

 <p>Royal University of Bhutan</p>	<h2>P9: ROYAL UNIVERSITY OF BHUTAN</h2> <p>Thimphu, Bhutan</p> <hr/> <p><i>Departments concerned with SUNRAISE-related topics:</i></p> <ul style="list-style-type: none">- Department of Environment and Climate Studies- Department of Forest Science- Department of Agriculture- Department of Animal Science <hr/> <p><i>Contact person:</i> Om Katel (ombhutan2016@gmail.com)</p>
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The Royal University of Bhutan (RUB) is the only national university in Bhutan. Launched in 2003, it is a centre of research, tertiary education and services in the country, constituted by 11 colleges spread across the country. In them, a wide spectrum of research and training topics are handled, going from language and culture studies to natural resource management to business management to education, among others. The objective is the provision of a tertiary education of good quality fulfilling the needs of the country for a skilled population, and the creation and transfer of knowledge relevant for Bhutan.

Sustainability research and training is primarily conducted at the College of Natural Resources, within which the departments of environment and climate studies, forest science, agriculture, and animal science stand out. Its aim is the promotion of economic development and nature conservation nationwide. To that end, knowledge is generated through research in natural resource management, rural development and environmental science. The early establishment of the college as one of the constituent university colleges shows the institutions' commitment to sustainability research and training from its early stages. Sustainability relevant topics included in the research agenda of the college encompass (summarised and shortened):

- Natural resource management, with a special focus on water resource, watershed, soil and biodiversity management;
- Wildlife conservation strategies, diversity and patterns; impact of protected spaces for wildlife conservation; analysis of invasions by alien species; valuation of ecosystem services; human – wildlife interactions/conflicts;
- Impacts of human activity and climate change on wildlife, water resources, etc.; climate change vulnerability and risk assessment; strategies of climate change mitigation and adaptation, and resilience building; forest and vegetation management for carbon sequestration;
- Smart agriculture and its linkage to forests/water/livestock management; feasibility of sustainable crop production, food processing, product development and nutrition; strategies for self-reliance and food security;
- Livelihood of the mountain people.

A wide range of methods is used to conduct all these analyses, comprising field exploration and mapping activities. This (see a more detailed research profile attached) is a reflection of the capabilities and intentions of RUB to carry out research and training activities adhering to SUNRAISE research priorities. Importantly, national policy priorities and, to a lesser extent, international ones are in the core of the research and training activities and consultation services developed at RUB. The mandate to contribute to the fulfilment of the priorities set up in the Gross National Happiness policy should be stressed. The provision of knowledge to the community and other stakeholders based on the research undertaken and the various cooperation projects of RUB with several international partners are a proof of that. The creation of knowledge in an international context and, thus, based on international priority areas is, actually, one of the key objectives set up in the charter and the statutes of RUB. This context together with the results of surveys/interviews with RUB's academic staff and local stakeholders leads us to make the following recommendations on key subject areas for sustainability that might additionally be considered in future research projects. Key findings in the international scientific literature and policy priorities are considered when defining the list of possible additional research topics:

- Governance of and power plays during the sustainability transformation of mountain territories (i.e. moving beyond the technical/ecological focus of most of the research done); analysis of alternative promising community-led and top-down governance tools and strategies for change and their efficacy;
- Science and management strategies for holistic and integrated change towards a low carbon society; way measures related to the management of green infrastructure, water resources and food production can contribute not only to the adaptation to climate change and sequestration of carbon, but also to the reduction of emissions;
- Prospects for sustainable food production, alternative water management and biodiversity enhancement in urban areas (altogether, prospects for an integrative sustainable management in cities);
- Impacts and dynamics of land-use/land-cover change (including urban sprawl); analysis of the exacerbation of climate changes/changes in the micro-climate caused by land-use/land-cover changes and strategies for the simultaneous attenuation of the negative effects of both;
- Ecological and social impacts of the economic transition in Bhutanese mountain communities (e.g. from a subsistence to a tourism-based economy).

