry of the Climate System, and Climate-Related Economics and Social Sciences. Table 1 provides an overview of the focused programs internationally at all levels of higher education: bachelor, masters, and doctorate, covering various interdisciplinary topics concerning climate change.

Table 1: International universities with focused degree programs

Universities	Focused programs
University of Hamburg, Germany	**Master of Science Integrated Climate System Sciences** UHH offers a Master of Science program in Integrated Climate System Sciences with three study tracks, i.e., Physics of the Climate System: Biogeochemistry of the Climate System and Climate-Related Economics and Social Sciences. Students study all three tracks during the first semester. After the second semester, the student can have a personal curriculum, either an in-depth focus on one of the three tracks or an interdisciplinary approach whereby one combines various courses from the three tracks—external Enablers. https://www.sicss.uni-hamburg.de/msc-programs/msc-integrated-climate-science.html
Leeds University, United Kingdom	**MSc Climate Change and Environmental Policy** Climate Change and Environmental Policy Master's degree provides students a unique combination of training on the physical, social and policy aspects of climate change and broader environmental policy and governance. This Master's course combines modules taught at the School of Earth and Environment with optional modules from the School of Geography, the School of Politics and International Studies, Leeds University Business School, and the School of Media and Communication. https://courses.leeds.ac.uk/g752/climate-change-and-environmental-policy-msc
University of Hohenheim	**Earth and Climate System Science degree program** The core of the innovative Earth and Climate System Science degree program at the University of Hohenheim is composed of analyzing processes and interactions of various components of the Earth's system. This includes investigating human activities, population growth, food production, food security, the use of land and surfaces, and climate change. https://www.uni-hohenheim.de/en/earth-and-climate-system-science-masters
The University of Warwick, United Kingdom	**BASc Global Sustainable Development** The University of Warwick offers BASc Global Sustainable Development as single honors and joint honors degree. The Joint honors stream provides the chance to combine the unique interdisciplinary approach of GSD with a growing amount of conventional degree programs, including Politics, Life Sciences, Economics, Psychology, and History. The department employs a problem-based learning approach, introducing students to critical issues such as climate change and social justice and asking them to propose innovative solutions to these complex problems. https://warwick.ac.uk/study/undergraduate/courses/gsd/
University of Lisbon, New University of Lisbon (Portugal), and University of East Anglia (United Kingdom)	**Ph.D. Climate Change and Sustainable Development Policies – Joint program** A three-year Ph.D. in Climate Change and Sustainable Development Policies focused on interdisciplinary training combining the physical, natural, social, and human sciences. http://alteracoesclimaticas.ics.ulisboa.pt/en/

Bard College (USA)	**Bard MBA in sustainability** Bard College offers an MBA Programme that integrates sustainability into its business curriculum, preparing students for leadership positions in various business environments—from innovative start-ups to major corporations. The Programme provides a grounding in management essentials, focusing on economic success, environmental integrity, and social equity. https://gps.bard.edu/academics/mba-in-sustainability
University of Groningen (Netherlands)	**BSc Global Responsibility & Leadership** The degree is designed based on the UN Sustainable Development Goals. It is a transdisciplinary program dedicated to addressing global challenges and finding local solutions. Students can also undertake a Living Lab project and do a Capstone project, such as developing an app or filming a public announcement rather than writing a dissertation. https://www.rug.nl/bachelors/global-responsibility-leadership/?lang=en
SOAS (UK)	**Master programs** SOAS offers various graduate courses focusing on environmental and climate-related research and teaching. There are two climate-specific MSc programs (MSc Climate Change and Development, MSc Global Energy and Climate Policy and Sustainable Development), which are available online or on-campus. Other programs integrating climate change into their curriculum include MSc Economics concerning Environment and Development, MSc Environment, Politics and Development, LLM in Environmental Law, MA in Environmental Law, and Sustainable Development. https://www.soas.ac.uk/cedep/online-programmes/
Lund University (Sweden)	**MSc in Disaster Risk Management and Climate Change Adaptation** Under this degree, the university offers a mix of practical and theoretical learning on climate change, with a strong focus on adaptation and risk management. The program has connections with potential hosts for interns and students conducting research for their master's thesis within the UN system, the Red Cross/Red Crescent movement, and Governmental agencies on different administrative levels in various parts of the world. Link here. https://www.lunduniversity.lu.se/lubas/i-uoh-lu-TAKAK
The University of Edinburgh, United Kingdom	**LLM in Global Environment and Climate Change Law** The LLM in Global Environment and Climate Change Law is designed to provide students with specialist knowledge of the legal issues and techniques related to environmental protection and the management of natural resources, with a focus on climate change. https://www.law.ed.ac.uk/study/masters-degrees/llm-global-environment-and-climate-change-law
Columbia University	**Climate and Society program** The Climate and Society program at Columbia covers dynamics of climate variability and change, regional climate and climate impacts, managing climate variability, and adapting to climate change. http://www.columbia.edu/cu/climatesociety
The University of Sussex, United Kingdom	**Climate Change, Development and Policy MSc** This MSc degree emphasizes understanding the implications of climate change and climate policies for equity between and within countries. The students gain specialist knowledge of the earth system and climate impacts, such as water, food, and ecosystem services. http://sussex.ac.uk/study/masters/courses/climate-change-development-and-policy-msc
Dublin City University	**MSc in Climate Change: Policy, Media, and Society** DCU's MSc program interrogates how societies respond to climate change and how that response can be strengthened. It examines the roles played by politics, regulation, law, education, and the media in creating the overall societal response demanded by climate change.

	https://www.dcu.ie/courses/postgraduate/school-law-and-government/msc-climate-change-policy-media-and-society
Loughborough University, United Kingdom	**MA - Climate Change Politics and Policy** The MA Climate Change Politics and Policy degree addresses the urgent societal challenge of climate change with a broad, international, problem-focused perspective that will suit students from various backgrounds. https://www.lboro.ac.uk/study/postgraduate/masters-degrees/a-z/climate-change-politics-and-policy/
University of Michigan	**Environment and Sustainability and Public Policy** The dual Master of Public Policy (MPP) and Master of Science (MS) in SEAS degree program provides students with the opportunity to study environment and sustainability issues through the lens of public policy analysis. The dual degree program offers a combined approach to these topics through academic rigor and applied practice. Although sequential learning of the MPP and MS in SEAS is possible, this dual program is designed to maximize synergies, reduce the time to graduation, and provide a model for preparing a new generation of graduates skilled in addressing essential topics like renewable energy and climate change using policy analysis techniques. https://seas.umich.edu/academics/dual-degree-programs/natural-resources-environment-and-public-policy-ms-and-mpp
The University of Bayreuth	**MSc in Environment, Climate Change, and Health** During the last two decades, it has been proven that environmental and climate changes are related to substantial physical and mental hazards to humans. There is an increase in infectious diseases, cardiovascular diseases, allergies, and a rising incidence of tumor diseases. For appropriate management of climate-environment and health-associated difficulties in the near future, an emphasis must be given to understanding the correlation between environment, climate change, and health from a scientific and educational point of view. https://www.uni-bayreuth.de/en/master/ecch

Mainstreaming climate change into existing programs

This approach involves mainstreaming climate change into existing curricula, introducing new modules, improving the existing curriculum, and providing staff training. In this regard, instead of introducing new degree programs, universities are figuring out best practices to revisit their current curriculum to see how climate change may be better integrated by introducing new course modules or adapting the old course modules with better reflection on climate change in the existing degree programs at the higher education institutes. Table 2 details the examples where the universities have been instrumental in introducing optional modules and extra qualifications/training for their faculty and students.

Table 2: Interventions to mainstream climate change into existing curricula in different universities.

Universities	Interventions on mainstream CC into existing curriculum
Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU):Germany	Climate and Environmental Sciences from Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) offers the opportunity to specialize in one major subject area of Physical Geography by allowing students to take advantage of an individually tailored master's program; this will enable a specific qualification in a chosen field of interest
Antioch University New England	**New courses on climate adaptation and resilience** The MS in Environmental Studies with a concentration in Sustainable Development and Climate Change integrates new courses in *climate change adaptation and resiliency, environmental site assessment, sustainable community planning, building sustainable organizations, applied internships, and projects*. Graduates of this program are prepared for various environmental careers in the

	public and private sectors, including environmental regulation, environmental consulting, local and regional planning, and non-profit environmental leadership. http://www.antiochne.edu/es/sdcc/
Arizona State University	**Track on society and sustainability- BA in Sustainability** The BA in Sustainability degree at ASU's School of Sustainability includes a track on community and sustainability that "addresses vulnerability and adaptation to risks, environmental justice and intergenerational equity, sustainability values and normative views, collaborative decision-making, and social structures and governmental institutions." http://schoolofsustainability.asu.edu/future-students/undergraduate/bachelor-arts.php
University of Massachusetts Amherst	**Planning for Climate Change and Energy Uncertainty course** UMass Amherst is beginning to address adaptation in a variety of courses. One example is the Planning for Climate Change and Energy Uncertainty course in the Landscape Architecture & Regional Planning department, which focuses on the implications of these coming conditions for the built environment and municipal governments.
The University of Surrey, United Kingdom	**Global Graduate Award in Sustainability** This free course is open to all students and aims to provide an understanding of a wide range of challenges affecting the sustainability of the planet and some solutions. It focuses on the three pillars of sustainability (economic, social, and environmental), and all topics are applied to a case study family. https://study.surrey.ac.uk/extracurricular-study/global-graduate-award-sustainability
The University of Leeds, United Kingdom	**Creating Sustainable Futures** Leeds has developed an optional interdisciplinary module, designed to expose students to many environmental, social, and economic issues, an elective program in which students from any discipline can do. Students can also participate in practical projects to solve sustainability problems at work, in communities, or individual lifestyles. The University of Leeds also offers a variety of sustainability-related degrees. https://webprod3.leeds.ac.uk/catalogue/dynmodules.asp?Y=201819&M=SOEE-1610
Hanze University of Applied Sciences in Groningen (Netherlands)	**Future Literacy** Futures Literacy, developed within UNESCO, uses the future as a tool to address societal challenges. Their approach is through learning by doing/action-research workshops to enable participants to reveal, reframe and rethink their assumptions about the future. Link here.
University of Washington	**Climate Justice Seminar** The School of Law at UW offers a Climate Justice Seminar that includes students and faculty working for communities impacted by the climate crisis to create climate adaptation assessments and apply corresponding legal and policy tools to further climate justice goals. http://www.law.washington.edu/CourseCatalog/Course.aspx?ID=B576
Nottingham Trent University, United Kingdom	**Card game/ role play** A designed card game to be used in the faculty of education or a role-play about the climate change negotiation at the 21st Conference of Parties of the United Nations Framework Convention on Climate Change in Paris in 2015.
Harvard University	Several courses covering climate adaptation are offered at Harvard, including Creating Resilient Cities: Climate Adaptive and Anticipatory Practices at the Harvard Graduate School of Design and Urban Response to Sea Level Rise at the Harvard Law School.

