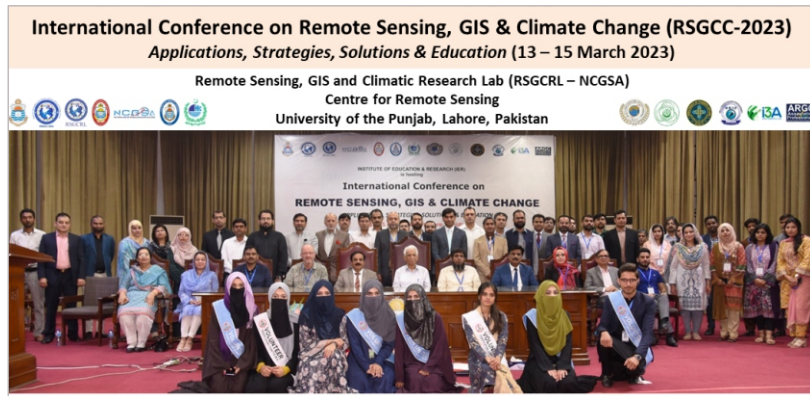# FACT BOOK 2020-23

RSGCRL

REMOTE SENSING, GIS AND CLIMATIC RESEARCH LAB
(National Center of GIS and Space Applications)
Centre for Remote Sensing
University of the Punjab, Lahore, Pakistan

International Conference on Remote Sensing, GIS & Climate Change (RSGCC-2023)
Applications, Strategies, Solutions & Education (13 – 15 March 2023)

Remote Sensing, GIS and Climatic Research Lab (RSGCRL – NCGSA)
Centre for Remote Sensing
University of the Punjab, Lahore, Pakistan

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

CONTACT

RSGCRL, Centre for Remote Sensing
University of the Punjab, New Campus, Lahore 54590, Pakistan

http://pu.edu.pk/home/subdepartment/67030

(+92 42) 99233146

admin.rsgcrl@pu.edu.pk   ;   director.rsgcrl@pu.edu.pk

https://www.linkedin.com/in/rsgcrl/

https://twitter.com/rsgcrl

https://www.facebook.com/rsgcrl

https://www.instagram.com/climateresearch_lab/

https://www.youtube.com/channel/UCzHTLnN5PNFtrDHl0Qy_n_Q/

Title Photo: Opening ceremony of "International Conference on Remote Sensing, GIS and Climate Change (RSGCC-2023): *Applications, Strategies, Solutions and Education*" held on 13-15 March, 2023 at the Quaid-i-Azam Campus, University of the Punjab, Lahore, Pakistan.

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

"In the name of Allah, the Most Gracious, the Most Merciful."

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

CONTENTS

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

Prof. Dr. Khalid Mahmood
Vice-Chancellor, University of the Punjab

Vice Chancellor's Message

This booklet, "Fact Book 2020-23" of Remote Sensing, GIS and Climatic Research Lab (RSGCRL), is a reflection of academic and research achievements of the lab, accomplished during the last three years from its establishment at University of the Punjab, Lahore. Under the ambit of Higher Education Commission (HEC) of Pakistan, National Center of GIS and Space Applications (NCGSA) has been established with seven constituent national labs in the country. RSGCRL is one of these seven labs to contribute towards developing capabilities in the emerging technologies. I hope that this Booklet will be helpful for researchers, professionals, Remote Sensing, GIS and Climate Change analysts and data users in and beyond Pakistan, seeking information about RSGCRL.

Academically professional and competent research team at RSGCRL has shown commitment and dedication to this national duty. This team of academicians have successfully achieved first year targets (203 achievements against 17 quantified targets), second year targets (568 achievements against 35 quantified targets), and for the entire period of three years of the project (2860 achievements against 81 quantified targets) showing a tremendous potential and devotion to this lab. RSGCRL has also significantly contributed to the institutional capacity building and professional development in the fields of RS&GIS and Climate Change by offering internships, workshops, theses research work, seminars and collaborations under different domains of the lab.

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

The establishment of the state-of-the-art RSGCR Lab at Punjab University in Pakistan, with latest equipment and professional research team of experts, analysts, and scholars will futuristically be a great asset for developing RS&GIS and space applications and preparedness to manage, adapt and mitigate climate change and its risks concerning to Pakistan and to the region.

I commend the achievements and accomplishments of RSGCRL team mentioned in this booklet.

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

Dr. Zia Ul Haq
Principal Investigator/Scientific Director, RSGCRL

Director's Message

It is a great pleasure and honour for me to introduce RSGCRL, its research team, and present the summary of activities performed and accomplishments during the last three years or so.

Presently, RSGCRL team is focusing on four major areas of research, development and capacity building:

Developing Remote Sensing and GIS applications, models, tools, technologies, and scientific approaches to support sustainable developments in the fields of food security, agriculture, and environment; developing assessment & management strategies for disasters, hazards, risks assessment; air and water pollution assessment and solutions; efficient management of natural resources and urban areas; and support to a pathway towards a blue economy.

Improving the scientific understanding of physical bases, current state & future scenarios of the climate in Pakistan, including information relevant to both, regional dynamics and corresponding sectors, the role of human influence, and helping in limiting human-induced climate change.

Studying socioeconomic footprints of climate change/air pollution/ environmental policies & laws on vulnerable communities of the society having less technological literacy, limited adoptability and

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

non-availability of alternate-solutions leading to increase in socioeconomic disparities, poverty and unemployment; preparing guidelines & providing feedback to policy makers to adopt pro-poor approach in implementation of climate change/air pollution/environmental policies & laws in Pakistan.

Developing institutional and professional capacity in RS&GIS and climate change domains through stipend based theses research work, publications, paid internships, free workshops, seminars, and multilayered collaborations. In this regard two major programmes have been launched, "Institutional Capacity Building and Professional Development Programme" and "Faculty Development Programme in Remote Sensing, GIS and Climate Change" to improve the skills for informed and efficient decision-making processes and to produce qualified workforce. Also, a "National Campaign on Climate Change" has been launched to create awareness in masses about RS&GIS applications, and issues & responsibilities regarding the climate change.

I acknowledge the support from resource persons, researchers & students and participants who have greatly contributed to RSGCRL achievements. The generous financial support from the Vice Chancellor, and assistance from Treasurer, Audit, ORIC, P&D staff of University of the Punjab. The cooperation from NCGSA Central Directorate, and HEC & Planning Commission officials is greatly acknowledged which enabled the smooth establishment and operation of the lab.

May Allah grant us the ability to serve the humanity! Ameen.

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

1   About RSGCRL

RSGCRL has been established at University of the Punjab, Lahore as an affiliated National Lab with National Center of GIS and Space Applications (NCGSA) under Government of Pakistan's Public Sector Development Programme (PSDP) sponsored by Higher Education Commission (HEC) of Pakistan. The RSGCRL aims to promote and facilitate education, research activities and collaborations to study and develop GIS and Space Applications with particular emphases on climate change and sustainable development in Pakistan.

Pakistan is amongst the most vulnerable countries facing climate change risks with very low technical, financial and professional capacity to manage, adapt and mitigate its adverse impacts. Climate change aggravates the social inequalities, and intensifies social factors leading to displacements, conflicts, instability, and changes in migration patterns.

The development of GIS and Space Applications in this domain is not only something that can be shared with international organizations but it can also help in improving living standards of Pakistan through sustainable solutions for healthy environment, better urban planning, saving of natural resources, etc. The availability of such a lab with latest equipment and competent team of experts and analysts can be of great advantage to manage, adapt and mitigate climate change and allied problems.

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

2   RSGCRL Core Team

Dr. Zia Ul Haq
Principal Investigator/Director
director.rsgcrl@pu.edu.pk
PhD in Space Science
(HEC Approved Supervisor)

Research Interests: Remote Sensing of Atmosphere, Sustainable Development, Atmospheric Reactive and Greenhouse Gases, Air Pollution Impact linkage with Climate Chang, Socioeconomics of Climate Change, Climate Projections and Adaptation
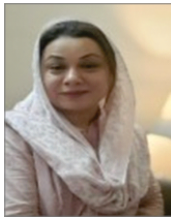
Dr. Syeda Adila Batool
Co-Principal Investigator
aadila.spsc@pu.edu.pk
PhD in Environmental Sciences
(HEC Approved Supervisor)

Research Interests: Sustainable Development, Urban Climate, Climate Projections and Adaptation, Solid Waste Management, Life Cycle Assessment, Greenhouse Gases Emissions and Impact on Ecology, Climate and Human Health

Dr. Khalid Mahmood
Co-Principal Investigator
khalid.spsc@pu.edu.pk
PhD in Space Science
(HEC Approved Supervisor)

Research Interests: Hazard Assessment and Spatial Patterns Identification of Environmental Variables, Landuse/Landcover (LULC) Monitoring, Groundwater & Surface Water Assessment and Management, Municipal Solid Waste, Vegetation Monitoring, Rainwater Harvesting, Geospatial Intelligence, Climate Change Assessment for Sustainable Development

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

Dr. Salman Tariq
Co-Principal Investigator
salman.spsc@pu.edu.pk
PhD in Space Science
(HEC Approved Supervisor)

Research Interests: Remote Sensing of Atmosphere and Air Pollution, Climate Modelling, Sustainable Development, Transboundary Aerosols, Radiative Forcing of Aerosols, Coastal Environments, Hazards and Extremes, Climate Tourism and Recreation, Solar-Terrestrial Atmosphere Coupling

Dr. Shahid Parvez
Team Lead
shahid.spsc@pu.edu.pk
PhD in Space Science

Research Interests: Remote Sensing of Landuse/Landcover (LULC) Changes, Microwave Remote Sensing, Photogrammetry, SAR & LiDAR Data Applications, Climate Change-Glacier-Water Nexus, Sustainable Development
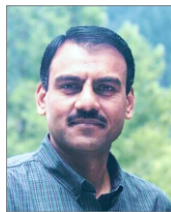
Dr. Asim Daud Rana
Team Lead
asim.spsc@pu.edu.pk
PhD in Space Science

Research Interests: Remote Sensing of Landuse/Landcover (LULC), Climate Change, Sustainable Development, Atmospheric Remote Sensing, Phenology, Urban Green Spaces, Coastal Environments

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

3   Areas of Research and Development

The research and development activities at RSGCRL are mainly focused on the following major areas and serious challenges faced by Pakistan by using latest tools, technologies, and scientific approaches related to RS&GIS and climate change:

i   Climatic Studies

Climate Projections and Adaptation, Climate Change and Sustainable Development, Climate Change Impacts on Ecology and Human Health

ii   Food Security, Agriculture and Biodiversity

Adaptation & Mitigation of Climate Change for Sustainable Food Security & Production, Agriculture, crop patterns

iii   Disasters and Calamities Management

Disasters, Hazards and Risks Assessment and Management, Early Warning Systems, Floods, Earthquakes, Droughts, Heatwaves, Fires, Transboundary Air Pollution

iv   Environment, Air Pollution and Health

Air Quality, Climate Change and Human Health, Environmental Bio-Thermal Hazards, Sustainable Environment

v   Landuse/Landcover

Landuse/Landcover Mapping, Deforestation, Desertification, Land Degradation

vi   Water and Ocean Studies

Coastal and Marine Pollution, Freshwater Resources and Ecosystems, Ground and Surface Water Availability and Quality, Water Pollution, Monitoring of Water Resources, Glaciers Melting, Climate Change Impact on Hydrological Cycle, Ocean Ecology, Ocean Warming

vii   Urban Studies

Urban Green Space, Urban Heat Island, Solid Waste Management, Air Pollution, Urban Climate, e-Waste, Life Cycle Assessment, Sustainable Consumption and Production

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

xiii   Socioeconomics and Resource Management

Socioeconomic Impacts of Climate Change, Economic Growth and Air Quality, Econometric Modeling of Climate Change, RS&GIS Applications in Economic and Management Sciences, Sustainable Development, Blue Economy, Economic Sectors and Services, Cost Effective Solutions and Efficient Management of Resources, RS&GIS for Knowledge Economy

ix   Institutional Development, Capacity Building and Public Awareness

Institutional Development, Capacity Building, Woman Participation, Knowledge Sharing and Skills Development, Public Awareness, Lifelong Learning in Climate Studies, Quality Education and Research Skills in RS&GIS and Climate Change

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

4   RSGCRL and PV-2025, PSV2047, MDGs and SDGs

The emerging demand of GIS and Space Applications for climate change studies for the socio-economic development of Pakistan along with Government of Pakistan Vision 2025, Space Vision 2047 of National Space Agency of Pakistan, Millennium Development Goals (MDGs) and achievement of Sustainable Development Goals (SDGs) impelled the Higher Education Commission of Pakistan (HEC) to establish Remote Sensing, GIS and Climatic Research Lab (RSGCRL) at University of the Punjab, Lahore, Pakistan. RSGCRL is linked to these goals as described below:

i   Pakistan Vision 2025

People First (Developing Social and Human Capital and Empowering Women), Growth (Sustained, Indigenous, and Inclusive Growth), Security (Energy, Water, and Food Security), Entrepreneurship (Private Sector and Entrepreneurship-Led Growth), Knowledge Economy (Developing a Competitive Knowledge Economy Through Value Addition), Connectivity (Modernizing Transport Infrastructure and Regional Connectivity).

ii   Millennium Development Goals (MDGs)

Eradicate Extreme Poverty & Hunger (MDG-1), Empower Women (MDG-3), Reduce Child Mortality (MDG-4), Improve Maternal Health (MDG-5), Combat HIV/AIDS, Malaria and Other Diseases (MDG-6), Ensure Environmental Sustainability (MDG-7), Develop A Global Partnership for Development (MDG-8).

iii   Sustainable Development Goals (SDGs)

No Poverty (SDG-1), Zero Hunger (SDG-2), Good Health and Well-Being (SDG-3), Quality Education (SDG-4), Gender Equality (SDG-5), Clean Water and Sanitation (SDG-6), Affordable and Clean Energy (SDG-7), Decent Work and Economic Growth (SDG-8), Reduced Inequalities (SDG-10), Sustainable Cities and Communities (SDG-11), Responsible Consumption and Production (SDG-12), Climate Action (SDG-13), Life Below Water (SDG-14), Life on Land (SDG-15), Partnerships to Achieve the Goal (SDG-17).