With a view to make the most of the mountain research capacity at RUB, further cooperation in research and training among the departments of environment and climate studies, forest science, agriculture, and animal science is highly advisable. The cooperation with the community and decision-makers might additionally be further strengthened. The usage of citizen science approaches is particularly promising, rather than just the conduction of questionnaires, interviews, etc. with stakeholders.

Summary of the research profile:

SUNRAISE-RELEVANT RESEARCH TOPICS

1.	Impacts of climate change and resilience building for the adaptation capacity of stakeholders (especially farmers)
2.	Natural resources management in mountain areas, with a special focus on water and soil management
3.	Human's role in biodiversity conservation and their impacts on ecosystems
4.	Smart agriculture and its linkage to forests and water management and livestock rearing for rural development
5.	Agribusiness promotion as a way to reduce youth unemployment and rural urban migration

KEY PERSONALITIES, POTENTIAL MASTER'S AND DOCTORAL SUPERVISORS

- Prof Dr. Dhan B. Gurung – *Research interests: Wildlife*
- Prof. Dr. Thubten Sonam – *Research interests: Agricultural enterprises; Rural development*
- Assoc. Prof. Dr. Penjor – *Research interests: Livestock production*
- Assoc. Prof. Dr. Tulsi Gurung – *Research interests: Horticulture; Climate smart agriculture.*
- Assoc. Prof. Dr. Sonam Tashi – *Research interests: Organic Agriculture*
- Asst. Prof. Dr. Ugyen Thinley – *Research interests: GIS; Precision farming*
- Asst. Prof. Dr. Rekha Chhetri – *Research interests: Soil nutrition and management*
- Dr. Om Katel – *Research interests: Natural resources management; Climate change vulnerability and adaptation, Biodiversity conservation*
- Dr. Tshering Dorji – *Research interests: Aquatic ecology; Water resources management*
- Dr. Nedup Dorji – *Research interests: High altitude Yak production and management*

CURRENT AND PAST PROJECTS

Project 1: "Sustainable livestock management in the high altitude areas"	Funded by: Annual University Research Grant (AURG), Royal University of Bhutan	Project type: research
	Keywords: Livestock production; Management; Feed and fodder; Grazing lands	

<p>Project 2: “Nutrition and Environment Contribution of Livestock to Livelihood and its Impact on Environment”</p>	<p><i>Funded by:</i> Bhutan Foundation</p> <p><i>Keywords:</i> Environment; Livestock; Livelihoods</p>	<p><i>Project type:</i> research</p>
<p>Project 3: “Water Resources Management in the high altitude wetlands”</p>	<p><i>Funded by:</i> Kurita Foundation Japan/ USA</p> <p><i>Keywords:</i> Lake mapping; Water discharge; Climate change; Water dynamics</p>	<p><i>Project type:</i> research</p>
<p>Project 4: “Ecosystem Assessment for resilient development”</p>	<p><i>Funded by:</i> Royal Society for the protection of Nature (NGO), Bhutan</p> <p><i>Keywords:</i> Black necked crane; Habitat; Habitat encroachment; Protection and resilience development</p>	<p><i>Project type:</i> research</p>
<p>Project 5: “Enhancing the resilience of Climate Smart agriculture”</p>	<p><i>Funded by:</i> Bhutan Trust Fund for Environmental Conservation (BTSEC)</p> <p><i>Keywords:</i> Temperature change; Precipitation change; Crop production; Low carbon technologies</p>	<p><i>Project type:</i> community development</p>
<p>Project 6: “Livelihood Vulnerability Approach to Assessing Farmers Vulnerability to Climate Change in central Bhutan”</p>	<p><i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan</p> <p><i>Keywords:</i> High altitude; Low altitude; Level of vulnerability; Livelihoods</p>	<p><i>Project type:</i> research</p>
<p>Project 7: “Sustainable development Smart Agriculture Capacity (SUNSPACE)”</p>	<p><i>Funded by:</i> Erasmus + programme of the European Union</p> <p><i>Keywords:</i> Resilience; Capacity building; Low carbon technology; Smart technology</p>	<p><i>Project type:</i> community development</p>
<p>Project 8: “Resilience marker of climate change in high altitude areas”</p>	<p><i>Funded by:</i> International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal</p> <p><i>Keywords:</i> Cow dung; Livestock rearing; Crop farming; Compost; Grazing areas; Crop type</p>	<p><i>Project type:</i> community development</p>