University-wide Integrated Interventions

The universities are deeply interested in integrating climate change awareness through teaching across all disciplines and departments. Perhaps this approach could be considered the most innovative and rewarding. The prime aim of these interventions is to cover a broad curriculum with a newly designed offer taking different forms. For example, it could be a SPOC (Small Private Online Course, a version of a MOOC – Massive Open Online Course but only accessible for on-campus students) focusing on Economics of Climate Adaptation. Alternatively, it could be a module that all Undergraduates must take in their first year of study, such as the module "*Science Bears Responsibility*" in the Leuphana's Bachelor's Programme. The new module/course may be equally appealing to students from different disciplines, provided that the module covers general information on climate change science, which the students will later adapt to their discipline. Alternatively, students learn in a module/course to reflect on a challenge through the lenses of different fields; for example, a MOOC on food and climate change might look at the problem from the perspectives of agriculture, law, food production, nutrition and so on encouraging students to appreciate and apply transdisciplinary approaches in analyzing and solving challenges. Relevant to that, the Potsdam Institute of Climate Impact Research (PIK) has introduced an online educational platform on climate change information, scenarios, and impact, providing direct access to faculty and students to basic climate change concepts and teaching material and course guidelines. Table 3 provides more examples of universities adopting this approach to bring the transdisciplinary aspect into their programs, particularly emphasizing climate education through digital means.

Table 3: University-wide integrated interventions for bringing the transdisciplinary aspect into their existing degree programs with a focus on climate change education.

Institutions/ Universities	Integrated Interventions
Potsdam Institute for Climate Impact Research (PIK), Germany	**The online educational platform on climate change information, scenarios, and impact** PIK remains instrumental due to its integrated approach to connecting research with academia and industry. PIK jointly offers master's and Ph.D. programs with various German Universities and provides an opportunity for students to work on global research projects on climate change. Further, PIK has also developed a new online educational platform to offer students and teachers a concise package of information and scenarios on climate change and its impacts across various sectors in Germany. Knowledge stretches from agriculture to tourism and significantly scales down to the district level. Besides offering interactive climate projection tutorials, the platform encompasses a glossary on basic climate change concepts, teaching materials, and course guidelines. www.KlimafolgenOnline-Bildung.de
Manchester Metropolitan University, United Kingdom	**Big Impact** The University has several initiatives integrating climate change and environmental issues into its teaching. The Big Impact is a program of sustainability events, activities, learning, and volunteering opportunities from Manchester Met's Environment team, available to staff, students, and local community members. Ideas into Action is a program where people can submit ideas for sustainability action and change. https://www.mmu.ac.uk/sustainability
Utrecht University (Netherlands)	**Pathways to Sustainability** Sustainability research at Utrecht University combines five faculties: Geosciences, Sciences, Law, Economics and Governance, Social and Behavioral Sciences, and Humanities. It aims to identify and understand transformative pathways in four areas: Food; Industry; Infrastructure in cities, Water, Climate, and Future Deltas.

	https://www.uu.nl/en/research/sustainability
Nottingham Trent University, United Kingdom	**The Green Academy** NTU commits to embedded environmental and sustainability issues in its course curriculum. The emphasis is on Education for Sustainable Development (ESD) in both the formal and informal curriculum and delivering the innovative *Sustainability in Practice* certificate. Link here. https://www.ntu.ac.uk/about-us/sustainability/sustainability-in-education

Trans-university Integrated Initiatives

This approach involves externally integrated climate change awareness into university teaching and collaboration between universities. A few examples of the institutions which have adapted the trans-university integrated initiatives are provided in table 4.

Table 4: Integrated initiatives between the universities for integrating climate change in their teaming schemes while developing university-university collaboration.

Institutions	Trans-university integrated initiatives
Second Nature (USA)	**The Climate Leadership Network** Second Nature works with a network of 600+ universities & colleges (since 1993) on climate change commitments and research-based action on campus and in local communities. The Climate Leadership Network is comprised of colleges and universities across all 50 states, including the District of Columbia, that have committed to act on climate and prepare students through research and education to solve the challenges of the 21st century.
NurSus Europe	**Climate change and sustainability for healthcare** NurSus Europe provides materials to put climate change and sustainability at the heart of healthcare training. The toolkit offers lectures and activities that can be adapted to meet the needs of students studying geography, design, nursing, midwifery, environment, public health, and health planning and management. The toolkit's content is based on evidence from literature, nurse education experts, and student groups and is available in six languages – English, French, Spanish, German, Dutch, and Polish.
The Least developed countries' universities consortium on Climate change	The Least Developed Countries (LDC) Universities Consortium on Climate Change (LUCC) is a network between Southern universities to develop joint research projects and implement teaching and training programs on different climate change topics in universities and training Institutes in all the 48 LDCs. The consortium will focus on climate change adaptation, especially community-based adaptation. Participating countries are Bangladesh, Bhutan, Nepal, Ethiopia, Sudan, Tanzania, Uganda, The Gambia, Senegal, and Mozambique.
EU-funded ERASMUS+ BECK Programme involving Universities of EU, Russia, Sri Lanka, and Bangladesh	The BECK project funded by the ERASMUS+ Programme is aimed to address this approach by introducing new harmonized MOOC modules to the higher-education curricula of 4 European, 5 Russian, and 5 Asian higher education institutions (HEI). Based on the cross-institutional capacity needs assessment survey, the project adapted a common framework for the MOOC development and implementation across the partner institutions. This research aims to develop a framework to ensure the curricula development, followed by pedagogical principles while adhering to the quality benchmarks in its

	implementation. This framework establishes common grounds for BECK MOOC while assisting the partner institutions with necessary capacity building for teaching and learning measures. The BECK project continues to disseminate the MOOC modules via the BECK virtual interuniversity and support the effective implementation of the developed framework.
International University Climate Alliance	The Climate Alliance provides a central hub for universities globally to share the latest climate research with the public and enable greater collaboration between leading research teams, supporting global leaders, policy makers, and industry in planning for and responding to climate change

3.2. National and sub-national policies/ strategies and international commitments

As part of this scoping study, important policy documents and strategy papers were reviewed to understand the level of integration of climate change education into national and sub-national priorities on climate change mitigation and adaptation in Pakistan. Interestingly, all the policy documents have highlighted the importance of the education sector in building national resilience to climate change. For instance, the National Climate Change Policy (NCCP) adopted in 2012 realizes the lack of institutional capacity to meet the 21st century's most significant challenge of climate change and rightfully mentioned that Pakistan has insufficient trained human resources to deal with climate change due to lack of investment in climate change education coupled with brain drain. The revised policy (2021) also remarks that *"the country does not have enough climate change scientists, modelers, technologists, and experts who can handle international negotiations, which are critical for every country."* Thus, the NCCP strongly recommends capacity building and institutional strengthening as a priority area for the Govt. to work on under the envisaged climate change authority and climate change fund.

In line with the obligations at the national level (i. e. NCCP, 2021), provinces also recognize the importance of transforming their educational systems to prepare the current and future generations to play their role in addressing the climate change issues. Notably, the revised draft of the Climate Change Policy of Khyber Pakhtunkhwa (2022), which is going to be validated soon, has put climate education as a top priority and shown great interest in "*introducing the concepts of Climate Change mitigation, adaptation, and natural resources management in academic curriculums at all levels of education."* The draft policy document also fosters the capacity building of young scientists and researchers on climate change impact assessment and management and improved coordination between academia, research, and policy for a collective response to climate change. Realizing the importance of climate education consistent with national and sub-national climate change policies, Pakistan also raises its ambitions in the recently submitted National Determined Contributions (NDCs), where the country wants to achieve the goal of integrating climate change into the curriculum at all levels of the education by 2030 through the concerted efforts of the Ministry of Climate Change, Global Change Impact Studies Centre (GCISC), Higher Education Commission and Federal Ministry of Education and Professional Training (*NDC 2021, section 6.2.1 page 59).* This impressive statement demonstrates the commitment of the Govt. of Pakistan to set up the change process by training the young generation by teaching them the concepts and approaches to deal with the unprecedented impacts of climate change.

4. Findings of KIIs and FGDs

To capture the current state of mainstreaming climate change, the scoping study conducted about 40 KIIs, consisting of 25% female participants, while 75% were male respondents (Table 5). During these interviews, the participation of females was not significant, but this reflects the overall outlook of the education and research sectors, having already a limited number of female faculty and researchers. When it comes to the specialized field of climate change, females are further lesser in number in this discipline. The analysis of the KIIs data revealed that most of the respondents were from environmental sciences backgrounds (28%), followed by the agricultural and social sciences with respective values of 25 and 20%. There were also considerable numbers of key informants having degrees in engineering and economics. Greater than half of the sample population (58%) interviewed during this scoping study were between 40-50 years, while those between 30-40 years of age constituted 40% of the sample. Interestingly, the time in current position by the interviewees highlights that a significantly higher number of the experts were in their early careers, i.e., having <5 years of experience in teaching and research, followed by mid-careers (33%) and those at the advanced stage of their careers (30%).

Table 5. Summary statistics of key informants who were interviewed in person

Gender	%	Age (years)	%
Male	75	<30 years	0
Female	25	30-40 years	40
		>40 years	58
Knowledge/ expertise area	**%**	**Role**	**%**
Social Sciences including Public Policy/ governance	20	Senior faculty/ researcher (>10 years)	30
Environmental Sciences	28	Mid-career faculty/ researcher (5-10 years)	33
Agricultural Sciences	25	Early career faculty/ researcher (<5 years of experience)	37
Engineering	13		
Physical sciences	2		
Business and Economics	10		
Others	2		

4.1. The current state of integration of climate change into higher education curricula

The status of integration of climate change into the university curricula was recognized through conducting key informant interviews with faculty members and researchers from more than 15 universities and research institutions in Islamabad, KP, and Punjab. When asked if the climate-change-related aspects were covered under the current curricula guidelines, 57.5% responded positively. The respondents from the remaining universities replied otherwise. They stated that no attempts were made to develop guidelines for teaching climate change in any degree program offered by their universities. The list of courses being part of the curriculum of the universities surveyed under this study is given in Appendix 1.

The universities are offering bachelor, master, and doctorate degrees encompassing climate change courses. Primarily, climate change courses are being taught as part of degrees in environmental sciences, geography, env. engineering, agriculture, social sciences, env. science, applied hydrology, RS, and GIS; however, the scope and intensity of the university's climate-

related courses highly depend on the degree, discipline, and availability of the trained human resource. The findings of the scoping work also show that none of the universities in Pakistan have fully adapted their curricula to climate change. It is also possible that a university offering many climate-related courses in a one-degree program does not offer relevant courses to other degree programs. This inconsistency in the process of mainstreaming climate change within an institution also reflects the lack of pertinent expertise and technical skills at the university, the lack of clear guidelines to steer the process, and gaps in understanding the cross-cutting issue of climate change was impacting different sectors. For instance, the environmental science degree program at COMSATS University Islamabad offers six courses on climate change. Still, the same university does not have any climate-related courses designed for its biological sciences or economics degree programs taught at bachelor's and master's levels.

Further, the results of the scoping study revealed that the level of mainstreaming climate change into higher education curricula varies **across universities** based on their geographical location, the expertise of faculty members, collaboration with international universities, industry, and research. For instance, the National University of Science and Technology (NUST) was at the forefront of mainstreaming climate change into its curricula. The curriculum being taught at the NUST revealed that the university was offering 16 specialized courses on climate change, being taught under various degree programs, including RS and GIS, environmental sciences, development studies, and economics. Similarly, COMSATS University Islamabad introduced several climate-related courses for degree programs in environmental sciences; however, this mainstreaming of climate change was not extended to other degrees such as development studies and economics. Surprisingly, CUI's bachelor programs lack even the introductory courses on climate change.