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

International Impact Factor Publications 120
Impact Factor **551** Q1 **68** Q2 **43**

Research Stipends Dispersed   6.3 mPKR
MS/PhD Research Graduates & Internees

Linkages & Collaborations Developed 230
National **99** International **131**

International Impact Factor Citations 719
excluding self-citations

Publications Authors & Theses Supervisors 214
National **105** International **109**

Research Theses Supervised 116
MSc/BS **42**   MS **66**   PhD **8**

Authors Institutional Affiliations Count 142
National **47** International **95**

Capacity Building Events Organised 68
Seminars **34**   Workshops **22** Webinars **12**

Research Degree Programmes Launched 2
MS & PhD in Remote Sensing

International Conferences Organised 2

Authors Affiliation Countries Count 24

Impact Factor Journals Count 57

Capacity Building: Direct Beneficiaries 2072
Research Graduates **200**   Internships **345**   Workshops **924**
Seminars/Webinars **603**   Female beneficiaries Ratio **45%**

Researchers Included in Top 2% Productive Scientists of the World 2

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

6   RSGCRL Targets and Achievements

I   First Year Quantified Targets and Achievements

Key Components	First Year Targets (2020-21)	First Year Achievements (2020-21)
Academic Research & Development (Reports, Papers, Patents, Theses, Books)	8	45
Data & Inventory Management (Datasets, Inventories)	0	22
Models and Maps Development (Models & Maps)	0	54
Capacity Building (Internships, Workshops, Academic Programs)	6	43
Linkages and Commercialization (Academia & Industry)	3	39
Cumulative Targets and Achievements	17	203

Table-1   First year quantified targets and achievements (2020-2021)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

Graph-1 First year quantified targets and achievements (2020-2021)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23
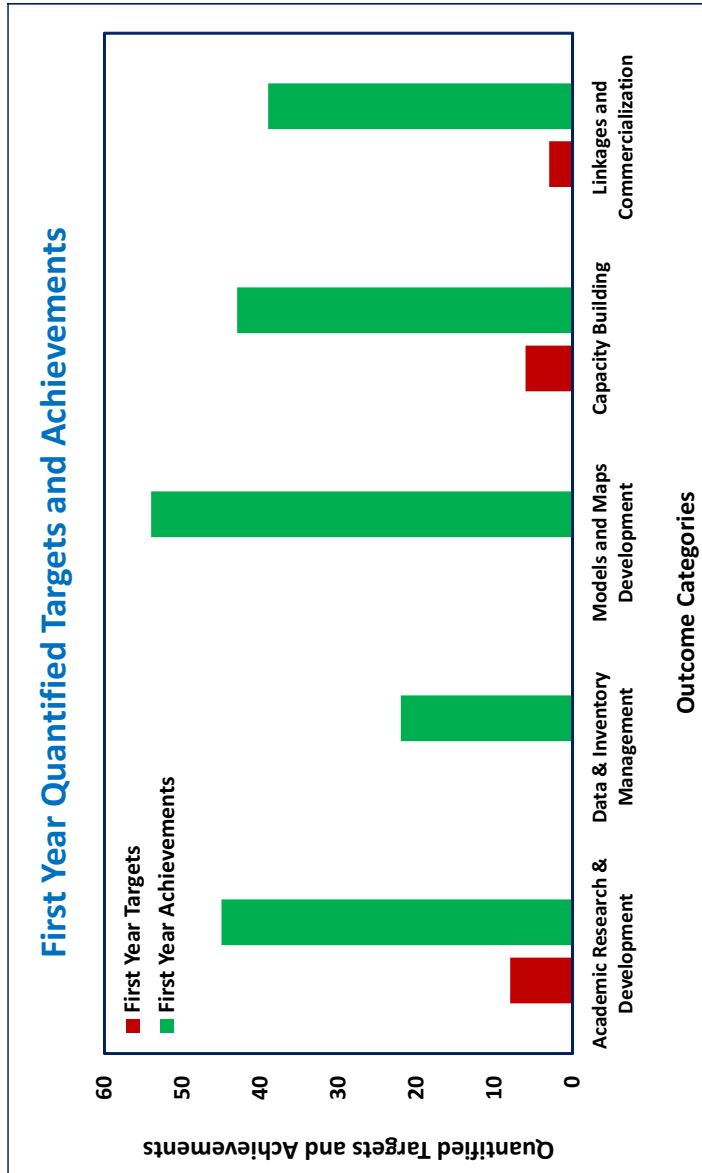
ii   Second Year Quantified Targets and Achievements

Key Components	Second Year Targets (2021-2022)	Second Year Achievements (2021-22)
Academic Research & Development (Reports, Papers, Patents, Theses, Books)	12	65
Data & Inventory Management (Datasets, Inventories)	2	164
Models and Maps Development (Models & Maps)	6	135
Capacity Building (Internships, Workshops, Academic Programs)	11	166
Linkages and Commercialization (Academia & Industry)	4	38
Cumulative Targets and Achievements	35	568

Table-2   Second year quantified targets and achievements (2021-2022)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

Second Year Quantified Targets and Achievements

Legend:
- Second Year Targets
- Second Year Achievements

Outcome Categories: Academic Research & Development, Data & Inventory Management, Models and Maps Development, Capacity Building, Linkages and Commercialization

Y-axis: Quantified Targets and Achievements

Graph-2 Second year quantified targets and achievements (2021-2022)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

iii   Third Year Quantified Targets and Achievements

Key Components	Third Year Targets (2022-2023)	Third Year Achievements (2022-2023)
Academic Research & Development (Reports, Papers, Patents, Theses, Books)	7	217
Data & Inventory Management (Datasets, Inventories)	2	50
Models and Maps Development (Models & Maps)	6	112
Capacity Building (Internships, Workshops, Academic Programs)	12	1526
Linkages and Commercialization (Academia & Industry)	2	184
Cumulative Targets and Achievements	29	2089

Table-3   Third year quantified targets and achievements (2022-2023)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23
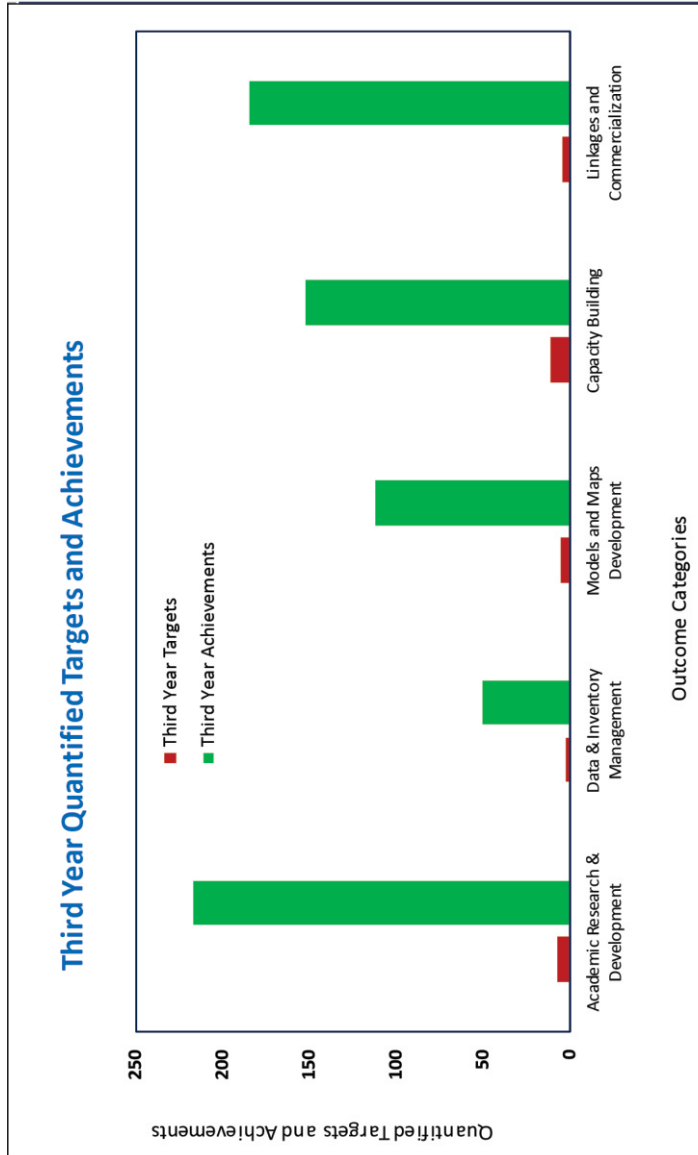
Graph-3 Third year quantified targets and achievements (2022-2023). For better graphical representation Capacity Building achievements number has been divided by 10 for better visualization.

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

iv   Overall Quantified Project Targets and Achievements

Key Components	Overall Project Targets (2020-2023)	Overall Project Achievements (2020-23)
Academic Research & Development (Reports, Papers, Patents, Theses, Books)	27	327
Data & Inventory Management (Datasets, Inventories)	4	236
Models and Maps Development (Models & Maps)	12	301
Capacity Building (Internships, Workshops, Academic Programs)	29	1735
Linkages and Commercialization (Academia & Industry)	9	261
Cumulative Targets and Achievements	81	2860

Table-4   Overall quantified project targets and achievements (2020-2023)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

Graph-4 Overall quantified project targets and achievements (2020-2023). For better graphical representation Capacity Building achievements number has been divided by 10 for better visualization.
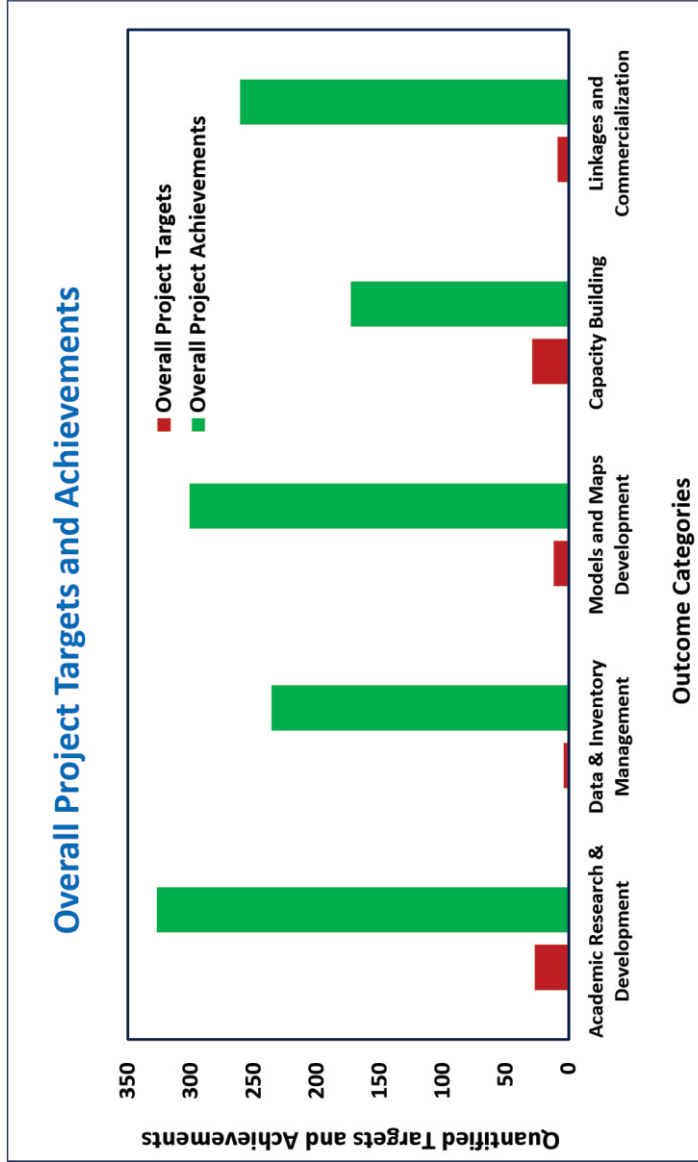
Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