<p>Project 9: “Air quality assessment in the Lobesa community”</p>	<p><i>Funded by:</i> International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal</p> <p><i>Keywords:</i> -</p>	<p><i>Project type:</i> research</p>
<p>Project 10: “Water quality assessment and its relation to microinvertebrate in the rivers of western Bhutan”</p>	<p><i>Funded by:</i> National Geographic Society</p> <p><i>Keywords:</i> Quality indicator; Composition of metals; Macroinvertebrate; Physio-chemical parameter</p>	<p><i>Project type:</i> research</p>
<p>Project 11: “Economic feasibility of rearing male Hy-line Brown layer chicks of meat purpose”</p>	<p><i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan</p> <p><i>Keywords:</i> Fibre diet; Non-feed, commercial laying hens</p>	<p><i>Project type:</i> research</p>
<p>Project 12: “Impact of climate change on welfare of cattle and cattle farming in Bhutan”</p>	<p><i>Funded by:</i> Norwegian Programme for Capacity Development in Higher Education and Research for Development, Norway</p> <p><i>Keywords:</i> Climate change; Cattle; Welfare</p>	<p><i>Project type:</i> research</p>
<p>Project 13: “Assessment of Biomass, Carbon Stock and Climate Change Mitigation Potentials of Balcooa Bamboo (<i>Bambusa balcooa</i> Roxb.) in western Bhutan”</p>	<p><i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan</p> <p><i>Keywords:</i> Carbon stock; Bamboo; Climate change</p>	<p><i>Project type:</i> research</p>
<p>Project 14: “Distributional patterns and habitat preferences of aquatic flora across water bodies in Wangdue Phodrang and Punakha Districts”</p>	<p><i>Funded by:</i> Norwegian Programme for Capacity Development in Higher Education and Research for Development, Norway</p> <p><i>Keywords:</i> Aquatic flora; Habitat preference; Bhutan</p>	<p><i>Project type:</i> research</p>
<p>Project 15: “Rapid assessment of roadside bird diversity in Punakha District, Bhutan”</p>	<p><i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan</p> <p><i>Keywords:</i> Bird diversity; Road side; Wangdue</p>	<p><i>Project type:</i> research</p>

Project 16: “Coccinellidae diversity of Bhutan (Insecta: Coleoptera); Final compilation from unexplored dzongkhags”	<i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan	<i>Project type:</i> research
	<i>Keywords:</i> Insects; Diversity; Bhutan	
Project 17: “Assessment of nutrient from <i>Parthenium hysterphorus L.</i> compost using different inoculants”	<i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan	<i>Project type:</i> research
	<i>Keywords:</i> Nutrient; <i>Parthenium spp</i> ; Inoculants; Compost	
Project 18: “Rainfall Pattern and Water Poverty and their Implication to Local Livelihoods in the Context of Changing Climate in Bhutan”	<i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan	<i>Project type:</i> research
	<i>Keywords:</i> Climate change; Livelihoods; Precipitation; Water discharge	
Project 19: “Assessing vulnerability of wildlife habitat to climate change impacts in Bhutan”	<i>Funded by:</i> World Wildlife Fund for Nature Conservation (WWF)	<i>Project type:</i> capacity building for external stakeholders
	<i>Keywords:</i> Climate extremes; Precipitation; Temperature; Vulnerability; Wildlife	
Project 20: “Quality assessment of Datsi (home-made cottage cheese)”	<i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan	<i>Project type:</i> research
	<i>Keywords:</i> Cheese quality; Fermentation; Local cheese	
Project 21: “Designing competency based curriculum for the college of Natural Resources, RUB, for enhanced food security in Bhutan”	<i>Funded by:</i> NUFFIC, The Netherlands	<i>Project type:</i> capacity building for external stakeholders
	<i>Keywords:</i> Curriculum; Competency; Knowledge; Skills	
Project 22: “Bat diversity assessment in Bhutan”	<i>Funded by:</i> International Foundation for Science (IFS)	<i>Project type:</i> research
	<i>Keywords:</i> Abundance; Bat diversity; Habitat; High altitude	