While comparing the integration and mainstreaming of climate change **across disciplines**, it is primarily restricted to environmental sciences and RS and GIS programs. Severe lacking was noted for mainstreaming of climate change into other degree programs. For example, public policy, governance, economics, health, and even the curriculum of the agricultural universities were not updated, despite the intense negative impacts of climate change on the agriculture sector. Similarly, the universities in the study area did not have any module dealing with the micro or macroeconomic approaches to climate change impact and adaptation assessment. A similar trend was reported regarding climate risk analysis and risk assessments. Most courses teach general approaches to environmental risk assessment without a practical understanding of various methodologies and models to assess climate-related risks and their impacts at multiple levels.

New degree programs: while reviewing the data of the universities on new degree programs on climate change, it was noted that none of the universities in Pakistan tried to introduce specialized degree programs on interdisciplinary topics related to climate change to deal with the cross-cutting issue of climate change. It was either due to a lack of technical capacities available with the universities or to the lack of guidance from the regulatory bodies established at the university or higher education commission level. For instance, the University of Agriculture Faisalabad is offering a master's degree in climate change, focusing on agriculture and water. However, the proposed degree program has lost momentum due to a lack of teaching capacity at the university and low demand or connectivity with the job market. Similarly, the climate change center (CCC) at the university of agriculture Peshawar has approved a degree program in climate change since 2016. Still, the programs have not been initiated due to the unavailability of trained human resources and logistics. For the same reasons, Arid Agriculture University Rawalpindi could not establish a climate change department under its Institute of Geo-Information and Earth Observation.

Interestingly, all the failed attempts to start the dedicated program on climate change were made by agricultural universities across Pakistan, mainly due to the high vulnerability of the agriculture sector and its importance for food security and economic development in the country.

4.2. Key challenges being faced by universities on climate mainstreaming

The responses of the academic experts and researchers concerning the challenges of mainstreaming climate change are presented in figure 1. The data highlighted the lack of expertise of faculty on climate change issues as the primary bottleneck, whereby approximately 58% of the respondents lacked the critical skills regarding climate change, while the majority of these 58% individuals lacked the basic understanding of climate change adaptation and mitigation. Ironically, >40 of the KIIs, teaching climate change-related courses were doing so without proper training on the subject. They primarily rely on their resources and material for preparing the lectures, or they would borrow the lectures from others within the university or from other universities. The nonexistence of a training program dedicated to the capacity building of the faculty engaged in teaching climate-related modules was another major challenge identified during the KIIs (45%) and FGDs. Inadequate training facilities and access to training material often lead to poor delivery of concepts to students and may cause disinterest among students in the subject. This was evident from the reducing number of students enrollment in the climate change degree offered by the university of agriculture Faisalabad, whereby in the first year of the launch of this degree program, student enrollment was around 50, but over a short span of 5 years, student enrollment in this degree program is dropped down to 10-12/annum.

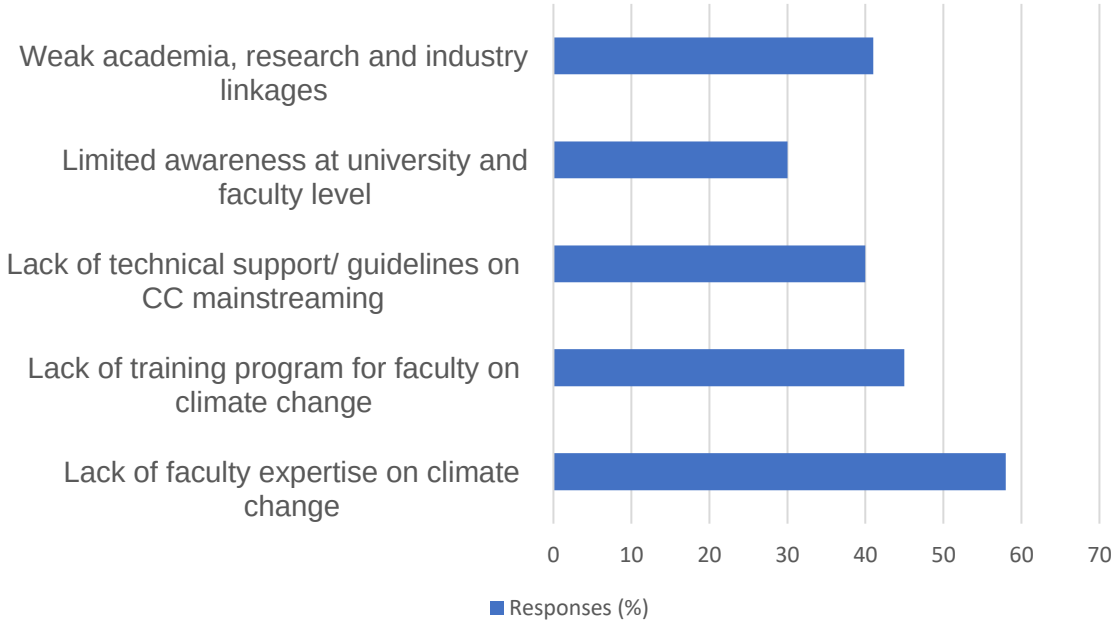

Figure 1: Responses of key informants on challenges faced for mainstreaming climate change.

Limited technical backstopping and non-availability of the proper guidelines for universities and faculty (40%) make it difficult for universities and faculty to properly implement climate change education and related concepts into different degree programs as a cross-cutting issue. For this reason, several important degree programs, including public health, development studies, economics, social sciences, engineering, agricultural and biological sciences, offered at various universities do not have a single course on climate change in their curricula. Weak academia, research, and industry linkage were noted as another challenge restricting universities from taking climate change very seriously. A positive connection between the three tiers may enlighten the

universities to revisit their curricula per market demand. For instance, the NUST University has extensive connectivity with industry, international and national research institutions hence integrating >15 courses on climate change to cater to the needs of various degree programs, including development studies, public policy, economics, RS, and GIS, and environmental sciences. The gap between academia, research, and industry may impact students finding internship opportunities to develop their practical skills on climate change solutions.

4.3. Internal capacity analysis and expertise in climate education/ research in Pakistan

This section assesses internal capacities on climate change education and research. While answering the question on participation in formal training on climate change, more than 58% responded that they never received any formal training on climate change, whereas 30% of the respondents managed to learn the respective courses through their efforts based on their past teaching and research experience (Table 6). On the other hand, only 6% of the respondents had received some training related to climate change organized by their universities. When asked about the competencies of university teachers to teach climate change courses; 29% of the respondents replied in the negative, while more than half of the interviewees were moderately ready to teach climate change courses, while only 14% of the academicians claimed to be fully prepared or competent enough to lead the modules on climate change.

The research focus of most of the respondents encompassed adaptation, mitigation, and climate change resilience. About 30% of the faculty members were involved in academic research/supervision of thesis research on climate change issues, which is relatively low as per the potential funding available from internal and external sources.

Table 6: Internal expertise/ training of faculty members on climate change.

Statements	Responses (%) n=40
Prior training received on climate change	
Yes	6
No, learning by doing/ own efforts	30
No formal training on climate change	58
Planned to attend some training courses	6
Preparation level of faculty to teach climate change-related courses	
Not prepared at all	29
Moderately prepared	56
Fully prepared	15
Involved in academic research/ supervision of thesis research on climate change topics	30

The mapping of experts on climate change-related topics was done to see how expertise varies across disciplines, universities, and research institutions (appendix II). Data revealed that most departments at different universities often depend on one to two faculty members who were either foreign qualified or learned some basics of climate change by doing. Further, the expertise in climate modeling/ projections and simulations is mainly available from the Pakistan Meteorological Department (PMD), followed by Global Change Impact Studies Center (GCISC) and National

Agricultural Research Center (NARC). One of the interviewees from a university said that the lack of modeling expertise at university level is mainly due to limited access to climate data, projections, and modeling tools and access to servers that are required to run complex and heavy models. However, on the other hand, for impact assessment, most of the expertise focuses on agriculture and water resources and is mainly available with GCISC, and NARC, followed by leading agricultural universities such as UAF, Arid Agriculture, and Punjab University. It is important to mention that, except for a few, most universities in KP severely lack capacities on both fronts, i.e., future climate change projections and climate impact assessment. The study further shows universities' dominance in climate change adaptation, which involves intensive field research, field trials, and socio-economic surveys and assessments. The major research institutions often lack such expertise due to their limited scope or outreach at the local level and networking with local departments. That is why research publications from national research institutions often focus on impact assessments using top-down approaches and modeling without fully capturing the local context, scenarios, and perspectives. Further, there is limited capacity in the study regions on interdisciplinary issues related to climate change, i.e., climate policy, climate governance, climate change, and health. Climate change communication is lacking both with research institutions and universities. This lacking capacity with research institutions and universities is also one reason for discontent with academia and research with development and policy. That is why most of the demand by the development sector and government departments on interdisciplinary climate change issues is often filled by a limited number of leading and well-known consultants.

Table 7: Mapping of experts and relevant expertise across universities and research institutions in the study area.

Expertise	Universities	Research institutions
Climate sciences/ simulation/ modeling	5	17
Climate impact assessment (agriculture/ water)- using impact modeling	18	3
Climate change and health (impact assessment)	0	1
Climate Risk analysis*	6	15
Climate Policy/ Governance	3	0
Economics of Climate Adaptation (micro & macro analysis)/ adaptation assessments	16	4

4.4. Mapping of research projects on climate change

Before mapping the research, projects being implemented by research organizations and universities, we tried to capture and list down the different funding channels open for Pakistani researchers.

Funding options applicable only to universities

Higher Education Commission is the regulatory body for universities. It acts as a funding channel for universities and faculty to implement research projects on various topics, including climate change, through a competitive process (see the link for details on the funding stream available with HEC for universities https://www.hec.gov.pk/english/services/RnD/Pages/Research-Grants.aspx). Despite having many funding channels available locally, projects focusing on climate change are very rare, mainly due to limited technical capacities in writing funding proposals. Most of the key informants believed they never received any training on proposal

writing while working at a university or research institution. Some faculty members attended such proposal writing training during their doctorate studies at foreign universities.

It is also important to mention that HEC manages various international linkages and research support programs that support Pakistani researchers to implement joint research projects and participate in foreign capacity-building training workshops. So far, HEC is implementing the following three research programs with France, Turkey, USA, and UK.

- Pak-FRANCE Peridot Research Program
- PAK-TURK Researchers' Mobility Grant Program
- Pak-US Joint Research Program (with USA)
- Pak-UK Education Gateway

However, no such linkage is seen with German institutions, particularly research. However, the German Education Exchange Service (DAAD) does cooperate with HEC on HEC-funded and German-funded Ph.D. programs for Pakistani students in Germany. Similarly, DAAD also runs a small competitive grant for German Alumni at Pakistan universities to support 2-year research projects.

Funding options applicable to both universities and research institutions

In addition to local funding available with HEC, many national and international funding sources specifically focusing on climate change are available and open for Pakistan researchers working at research institutions and universities. Below is the list of some key funding streams open for Pakistani researchers.

- Asia-Pacific Network for Global Change Research Collaborative Regional Research Programme (CRRP) and Capacity Development Programme (CAPaBLE)
- Grand Challenges Canada
- Pakistan Science Foundation

Further, another shortcoming identified by some participants was that there is no awareness-raising at HEC and university level about potential funding channels available from international donors. When the universities and research institutions were asked about the source of information about funding calls, it was noted that only COMSATS University Islamabad has developed an open access funding agencies guidebook for faculty and researchers on potential funding channels available locally and internationally. However, due to limited information, many of the faculty members at CUI were unaware of this guidebook. This guidebook may be taken as a reference and digitized and adapted by relevant research institutions and universities to create awareness of potential funding channels available.