7 RSGCRL Sustainable Development Goals (SDGs) Wheel
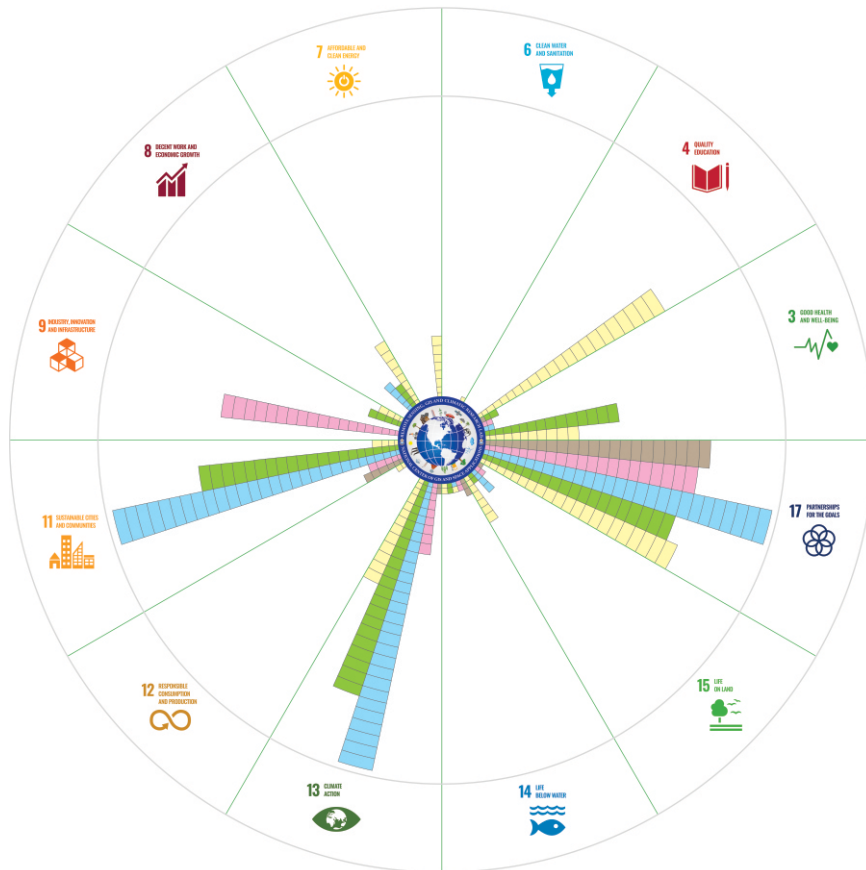
▢	**Academic Research and Development** (Report, Paper, Patent, Thesis, Book)	▢	**Data and Inventory Management** (Datasets, Inventories)
▢	**Models & Maps Development** (Model & Map)	▢	**Capacity Building** (Internships, Workshops, Academic Programs)
▢	**Linkages and Commercialization** (Academia & Industry)		* each coloured box represents 10 quantifiable project achievements

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

8 Major Initiatives and Ongoing Tasks

1 *Established, first of its kind research centre in Pakistan*
Centre for Remote Sensing
University of the Punjab, Lahore

2 *Launched a national level programme on building a*
Responsible and Responsive Society

→ Institutional Capacity Building and Professional Development Programme

→ Climate Ambassadors

→ National Campaign on Climate Change (NC³)

→ Faculty Development Programme in RS, GIS & Climatic Research

3 *Initiated*
Digital Atlas of Pakistan (DAP)
Launched project to develop first interactive digital atlas

4 *Initiated*
National Observatory for Transboundary Air Pollution (Air-Trap)

5 *Initiated*
Hydrometeorological Hazards Cataloguing of Pakistan (Hydro-Cat)

6 *Established*
Association of Professionals for Remote Sensing, GIS and Climate Change (ARGC)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

9 Progress & Impact Keywords

i Data Sources Utilized

(Sensors/Satellites/Models/Emission Inventories/Estimates/Surveys)

HYSPLIT Model   AMSR-E/Aqua Satellite   Himawari-8 Satellite

World Bank   Landsat-5 & 8 Satellites   Planet Satellite

GPM Satellite   Quick Bird Satellite   ASTER/Terra Satellite

Directorate General of Health Services (Punjab)   TRMM Satellite

GRACE Satellite   Environmental Protection Department (EPD)
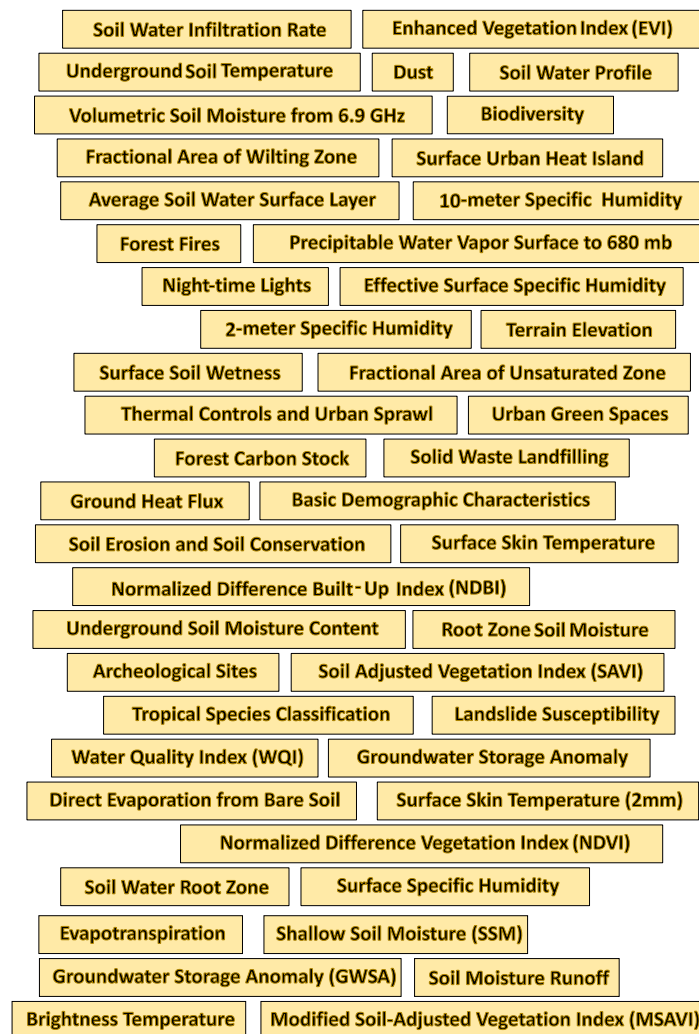
EASEWASTE Model   Shuttle Radar Topography Mission Satellite

MACCity Anthropogenic Emissions Inventory   AIRS/Aqua Satellite

Water and Sanitation Agency (WASA)   AMSR-2/GCOM-W1 Satellite

NOAA Satellite   Environmental Protection Department (EPD)

NASA FIRMS   MOPITT/Terra Satellite   MODIS/Aqua Satellite

OMI/Aura Satellite   SeaWiFS/SeaStar Satellite   MERRA-2 Model

MODIS/Terra Satellite   EDGAR Anthropogenic Emissions Inventory

Pakistan Meteorological Department   Worldview-3

Proba-V Satellite   MISR/Terra Satellite   OLS/DMSP Satellite

Sentinel 2 Satellite   CAMS Anthropogenic Emissions Inventory

Food and Agriculture Organization (FAO)   AERONET Sensor

FLDAS Model   GWP/CIESIN Estimates   Global Footprint Network

Handheld Laser Scanner   Gaofen 1 & 2 Satellites

The Urban Unit (UU)   Punjab Emergency Rescue Services-1122

Climate Hazards Group Infrared Precipitation with Station (CHIRPS)

Turkish Ministry of Environment, Urbanization and Climate Change

World Business Council for Sustainable Development   CALIPSO Satellite

Air Resources Laboratory of NOAA   Aerosol Robotic Network (AERONET)

KOF Swiss Economic Institute (KOF-SEI)   TROPOMI/Sentinel-5P Satellite

Suomi NPP/VIIRS   Integrated Multi-satellite Retrieval for GPM (GPM-IMERG)

Center for International Earth Science Information Network

gHM Estimates   National Renewable Energy Laboratory (NREL)

Stockholm International Peace Research Institute (SIPRI) database

Famine Early Warning Systems Network (FEWS-NET)

World Resources Institute   Lahore Waste Management Company (LWMC)

Multiangle Imaging Spectroradiometer (MISR)   Land Imager (OLI)

Statistical, Economic, Social Research and Training Centers of
Islamic Countries (SESRIC)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

9 Progress & Impact Keywords *(cont'd.)*

ii Land use/Land cover, Soil & Water
(Data Analyzed/Evaluated)

Soil Water Infiltration Rate	Enhanced Vegetation Index (EVI)

Underground Soil Temperature   Dust   Soil Water Profile

Volumetric Soil Moisture from 6.9 GHz   Biodiversity

Fractional Area of Wilting Zone   Surface Urban Heat Island

Average Soil Water Surface Layer   10-meter Specific Humidity

Forest Fires   Precipitable Water Vapor Surface to 680 mb

Night-time Lights   Effective Surface Specific Humidity

2-meter Specific Humidity   Terrain Elevation

Surface Soil Wetness   Fractional Area of Unsaturated Zone

Thermal Controls and Urban Sprawl   Urban Green Spaces

Forest Carbon Stock   Solid Waste Landfilling

Ground Heat Flux   Basic Demographic Characteristics

Soil Erosion and Soil Conservation   Surface Skin Temperature

Normalized Difference Built‑Up Index (NDBI)

Underground Soil Moisture Content   Root Zone Soil Moisture

Archeological Sites   Soil Adjusted Vegetation Index (SAVI)

Tropical Species Classification   Landslide Susceptibility

Water Quality Index (WQI)   Groundwater Storage Anomaly

Direct Evaporation from Bare Soil   Surface Skin Temperature (2mm)

Normalized Difference Vegetation Index (NDVI)

Soil Water Root Zone   Surface Specific Humidity

Evapotranspiration   Shallow Soil Moisture (SSM)

Groundwater Storage Anomaly (GWSA)   Soil Moisture Runoff

Brightness Temperature   Modified Soil-Adjusted Vegetation Index (MSAVI)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

9   Progress & Impact Keywords *(cont'd.)*

iii   Climate Change and Socioeconomics
(Data Analyzed/Evaluated)

Technological Innovation	Ecological Footprints	Energy Use
De-Carbonisation	Social Values and Ecosystem Management	
CO_2 emissions	Economic Freedom and Environmental Quality	
Economic Growth	Renewable Energy	Crop Production
Globalization	Solar Energy	Foreign Direct Investment
Population Growth	Gross Domestic Product (GDP)	
Tourism	Socio Economic Drivers of Renewable Energy	
Population Structure	Greenhouse Gases Emissions	
Discovering Historical Cultural Heritage	Financial Development	
Non-renewable Energy Use	Institutional Quality	
Unemployment	Financial Institutional Deepening	
Information and Communication Technology	Financial Globalization	
Levelized Cost of Energy	Labor productivity	Renewable Energy Transition
Resource Richness	Load Capacity Factor	Trade Openness	Inflation Rate
Transportation	Military Spending	Natural Resource Rents	Debt Service
Financial Inclusion	Financialization	Urban Population	Energy Transition
Value-Added Agriculture	Waste Generation	Government Effectiveness
Government Stability	Natural Resources	Renewable Energy Consumption
Private–Public Partnership	Green Investments	Hydrogen Production
Imported Products	Capital Formation	Carbon Footprint	Digitalization
Communication Technologies	De facto Financial Globalization	
Disposable Income	Exported Products	Competitive Industrial Performance
Greenhouse Gases Emissions	Ecological Status	Economic Complexity
Economic Policy Uncertainty	Electricity Consumption	Financial Deepening
De jure Financial Globalization	Governance	Environmental Performance

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

9 Progress & Impact Keywords *(cont'd.)*

iv Atmospheric Dynamics
(Data Analyzed/Evaluated)

Cloud Fraction From Cloud Mask	Tropopause Temperature
Relative Humidity	Precipitation Production Rate Convective
Tropopause Specific Humidity	Relative Humidity at Surface
Radiative Cloud Fraction	Rain Rate	Sea Level Pressure
Heat waves	Ratio of Annual Total Precipitation	UV Index
Surface Wind Speed	Cloud Cover	Typhoon Higos (2020)
Tropopause Pressure	Water Vapor NIR	Geopotential Height
Human Modification	Atmospheric Pressure	Precipitation
Precipitable Water	Total Surface Precipitation Flux
Rain Anomaly	Tropopause Height	Latent/Sensible Heat Flux
Tropopause Pressure	Evapotranspiration	Surface Air Pressure
Dust Column Mass Density (CMD)	Total Column Odd Oxygen
Planetary Boundary Layer Height	Dust Surface Mass Concentration (SMC)

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

9   Progress & Impact Keywords *(cont'd.)*

v   Atmospheric Chemistry
(Data Analyzed/Evaluated)

- Smog
- Organic Carbon
- Absorbing Aerosol Index
- Dark Target and Deep Blue AOD for land and ocean
- Tropospheric Carbon Monoxide
- Tropospheric Nitrogen Dioxide
- Air Pollution, Asthma and Acute Upper Respiratory Infection
- Tropospheric Formaldehyde
- COVID-19 and Air Pollution
- Tropospheric Methane
- Nitrogen Oxides
- Aerosol Scattering
- $PM_{2.5}$ and Health Risk
- Planetary Boundary Layer Sulphur Dioxide
- Air Pollution and Hospitalization
- Transboundary Air Pollution
- Aerosol Single Scattering Albedo
- Total Column Nitrogen Dioxide
- Black Carbon Extinction AOT
- Total Column Carbon Monoxide
- Aerosol Fine Mode Fraction
- Total Column Ozone
- Tropospheric Carbon Dioxide
- Volcanic Sulphur Dioxide
- Tropospheric Ozone
- Aerosol Angstrom Exponent
- Absorption Aerosol Exponent (AAE)
- Aerosol Refractive Index
- Absorption Aerosol Optical Depth (AAOD)
- UV Aerosol Index
- Aerosol Angstrom Exponent (AE)
- Aerosol Volume Size Distribution

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

The Role of Tourism and Renewable Energy towards EKC in South Asian Countries, Fresh Insights from the ARDL Approach

| *Impact Factor Journal Publication* | *Policy Implications* | *Renewable Energy & Socioeconomics* |