<p>Project 23: “Entrepreneurship development for college graduates and school leavers for enhanced food and nutrition security in Bhutan”</p>	<p><i>Funded by:</i> NUFFIC, The Netherlands</p> <p><i>Keywords:</i> Agribusiness; Entrepreneurship; Costs and benefits; Bhutan</p>	<p><i>Project type:</i> capacity building for external stakeholders</p>
<p>Project 24: “Determination of <i>Listeria monocytogenes</i> in cheese”</p>	<p><i>Funded by:</i> International Foundation for Science (IFS)</p> <p><i>Keywords:</i> Cheese quality; <i>Listeria sp.</i>; Fermentation</p>	<p><i>Project type:</i> research</p>
<p>Project 25: “Organic farming: feasibility assessment in Bhutan”</p>	<p><i>Funded by:</i> International Foundation for Science (IFS)</p> <p><i>Keywords:</i> Agriculture; Crop farming; Organic farming; People perception</p>	<p><i>Project type:</i> research</p>
<p>Project 26: “Institutional Capacity building of CNR’s staff in the areas of Sustainable Natural Resources Management”</p>	<p><i>Funded by:</i> Thailand International Cooperation (TICA)</p> <p><i>Keywords:</i> Capacity building; Higher education; Research skills</p>	<p><i>Project type:</i> capacity building, education</p>
<p>Project 27: “Farmers’ adoption of clean technologies for cooking in Bhutan”</p>	<p><i>Funded by:</i> South Asian Network for Development and Environmental Economics (SANDEE)</p> <p><i>Keywords:</i> Farmers; Adoption of fuel efficient stoves; Factors; Cost-benefit</p>	<p><i>Project type:</i> research</p>
<p>Project 28: “Transformative Water Management Adaptation”</p>	<p><i>Funded by:</i> USA</p> <p><i>Keywords:</i> Water use; Management; Scarcity; Land use</p>	<p><i>Project type:</i> research</p>
<p>Project 29: “Spring water revival project in relation to climate change impacts”</p>	<p><i>Funded by:</i> Kurita Japan Scholarships, Japan</p> <p><i>Keywords:</i> Water recharge; Mapping; Factors</p>	<p><i>Project type:</i> research</p>