The research projects being implemented by researchers in Pakistan on climate change were mapped as a part of this scoping study. The mapping research projects and their status, particularly at the university level, are challenging due to the lack of a repository or digital database available at the HEC level. As per the findings of the KIIs, 19 out of 40 respondents had completed projects with a focus on climate change, while the remaining 21 interviewees had no experience working on projects in the field of climate change. An insufficient number of 5 respondents have worked on the research projects in collaboration with German partners (individuals, funding organizations, and research organizations). Research projects executed by Pakistani researchers are listed in Appendix III. The list of projects is categorized by institutions to give an overview of

the number of projects per university or institution. It can be easily identified by looking into the list of projects that most were being implemented at research institutions focused on the impact of projected changes on various sectors using historical data and data from climate models. Whereas the projects implemented at the university level usually use a bottom-up approach relying on data collected through field experiments, field observations, and community-level surveys. Another interesting finding of the scoping study was that having dedicated research centers or units on climate change enables universities to collaborate expertise on climate change and bring more funds to research the climate change issues. In this regard, CCRD, one of the pioneering research centers on climate change established at CUI, Islamabad, may be taken as a reference. CCRD, since its establishment, has managed to implement numerous interdisciplinary projects from national and international funding agencies on climate, covering mitigation and adaptation topics related to agriculture, water, health, environmental impact assessment, and carbon footprints.

BOX 1	Pakistan and German Cooperation in Education and Research

- **Academic and education cooperation between Germany and Pakistan mainly focuses on the exchange of scholarship holders** (individual support), **where DAAD and HEC cooperate to offer- the Pakistan government scholarship program and the further training measures for young university teachers at German universities (offered by DAAD)**
- **Excellent cooperation in research project funding within the "German-Pakistani Research Cooperation" program exists;** however, this support is only limited to study and research stays, participation in scientific events, and acquisition of project-specific equipment.
- According to the HRK Higher Education Compass, there are 41 partnership agreements between German and Pakistani universities. The DAAD is currently funding 20 German-Pakistani research cooperation.
- **University excellence in development cooperation – exceed: As part of the 2020-2024 funding phase, the program aims to establish research priorities on topics of the 2030 Agenda for Sustainable Development at the participating universities.**
- **University of Agriculture, Faisalabad is the only university in Pakistan that the part of BMZ supported 8-country consortium established by Kassel University on 'Decent work' through its International Centre for Development and Decent Work (ICDD).**
- **DAAD also supports the program "Alumni Programme for the Support and Retention of Foreign Alumni from Developing Countries (BMZ) and from Non-Developing Countries (AA)" in a joint call for tenders.**
- For a few years now, there has been an increasing interest in cooperation between German universities in technical and scientific subjects. This is often initiated by Pakistani junior researchers who have completed their doctorates at German universities.

5. Findings- need assessments of higher education and research institutes

5.1. Need assessment at university on CC mainstreaming

The GAP analysis indicated that quite a few universities/institutions in the study areas attempted to integrate and mainstream climate change into existing undergraduate and postgraduate university programs. However, most universities introduced climate-related courses as elective/optional modules. During the KIIs and consultative meetings with stakeholders, all informants expressed that climate change modules being taught as part of degree programs across the universities were not updated; hence, obsolete curricula could not cope with the emerging challenges. **Along with faculty training, the respondents recommended extensive revision of the curriculum** by updating the course contents of existing courses and adding new course modules on climate change. A usual practice of curriculum revision after every 4-5 years

at the HEC level was insufficient; instead, curriculum revision committee should be established at the department level to update the curriculum after one academic year. Another critical point raised by the experts during the consultative session was that the curriculum should be need-based as per national priorities and international commitments made by the Govt. of Pakistan from time to time. The reason is that Pakistan was far behind the commitments made during the Paris agreement and no serious efforts were made at academic and research level to provide the students training for taking up the assignments when employed by the relevant departments. The sustainability center at the GC University Lahore was putting efforts to include the climate change course in all the degree programs offered by this university. They were continuously reviewing their course catalog and improving the contents to align with the emerging needs in the field of climate change. Similarly, NUST, Islamabad, has introduced a few courses (both core and elective) on climate change, especially at their Institute of GIS. Worth mentioning that courses offered as GIS degree programs are integrated with the curriculum of other degrees offered by NUST. Both GC Lahore and NUST may be a reference model for other universities to mainstream CC into their curricula.

The dedicated degree program on climate change initiated by a few universities (e.g., master's in climate change by the University of Agriculture Faisalabad) was not yielding the desired results. This program primarily focused on agriculture rather than broad-spectrum and did not cover the other vulnerable sectors (e.g., energy, health, gender, etc.). Instead, GC University and Punjab University Lahore taught climate change as a core course of several degree programs, including environmental sciences, geography, earth sciences, etc. The experts believed that this model was more effective than the dedicated program on climate change. The participants of FGDs expressed that climate change should be integrated with the existing degrees, whether in social sciences, natural sciences, or engineering, rather than separate programs in climate change. Moreover, it was also suggested by the workshop participants that a national dialogue should be conducted to consult all the stakeholders before introducing new courses and degree programs in climate change. The recommendations from the national policy dialogue should be given the highest consideration while revisiting the curriculum.

The existing curriculum on climate change needs drastic revisions and, more importantly, new modules on climate risk assessments, climate policy and governance, climate adaptation and mitigation, and climate modeling and projections. Ironically, few of these courses are part of the curriculum of some mapped universities, but due to a lack of trained human resources, these courses were never offered (e. g. PMAS University of Arid Agriculture, Rawalpindi). The new proposed courses in the respective degree programs or those needing revisions are listed in table 8.

Table 8: Proposed new modules on climate change for integration into the existing curriculum for different degree programs

No	Course module/ Topic	Learning objectives	Relevant degree programs where course may be introduced	Reference (local/ global)	Target University for potential intervention/ mode
1	Climate Risk Assessment - Introduction and methodologies	Introduction to different methodologies to assess climate risks; risk assessment frameworks; digital tools being used for impact assessment	• BS/MS RS & GIS • BS/MS Physical Geography • BS/MS Climatology/ meteorology • BS/MS Environmental Economics		NUST, GC Lahore

			• BS/MS Economics/ Development studies		
2	Climate Change Uncertainty and Risk: from Probabilistic Forecasts to Economics of Climate Adaptation	knowledge in uncertainty and risk quantification (probabilistic modeling) and an understanding of the economics of climate adaptation. The students would be able to construct their uncertainty and risk assessment models (in Python).	• MS RS & GIS • MS Physical Geography • MS Climatology/ Statistics/ Meteorology • MS Economics/ Development studies/ Economics	Link ETH Zurich	NUST COMATS
3	Climate Change Uncertainty and Risk CLIMADA exercise	Acquaintance with the economics of climate change adaptation. Use of the CLIMADA storm model relates wind fields to economic damages due to natural hazards.	MS RS & GIS MS Physical Geography MS Climatology MS Economics and related programs MS Statistics	Link	COMSATS NUST UoP, Peshawar. With technical support from PMD and GCISC.
4	Climate Change: Impacts and Adaptation	The module provides an overview of methods to assess climate change impacts, key concepts, results, and strategies related to adaptation to climate change. Knowledge of regional and sectorial climate change impacts, adaptation strategies, adaptation policy, and implementation of adaptation	BS/MS Environmental Sciences BS/MS Economics programs BS/MS Development studies BS/MS Public Policy and governance	Leeds University Module and Programme Catalogue (leeds.ac.UK)	University of Punjab COMSATS IMSciences Peshawar
5	Climate Change Mitigation	The module outlines the relative significance of sources of GHGs and the potential technologies and strategies for reducing them. Students will develop an understanding of the critical challenges for controlling the emissions of greenhouse gases from different sources (energy, housing, transport)	BS/MS Environmental Sciences BS/ MS Environmental Economics BS/MS Meteorology BS/MS Physical Geography BS/ MS Agricultural programs	Module and Programme Catalogue (leeds.ac.uk)	Uni. of Agriculture, Faisalabad NUST
6	Climate communication	The course addresses themes and theories relevant to climate communication, including conceptual and historical contexts, political and social dimensions of climate change and denial, the relationship between media and climate change, environmental movements and campaigns, and science and risk communication. How can messages about climate change and the environment be crafted to change people's attitudes and behavior	BS/MS Mass communication	Module and Programme Catalogue (leeds.ac.uk)	NUST University of Punjab
7	Climate change policy for development	Core course	Development studies	IMS Global: link	NUST PIDE
8	Climate Change and Health	This comprehensive course provides foundational, theoretical, and practical	BS/ MS health sciences/ public health programs	link	University of Health Sciences; Punjab University

		knowledge and skills in the field of climate change and its impact on public health.	BS/MS Env Sciences programs		
9	Climate Change and Agriculture	Giving a basic understanding of how agriculture and climate change are interlinked and how climate change affects food systems	BS/ MS Agricultural sciences BS/MS Agribusiness/ Agr Economics	Uni. of agri. FSD Global: link	University of Agriculture
10	Climate-resilient agricultural systems/ value chains/ agribusiness	Teaching how we can make our food systems and agricultural value chains more resilient to changing climate	BS/ MS Agricultural programs BBA/MBA/ Agribusiness	link	University of Agriculture, Faisalabad
11	Macro and micro-economic modeling on climate change	Integrating climate risks into macroeconomic forecasts, mapping the impacts of climate change on social and economic aspects such as income and employment, and identifying appropriate adaptation measures.	MS Economics MS Statistics/ Mathematics	link CRED GIZ	PIDE IMSciences Uni of Peshawar NUST COMSATS
12	Gender and Climate Change	Teaching gender dimensions of climate change covering a range of themes and sectors	MS Gender studies MS Development Studies/ Economics	Link UNDP	UoP PU QAU Fatima Jinnah University
13	Introduction to International Climate Finance	To introduce the concepts of climate finance and global practices on the subject	MS Financial Management ACCA/ CA MS Economics and finance	Link	PU NUST COMSATS IMS UoP
14	Global policies/ negotiations on climate change	To teach global policies and conventions on climate change from Pakistan's perspective	MS Political Economics BS/MS conflict studies/ development studies MS International Relations	link	IMS UoP PU NUST
15	Climate communication	This module will address themes and theories relevant to climate communication, including conceptual and historical contexts, political and social dimensions of climate change and denial, the relationship between media and climate change, environmental movements and campaigns, and science and risk communication.	MS international relations MS Development studies MS Mass communication Business studies Journalisms course	link	NUML IBA

5.2. Individual capacity needs regarding climate change education and research

The capacity needs of faculty and researchers are discussed based on the analysis of data collected through KIIs and FGDs and matching it with the current state of capacities available with universities and research institutions.