A threat to Sustainable Development

| *Newspaper Article* | *Public Awareness* | *Air Pollution Impact* | *Sustainable Develop.* |

Comparison of Tropospheric NO_2 over Three Urban Locations Indo-Gangetic Plain

| *Scientific Contribution* | *Satellite & GIS Applications* | *Urban Air Pollution* | *Capacity Building* |

Object Base Image Analysis for Delineation of Slope Units

| *Impact Factor Journal Publication* | *Remote Sensing Techniques* | *Landslide Susceptibility* |

Climate Change: Causes, Danger and Responsibilities

| *Newspaper Article* | *Public Awareness* | *Climate Change* | *Responsibilities & Response* |

Spatial Response Patterns of Trace Gases using Satellite Remote Sensing with Multi Satellite Data over different Landuse/Landcovers in Pakistan

| *PhD Thesis* | *Satellite Remote Sensing* | *Air Pollution* | *Capacity Building* |

Geospatial Technical Assistance for Watershed Management

| *Impact Factor Journal Publication* | *GIS Applications* | *Water Resources Management* |

Climate Change and Cloud Burst

| *TV Talk* | *Public Awareness* | *Climate Change Impacts* | *Societal Preparedness* |

Spatiotemporal Growth Modeling and Simulation of Land-Cover type using Stochastic Remote Sensing Modeling Techniques. A case study of Faisalabad

| *Scientific Contribution* | *Remote Sensing Techniques* | *Landuse & Landcover* | *Capacity Building* |

Characterizing Air Pollution and its Association with Emission Sources in Lahore: A Guide to Adaptation Actions to Control Pollution and Smog

| *International Scientific Contribution* | *Air Pollution Control Measures* | *Urban Sustainability & Health* |

Lifecycle Assessment of Municipal Solid Waste Management System of Islamabad

| *Scientific Contribution* | *Solution Development* | *Sustainable & Safe Cities* | *Capacity Building* |

Synergic use of Neural Networks Model and Remote Sensing Algorithms to Estimate Water Clarity Indicators in Khanpur Reservoir, Pakistan

Acta Geophysica Sinica

| *Impact Factor Journal Publication* | *RS&GIS Applications* | *Fresh Water Reservoir Management* |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Investigating the Relationship of Aerosols with Enhanced Vegetation Index and Meteorological Parameters over Pakistan *Atmospheric Pollution Research*

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution Variability |

Earth Observation and Smart Sensing for Natural and Urban Ecosystems

| Seminar | Public Awareness | RS&GIS Applications | Institutional Capacity Building |

Soil Moisture Mapping of Sheikhupura using SAR Satellite Images

| Scientific Contribution | Satellite & GIS Applications | Food Security | Capacity Building |

Particulate Matter ($PM_{2.5}$) and Diseases: an Autoregressive Distributed Lag (ARDL) Technique *Environmental Science and Pollution Research*

| Impact Factor Journal Publication | Policy Implications | Air Pollution & Health |

Utilization of Remote Sensing in Sample Surveys and Censuses

| Workshop | Public Awareness | RS&GIS Applications | Institutional Capacity Building |

Assessment of Air Quality during Smog Episodes over Lahore Region

| Scientific Contribution | Satellite Applications | Air Pollution & Health | Capacity Building |

A Study of Thermal Controls in Rapidly Developing City using Remotely Sensed Satellite Data: Spatiotemporal Perspective *Acta Geophysica*

| Impact Factor Journal Publication | RS&GIS Applications | Urban Sustainability & Health |

5 Day- Basic Training on Satellite Remote Sensing and Image Processing Techniques

| Workshop | Public Awareness | Air Pollution Impact | Institutional Capacity Building |

Comparative Simulations of GIS Based Rainwater Management Solution

| Scientific Contribution | Solution Development | Water Resources Manag. | Capacity Building |

Socio-Economic Drivers of Renewable Energy: Empirical Evidence from BRICS *International Journal of Environmental Research and Public Health*

| Impact Factor Journal Publication | Policy Implications | Climate Change & Socioeconomics |

Climate Change and Food Security

| Webinar | Policy Making | Climate Change Impacts | Professional Development |

Geospatial Alternates for Environment Impact Assessment of MSW Dumps

| Scientific Contribution | Economic Alternatives | Sustainable & Safe Cities | Capacity Building |

Spatio-temporal Variations in Fine Particulate Matter and Evaluation of Associated Health Risk over Pakistan *Integrated Environmental Assessment and Management*

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution & Health |

Assessment of Aerosols over South Asia by using Geo-Spatial Techniques

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Does the Modifying Role of Institutional Quality Remain Homogeneous in GDP-CO_2 Emission Nexus? New Evidence from ARDL Approach
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Policy Implications | Climate Change & Socioeconomics |

Development of New Global Agro-Ecological Zoning Database

| Consultative Talk | Policy Making | Resource Management | Institutional Capacity Building |

Monitoring Influences of Major Atmospheric Gases and Meteorological Parameters against NO_2 Concentration over Lahore Pakistan

| Scientific Contribution | RS&GIS Applications | Air Pollution | Capacity Building |

The Interactional Role of Globalization in Tourism-CO_2 Nexus in South Asian Countries
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Policy Implications | Climate Change & Socioeconomics |

Environment & Climate Justice

| Webinar | Public Awareness | Climate Change Impacts | Sustainable Development |

Aerosols Variability over the Central Location in the Indo-Gangetic Basin

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

Air Pollution and Hospitalization in Megacities: Empirical Evidence from Pakistan
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Policy Implications | Climate Change & Socioeconomics |

Geographic Information System (GIS) & Remote Sensing (RS), Theory & Application

| Training Course | Public Awareness | RS&GIS Applications | Professional Development |

Study of Aerosol Variability over India and Pakistan using Remote Sensing

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

A Study of the Passage of High-Speed Solar Wind Streams, their Plasma/Field Properties and Space Weather Effects of Geomagnetic Disturbances
Journal of Astrophysics & Astronomy

| Impact Factor Journal Publication | Deep Space Observations | Space Weather and Earth |

Short-Term/Fast-Track Measurement to Limit the Urban Air Pollution

| Policy Recommendations | Public Awareness | Air Pollution | Institutional Capacity Building |

Analysis of Formaldehyde (H_2CO) over Lahore, Pakistan using Satellite Data

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

A Comparative Assessment of Machine Learning Models for Landslide Susceptibility Mapping in the Rugged Terrain of Northern Pakistan
Applied Sciences

| Impact Factor Journal Publication | Landslide Susceptibility | Natural Hazards Mapping |

Space-Borne Remote Sensing Data and Application in Life Sciences

| Seminar | Public Awareness | RS Applications | Institutional Capacity Building |

Monitoring a Spatial Zoning of Carbon Monoxide over Pakistan using Sentinel-5 Satellite Data

| Scientific Contribution | Satellite & GIS Applications | Air Pollution | Capacity Building |

Effects of Population Structure on CO_2 Emissions in South Asian Countries: Evidence from Panel Estimation
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Policy Implications | Climate Change & Socioeconomics |

Smog and Air Pollution

| TV Talk | Public Awareness | Air Pollution Impact | Societal Preparedness |

Statistical Modeling of Carbon Monoxide over Mega City Lahore

| Scientific Contribution | Satellite Applications | Air Pollution Modeling | Capacity Building |

Impact Assessment of Land Cover and Land use Changes on Soil Erosion Changes (2005–2015) in Pakistan
Land Degradation & Development

| Impact Factor Journal Publication | RS&GIS Applications | Landuse & Landcover Assessment |

Limiting Ambient Air Pollution and Smog over Lahore Region: Framework for an Informed, Intelligent and Dynamic Decision Support System (IIDDSS)

| Policy Recommendations | RS&GIS Applications | Institutional Capacity Building |

Sustainable Solid Waste Management System for Northern Lahore

| Scientific Contribution | Solution Development | Sustainable & Safe Cities | Capacity Building |

Environmental Spatial Heterogeneity of the Impacts of COVID-19 on the Top-20 Metropolitan Cities of Asia-Pacific
Scientific Reports

| Impact Factor Journal Publication | RS&GIS Applications | Urban Environments |

Triggers and Mitigating the Drought, Heat Wave and Cyclone

| Seminar | Public Awareness | RS&GIS Applications | Institutional Capacity Building |

Aerosol Climate Interaction over Arabian Sea

| Scientific Contribution | Satellite Applications | Air Pollution Impact | Capacity Building |

Decarbonize Russia a Best Worst Method Approach for Assessing the Renewable Energy Potentials, Opportunities and Challenges
Energy Reports

| Impact Factor Journal Publication | RS&GIS Applications | Lessons from Developed Countries |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

A Comparative Study of Support Vector Machine and Maximum Likelihood Classification to Extract Land Cover of Lahore District, Punjab, Pakistan
Pakistan Journal of Scientific and Industrial Research A: Physical Sciences

| *Impact Factor Journal Publication* | *RS&GIS Applications* | *Urban Management* |

Assessment of Air Quality Over Pakistan Using Sentinel-5P Observations

| *International Conference Talk* | *Public Awareness* | *Air Pollution* | *Professional Development* |

An Empirical Study of the Association between CO_2 Emissions, Urbanization, Industrialization, Trade and Economic Growth based on ARDL Approach

| *Scientific Contribution* | *Socioeconomics & Climate Change* | *Air Quality* | *Capacity Building* |

Renewable Energy and Foreign Direct Investment: Does the Governance Matter for CO_2 Emissions? Application of CS-ARDL
Environmental Science and Pollution Research

| *Impact Factor Journal Publication* | *Policy Implications* | *Climate Change & Socioeconomics* |

Applications of Geospatial Technologies in Economic Studies

| *Seminar* | *Public Awareness* | *RS&GIS Applications* | *Institutional Capacity Building* |

Assessing Potential of Lidar Data for 3D Modeling

| *Scientific Contribution* | *Remote Sensing Applications* | *Data Modelling* | *Capacity Building* |

Nexus between Greenhouse Gas Emissions, Energy use and Economic Growth: Empirical Evidence from South Asian Countries
Polish Journal of Environmental Studies

| *Impact Factor Journal Publication* | *Policy Implications* | *Climate Change & Socioeconomics* |

Sentinel-5P Observations of NO_2 Variability during Covid-19 Lockdown in Mega-cities of Pakistan

| *International Conference Talk* | *Public Awareness* | *Air Pollution* | *Professional Development* |

Effect of Aerosol on Ultraviolet Radiations over Makkah

| *Scientific Contribution* | *Satellite Applications* | *Satellite Based UV Index* | *Hazard Preparedness* |

Associations of Air Pollution Concentrations and Energy Production Dynamics in Pakistan During Lockdown *Environmental Science and Pollution Research*

| *Impact Factor Journal Publication* | *RS&GIS Applications* | *Air Pollutants Emissions* |

Art and Science: Collaboration in Research Paradigm

| *Seminar* | *Public Awareness* | *Multidisciplinary Collaboration* | *Institutional Capacity Building* |

Geospatial Technical Assistance for Watershed Management

| *Scientific Contribution* | *GIS Applications* | *Water Resources Manag.* | *Sustainable Develop.* |

Exploring the Existence of Environmental Phillips Curve in South Asian Countries *Environmental Science and Pollution Research*

| *Impact Factor Journal Publication* | *Policy Implications* | *Climate Change & Socioeconomics* |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Long-term Spatiotemporal Trends in Aerosol Optical Depth and its Relationship with Enhanced Vegetation Index and Meteorological Parameters over South Asia
Environmental Science and Pollution Research

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution & Vegetation Health |

Biodiversity and Peace

| Webinar | Public Awareness | Climate Change Impacts | Sustainable Development |

Spatial and Temporal Analysis of NO_2 over Pakistan using Satellite Remote Sensing and GIS Techniques

| Scientific Contribution | Satellite & GIS Applications | Air Pollution | Capacity Building |

Evaluating the Influences of Natural Resources and Ageing People on CO_2 Emissions in G-11 Nations: Application of CS-ARDL Approach
International Journal of Environmental Research and Public Health

| Impact Factor Journal Publication | Policy Implications | Air Pollution & Health |

Detection of New NO_2 Hotspot In South Asia Through Improved Retrievals of TROPOMI

| International Conference Talk | Public Awareness | Air Pollution | Professional Development |

Satellite Based Indices along with GIS Analysis for Studying Soil Salinity in Muzaffargarh, Punjab, Pakistan

| Scientific Contribution | Economic Alternatives | Landuse & Landcover | Capacity Building |

Analyzing the Role of Meteorological Parameters and CO_2 Emissions towards Crop Production, Empirical Evidence from South Asian Countries
International Journal of Environmental Research and Public Health

| Impact Factor Journal Publication | Policy Implications | Air Pollution and Crops |

Study of Physical and Optical Properties of Polar Aerosols

| Scientific Contribution | Satellite Applications | Air Pollution and Glaciers | Capacity Building |

Satellite Based Bio-Thermal Impact Insights into MSW Open Dumps: A Pair-Unified Proximity Scenario
Geomatics, Natural Hazards and Risk

| Impact Factor Journal Publication | RS&GIS Applications | Urban Sustainability |

GIS Theory and Training

| Lecture Series and Workshop | GIS Applications | Institutional Capacity Building |

Application of EASEWASTE Model for Assessing Environmental Impacts from Solid Waste Landfilling
Archives of Environmental Protection

| Impact Factor Journal Publication | Solid Waste Management | Urban Sustainability |