During the interviews, the respondents **desired training on methodologies and tools, climate risk analysis, impact assessments and climate adaptation, mitigation, and social and economic assessment of climate change.** Many interviewees noted that their degree was irrelevant to their employment tasks on climate change; hence extensive training on climate change indicators and social, economic, and environmental impacts of the same were direly needed. The academic representatives wanted to be trained in climate modeling skills/projections

and climate risk assessments. At the same time, those from research institutions were interested in getting training in translating their assessments into action at local level while working with local stakeholders and communities. **The participants of the consultative workshops were of the view that the training board shall be established under the auspices of the Ministry of Climate Change.** The suggested board should be only tasked with organizing sector-specific training in climate change. Interestingly the same has been envisioned in the revised National climate change policy and NDC document, where it was suggested that the Ministry of Climate Change should jointly work with the Global Change Impact Studies Centre (GCISC), Higher Education Commission, and Federal Ministry of Education and Professional Training to integrate climate change into higher education curriculum as well as build the capacities of relevant faculty and researchers by 2030.

Most interviewees expressed that they did not receive any training on climate change, nor were they serving the current positions by choice. Unfortunately, many of the respondents were unfamiliar with the basic concepts of climate change, and sadly few could not differentiate between adaptation and mitigation. Therefore, **it is recommended to raise awareness of climate change concepts among the academicians and researchers engaged with climate change teaching and research, respectively. Training and information tools on climate change can be made available online by the research organizations such as GCISC and PMD and streamed through the digital platform proposed in the previous section.** Such tools are available online and provided by different research and academic institutes globally. For instance, PIK has recently launched a digital training portal for students and faculty to teach climate modeling and simulations. Similar selective tools and manuals can be adapted to the case of Pakistan and made available to the students, faculty, and other stakeholders through digital means. **To get the students and faculty engaged with such tools, using those tools and training manuals on climate change should be counted towards the credit hours for the respective students.** This could be made possible through the engagement of HEC in this process; after that, HEC directives to universities for using this platform would be highly productive. In case of the reluctance of HEC to issue such a directive, a certificate of participation to the respective students and researchers could be another way to engage them in climate change-related topics.

Moreover, fewer faculty available on climate modeling necessitates the extensive training of faculty and access to the modeling software and tools. **PMD and GCISC having an enriched modeling software inventory could provide this facility to academics and researchers across universities and research institutes. In this regard, special MOUs or agreements may be signed with the support of HEC, MOCC, PMD, and GCISC.** Same arrangements may be used to fulfill another recommendation by university researchers on using supercomputers and mighty servers available mainly with PMD or GCISC. Often universities lack access to such systems on account of limited resources.

Frequent exchange visits and networking between inter-provincial universities and research institutions may be supported. Similarly, joint research cooperation between Pakistan and German as well as European institutions on climate change may be strengthened. For this purpose, GIZ can shortlist the target universities from Germany and help the climate change professionals from selected Pakistani universities for short-term visits to the selected institutions in Germany.

BOX 2	Individual training and capacity measures on climate change

- **Specialized training** and TOTs for faculty and researchers **on methodologies and tools, climate risk analysis, impact assessments, and climate adaptation, social and economic assessment of climate change**

- General awareness-raising events for faculty and students on basic concepts of climate change and learning tools available globally and locally on climate change education and research
- Development and adaptation of digital learning tools for availability to Pakistan researchers, faculty, and students while linking to the universal credit system through HEC
- Improved networking and arrangements between universities and research institutions to build knowledge and expertise exchange on climate change and the use of available tools, methodologies, and servers
- Interprovincial exchange visits and stays of researchers and faculty on climate change topics
- International exchange visits and research cooperation between Pakistan and Germany

5.3. Improved institutional capacity and networking between policy, research, and industry

Lack of networking between research, industry, and policy was desperately felt among the experts interviewed during this study. Therefore, establishing such a facility for better coordination among stakeholders working on climate change is crucial. This platform may serve as a coordination hub between research, academia, and industry to exchange understanding on the current state of knowledge on climate change and challenges and devise potential solutions to the issues. An ideal structure of such a platform could be jointly administered by the global change impact study center (GCISC) and the higher education commission (HEC) of Pakistan. Instituting this digital platform can be based on the already established collaboration between GCISC and HEC, where the former is benefitting from the MS teams' facility administered by the latter. Although the HEC and GCISC can jointly administer this platform, appointing a dedicated digital ambassador may be tremendously effective.

The extent of vulnerabilities to climate change warrants concerted efforts by all stakeholders rather than working in isolation. To address these challenges, political dialogue should be initiated to integrate climate change in all disciplines and sectors. This national dialogue should be undertaken at the ministry level, rendering a leading role to the ministry of climate change and engaging the planning commission, HEC, and other stakeholders. Considering the ever-increasing impacts of climate change and little attention paid to integrate climate change in our national curriculum, The ministry of federal education and professional trainings should also be part of this initiative. The involvement of the education ministry is crucial to align the climate change policy with education policy for integrating climate change at the primary, secondary, and tertiary levels.

Due to the absence of a deep understanding of the climate change issue, the already resource-deficient institutions started working in isolation. This scenario resulted in duplication of the work on some issues while ignoring the others. Moreover, the institutes engaged in climate change education and research lost momentum over time due to a lack of interest at the Govt. level. On the other hand, the impacts of climate change went on unaddressed, and now Pakistan stands in the top 10 the most vulnerable countries to climate change globally. This situation necessitates the institutions to adopt the dual role, i. e., work in tandem with improved networking at the national and global scale and secondly put joint efforts into enhancing the institutional strengths in the field of climate change. For this purpose, the following measures are proposed.

- Higher Education Commission (HEC) should adopt a proactive approach to establishing the interdisciplinary research centers in the selected universities under the commission's jurisdiction.
- These centers must be climate-focused, well connected with academia and industry, and tasked with conducting high-quality research in climate change adaptation and mitigation,

addressing the interdisciplinary issues, and providing advisory services to the development and corporate sector.

- The proposed centers should be linked with Govt. ministries/departments, business forums, the development sector, and international research institutes. GIZ may take the lead to help build connections by developing forums for such linkages.
- Institutional capacity may be improved by strengthening the existing centers of excellence engaged in climate change research. (e. g. The Center for Climate Research and Development (CCRD) at CUI was developed in 2014 with advisory services from the PIK. However, due to limited resources, the center has not played the role envisaged at its inception. Same goes with the climate change centers established with IMS Peshawar and Agriculture University Peshawar. Establishing new centers of excellence in specialized universities is recommended.

6. Conclusion

As expected, the scoping study revealed valuable information for mainstreaming climate change in the curricula of the higher education institutions in the KP and Punjab. Regarding the first part of the study, for skills assessment of universities and faculty members was significant in understanding the current scenario of climate change integration in the course outlines for different degree programs. It was observed that most universities had 1-2 approved courses on climate change adaptation and mitigation, but none on climate risk assessment. The most surprising outcome was that >40% of the faculty members in different universities were teaching climate change courses without obtaining any training. They admitted that their employer university had forced them to teach climate change-related modules. None of the universities surveyed manifest a high level of integration of climate change in their curriculum. Even the specialized universities (e. g. agricultural universities) had minimal integration of climate change in their curricula. Overall, the respondents reflected that climate change was on their organization's mission, but limited resources and lack of support from the respective university, HEC, and Govt. was the heralding challenge for integrating climate change into their curricula. The majority of the courses on climate change are part of the approved curriculum of the universities, but the lecturers are not trained enough to transfer the core knowledge on climate change to students. In fewer universities, the approved courses were not offered since their approval because relevant faculty was not available with the universities to teach the respective module. Continuously enhancing faculty capacity through seminars and workshops with organizational support from the employer through resources, funds, and developing linkages with national and international experts would help them develop a high level of awareness, advocacy, and commitment to mainstream climate change concepts and practices in their lectures.

Coordination between universities, researchers, industry, and the development sector was missing, which needs to be strengthened. To address this issue, planning departments at the provincial level should set up a climate change cell to serve as a coordination hub for the stakeholders. The participants stressed the demand-driven inclusion of the climate change module in the curriculum.

7. Way forward/ next steps

Here a list of options is presented as a way forward for GIZ's SAR project with tentative timeline and budgeting details.

Table 9. A way forward for SAR project

Intervention with sub-activities	Beneficiary	Tentative timeline (months)	Tentative budget (Euros)/ Remarks
Intervention 1: Development of a guidebook for HEC/ Universities on mainstreaming of climate change and related capacities *This scoping study may be further improved to act as a guideline for HEC with best global practices*	Universities and Higher Education Commission	3-4	8,000
Intervention 2: Development of new course modules Sub activities: 1. Short-listing and prioritization of course modules, relevant degree programs, and pilot universities 2. Workshops (1-2 days) across target universities for seeking the insight of experts on proposed topics for climate change modules. 3. Compilation of proposed contents and collection of the relevant material, case studies, and practical components to be part of the curriculum. 4. Workshops in the same universities board of studies/ syndicate body and a possibly wider audience for validation/approval of the prepared contents. 5. Prepared course contents to be handed over to the curriculum approving authorities of all relevant departments for approval. 6. Development of TOT module for the faculty to be engaged in teaching particular course module	Universities will be the direct beneficiaries, while research institutes shall benefit from the trained human resource after graduating.	6-7	50,000
Intervention 3: Piloting the developed course module and TOT at select universities **Sub-activates** 1. Faculty orientation and identification of relevant faculty and researchers for training 2. Training workshops for faculty on developed modules at pilot universities **3.** Provision of related software and tools to be used for teaching/ research	Universities/research institutes/planning departments	4-5	50,000
Intervention 4: Digital platform for training/ course modules for students and faculty. 1. Appointing a digital ambassador to be housed at GCISC 2. GCISC and HEC collaboration facilitated by GIZ to formulate a platform and draft the TORs for working. 3. Linking the platform with international organizations such as	Universities	4-5	40,000

PIK for accessing the course/training module. This digital platform should give access to the faculty and students.			
Intervention 5: Networking between university/ research and industry • Platform to be established where academia and research can connect with policy and development to share their recent findings and exchange new avenues of cooperation and support • Organizing awareness-raising events along with climate job fairs to promote the importance of climate change subjects among students and faculty • Support MoUs and agreements between interprovincial universities and research institutions to exchange knowledge, tools, and methodologies and joint supervision of research students and projects. • Support international linkages on climate education and research	Academia/research institutes/industry	6-7	40,000
Intervention 6: General awareness-raising and outreach among universities, faculty, and students on climate change	Academia/ research	6	12,000

7.1. Engagement of universities/ suitability analysis of universities

The following universities can be considered for the future engagements and implementation of the recommendations of this study. Comparatively these universities have several merits distinguishing them from the remaining institutes.

Table 10: Suitability analysis of the universities for engagement in the future for interventions in the curriculum on climate change or execution of projects on climate change.

Location	University/Department	Pros	Cons
Federal capital	COMSATS University Islamabad (CUI)/ Centre for Climate Research and Development/Department of Meteorology.	CUI has a dedicated center to work on climate change and actively coordinates with internationally well-recognized research centers on climate change (e.g., PIK, IIASA, AIT). A range of expertise is available, i.e., water, food security, and health. CCRD has completed numerous projects on climate change funded by international organizations. CUI is centrally administered from Islamabad, having seven campuses located in Islamabad, Punjab, and KP, exhibiting an adequate resource base for broader coordination.	
	National University of Science and Technology (NUST).	NUST has numerous Interdisciplinary research departments, centers of excellence, and extensive national and international collaborations in academia and industry	Administered by the military, effective coordination may be challenging due to unnecessary checks by the administration.