Studying Ozone Variability, Trends and Climatology over Pakistan using Remote Sensing and Geographic Information System

| Scientific Contribution | RS&GIS Applications | Climate Change | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Physio-chemical Evaluation and Co-combustion Efficiency of Different Biomass Waste Fractions with Indigenous Coal Blends for Utilization as Alternative Fuel
Global Network of Environmental Science and Technology Journal

| Impact Factor Journal Publication | Solid Waste Management | Alternative Fuels |

Exploring Association and Prediction of Evapotranspiration Based on Meteorological Factors in Lahore

| Scientific Contribution | Satellite Applications | Climate Change | Capacity Building |

Technical Performance Prediction and Employment Potential of Solar PV Systems in Cold Countries- A Case Study of the Sverdlovsk Region of Russia
Sustainability

| Impact Factor Journal Publication | Renewable Energy | Lessons from Developed Countries |

GIS and Space Applications in Geosciences

| Seminar | Public Awareness | RS&GIS Applications | Institutional Capacity Building |

A Temporal Comparison to Investigate Groundwater Quality in Adjacent Areas of Landfill Sites of Lahore Using GIS

| Scientific Contribution | GIS Applications | Urban Sustainability | Capacity Building |

Effect of Increased Urbanization on Surface Temperature and Air Pollution in Lahore using Remote Sensing and GIS

| Scientific Contribution | Satellite & GIS Applications | Urban Sustainability | Capacity Building |

Exploring the Roles of Renewable Energy, Education Spending, and CO_2 Emissions towards Health Spending in South Asian Countries
Sustainability

| Impact Factor Journal Publication | Policy Implications | Greenhouse Gases Emissions |

Tropical Species Classification with Structural Traits using Handheld Laser Scanning Data
Remote Sensing

| Impact Factor Journal Publication | Machine Learning Classifiers | Vegetation Classification |

Triggers and Mitigating the SMOG and Transboundary Pollution

| Seminar | Public Awareness | RS&GIS Applications | Institutional Capacity Building |

A Physical Knowledge-based Machine Learning Method for Near-Real-Time Dust Aerosol Properties Retrieval from the Himawari-8 Satellite Data
Atmospheric Environment

| Impact Factor Journal Publication | RS&GIS Applications | Machine Learning | Air Pollution |

Response of Enhanced Vegetation Index Changes to Latent/Sensible Heat Flux and Precipitation over Pakistan using Remote Sensing
Environmental Science and Pollution Research

| Impact Factor Journal Publication | RS&GIS Applications | Vegetation Cover Heath |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Impact of Agriculture Development, Technological Innovation, Forestry, and Economic Growth on Environmental Degradation: Fresh Evidence from E-7 Countries

| Conference Publication | Socioeconomic Impacts | Environmental Degradation |

CCD Photometry and Light Curve Analysis of Star Geminorum

| Scientific Contribution | Deep Space Remote Sensing | Space-Earth Coupling | Capacity Building |

A Study of Aerosol Properties and their Relationship with Meteorological Parameter over Lahore

| Scientific Contribution | Satellite & GIS Applications | Air Pollution | Capacity Building |

A Study of Seasonal Variation Planetary Boundary Layer and its Impact on Air Pollution over Lahore

| Scientific Contribution | Satellite Applications | Climate Change | Capacity Building |

Effects of Human Capital, Natural Resources, Urbanization, Energy Consumption Carbon Emissions in the Top Ten Emitter Countries
Economic Research

| Impact Factor Journal Publication | RS&GIS Applications | Gases Emissions & Socioeconomics |

Image Classification, OBIA and Google Earth Engine

| Workshop | RS&GIS Applications | Institutional Capacity Building |

The Effects of Technological Innovation, FDI and Financial Development on CO_2 Emissions: Evidence from G-8 Countries *Environmental Science and Pollution Research*

| Impact Factor Journal Publication | Policy Implications | Greenhouse Gases & Socioeconomics |

Remote Sensing of Aerosol Properties During Intense Smog Events over Lahore (Pakistan) *Kuwait Journal of Science*

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution |

An Assessment of Particulate Matter ($PM_{2.5}$) over Lahore using Remote Sensing, GIS and its Effects on Human Health

| Scientific Contribution | RS&GIS Applications | Air Pollution & Health | Capacity Building |

Study of NO_2 Hotspots over Pakistan and its Relationship with Meteorological Parameters using Sentinel-5 Satellite Data

| Scientific Contribution | RS&GIS Applications | Air Pollution | Capacity Building |

Unveiling Falling Urban Trees Before and During Typhoon Higos (2020): Empirical Case Study of Potential Structural Failure using Tilt Sensor *Forests*

| Impact Factor Journal Publication | Remote Sensing Applications | Natural Hazards Impacts |

Study of Atmospheric Nitrogen Dioxide Climatology over Punjab (Pakistan) using Satellite Data

| Scientific Contribution | Satellite & GIS Applications | Air Pollution | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Satellite Remote Sensing and Image Processing Techniques for Monitoring MSW Dumps

| Conference Publication | Image Processing Techniques | Solid Waste Management |

Spatial Patterns and Temporal Trend of Remotely Sensed Fine Particulate Matter Concentration from 1998 to 2016 in Pakistan

| Scientific Contribution | RS&GIS Applications | Air Pollution | Capacity Building |

Statistical Analysis of Satellite Retrieved Tropospheric Formaldehyde over Punjab (Pakistan)

| Scientific Contribution | Satellite & GIS Applications | Air Pollution | Capacity Building |

A Spatio Temporal Assessment to Investigate Ground Water Quality in Adjacent Areas of Landfill Sites of Lahore

| Conference Publication | RS&GIS Applications | Urban Ground Water Quality |

5th Season of Pakistan

| Webinar | Public Awareness | Climate Change Impacts | Sustainable Develop. |

Modeling the Effect of Meteorological Parameters on Tropospheric NO_2 Concentration in Pakistan

| Scientific Contribution | Satellite & GIS Applications | Air Pollution | Capacity Building |

A Comprehensive Study of Pan-Sharpening Algorithms for Remotely Sensed Images

| Scientific Contribution | Remote Sensing Techniques | Landuse & Landcover | Capacity Building |

Remote Sensing & GIS (Theory and Training)

| Lecture Series and Workshop | RS Applications | Institutional Capacity Building |

Environmental Impacts of Shifts in Energy, Emissions, and Urban Heat Island During the COVID-19 Lockdown across Pakistan

Environmental Science and Pollution Research

| Impact Factor Journal Publication | RS&GIS Applications | Anthropogenic Activities & Hazards |

Air Pollution Trends Measured from MODIS and TROPOMI: AOD and CO over Pakistan

Environmental Science and Pollution Research

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution Assessment |

Spatio-Temporal Study of Road Traffic Crashes (RTCs) in Kasur District Using GIS Techniques

| Scientific Contribution | GIS Applications | Urban Safety | Capacity Building |

Variability of Aerosols and its Relation with ENSO using Satellite Measurement

| Scientific Contribution | Satellite Applications | Air Pollution -ENSO | Capacity Building |

Spectral Analysis of Forested and Non Forested Landcovers using Satellite Remote Sensing

| Scientific Contribution | Satellite Applications | Landuse & Landcover | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

A Time Series Forecasting Analysis of Overall and Sector-based Natural Gas Demand: A Developing South Asian Economy Case

Environmental Science and Pollution Research

| Impact Factor Journal Publication | Socioeconomics Impacts | Forecasting of Natural Resources |

Can Financial Institutional Deepening and Renewable Energy Consumption Lower CO_2 Emissions in G-10 Countries: Fresh Evidence from Advanced Methodologies

International Journal of Environmental Research and Public Health

| Impact Factor Journal Publication | Policy Implications | Renewable Energy |

A Satellite Based Multi-Time Analysis of Bio-Thermal Hazards for MSW Open Dump

| Scientific Contribution | Satellite & GIS Applications | Hazards Assessment | Capacity Building |

Quantitative Analysis of Carbon Footprint at University of the Punjab, Lahore

| Scientific Contribution | Urban Management | Carbon Emissions | Capacity Building |

Comparison of Stochastic and Traditional Water Quality Indices for Mapping Groundwater Quality Zones

Environmental Earth Sciences

| Impact Factor Journal Publication | GIS Applications | Urban Water Quality |

Assessing the Linkages of Economic Freedom and Environmental Quality in South Asian Countries: Application of CS-ARSL

| Impact Factor Journal Publication | Policy Implications | Environment & Socioeconomics |

Study of Seasonal Variation of SO_2, NO_2 & AOD over South Asia using Remote Sensing

| Scientific Contribution | RS&GIS Applications | Air Pollution Climatology | Capacity Building |

Role of Remote Sensing in Ecosystem Restoration

| Seminar | Public Awareness | RS Applications | Institutional Capacity Building |

A Study of Variability of Aerosol Radiative Forcing over Lahore using Remote Sensing

| Scientific Contribution | RS&GIS Applications | Climate Change | Capacity Building |

Geotechnical Concept and Support for Emergency Management

| Workshop | RS&GIS Applications | Institutional Capacity Building |

Satellite Based Thermal Profiling of Growing Cities in Relation to Land Transformation

| Scientific Contribution | Satellite Applications | Urban Sustainability | Capacity Building |

Zero Waste Management and Social Awareness

| Magazine Article | Public Awareness | Waste Management | Responsibilities & Response |

Modeling and Assessment of Particulate Matter ($PM_{2.5}$) as Major Cause of Smog in Pakistan

| Scientific Contribution | RS&GIS Applications | Air Pollution Modeling | Capacity Building |

Air Quality Management (AQM) in Pakistan: An Integrated Approach

| Policy Recommendations | RS&GIS Applications | Institutional Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Evaluating the potential footprints of land use and land cover and climate dynamics on atmospheric pollution in Pakistan
Frontiers in Environmental Science

| Impact Factor Journal Publication | RS&GIS Applications | Landuse & Landcover |

Southern Ocean in the Changing World

| International Symposium | Policy recommendations | Oceanic Impact | Sustainable Develop. |

Assessment of aerosol index and single scattering albedo over Pakistan using satellite remote sensing

| Scientific Contribution | Satellite Remote Sensing | Air Pollution | Capacity Building |

Analysis of air quality due to the eruption of La Palma using remote sensing
Acta Geophysica

| Impact Factor Journal Publication | RS&GIS Applications | Hazards Assessment |

R&D for Climate Resilient Cities in Punjab

| Consultation Session | Sustainable cities | Public health awareness | Responsibilities & Response |

Monsoon seasonal variation of aerosol physical properties and characterization of aerosols over Lahore and Karachi using remote sensing

| Scientific Contribution | Satellite Remote Sensing | Climate Change | Capacity Building |

Classification of aerosols using particle linear depolarization ratio (PLDR) over seven urban locations of Asia
Chemosphere

| Impact Factor Journal Publication | RS&GIS Applications | Urban Studies |

Integrated Solid Waste Management through EASEWASTE, a Life Cycle Assessment Model

| Workshop | Public Awareness | Climate Change Impacts | Societal Preparedness |

Quantification and mapping of social values associated with ecosystem management : A case of Margalla hills national park

| Scientific Contribution | Ecosystem Conservation | Environmental Management | Capacity Building |

The Impacts of Globalization and GDP on CO_2 Emissions: Do Technological Innovation and Renewable Energy Lower Some Burden in SAARC Countries
Journal of the Knowledge Economy

| Impact Factor Journal Publication | Modeling | Socioeconomics of Climate Change |

Analysis of spatiotemporal distribution of formaldehyde in organic aerosols in Lahore region using remote sensing data

| Scientific Contribution | Atmospheric Pollutants | Climate Change Impacts | Capacity Building |

Assessment of variability in $PM_{2.5}$ and its impact on human health in a West African country
Chemosphere

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution and Health |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Towards a reduction of emissions and cost-savings in homes: Techno-economic and environmental impact of two different solar water heaters
Energy Reports

| Impact Factor Journal Publication | Socioeconomics | Climate Change |

Statistical Modelling Techniques using R

| Workshop | Modeling | RS&GIS Applications | Institutional Capacity Building |

Variability of absorbing aerosols over South Asia using remote sensing

| Scientific Contribution | Statistical Techniques | Urban Air pollution | Capacity Building |

Marine plastic pollution detection and identification by using remote sensing-meta analysis
Marine Pollution Bulletin

| Impact Factor Journal Publication | Remote Sensing | Oceanic Pollution |

Visit of Zonguldak Bulent Ecevit University, Turkey for research facilities

| International Visit | Collaboration | RS&GIS Applications | Institutional Capacity Building |

Space borne observations of air pollution trends over Pakistan

| Scientific Contribution | Satellite Applications | Air Pollution & Health | Capacity Building |

Uncovering the potential impacts of financial inclusion and human development on ecological sustainability in the presence of natural resources and government stability: Evidence from G-20 nations
Resources Policy

| Impact Factor Journal Publication | Modeling | Socioeconomics & Sustainability |

Local Needs GAPS Analysis and Framework of Proactive National Disaster Preparedness & Response

| Workshop | Public Awareness | Risk Assessment | Institutional Capacity Building |

The association of meteorological parameters with covid -19 in Pakistan

| Scientific Contribution | Impact Assessment | Climate Change | Capacity Building |

Analyzing the impacts of renewable energy, patents, and trade on carbon emissions—evidence from the novel method of MMQR
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Modeling | Climate Change |

Python for GIS

| Workshop | Data Science | Machine Learning | Professional Development |

A study of optical and physical properties of dust aerosols over Pakistan using remote sensing

| Scientific Contribution | Satellite Applications | Air Pollution | Capacity Building |

Transportation in Africa under Paris Agreement 2 °C goal—a review of electric vehicle potentials, cleaner alternative fuels for the sector, challenges, and opportunities
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Cleaner Energies | Policy Review |

Analysis of spatiotemporal distribution of formaldehyde in organic aerosols in Lahore region using remote sensing data

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Analyzing the linkages of rural tourism, GDP, energy utilization, and environment: Exploring a sustainable path for China

Heliyon

| Impact Factor Journal Publication | Modeling | Environment & Socioeconomics |

Remote Senisng Based Tools for Air Pollution Monitoring

| Consultative Talk | Policy Making | Resource Management | Institutional Capacity Building |

Monitoring the Temporal variation of formaldehyde emissions over Islamabad, Pakistan using Max-DOAD and Satellite Observations

| Scientific Contribution | RS&GIS Applications | Air Pollution | Capacity Building |

Variation of air pollutants during COVID-19 lockdown phases in the mega-city of Lahore (Pakistan); Insights into meteorological parameters and atmospheric chemistry

Acta Geophysica

| Impact Factor Journal Publication | RS&GIS Applications | Urban Studies |

Satellite Image Classification using machine learning algorithms in R

| Webinar | Data Science | Climate Change Impacts | Sustainable Development |

Investigating the relationship of aerosol and cloud parameters over Pakistan using remote sensing

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

Investigating the Variability in Aerosol Optical Depth and Associated Population Exposure Risk in Pakistan Using MAIAC Data

Water, Air, & Soil Pollution

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution & Health |

Analysing Future hydroclimatic projections using CDO

| Training Course | Modeling | RS&GIS Applications | Professional Development |

Variability of carbonaceous aerosols over Pakistan using MERRA-2 reanalysis data

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

An investigation of nighttime variability in air quality of Naples (Italy) using wavelet coherence

Air Quality, Atmosphere and Health

| Impact Factor Journal Publication | RS&GIS Applications | Air Quality Assessment |

OGCs API - from WMS WFS to OPEN API

| Policy Recommendations | Modeling | Climate Change | Institutional Capacity Building |

Prediction of aerosol optical depth over Pakistan using novel hybrid machine learning model

| Scientific Contribution | Satellite & GIS Applications | Air Pollution Assessment | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Linear and wavelet analysis of aerosol optical depth (AOD) and prevailing meteorological factors during summer (2003–2016) over Turkey using Remote Sensing

Air Quality, Atmosphere and Health

| Impact Factor Journal Publication | RS&GIS Applications | Air Quality & Weather |

Time Series Analysis of Remote Sensing

| Workshop | Statistical Analysis | RS Applications | Institutional Capacity Building |

A study on physical and optical properties of volcanic aerosols using remote sensing

| Scientific Contribution | Volcanology | Air Pollution & Impact Assessment | Capacity Building |

How Do Green Investments, Foreign Direct Investment, and Renewable Energy Impact CO_2 Emissions? Measuring the Role of Education in E -7 Nations

Sustainability

| Impact Factor Journal Publication | Policy Implications | Climate Change & Socioeconomics |

AI & ML for Hydrological Modeling

| Workshop | Water Resource Management | Predictive Modeling | Modeling & Simulation |

Deep Learning for the land sliding data of Pakistan

| Scientific Contribution | Satellite Applications | Landuse/Landcover | Capacity Building |

The role of financial inclusion and globalization toward a sustainable economy in ASEAN countries: evidence from advance panel estimations

Environment, Develop. and Sustainability

| Impact Factor Journal Publication | Modeling | Socioeconomics |

Statistical Downscaling of Climatic Data using Cmhyd Model

| Workshop | RS&GIS Applications | Institutional Capacity Building |

Vulnerability assessment of Latboh lake as potential GLOF

| Scientific Contribution | Solution Development | Sustainable & Safe Cities | Capacity Building |

Influence of aerosols on snow cover during 2003 to 2021 over Northern Pakistan

Air Quality, Atmosphere and Health

| Impact Factor Journal Publication | RS&GIS Applications | Air Quality & Climatology |

Hands-On Experience of CubeSat Development

| Workshop | Product development | RS&GIS Applications | Institutional Capacity Building |

Regionalizing the climate of South Asia using Koppen classification

| Scientific Contribution | Satellite Applications | Climate Change Impact | Capacity Building |

Evolution of Solid Waste Management System in Lahore: A Step towards Sustainability of the Sector in Pakistan

Applied Sciences

| Impact Factor Journal Publication | Sustainable Cities | Solid Waste Management |

Cluster Analysis of Backward Trajectories using HYSPLIT Model

| Seminar | Public Awareness | RS&GIS Applications | Professional Development |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

How military spending, economic growth, and renewable energy impacts ecological footprints in Next Eleven nations *Environmental Science and Pollution Research*

| Impact Factor Journal Publication | Modeling | Socioeconomic Policies |

Applications of Remote Sensing in Vegetative Landcover Mapping using Satellite Indices

| Seminar | Public Awareness | Landuse/Landcover | Professional Development |

Synergies between the urban heat island (UHI) and heat waves (HWS) and their impact on urban environment

| Scientific Contribution | Socioeconomics & Climate Change | Ecology | Capacity Building |

Assessing the connection between competitive industrial performance on load capacity factor within the LCC framework: Implications for sustainable policy in BRICS economies *Environmental Science and Pollution Research*

| Impact Factor Journal Publication | Policy Implications | Sustainable Economies |

Eid-ul-Adha & Our Environment

| Seminar | Public Awareness | RS&GIS Applications | Institutional Capacity Building |

Assessment of drought hazards a study of Multan district

| Scientific Contribution | Remote Sensing Applications | Risk Management | Capacity Building |

Examining the Role of Renewable Energy, Technological Innovation, and the Insurance Market in Environmental Sustainability in the United States: A Step toward COP26 Targets *Energies*

| Impact Factor Journal Publication | Modeling | Climate Change & Socioeconomics |

Applications of Optical and Microwave Remote Sensing in Snow Distribution and Snowmelt Monitoring

| Seminar | Climate Studies | Cryospheric Science | Institutional Capacity Building |

A study on the variability of aerosol & radiative forcing using AERONET.

| Scientific Contribution | Satellite Applications | Satellite Based UV Index | Hazard Preparedness |

Identifying the natural and anthropogenic drivers of absorbing aerosols using OMI data and HYSPLIT model over South Asia *Air Quality, Atmosphere and Health*

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollutants Emissions |

Winter, Smog & Lahore

| Seminar | Public Awareness | Multidisciplinary Collaboration | Institutional Capacity Building |

Impact of meteorological parameters on aerosol optical depth and particulate matter in Lahore

| Scientific Contribution | Meteorology | Air Quality Assessment | Public Health |

The Impact of Debt Service and Inflation on Economic Growth in Pakistan Evidence from ARDL Model and Approximate Bayesian Analysis *Pakistan Journal of Comm. and Social Sciences*

| Impact Factor Journal Publication | Modeling | Socioeconomics |

GIS Day 2021

| Seminar | Public Awareness | GIS for Climatic Studies | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Analyzing the contribution of renewable energy and natural resources for sustainability in G-20 countries: How gross capital formation impacts ecological footprints

Heliyon

| Impact Factor Journal Publication | Modeling | Socioeconomics & Ecology |

Waste Management in Developing Countries

| Seminar | Public Awareness | Infrastructure Development | Sustainable Development |

Invitro anticancer potential of ciotrullus colocynthis protein engineered quantum dots

| Scientific Contribution | Bioengineering | Nanotechnology | Capacity Building |

Prediction of aerosol optical depth over Pakistan using novel hybrid machine learning model

Acta Geophysica

| Impact Factor Journal Publication | Modeling | Air Pollution Projections |

Aerosol Pollution Identification using newly developed MAIAC Algorithm: An Investigation over Pakistan

| Seminar | Public Awareness | Air Pollution | Professional Development |

A study of precipitation anomalies in Pakistan using satellite remote sensing and GIS

| Scientific Contribution | Economic Alternatives | Landuse & Landcover | Capacity Building |

An analysis of aerosol properties during a dust storm due to the TAUKTAE cyclone using remote sensing

Air Quality, Atmosphere and Health

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution Hazards |

Study of spatial patterns of drought in Pakistan using satellite remote sensing and GIS

| Scientific Contribution | Satellite Applications | Impact Assessment | Capacity Building |

Long-term spatio-temporal trends in atmospheric aerosols and trace gases over Pakistan using remote sensing

Acta Geophysica

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution Assessment |

Recent Floods in Pakistan (Causes and Preventions)

| Seminar | GIS Applications | Institutional Capacity Building |

The impact of economic growth, tourism, natural resources, technological innovation on carbon dioxide emission: evidence from BRICS countries

Envir. Scie. & Pollution Research

| Impact Factor Journal Publication | Modeling | Climate Change & Socioeconomics |

Analysis of Tropospheric NO_2 by exploring South Asia's 1st NASA Pandora Spectrometer, Islamabad, Pakistan

| Scientific Contribution | RS&GIS Applications | Climate Change | Capacity Building |

Assessment of Drought Hazards: a Study of Multan District

| Scientific Contribution | Satellite Applications | Food Security | Hazard Preparedness |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

A causal link between financialization and ecological status a novel framework for Asian countries
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Modeling | Socioeconomics & Ecology |

Assessment of Snow Cover Extent in Shigar District Gilgit-Baltistan Using Geospatial Techniques

| Scientific Contribution | Satellite Applications | Cryosphere | Capacity Building |

How do natural resources and economic growth impact load capacity factor in selected Next-11 countries Assessing the role of digitalization and government stability
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Modeling | Lessons from Other Countries |

Introduction to GIS & QGIS

| Lecture Series & Workshop | RS&GIS Applications | Institutional Capacity Building |

Assessment of Climate Pattern in Urban Expansion Scenario; A Case Study of Lahore

| Scientific Contribution | GIS Applications | Urban Sustainability | Capacity Building |

Exploration of microplastic concentration in indoor and outdoor air samples and attributes human health risk

| Scientific Contribution | Material Science | Toxicology | Capacity Building |

Analyzing the validity of load capability curve how economic complexity, renewable energy, R&D, and communication technologies take their part in G-20 countries
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Policy Implications | Socioeconomics |

Renewable energy transition, resource richness, economic growth, and environmental quality assessing the role of financial globalization
Renewable Energy

| Impact Factor Journal Publication | Policy Implications | Socioeconomics |

Role of Women in Climate Action

| Workshop | Public Awareness | Sustainable Practices | Institutional Capacity Building |

Terrestrial and groundwater storage characteristics and their quantification in the Chitral (Pakistan) and Kabul (Afghanistan) river basins using GRACE-FO satellite data
Groundwater for Sustainable Development

| Impact Factor Journal Publication | RS&GIS Applications | Water Management | Sustainability |

Investigating the Spatiotemporal Distributions of NO_2, SO_2 and their Association with NDVI in Lahore (Pakistan) and Its Adjoining Region of Punjab (India)
Journal of the Indian Society of Remote Sensing

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution & Vegetation Heath |

Indices based mapping of terrestrial vegetative Land cover of Pakistan

| Scientific Contribution | Satellite & GIS Applications | Index Development | Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Analysis of aerosol optical depth and relation to covariates during pre-monsoon season (2002–2019) over Pakistan using ARIMAX model and cross-wavelet analysis
Environmental Research

Impact Factor Journal Publication	Modeling	Air Pollution Climatology

Variability of aerosol parameters over Lahore and Karachi

Scientific Contribution	Aerosol Remote Sensing	Urban Pollution	Capacity Building

Spatio-temporal changes in the urban green spaces of Lahore Pakistan

Scientific Contribution	Satellite & GIS Applications	Urban Ecology	Capacity Building

Use of geospatial techniques to assess the impact of land use and land cover changes on the land surface temperature of Lahore-Punjab

Scientific Contribution	Impact Assessment	Sustainable Development	Capacity Building

Assessment of long-term trends in chlorophyll-a and sea surface temperature in the Arabian Sea and their association with aerosols using remote sensing
Ocean and Coastal Management

Impact Factor Journal Publication	RS&GIS Applications	Air Pollution & Oceanic Ecology

Geospatial Alternatives for Groundwater Assessment: GRACE

Seminar	Groundwater Depletion and Sustainability	Institutional Capacity Building

Exploring association and forecasting of evapotranspiration based on meteorological factors over megacity Lahore (Pakistan) and central place of Indo-Gangetic Basin
Environment, Development and Sustainability

Impact Factor Journal Publication	RS&GIS Applications	Climatology & Urban Studies

Role of meteorological parameters with the spread of Covid-19 in Pakistan: application of autoregressive distributed lag approach
International Journal of Environmental Science and Technology

Impact Factor Journal Publication	Modeling	Air Pollution & Health

Exploration snowmelt Sun off Modeling (SRM) in the Hunza River Catchment using RS & GIS

Scientific Contribution	RS&GIS Applications	Impact Assessment	Capacity Building

Spatial temporal analysis of frequency and intensity of precipitation of Lahore

Scientific Contribution	RS&GIS Applications	Climate Change	Capacity Building

Exploring potential impacts of climatic variability on production of maize in Pakistan using ARDL approach
Acta Geophysica

Impact Factor Journal Publication	Modeling	Climate Change & Food

Exploring anomalous glaciers behaviors in response to climate variability over Karakoram region

Scientific Contribution	Glaciology	Predictive Analysis	Capacity Building

Floating Satellite, CanSAT and CubeSAT

Seminar	Space Exploration	Technology Development	Institutional Capacity Building

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

A study on optical properties, classification, and transport of aerosols during the smog period over South Asia using remote sensing
Environmental Science and Pollution Research