		Easy access for organizing workshops/conferences/symposia	
Khyber Pakhtunkhwa (KP)	The University of Peshawar (UOP)	The UoP hosts diverse departments, including environmental sciences, geography, and centers of excellence, which offer a range of courses under these programs. They are also working on a new degree program in gender-based adaptation to climate change.	
	The Institute of Management Sciences (IM Sciences), Peshawar.	IMSciences is developing a specialized center for climate and water governance, employing multidisciplinary human resources, and integrating climate change into the curriculum. Offering degrees in social sciences and development studies encompassing climate change. Moreover, IMS is already well connected with GIZ.	
Punjab	The University of the Punjab, Lahore	PU hosts diverse departments, and extensive expertise is available with the institute. They are already providing training on CC to different stakeholders from the college of earth and environmental sciences (CEES) platform. Offering "***Climate change adaptation & mitigation***" as a mandatory course for MS degree in environmental sciences. They keep updating the curriculum after every three years. Moreover, this university is well connected with Punjab's EPA, PMD, and P&D.	
	Fatima Jinnah Women University (FJWU), Rawalpindi.	Easy access and renowned environmental sciences programs, gender studies, behavioral sciences, and anthropology. Above all, this is a female-dominated university that may be used to address the gender balance issue.	FJWU has limited trained human resources. In some departments, subject specialists are not available.
	University of Agriculture Faisalabad (UAF).	The only university in Pakistan offering a master's degree in "**Climate Change**" has a broader infrastructure resource base. The climate change program coordinator is German alumni and has already executed research projects funded by German organizations (e. g. Georg -August University Gottingen, AVH Foundation Germany). Engaged in the execution of mega projects on climate change (e. g. South Asia Nitrogen Hub-2019-2025), funded by the global challenges research fund (GCRF) and United Kingdom Research and Innovation (UKRI).	UAF has limited capacity in modeling skills and making climate projections. Primarily, UAF is an agriculture university; hence their climate change degree is agriculture centric.

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ANNEXURES

Appendix I. Modules/courses on climate change, being taught under different degree programs by the key Universities in the federal capital, Khyber Pakhtunkhwa, and Punjab

Degree programs	Courses taught	Reference/ university
Agricultural Sciences	Agron-202 Climate Change and Crop Productivity	UAF, Agronomy Department
	FRW - 204: Biodiversity and Climate Change AE - 201: Economics of Climate Change PBG-310 Breeding Climate Smart crops	PU, Agronomy department/ Horticulture (BS)
	SES-730 Climate Change and Environ. Sustainability	UAF (Agribusiness)
	Climate change and Agriculture (MS/PhD)	Agriculture University Peshawar
Biological sciences	N/A	COMSATS University Islamabad
	N/A	Punjab University
Environmental and Earth Sciences	**Climate change Adaptation & Mitigation**	Punjab University, Lahore (Dr. Abdul Qadir)
	Climate change Adaptation & Mitigation CE-834 Climate Change and Hydrological Cycle GIS-842 Hazards and Disaster Management	NUST, Islamabad (Prof. Fahim A. Khokhar)
	Global Environmental Changes (MS/ PhD) Plant Dversity and Climate Change (MS/ PhD) Climate Change and Global Politics (MS/ PhD) Carbon Sequestration and Climate Change (MS/PhD) Climate Change and global Initiatives (BS) **Climatology (BS)** **Food Security and Climate Change (BS)**	COMSATS University Islamabad
	Environmental Impact and Risk Assessment **Climatology** Global Environmental Changes Climate Change and Agriculture Agrometeorology	Arid Agriculture, Rawalpindi
	S-617/ENV-601 Climate Change and Environment	UAF, Env Sci.
	Environment Risk Assessment & Management Climate change Adaptation & Mitigation	Punjab University
	Climate change Adaptation & Mitigation (MS) Climate Change (BS)	UVAS, Lahore
	Disaster mitigation Natural hazards, assessment, mapping, and mitigation tools. Paleoclimatology Climate change Application of GIS and RS to Hazard mapping	university of Peshawar, Geology

Meteorology/ Geography	Climatology	COMSATS University Islamabad
	G303 Climatology (BS Geography)	Punjab University
Humanities/Linguistics	N/A	QAU, Islamabad
		PU, Lahore
		UoP, Peshawar
Development studies	Climate Change	NUST (Dr. Umar Khayyam)
	Adaptation to Climate Change and Disasters (Disaster Management Specialization) BS	COMSATS Islamabad
	Climate Change and Development (MS)	COMSATS University Islamabad
	DS-776 Economics of Climate Change (MS)	PIDE, Islamabad
Economics/ Environmental Economics	Economics Of Environment and Natural Resources (MS)	NUST (Dr. Umar Khayyam)
	ERE-712 Economics of Climate Change (MS)	UAF, Faisalabad
	N/A	UAF, Agricultural Economics
	N/A	PIDE, Islamabad
	N/A	AWKU, Mardan
Governance and Public Policy	Disaster Management and Risk Reduction (Elective)	NUST (Dr. Umar Khayyam)
	Environmental Policy Frameworks (Elective)	NUST (Dr. Umar Khayyam)
	Climate change policy for development	IMS (Dr Shakeel Hayat)
	N/A	PIDE, Islamabad
	N/A	NDU
	N/A	Uni Peshawar, Political sciences
RS and GIS	DM-803 Disaster Risk Reduction and Preparedness DM-804 Disaster Response and Recovery ENE-802 Environmental Impact Assessment ENS-805 Climate Change ENS-832 Rs & GIS Applications in Environment ENS-834 Environmental Risk Assessment GIS-842 Natural Hazards and Disaster Management URP-807 Disaster Management DM-812 Env. Framework on Disaster Management CSE-800 Introduction to Modeling and Analysis	Dr Azmat (NUST)
	N/A	COMSATS
	Natural Hazards and Disaster Management	PU Lahore
Health	N/A	KE, Lahore
	Environmental and Occupational Health	PU, Lahore
	N/A	KMU, Peshawar
	Occupational Health & Environment Hazards	IMS, Peshawar
MS disaster management		NUST
		UoP
Environmental Engineering	SEE-506 Meteorology & Climate Change	UAF, Faculty of Agr Eng.
	N/A	UET Lahore
City and regional planning	**RP-308 Climate Change Adaptation &Disaster management (BS)**	UET, Lahore

Specialized programmes on climate change		
MS Climate change	**C-702 Climate Change Impact Assessment** **CC-703 Climate Change Mitigation and Adaptation** **CC-704 Critical Readings in Climate Change** CC-705 Aquaculture and Climate Change CC-706 Public Health in Changing Climate CC-707 Climate Change and Livestock C.PHY-712 Crops for Changing Environment AGR-727 Climate Change and Agriculture ERE-712 Economics of Climate Change SES-730 Climate Change and Enviro. Sustainability ID-717 Climate Change and Water resources	UAF
M.Sc. In Community Development and Environmental Management	CRP-635 Climate Change Impacts and Adaptation CRP-631 Disaster Management	UET Lahore
MS Environment and Climate Sciences	Climate Change Adaptation and Mitigation Hydro-Climatic Modeling Climate Change and Global Climate Modeling	IST, Islamabad (pending)
Financial management/ Climate Finance	No course on climate finance/ climate change	LUMS, Lahore
	No course on climate finance/ climate change	IMS, Peshawar

Appendix II. Climate change experts in the Universities and research institutes in the federal capital, Khyber Pakhtunkhwa, and Punjab

No	Expert	Designation	Institution	Expertise	Contact details	Collaboration with German Universities
1	Dr. Shakeel Hayat	Assistant Professor	Institute of Management Sciences, Peshawar	Climate adaptation and advocacy	Phone: Email: shakeel.hayat@imsciences.edu.pk	The German Red Cross, GIZ.
2	Dr. Liaqat Ali	Director, National Center of excellence in Geology	Uni. of Peshawar	Adaptation & Mitigation	Phone: Email: liaqat.nceg@uop.edu.pk	No
3	Dr. Shehla Gul	Lecturer, Department of Geography.	University of Peshawar	Gender based climate change adaptation	Email: sgul@uop.edu.pk	No
4	Dr. Muhammad Sanaullah	Assistant Professor/ Coordinator CC program	University of Agriculture Faisalabad	Carbon sequestration, Mitigation.	Email: sanasial@gmail.com	Georg -August University Gottingen, Germany funded by AVH foundation Germany
5	Dr. Saeed A. Asad	Associate Professor Centre of Climate Research and Development/ Department of Biosciences.	COMSATS University Islamabad	Climate Adaptation	Email: saeed.asad@comsats.edu.pk	1.Potsdam Institute for Climate Impact Research (PIK), Germany. 2.BMBF 3.DAAD
6	Dr. Fahim Khokhar	Assistant Professor, Institute of Environmental Sciences and Engineering	National University of Science and Technology (NUST), Islamabad	Impacts assessment and monitoring	Email: fahim.khokhar@iese.nust.edu.pk	PhD from Universität Leipzig, Germany.
7	Muhammad Arshad	Assistant Professor, Institute of Environmental Sciences and Engineering	National University of Science and Technology (NUST), Islamabad	Climate Impact assessment	Email: marshad@iese.nust.edu.pk	No
8	Dr. Sofia Baig	Ass. Professor, Institute of Environmental Sciences and Engineering	National University of Science and Technology (NUST), Islamabad	Climate impact assessment	Email: sofia.baig@iese.nust.edu.pk	No
9	Dr. Abdul Qadir	Professor, College of Earth and Environmental Sciences	University of the Punjab Lahore	Adaptation, climate risk assessment and management.	Email: aqadir.cees@pu.edu.pk	No
10	Dr. Saima Siddiqui	Asst. Professor, Centre for Integrated	University of the Punjab Lahore	Adaptation, socio-economic and	Email: saimasiddiqui.cimr@pu.edu.pk	No

		Mountain Research (CIMR)		environmental impacts of CC.		
11	Dr. Syed Aziz ur Rehman	Asst. Professor, Department of Environmental sciences	University of Veterinary and Animal Sciences Lahore	Adaptation, mitigation (energy)	Email: syed.aziz@uvas.edu.pk	No
12	Dr. Faiza Sharif	Sustainable Development Studies Centre	GC University Lahore	Gender based climate change studies. Climate change and SDGs	Email: faizasharif@gcu.edu.pk	No
13	Dr. Bashir Ahmad	Director, Climate change, alternate energy, and water research institute	Pakistan Agricultural Research Council	Climate modeling and projections; Climate Adaptation	dr.bashir70@gmail.com	No
14	Dr. Mukhtar Ahmad	Associate Professor, Dept. Agronomy	PMAS Arid Agriculture University Rawalpindi	Climate modelling and projections; Climate Impact Assessment	Email: ahmadmukhtar@uaar.edu.pk	No
15	Dr. Azeem Khalid	Chairman Department of Environmental Sciences	PMAS Arid Agriculture University Rawalpindi	Climate Adaptation	Email: azeem@uaar.edu.pk	No
16	Dr. Zia Ur Rehman Hashmi	Head, Water Resources and Glaciology	Global Change Impact Studies Center (GCISC)	Adaptation, Climate change resilience, Impact assessment	ziahashmi77@gmail.com	No
17	Mr. Muhammad Arif Rashid Goheer	Head, Agriculture, Forestry and Land use section	Global Change Impact Studies Center (GCISC)	Climate Adaptation; Impact Assessment and communication	arifgoheer@gmail.com	Working with GIZ on Transparency platform (MRV/M&E) and risk assessments
18	Shaukat Ali	Senior Scientific officer, Climatology and Environment section.	Global Change Impact Studies Center (GCISC)	Climate modelling, Impact assessment to CC & health/ climate risk and vulnerability assessment	pirshauki@gmail.com	No
19	Dr. Kaleem Anwar Mir	Scientific officer, Climatology and Environment section	Global Change Impact Studies Center (GCISC)	Climate change and public health; climate adaptation	kaleem.anwar@gcisc.org.pk	No
20	Dr. Muhammad Mubashar Dogar	Scientific officer, Climatology and Environment section	Global Change Impact Studies Center (GCISC)	Climate Modeling, climatic variability/ predictability/ impacts	mubashardogar@yahoo.com	No