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution Assessment |

Spatial Patterns and Temporal Trend of Remotely Sensed Fine Particulate Matter Concentration from 1998 to 2016 in Pakistan

| Scientific Contribution | RS&GIS Applications | Air Pollution | Capacity Building |

Trends in extreme rainfall indices in Pakistan by using satellite remote sensing

| Scientific Contribution | Satellite & RS Applications | Spatial Analysis | Capacity Building |

Investigating the Potential Climatic Effects of Atmospheric pollution across China under the National Clean Air Action Plan
Remote Sensing

| Impact Factor Journal Publication | Climate Change Policies | Lessons from other Countries |

A study to assess the hydrometeorological events in northern Pakistan using geospatial techniques

| Scientific Contribution | Satellite & GIS Applications | Hydrometeorology | Capacity Building |

Spatial patterns of rainfall and associated flood characteristics over Pakistan

| Scientific Contribution | Remote Sensing Techniques | Natural Hazards | Capacity Building |

Arc GIS Enterprise/Online

| Seminar | GIS Applications | Institutional Capacity Building |

Exploring the roles of green finance and environmental regulations on CO_2es: defining the roles of social and economic globalization in the next eleven nations
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Modeling | Socioeconomics & Climate Change |

How Economic Growth Contributes to CO_2 Emissions in the Presence of Globalization and Eco-Innovations in South Asian Countries?
Resources Policy

| Impact Factor Journal Publication | Climate Change & Socioeconomics | Anthropogenic Emissions |

Prediction of heat waves in South Asia using statistical analysis techniques

| Scientific Contribution | Data Science | Public Policy | Capacity Building |

Source apportionment of aerosols in the metropolitan cities of Pakistan and effective policy options

| Scientific Contribution | Aerosol Science | Policy Analysis | Capacity Building |

Remote sensing of nighttime air quality over the megacity of Lahore, Pakistan
Urban Climate

| Impact Factor Journal Publication | Satellite & GIS Applications | Urban Environments |

Long term spatiotemporal trends and health risk assessment of remotely sensed $PM_{2.5}$ concentrations in Nigeria
Environmental Pollution

| Impact Factor Journal Publication | Air Pollution & Health | Lessons from other Countries |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Lahore Urban Ecology and Modernization: A GIS and RS Perspective

| *Scientific Contribution* | *Urban Management* | *Climate Change* | *Capacity Building* |

Estimating environmental efficiency of the selected Asian countries: does convergence exist?
Environmental Science and Pollution Research

| *Impact Factor Journal Publication* | *Modeling* | *Enviromental Studies* |

Defining the roles of socio-economic factors and bureaucratic quality to minimize the impacts of fossil fuels consumption on CO_2 emissions in G-20 countries
Environmental Science and Pollution Research

| *Impact Factor Journal Publication* | *Policy Implications* | *Environment & Socioeconomics* |

Maritime Aerosol Optical and Microphysical properties over Arabian Sea

| *Scientific Contribution* | *Marine Aerosols* | *Earth Observation* | *Capacity Building* |

GIS and Space Applications in Geosciences

| *Seminar* | *Natural Resource Management* | *GIS Applications* | *Institutional Capacity Building* |

Spatio-Temporal Distribution of Aerosols and Carbon Monoxide over Pakistan using Remote Sensing

| *Scientific Contribution* | *RS&GIS Applications* | *Climate Change* | *Capacity Building* |

Sustainable Development and the role of Socio-economic Factors

| *Seminar* | *Sustainability* | *Development Economics* | *Institutional Capacity Building* |

A study of variability of Aerosols index and SO_2 over Pakistan using remote sensing

| *Scientific Contribution* | *Atmospheric Dynamics* | *Air Quality Monitoring* | *Capacity Building* |

Mapping Archaeological Heritage in South Asia (MAHSA)

| *Seminar* | *Cultural Heritage* | *Heritage Management* | *Interdisciplinary Collaboration* |

A study on the modification in aerosol loading over Karachi using remote sensing

| *Scientific Contribution* | *RS&GIS Applications* | *Air Pollution Modeling* | *Capacity Building* |

Space Weather: It's impacts on Technology

| *Seminar* | *RS&GIS Applications* | *Institutional Capacity Building* |

Variations in the aerosol index and its relationship with meteorological parameters over Pakistan using remote sensing
Environmental Science and Pollution Research

| *Impact Factor Journal Publication* | *RS&GIS Applications* | *Air Pollution Climatology* |

Satellite Based Indices/Models to Monitor Surface Water Reservoirs

| *Seminar* | *Hydrology* | *Water Pollution Impact* | *Sustainable Develop.* |

Satellite remote sensing of Formaldehyde by using Sentinel 5P data over South Asia

| *Scientific Contribution* | *Satellite & GIS Applications* | *Urban Air Pollution* | *Capacity Building* |

Remote sensing of air pollution due to forest fires and dust storm over Balochistan (Pakistan)
Atmospheric Pollution Research

| *Impact Factor Journal Publication* | *RS&GIS Applications* | *Hazards Assessment* |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Remote Sensing based analysis of soil types distribution in Pakitsan

| Scientific Contribution | Soil Science and Pedology | Land Use Planning | Capacity Building |

A study to assess hospital waste management in Sheikhupura by using GIS

| Scientific Contribution | Healthcare Management | Spatial Analysis | Capacity Building |

Monitoring changes and impacts of urban green spaces in Lahore using RS & GIS

| Scientific Contribution | Urban Ecology | Environmental Planning | Capacity Building |

Geospatial analytics for multi-decadal morphodynamics along Gwadar coastal zone
Journal of Coastal Conservation

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution & Oceanic Ecology |

Applications of Satellite Remote Sensing in Monitoring Aerosols, Enhanced Vegetation Index and Atmospheric Dynamics

| Seminar | Ecological Monitoring | Climate Change | Responsibilities & Response |

A geospatial assessment of hospital waste management in public and private sector; A case study

| Scientific Contribution | Environmental Health and Epidemiology | Capacity Building |

Evaluating the role of renewable energy and technology innovations in lowering CO_2 emission: a wavelet coherence approach
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Modeling | Socioeconomics & Climate Change |

Role of Land Use / Land Cover as Determinant of Local Thermal Print Using Google Earth Engine

| Seminar | Public Awareness | Microclimate Analysis | Societal Preparedness |

Can Geomagnetic storms affect stratospheric O_3 and NO_2 in the South Atlantic Anomaly Zone?

| Scientific Contribution | Geomagnetism | Aeronomy | Capacity Building |

Defining the role of renewable energy, economic growth, globalization, energy consumption, and population growth on $PM_{2.5}$ concentration: evidence from South Asian countries
Environmental Science and Pollution Research

| Impact Factor Journal Publication | Modeling | Socioeconomics & Air Quality |

Study of Methane climatology over Pakistan using RS and GIS techniques

| Scientific Contribution | Solution Development | Environmental Modeling | Capacity Building |

Object And Pixel Based Landuse Landcover Mapping and comparison, Based On Medium And High Resolution Satellite Imagery A Case Study of Deh Akro-Ii And Chotiari Wetland Complex, Sindh, Pakistan
Annals of Forest Research

| Impact Factor Journal Publication | RS Techniques | Landuse & Landcover |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Effect of Human capital, Natural resource, urbanization, energy consumption on carbon emissions in the top ten emitter countries
Economic Research

| Impact Factor Journal Publication | Modeling | Socioeconomics of Climate Change |

Use of Wavelet Transformation in analysing Essential Climatic Variables

| Seminar | Climate Data Analysis | Institutional Capacity Building |

The role of economic globalization in reducing CO_2 emissions implications for sustainable development in South Asian countries
Environment, Development and Sustainability

| Impact Factor Journal Publication | RS&GIS Applications | Climatology & Urban Studies |

Geospatial induces as an alternative for environmental impact assessment of dumped waste
Acta Geophysica

| Impact Factor Journal Publication | RS&GIS Applications | Urban Hazards |

Application of advance Remote Sensing based classification techniques

| Scientific Contribution | RS&GIS Applications | Resource Management | Capacity Building |

Biomass mapping of Sindh and Balochistan using microwave remote sensing

| Scientific Contribution | Agricultural Sciences | Forestry | Capacity Building |

Summertime variability of aerosols and covariates over Saudi Arabia using remote sensing
Air Quality, Atmosphere & Health

| Impact Factor Journal Publication | RS&GIS Applications | Air Quality Assessement |

Assessment of Coastal Vulnerability to Climate Change Impacts in Pakistan by using Remote Sensing and GIS

| Scientific Contribution | Coastal Studies | Oceanography | Capacity Building |

Investigating the long-term trends in aerosol optical depth and its association with meteorological parameters and Enhanced Vegetation Index over Turkey
Environmental Science and Pollution Research

| Impact Factor Journal Publication | RS&GIS Applications | Air Pollution Climatology |

Small Satellite Technology: Discussing CubeSat Projects in SSTR lab and their Applications in Climate Change

| Seminar | Climate Science | Environmental Monitoring | Capacity Building |

Hot spot analysis and long term trends of absorbing aerosols measured at different locations in Pakistan

| Scientific Contribution | Satellite & GIS Applications | Urban Air Pollution | Capacity Building |

Remote sensing of aerosols due to biomass burning over Kanpur, Sao-Paulo, Ilorin and Canberra
Atmospheric Chemistry

| Impact Factor Journal Publication | RS&GIS Applications | Air Quality Assessment |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Analysis of Relationship between O_3 and NO_2 Lahore, Pakistan

| *Scientific Contribution* | *Geospatial Analysis* | *Hazards Assessment* | *Capacity Building* |

Exploring the role of communication technologies, governance, and renewable energy for ecological footprints in G11 countries: implications for sustainable development
Sustainability

| *Impact Factor Journal Publication* | *Modeling* | *Socioeconomics & Climate Change* |

Investigating the Spatiotemporal Distributions of NO_2, SO_2 and Their Association with NDVI in Lahore (Pakistan) and Its Adjoining Region of Punjab (India)

| *Scientific Contribution* | *Satellite Remote Sensing* | *Air Pollution* | *Capacity Building* |

Asymmetric impacts of natural resources on ecological footprints: exploring the role of economic growth, FDI and renewable energy in G-11 countries
Resource Policy

| *Impact Factor Journal Publication* | *Modeling* | *Socioeconomics & Climate Change* |

Modeling Air Pollution, Socioeconomic and Climate Change Nexus in Pakistan using Remote Sensing and Geo-statistical Techniques

| *Scientific Contribution* | *Remote Sensing Techniques* | *Simulation* | *Capacity Building* |

The carbon footprint of a public sector University before and during the COVID-19 lockdown
Global NEST

| *Impact Factor Journal Publication* | *Climate Change* | *Greenhouse Gases Emission Assessment* |

Hydrometeorological trend analysis in Northern Pakistan using classical approaches and Recurrent Neural Network (RNN)

| *Scientific Contribution* | *Data Science* | *Computational Statistics* | *Capacity Building* |

Economic policy uncertainty and CO_2 emissions: a comparative analysis of developed and developing nations
Environmental Science and Pollution Research

| *Impact Factor Journal Publication* | *Modeling* | *Socioeconomics and Climate Change* |

Lets interact with processes: A way out from scratch to product delivery

| *Seminar* | *Product Development Lifecycle* | *Institutional Capacity Building* |

Financial institutional and market deepening, and environmental quality nexus a case study in G-11 economies using CS-ARDL
International Journal of Environmental and Public Health

| *Impact Factor Journal Publication* | *Modeling* | *Socioeconomics and Climate Change* |

Techno-economic optimization of PV system for hydrogen production and electric vehicle charging stations under five different climatic conditions in India
International Journal of Hydrogen Energy

| *Impact Factor Journal Publication* | *Climate Change* | *Alternative Energies* |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*

(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

Geospatial alternatives for quantification of bio-thermal influence zone in the vicinity of a solid waste dump

Waste Management and Research

| Impact Factor Journal Publication | Solutions Development | Urban hazards |

Environmental Impact Studies of Deh Akro II Wetland Complex Using Remote Sensing and Geospatial Techniques, Sindh, Pakistan

| Scientific Contribution | Environmental Impact Assessment | Conservation and Wetland Ecology |

Spatial and temporal variations in $PM_{2.5}$ and associated health risk assessment in Saudi Arabia using remote sensing

Chemosphere

| Impact Factor Journal Publication | Satellite & GIS Applications | Air Quality And Health |

Multi-control spatial history of groundwater reservoirs in Pakistan using satellite-driven data

Acta Geophysica

| Impact Factor Journal Publication | RS&GIS Applications | Groundwater Assessment |

Associating renewable energy, globalization, agriculture and ecological footprints implications for sustainable environments in South Asian

International Journal of Environmental Research and Public Health

| Impact Factor Journal Publication | Modeling | Socioeconomics and Sustainability |

Does globalization cause greenhouse gas emissions in Pakistan? A promise to enlighten the value of environmental quality

International Journal of Environmental Research and Public Health

| Impact Factor Journal Publication | Modeling | Socioeconomics & Climate Change |

Evaluating Landsat-8 and Sentinel-2 data consistency for high spatiotemporal inland and coastal water quality monitoring

Remote Sensing

| Impact Factor Journal Publication | RS&GIS Applications | Water Quality Assessment |

Assessment of air quality during worst wildfires in Mugla and Antalya regions of Turkey

Natural Hazards

| Impact Factor Journal Publication | RS&GIS Applications | Hazards Monitoring & Assessment |

Study of Atmospheric Nitrogen Dioxide Climatology over Punjab (Pakistan) using Satellite Data

| Scientific Contribution | Satellite & GIS Applications | Air Pollution | Capacity Building |

Geospatial passives for dynamic vegetation monitoring around thermal power plants

Environmental Science and Pollution Research

| Impact Factor Journal Publication | RS&GIS Applications | Environmental Hazards and Vegetation |

Bioinformatics in Climate Change and Environmental Studies: Challenges and Opportunities

| Seminar | Public Awareness | Computational Biology | Institutional Capacity Building |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

10 Activities completed under "Building a Responsible and Responsive Society" Programme *(cont'd.)*
(Scientific Contribution, Institutional Capacity Building, Professional Development, Public Awareness)

A geospatial assessment of bio-thermal influence around Çatalagzi power plant region
Geocarto International

| *Impact Factor Journal Publication* | *RS&GIS Applications* | *Bio-Thermal Hazards* |

Applications of Machine Learning Algorithms for High-Dimensional Datasets

| *Seminar* | *Data Science* | *Computational Statistics* | *Institutional Capacity Building* |

Comparative simulation of GIS based rainwater management solutions
Water Resource Management

| *Impact Factor Journal Publication* | *RS&GIS Applications* | *Water Resource Management* |

Applications of Remote Sensing and GIS in Monitoring $PM_{2.5}$ and Evaluation of Associated Health Risks

| *Seminar* | *Environmental Health and Epidemiology* | *Institutional Capacity Building* |

Characterizing air pollution and its association with emission sources in Lahore: a guide to adaptation action plans to control pollution and smog
Applied Sciences

| *Impact Factor Journal Publication* | *Policy Recommendations* | *Air Quality Management* |

Air pollution trends measured from MODIS and TROPOMI: AOD and CO over Pakistan
Journal of Atmospheric Chemistry

| *Impact Factor Journal Publication* | *Satellite & GIS Applications* | *Air Quality Monitoring* |

Climate Change and Role of Space Technologies in Pakistan

| *Panel Discussion* | *Consultation and Policy Making* | *Networking & Capacity Building* |

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships

Shaheed Benazir Bhutto University, Sheringal, Dir

Global Eco Lab (GEL), Lahore

University College Dublin, Ireland

UN Decade of Ocean Science for Sustainable Development

Cyprus International University, Turkey

Punjab Emergency Service (Rescue 1122), Lahore

City University of Hong Kong, China

The University of Lahore, Lahore

Yildiz Technical University, Turkey

The Urban Unit, Lahore

University of Peshawar, Peshawar

University of Veterinary and Animal Sciences (UVAS), Lahore

Islamia College University Peshawar, Peshawar

Quaid-i-Azam University, Islamabad

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships *(cont'd.)*

UN Climate Change Paris Committee on Capacity Building

Ural Federal University, Russia

Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi

Forman Christian College University, Lahore

Shenzhen University, China

University of Swat, Swat

SDGs Academy, Pakistan

The University of Edinburgh, United Kingdom

Northwest University, China

University of Bahrain, Sakhir, Bahrain

University of Management and Technology, Lahore

University of Karachi, Karachi

Lahore College for Women University, Lahore

Riphah International University

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships *(cont'd.)*

The Islamia University of Bahawalpur, Pakistan

Xi'an Jiaotong University, China

University of Wollongong, Malaysia

Xinjiang University, China

Tianjin University of Commerce, China

Near East University, Türkiye

University of Education, Pakistan

Higher Education Department, Punjab, Pakistan

ILMA University, Pakistan

University of Adelaide, Australia

National Uni. of Computer and Emerging Sciences, Pakistan

Nanjing University, China

Gyeongsang National University, South Korea

East China University of Science and Technology, China

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships *(cont'd.)*

University of Naples Federico II, Italy

PSGVPAS College, India

Prince Sattam Bin Abdulaziz University, Saudi Arabia

Helwan University, Egypt

Aswan University, Egypt

Academy of Economic Studies, Romania

Weifang University of Science and Technology, China

Cape Peninsula University of Technology, South Africa

National Institute of Disaster Management (NIDM), Pakistan

Alexandria University, Egypt

Shandong University of Technology, China

Ağrı İbrahim Çeçen University, Turkey

AKFA University, Uzbekistan

Amirkabir University of Technology, Iran

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11   Linkages, Collaborations & Memberships *(cont'd.)*

Ataturk University, Turkey

Capital Development Authority (CDA), Islamabad, Pakistan

Cardiff University, UK

Central South University, China

Centre for Higher Education Development, South Africa

Chinese Academy of Sciences, China

COMSTECH, Pakistan

University of Calgary O'Brien, Canada

Dhofar University, Oman

Engineering Consultancy Services Punjab, Pakistan

Federal Urdu University, Karachi, Pakistan

Gangneung-Wonju National University, South Korea

Geological Survey of Pakistan, Quetta, Pakistan

Global Ambassador of Sustainability, Saudi Arabia

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11   Linkages, Collaborations & Memberships *(cont'd.)*

Rutgers University, USA

Northeastern University, China

Khushal Khan Khattak University, Pakistan

King Saud University, Saudi Arabia

Jilin University, China

Interdisciplinary Centre for Water Research, India

Muhammad Nawaz Shareef University of Agriculture, Pakistan

Dokuz Eylul University, Türkiye

University of Szeged, Hungary

New Mexico State University, USA

Northeast Agricultural University, China

Wuhan University, China

Mississippi State University, USA

Tulane University, USA

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships *(cont'd.)*

Balochistan University of IT, Engg. and Management Sciences

International Center for Integrated Mountain Develop, Nepal

Sultan Qaboos University, Oman

Kinnaird College for Women, Lahore

Superior University, Lahore

Kean University, USA

Sukkur IBA University, Sukkur

Climate Chain Coalition, France

Institute of Space Technology (IST), Islamabad

The Climate Action Network, Germany

NUR International University, Lahore

University of California, Davis, California, USA

University of Agriculture Faisalabad, Faisalabad

National Disaster Management Authority, Islamabad

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11　Linkages, Collaborations & Memberships *(cont'd.)*

International Union for Conservation of Nature (IUCN)

İSKİ General Directorate, PID, Türkiye

Mainz University of Applied Sciences (i3mainz), Germany

Massey University, Auckland, New Zealand

Midlands State University, Zimbabwe

Offshore Monitoring Limited, Islamabad, Pakistan

Qatar University, Doha, Qatar

Saskatchewan Polytechnic, Saskatchewan, Canada

Stuttgart University of Applied Sciences, Germany

Tianjin University, Tianjin, China

University of California, Davis, California, USA

University of Saskatchewan, Canada

University of Calgary O'Brien, Canada

Auburn University, Auburn, AL, USA

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11   Linkages, Collaborations & Memberships *(cont'd.)*

Government College Women University, Sialkot, Pakistan

Government Queen Mary College, Lahore, Pakistan

Hangzhou Finance and Investment Group CO., Ltd., China

Heidelberg University, Germany

Indian Institute of Science, Bangalore, India

Alberta Health Services, Canada

Intl. Association of Survey Statisticians (IASS), Austria

International Universities Climate Alliance, Australia

International Waste Working Group, Germany

Islamic Azad University, Iran

Istanbul Technical University (ITU), Turkey

Jiangxi University of Science and Technology, China

Karachi University, Karachi, Pakistan

King Khalid University, Abha, Saudi Arabia

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11   Linkages, Collaborations & Memberships *(cont'd.)*

Massachusetts Institute of Technology (MIT), Cambridge, USA

Minhaj University, Lahore, Pakistan

Nanjing Uni. of Information Science and Tech., China

National Engineering Services Pakistan (NESPAK), Pakistan

National Institute of Business Administration (IBA), Pakistan

National Institute of Oceanography, Karachi, Pakistan

NED University of Engineering & Technology, Pakistan

Pakistan Council of Sci. & Indust. Res. Lab., Lahore, Pakistan

SUPARCO, Islamabad, Pakistan

PISTAR, Lahore, Pakistan

Punjab Central Busin. Dist. Dev. Auth. (CBD), Lahore, Pakistan

Punjab Irrigation Department, Lahore, Pakistan

Sichuan Normal University, China

Sui Northern Gas Pipelines Limited, Lahore, Pakistan

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11   Linkages, Collaborations & Memberships *(cont'd.)*

Government College University, Faisalabad

Sardar Bahadur Khan Women University (SBK), Quetta

Zonguldak Bülent Ecevit University, Türkiye

National University of Sciences & Technology, Islamabad

Institute of Business Administration (IBA), Karachi

Lahore School of Economics (LSE), Lahore

North South University, Dhaka, Bangladesh

Bahauddin Zakariya University, Multan

Government College University, Lahore

UK Centre for Ecology and Hydrology

Nanjing Peace Porum, China

Daffodil International University, Dhaka, Bangladesh

UN Education, Scientific and Cultural Organization

The Hong Kong Polytechnic University, China

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships *(cont'd.)*

Goethe University, Germany

Deutsche Bundesbank, Germany

Dafodil International University, Bangladesh

The Arctic University of Norway, Norway

University of Nottingham, China

Oklahoma State University, USA

University of Bremen, Germany

Nanjing Normal University, China

University of Chinese Academy of Sciences, China

IGSNRR, CAS, China

Osmaniye Korkut Ata University, Türkiye

Qingdao University, Qingdao, China

UN Food and Agriculture Organization (FAO), Italy

King Abdulaziz University, Saudi Arabia

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships *(cont'd.)*

Sunway University, Malaysia	
University College Dublin, Ireland	
University Lucian Blaga of Sibiu, Romania	
University of Central Punjab (UCP), Lahore, Pakistan	
University of Engineering and Technology, Lahore, Pakistan	
University of Huddersfield, UK	
University of Kohsar, Muree, Pakistan	
University of Okara, Okara, Pakistan	
University of Pitesti, Romania	
University of Sussex, UK	
University of Utara Malaysia, Malaysia	
University of Venda, South Africa	
Institute of Automation, CAS, Beijing, China	
World Food Programme (WFP), Pakistan	

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11 Linkages, Collaborations & Memberships *(cont'd.)*

Zhejiang University, China

Environmental Protection Agency (EPA), Lahore, Pakistan

I3A Solutions, Islamabad, Pakistan

Artvin Coruh University, Türkiye

Bahawalpur Waste Management Company, Bahawalpur

Barcelona Supercomputing Center, Barcelona, Spain

Beijing Normal University, Beijing

Central American University, El Salvador

Data Science and Geohazards Monitoring, New Zealand

Ten Billion Tree Tsunami Program, AJ&K, Pakistan

Noakhali Science and Technology University, Bangladesh

Frankfurt Am Main, Frankfurt, Germany

GIS & Space Appli. in Geosciences, Uni. of Peshawar, Pakistan

Henan Polytechnic University, China

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

11   Linkages, Collaborations & Memberships *(cont'd.)*

Bahçesehir Cyprus University, Northern Cyprus, Turkey

Applied Science Private University, Amman, Jordan

Fayoum University, Fayoum, Egypt

Linkoping University, Linkoping, Sweden

Middle East University, Amman, Jordan

Centurion University of T&M, Odisha, India

University of Tishreen, Lattakia, Syria

Guangzhou College of Commerce, Guangzhou, China

Linyi Vocational University of S&T, Linyi, China

Vellore Institute of Technology, Tamil Nadu, India

C.K. Tedam University of Tech. & Applied Sciences, Ghana

Yinchuan University of Science and Technology, China

ARGCC, Pakistan

Centre for Remopte Sensing, Lahore, Pakistan

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

International Conference on Remote Sensing, GIS & Climate Change (RSGCC-2023)
Applications, Strategies, Solutions & Education (13 – 15 March 2023)

Remote Sensing, GIS and Climatic Research Lab (RSGCRL – NCGSA)
Centre for Remote Sensing
University of the Punjab, Lahore, Pakistan

Conference Events
- 94+ oral presentations
- 36+ poster presentations
- 7 workshops
- 3 panel discussions
- 19 technical sessions
- 6 professional networking sessions
- Parallel sessions/events at 6 venues
- Tree plantation drive
- Geospatial S&T exhibition
- Launching of ARGC

Presenters from
13+ Countries:
Australia, Canada, China, El-Salvador, Germany, Hong Kong, Iran, New Zealand, Qatar, Portugal, Spain, Turkey, Zimbabwe

13+ Cities of Pakistan:
(Bahawalpur, Faisalabad, Gujranwala, Haripur, Islamabad, Karachi, Khushab, Lahore, Multan, Murree, Peshawar, Quetta, Sialkot etc.)

1000+ participants/visitors

Awards
- 19 best oral presentation awards by RSGCC-2023
- 6 best oral & poster presentation awards by SUPARCO & RSGCC-2023
- 3 best poster awards by i3A Pvt Ltd
- 3 best poster awards by IWMI, Pakistan
- 3 best oral presentation (related to Waters) awards by IWMI, Pakistan
- 7 panelist awards for "Educating Climate Change Panel Discussion Session" conducted by IER, PU
- 3 best exhibitor awards by RSGCC-2023
- 7 shields to Workshop Resource Persons
- 14 best performance awards to Conference Support Team

Remote Sensing, GIS and Climatic Research Lab
(National Center of GIS and Space Applications)
University of the Punjab, Lahore, Pakistan

FACT BOOK 2020-23

12 News and Photo Gallery *(cont'd.)*

International Conference on Remote Sensing, GIS & Climate Change (RSGCC-2023)
Applications, Strategies, Solutions & Education (13 – 15 March 2023)

Remote Sensing, GIS and Climatic Research Lab (RSGCRL – NCGSA)
Centre for Remote Sensing
University of the Punjab, Lahore, Pakistan