21	Dr. Ishfaq Ahmad	Resilient Agriculture Specialist	Asian Disaster Preparedness Center (ADPC)	Climate Modeling; Climate risk assessments; Climate resilience (agriculture)	ishfaq.ahmad@adpc.net	No
22	Dr. Adnan Ahmad Tahir	Assistant Professor, Department of Environmental Sciences	COMSATS University Islamabad, Abbottabad campus	Climate Change impact assessment	adnantahir@cuiatd.edu.pk	No
23	Dr. Abdul Wakeel	Associate Professor, Institute of soil and Environmental Sciences	University of Agriculture Faisalabad	Climate change impact assessment in agriculture	abdulwakeel77@gmail.com	Yes
24	Dr. Syed Aftab Wajid	Associate Professor, Climatology lab, Department of agronomy.	University of Agriculture Faisalabad	Crop modeling, projections	aftabwajid@hotmail.com	No
25	Dr. Fahad Rasool	Department of agronomy	University of Agriculture Faisalabad	Crop modeling, climate projections	Email: drfahdrasul@gmail.com	No
26	Dr. Khalid Hussain	Assist. Prof. Department of Agronomy	University of Agriculture Faisalabad	Crop modeling, projections	Email: khalidkhanuaf@gmail.com	No
27	Dr. Nadeem Ashraf	Asst. Professor, Institute of soil and Environmental Sciences	University of Agriculture Faisalabad	Climate change impact assessment agriculture	Email: nadeemawan17@gmail.com	No
28	Dr. M. Faisal Shahzad	Assistant Professor, Pakhtunkhwa Economic Policy Research Institute (PEPRI	Abdul Wali Khan University Mardan, KP ·	Economics of Climate Adaptation; climate risk and vulnerability assessment	Email:	No
30	Dr M. Rafey Muzammal	Assistant Professor, Agricultural Extension	UAF, Faisalabad	Climate related disasters; risk and vulnerability assessments	Rafaymuzamil@gmail.com	No
31	Dr Habib Ur Rehman	Assistant Professor, Department of Agronomy	Muhammad Nawaz Shareef University of Agriculture, Multan, Punjab, Pakista	Future climate projections; impact assessment	habib.rahman@mnsuam.edu.pk	Uni-Bonn
32	Dr Shakeel Ahmad	Assistant Professor, Department of Agronomy	BZU Multan	Climate Impact assessment	shakeelahmad@bzu.edu.pk	No

33	Dr Burhan Ahmad	Meteorologist	Pakistan Meteorological Department	Future climate projections and modeling; impact assessment	burhan@pmd.gov.pk	No
34	Dr Qamar Uz Zaman Ch.	Climate expert/ consultant	Independnet consultant	Climate Policy; Climate Impact assessments		No
35	Farhana Gul	Assistant Professor	Uni of Swabi	Climate Adaptation; Economics impact assessment	faree_aup@hotmail.com	No
36	Muhammad Usman	Meteorologist	PMD	Climate future projections; risk analysis	usman666.m@gmail.com	No
37	Dr. Ghulam Haider	Assistant Professor, Atta-ur-Rahman School of Applied Biosciences	NUST, Islamabad	Climate smart agriculture; CC and plant ecology; climate change mitigation	ghulam.haider@asab.nust.edu.pk	No
38	Dr Fahad Saeed	Climate Expert	Climate Analytics	Climate modeling; impact assessment	fahad.saeed@climateanalytics.org	Yes
39	Dr. Muhammad Naveed Anjum	Assistant Professor, RS & GIS	Arid Agriculture, Rawalpindi	Climate Modeling; RS and GIS; Hydrological Modeling	naveedwre@uaar.edu.pk	No
40	Ijaz Ahmad	Centre of Excellence in Water Resources Engineering	University of Engineering and Technology, Lahore	Climate Modeling; hydrological modeling	ijaz.ahamd@cewre.edu.pk	No
41	Dr Tasneem Khaliq	Associate Professor	UAF	Climate impact assessment (Agriculture)		No
42	Dr. Dr. Shahnillah Haider Rizvi	Assistant Professor	Mohammad Ali Jinnah University	Climatology; climate modeling; heatwaves	rshahnilla@hotmail.com	No
43	Dr. Akhter Al	Agricultural Economist	CIMMYT	Climate adaptation; economics of Climate change; risk and vulnerability assessment	akhterali205@yahoo.com	No
44	Dr.Kashif Majeed Salik	Agricultural Economist	SDPI	Climate risk and vulnerability assessment; climate adaptation		No
45	Dr Ajaz Ahmad	Assistant Professor	IBA Karachi	environment and climate change economics.	ajazahmeda23@gmail.com	No
46	Dr Irfan Ahmad Rana	Assistant Professor	NUST, Islamabad	disaster risk reduction and	iarana@nit.nust.edu.pk	No

				climate change adaptation		
47	Dr. Azmat	Head of Department, RS and GIS	NUST, Islamabad	Climate Impact assessment; hydrological modeling; impact assessment	azmat@igis.nust.edu.pk	Yes
48	Dr Mohsin Hafeez	Country head	IWMI	Climate modeling; hydrological modeling	m.hafeez@cgiar.org	
49	Dr Azeem Ali Shah	Regional Researcher	IWMI, Lahore	Climate and water governance	a.shah@cgiar.org	
50	Dr Muhammad Mumtaz	Assistant Professor	FJU Rawalpindi	Climate governance	mumtaz86@hotmail.com	
51	Dr Khalid Mushtaq	Professor, Agricultural Economics	UAF, Faisalabad	Financial instruments/ climate adaptation	khalidmushtaq@uaf.edu.pk	No
52	Dr Raza Ullah	Assistant Professor	UAF, Faisalabad	DRR and Climate adaptation	raza_khalil@yahoo.com	No
53	Mr Shiraz Shah	Independent consultant	Consultant	DRR/ fiscal resilience/ MHVRA; climate adaptation	shirazalishah@hotmail.com	
54	Dr. Muhammad Hanif,	Chief Meteorologist	PMD, Islamabad	Climate projections/ forecasting	hanifwxc@hotmail.com	
55	Dr. Muhammad Tahir Khan	Deputy Director, climate change section	PMD, Islamabad	Climate change projections/ modeling	tahir@pmd.gov.pk	
56	Dr. Jehangir Ashraf Awan,	Deputy Director	PMD, Islamabad	Numerical Modelling, Climate Change & Data Mining	jehangir_awan@hotmail.com	
57	Gohar Ali,	Meteorologist	PMD, Islamabad		gohar@pmd.gov.pk	
58	Adnan Shafiq Rana,	Meteorologist	PMD, Islamabad	Remote Sensing and GIS, Glaciological Studies and Hydro-Meteorology	adnanshafiqrana@hotmail.com	
59	Dr. Furrukh Bashir		PMD, Islamabad		furrrukh@pmd.gov.pk	
60	Zeenat Yasmeen Soomro	Meteorologist	PMD, Islamabad	Remote Sensing & Geo-information Science; Hydrology & Water Resources	zeenat@pmd.gov.pk	
61	Syed Ahsan Ali	Electronic Engineer	PMD, Islamabad	Climate Change Science and	ahsan@pmd.gov.pk	

				Policy; High Performance Computing; Numerical Modeling; Climate Change research		
62	Dr Nasir Mehmood	Assistant Professor	UAAR, Rawalpindi	Climate adaptation; socioeconomic impact and vulnerability assessment	nasir@uaar.edu.pk; nasir.gujranwala@gmail.com	

Appendix III. Mapping of dedicated research centers and projects on climate change

1. *Mapping of climate-oriented centers and research institutions in Pakistan*

Name of center	University	Focused research areas	Focal person	Weblink
Centre for Climate Research and Development	COMSATS University Islamabad	Climate change adaptation in agriculture, water, health; outreach and advocacy activities, bioenergy, and climate change	Dr Saeed A. Asad, saeed.asad@hotmail.com	
Climate Change Centre	Agriculture University Peshawar	Climate change and agriculture linkages	Dr. Humayun	
Research group Climate Change and Development	Department of Development Studies, NUST Islamabad		Dr. Umar Khayyam	https://s3h.nust.edu.pk/department-page/research-groups-development-studies/
Research and Development Unit	Pakistan Meteorological Department			
Global Change Impact Studies Centre (GCISC)	GCISC	Climate risk assessment, climate change adaptation; climate policy and NDCs	Dr. Arif Goheer	

2. *Mapping of research projects being implemented by various universities and research institutions*

Global Change Impact Studies Centre (GCISC)

1. **GCF- FAO Project:** Transforming the Indus Basin with Climate Resilient Agriculture and Climate-Smart Water Management.
2. **Pak-BUR1:** Pakistan's First Biennial Update Report on climate change project under United Nations Framework Convention on Climate Change (UNFCCC) by Ministry of Climate Change (MoCC), Government of Pakistan
3. **FWO:** GLOF and Climate Change Risk and Vulnerability Assessment Study for FWO Hydropower Projects in Chitral.
4. **APN Project:** Towards robust projects of climate extremes and adaptation plans over South Asia (participating countries- Bangladesh, China, Nepal, Pakistan (Lead)
5. **APN Project:** Climate smart agriculture through sustainable water use management: Exploring new approaches and devising strategies for climate change adaptation in South Asia (CAF2015-RR12-NMY-Shaheen). Participating countries: Pakistan, Bangladesh, Sri Lanka, and Cambodia. Lead Organization: GCISC, Pakistan.
6. **Pak-SNC (2017-19).** Pakistan's Second National Communication (Pak-SNC) on climate change project under United Nations Framework Convention on Climate Change (UNFCCC) by Ministry of Climate Change (MoCC), Government of Pakistan.
7. **FAO (2018):** Project on the Preparation of Background papers for GCF project proposal 'Transforming of the Indus Basin with the Introduction of Climate Resilient Agriculture and Sustainable Water Management' awarded to GCISC by Food and Agriculture Organization (FAO), Pakistan.
8. **LEAD-Pak (2018):** Understanding Joint Water-Climate Change Challenge and Exploring Policy Options for Cooperation on the Afghan-Pak Transboundary Kabul River Basin.
9. **Pak-INDC (2016/17):** Preparation of Pakistan's Intended Nationally Determined Contributions to the 2015 agreement under United Nations Framework convention on Climate Change with the support of United Nations Environment program.

10. **APN Project:** Assessment of Food and Water Security in South Asia using Crop Simulation and Water Management Model, and appropriate strategies to meet future demand (2008-2013). Participating countries: Pakistan, Bangladesh, and Sri Lanka. Lead Organization: GCISC, Pakistan.
11. **APN Project:** Impacts of global change on the dynamics of snow, glaciers, and runoff over the Himalayan Mountains and their consequences for Highland and downstream regions (2008-2010). Participating countries: Pakistan, Nepal, China, and India. Lead Organization: Institute for Development & Innovation (IDI), Nepal.
12. **APN Project:** Runoff scenario and water-based adaptation strategies in South Asia (2013-2015). Participating countries: Pakistan, Bangladesh Nepal, and India. Lead Organization: The Small Earth Nepal (SEN), Nepal.
13. **APN Project:** Assessing Spatiotemporal Variability of NPP, NEP and Carbon Sinks of Global Grassland Ecosystem in Response to Climate Change in 1911-2011 (2013-2015). Participating countries: Pakistan, Uzbekistan, Mongolia, and China. Lead Organization: Nanjing University, China.

Pakistan Meteorological Department, PMD

1. Flood Risk Management being implemented with the support of JICA: https://ffws.pmd.gov.pk/
2. Capacity building workshops/ awareness raising on climate change, a collaboration between PMD and World Food Programme http://www.pmd.gov.pk/wfp/index.html

COMSATS University Islamabad

Centre for Climate Research and Development; http://ccrd.edu.pk/researchprojects.aspx

1. Sustainable bio energy development in emerging economies under global changes: current practice, perception, response, and management. Funded by Pakistan Science Foundation (2021-2024)
2. Identification and up-scaling of climate-smart agriculture (CSA) practices for sustainable food security in high altitude farming regions of Himalaya. Funded by Asia Pacific Network on Global Change Research (APN-GCR), Japan (2019-2022)
3. Mitigation strategies for enhanced Soybean production under changing climate scenarios in the Pothwar and Khyber Pakhtunkhwa. Funded by Agricultural Linkages Programme (ALP), Pakistan Agricultural Research Council (PARC) Islamabad, Pakistan (2018- 2021)
4. The Vulnerability of Pakistan's Water Sector to the Impacts of Climate Change: Identification of gaps and recommendations for action. Funded by Govt. of Italy and United Nation Development Program (UNDP) (2015- 2017).
5. Satellite Enhanced Snowmelt Flood and Drought Predictions for the Kabul River Basin (KRB) with surface and groundwater modeling. A regional project in collaboration with CUI, Kabul Polytechnic University, Kabul, Afghanistan, USAID, and Kazakhstan.
6. Sustainable food systems under climate change in South Asia. Funded by the Federal Ministry of Education and Research (BMBF), Germany. 2017- 2019).
7. Public perception and valuation of climate-related risks and willingness-to-pay for Policy interventions in metropolitan cities of Punjab, Pakistan. Funded by Higher Education Commission (HEC) of Pakistan (2017-2018).
8. Impacts of climate change on waterborne diseases. Funded by COMSATS University under COMSATS Research Grant Project (2018-2019)

COMSATS University Islamabad (Abbottabad Campus)

1. Multiple use water system for water resource management in context of climate change in Himalayan Region. funded by ICIMOD (2017-18)

National University of Science and Technology (NUST), Islamabad

https://igis.nust.edu.pk/research/research-projects/

1. Vulnerability of climate change on water resources and its consequences on agriculture water management in Pakistan, HEC funded
2. Understanding our Joint Water-Climate Change Challenge and Exploring Policy Options for Cooperation on the Afghan-Pak Trans-boundary Kabul River Basin
3. Implications of Climate Change on Snow Cover Dynamics and Hydrological Behavior in HK Karakorum-Himalayan Range, Funded by HEC.
4. The Pakistan Publishing and Mentoring Workshop – Tackling Climate Change Challenges in Pakistan, September 13-17, 2021.Funding Body: The British Academy & Global Challenges Research Fund (GCRF).
5. Adaptation to Climate Change: Building Resistant Livelihood for the Vulnerable Communities of Hazara and Malakand Division of KPK, Pakistan. Funded by HEC Pakistan (2017-19).

Climate Change Centre, Agriculture University Peshawar

https://www.aup.edu.pk/ccc.php

1. Climate Scenarios 2011-2040 of the ten Districts of Khyber Pakhtunkhwa – Pakistan with support of NSA
2. Climate Scenarios 2011 – 2040, Districts Haripur, Swabi, Attock and Chakwal Pakistan (2014) in collaboration with Inter-cooperation
3. Climate Change and Adaptation – Farmers Experiences from Rainfed Areas of Pakistan in collaboration with Inter-cooperation
4. Climate Scenarios 2011 – 2040, Bajaur & Mohmand Agencies (2014) in collaboration with Intercoperation
5. Climate Change in Bajaur and Mohmand Agencies (2014) in collaboration with Intercoperation
6. Effect of Sowing time The Yield of Different Maize Variety and Hybrids under Different Agro-Climatic Zones of Khyber Pakhtunkhwa – Pakistan (2015) in collaboration with Intercoperation
7. Response of wheat varieties to sowing Interval as rainfed / unirrigated crop In Khyber Pakhtunkhwa (2014 - 2016) in collaboration with Inter-cooperation
8. Climate Change Adaptation in Wheat (2016) in collaboration with Inter-cooperation
9. The effects of climate change on rainfall patterns and exiting rainwater management in Khyber Pakhtunkhwa (2017)
10. Impact of climate change on older men and women, In District Nowshera, Khyber Pakhtunkhwa – Pakistan (2017)

University of Agriculture, Faisalabad

1. AgMIP project https://agmip.org/pakistan-region/
2. USAD center for advanced studies on agriculture and food security projects
3. Climate smart wheat: Development of heat and drought tolerant wheat for Pakistan
4. Implementing climate smart dry chain technology for improving livelihoods of the maize farming community in Pakistan
5. Modeling approach for assessing the impact of climate change on growth and yield of wheat and groundnut and possible adaptation/management strategies under rainfed condition
6. Climate smart' agriculture for steering food security by fostering cropping intensity in seasonal gaps
7. Formation of Agro-Ecological Zones and Crop Suitability Maps in Punjab Province, Pakistan (FAO funded)

Arid Agriculture University, Rawalpindi

https://www.uaar.edu.pk/frw/research-11.php?dept_id=11 http://www.uaar.edu.pk/fcfs/research-1.php?dept_id=1; https://www.uaar.edu.pk/oric-research-comp.php

1. Modeling approach for assessing the impact of climate change on growth and yield of wheat and groundnut and possible adaptation/ management strategies under rainfed condition
2. Inter-Comparison of CENTURY and DSSAT model simulations to improve soil-based climate change resilience and adaptability of rainfed crop production systems in Pakistan (HEC funded)- ongoing
3. Sustainable cropping pattern for Pothwar plateau, Funded by PARC
4. Forest carbon stock and sequestration assessment in natural/ planted forests, forest soil carbon stock assessment, REDD+ & LULUCF.
5. Impact of climate change on forest resources, carbon balance and carbon sequestration potential of native forests.

Appendix IV: Interview Protocol for key informants

Survey to assess capacities and needs of universities and research institutions in term of climate sensitive curricula

Thank you for taking the time to participate in this survey.

This survey is being conducted as part of the GIZ Pakistan's project "Strengthening Climate Adaptation and Resilience (SAR)" which was formally launched in Islamabad in December 2021. The focus of one of the work packages under SAR is to:

- Conduct sector-specific assessments to understand the vulnerability of the key sectors affected by climate change and to build the capacities of relevant actors on climate risk analysis and on the proper interpretation and use of gender-sensitive climate risk data at the federal and provincial level (Khyber Pakhtunkhwa and Punjab).

The designed survey is the part of scoping study being conducted by GIZ Pakistan to fully understand the needs of academia and research related to climate risk assessments and management. The outcomes of the survey will be utilized to stock take the existing knowledge and capacities available in academia and research and identify potential areas of intervention on climate mainstreaming of higher education and research and the development of training modules and climate sensitive curricula.

All information provided in response to this survey will be kept anonymous.

SECTION 1: PERSONAL PROFILE

1. Name (for internal use only): _____

2. Age (years): _____

3. Sex: ☐ Female ☐ Male

4. Organization: _____

5. Position (for internal use only): _____

6. Time in current position (years): _____

7. Qualification/Degree: _____

8. Academic or technical background (sciences, social sciences, engineering etc.): _____

SECTION 2: INSTITUTIONAL CAPACITY

1. What is your role with respect to the research on the climate change being undertaken within your University/Centre/Department?

   ☐ Academic researcher ☐ Manager/research supervisor

2. What is the focus of the research being undertaken by yourself or those that you supervise in relation to climate change? (Multiple answers possible).

   ☐ Adaptation ☐ Mitigation ☐ Climate change resilience

   ☐ None of the above ☐ Other (Please specify) _____

3. On a continuum, where would you place the research being conducted by you or your organization on the scales below in terms of its degree of focus on climate risk assessment and management?

   ☐ 0% ☐ 1-25 ☐ 26-50% ☐ 51-75% ☐ 76-100%

4. Which degree programs having courses on climate change and being taught at your institution?
   a) _____
   b) _____
   c) _____
   d) _____
   e) _____

5. Can you provide the list of specific courses or training modules on climate risk analysis and methodologies to explore interaction of climate change with different sectors?

   ☐ Yes ☐ No

6. Are climate change-related aspects included in the guidelines of the course or have you chosen to address them along with another topic (e.g., environmental impacts)?

   ☐ Climate change-related aspects are included in the course guidelines

   ☐ Climate change-related aspects are not included in the course guidelines, but I have included them in the teaching.

7. Do you feel prepared to teach climate change-related aspects?

☐ Not at all
☐ To a little extent
☐ To a moderate extent
☐ To a great extent
☐ To a very great extent

8. Have you received or pursued training on matters related to climate change?

☐ Yes, my university provided training on climate change education
☐ Yes, I pursued a training on climate change education
☐ No, no training was received/pursued
☐ No, not yet, but future training is promptly envisaged/in progress

9. Have you or your university implemented any project(s) with focus on climate risk assessments or impact assessments in priority sectors.

☐ Yes ☐ No

If yes, enlist those projects below including title, duration, area etc.

a) _____

b) _____

c) _____

d) _____

10. Has your organization implemented any project(s) in collaboration with German researchers/ universities/ institutions/ funding agencies?

☐ Yes ☐ No

If yes, please provide the details of those projects (title/university/researcher name/funding organization)

a)_____

b)_____

_____

_____

SECTION 3: NEED ASSESSMENT

1. For climate risk assessments, does your university need any assistance in the followings for faculty development and developing new courses with strong focus on:

☐ Methodologies ☐ Modeling skills ☐ Software ☐ Training of trainers (TOT)

☐ Any other (Please specify) ----------

2. In which field related to climate change do you feel you need more training? (multiple answers possible)

☐ Climate change indicators
☐ Climate change mitigation
☐ Climate change adaptation

☐ Social impacts of climate change
☐ Environmental impacts of climate change
☐ Economic impacts of climate change
☐ Any other (Please specify);_____

3. What you recommend to mainstream climate change in various courses and degree programs offered at tertiary level (colleges/universities), and research institutions in the priority areas like agriculture, health, disaster management, water resources?

_____

_____

_____

_____

SECTION 4: INTERVIEW CLOSURE

1. Are there any other comments that you would like to make?

_____

_____

2. While all the information you have provided us will be kept anonymous, however, we would like to recognize your participation in this survey in the acknowledgements section of our report. Do you agree to have your' s and organization's name included in the list?

☐ Yes ☐ No

Thank you very much for your time for interview. However, at any stage if you would like to clarify any of your statement or provide additional information to us, please email us at; saeed.asad@hotmail.com