<p>Project 30: “Mapping and assessing the Saralbhanga river basin linking Sarpang, Bhutan, and Saralpara Assam, India”</p>	<p><i>Funded by:</i> International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal</p> <p><i>Keywords:</i> Transboundary river; Water management; Conflicts; Scarcity</p>	<p><i>Project type:</i> research, education</p>
<p>Project 31: “Climate Smart agriculture for capacity building of local farmers in Bhutan”</p>	<p><i>Funded by:</i> Bhutan Trust Fund for Environmental Conservation (BTSEC)</p> <p><i>Keywords:</i> Capacity building; Organic farming; Climate smart farming; Bhutan</p>	<p><i>Project type:</i> capacity building for external stakeholders</p>
<p>Project 32: “Institutional Capacity building of Renewable Natural Resources Staff”</p>	<p><i>Funded by:</i> Erasmus + programme of the European Union</p> <p><i>Keywords:</i> Education; Exchange; Collaboration</p>	<p><i>Project type:</i> capacity building for external stakeholders</p>
<p>Project 33: “Capacity building of staff of Ministry of Agriculture and Forests (MOAF)”</p>	<p><i>Funded by:</i> Ministry of Agriculture and Forests, Bhutan</p> <p><i>Keywords:</i> Education; Training</p>	<p><i>Project type:</i> capacity building</p>
<p>Project 34: “Mapping and Analysis of Phobjikha wetland”</p>	<p><i>Funded by:</i> Royal Society for the protection of Nature, Bhutan</p> <p><i>Keywords:</i> Ramsar site; Invasive species; Crane habitat</p>	<p><i>Project type:</i> research</p>
<p>Project 35: “Chilly Value chain in Sarpang and Tsirang”</p>	<p><i>Funded by:</i> Annual University Research Grant (AURG), Royal University of Bhutan</p> <p><i>Keywords:</i> Chilly; Cost and benefit; Value chain</p>	<p><i>Project type:</i> research</p>
<p>Project 36: “Exploring the invertebrate diversity of Bhutan”</p>	<p><i>Funded by:</i> National Geographic Society</p> <p><i>Keywords:</i> Aquatic habitat; Virgin rivers; Macro-invertebrates</p>	<p><i>Project type:</i> research</p>

Project 37: “Institutional Capacity building of the College of Natural Resources in effective management of Natural Resources”	<i>Funded by:</i> Consulate of Denmark in Thimphu, Bhutan	<i>Project type:</i> research, education, capacity building
	<i>Keywords:</i> Climate change; Education; Food security; Vulnerability	

CURRENT AND RECENT PhD THESES

There are no PhD students working on SUNRAISE-related topics in the institution yet. However, a PhD programme on Climate Studies at the College of Natural Resources has just been approved by the University and the process has already started to recruit some PhDs (September 2021). Thus, it is expected that one or more PhD students will be working on the field soon

RESEARCH AMBITIONS IN RELATION TO SUNRAISE

1.	<p>Becoming a centre of excellence in sustainable natural resources management and sustainable development. This wants to be achieved by:</p> <ul style="list-style-type: none"> - Offering improved higher education programmes that meet the needs of the country - Promoting research, technology and innovation on natural resources management and sustainable development in the country - Developing further research activities on: <ul style="list-style-type: none"> o Climate change o Food and nutrition o Water resources management o Sustainable management of land and forest o Waste management - Serving as a centre for high quality professional and advisory services - Fostering the academic culture infused with the Gross National Happiness values
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ENABLERS AND BARRIERS ENCOUNTERED FOR RESEARCH DEVELOPMENT

Enablers	Barriers
<ul style="list-style-type: none"> ➤ Location of the institution in the eastern Himalaya ➤ National legislation, in particular: The Gross National Happiness Policy 	<ul style="list-style-type: none"> ➤ Shortage of financial resources, due to, in part, the fact that Bhutan is a small country and economy

<ul style="list-style-type: none"> ➤ University policy ➤ Young and enthusiastic staff ➤ Experience in conducting research in agriculture, forests and ecosystem management/ services ➤ Participation in the SUNRAISE project 	<ul style="list-style-type: none"> ➤ Shortage of experience of faculty members in research and securing funding ➤ Absence of time series and high quality data covering a long time span, given the youth of the university ➤ Shortage of equipment
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NATIONAL RESEARCH/ POLICY SUPPORTING RESEARCH DEVELOPMENT

1.	Gross National Happiness (GNH) Policy
2.	Low Carbon Development Policy
3.	Conservation Policy
4.	Climate Change Policy

CAPABILITY IMPROVEMENT TARGETED TO FULFIL THE ASPIRED RESEARCH GOALS

Improvements are desired in:

- Equipment/ software
- Training for academic staff
- Cooperation among disciplines (co-creation)
- Internationalisation of the university through support from external experts and the establishment of long-term mobility programmes with universities in Europe and Russia
- Access to external or international databases

ENABLERS AND BARRIERS ENCOUNTERED FOR RESEARCH TRAINING

Enablers	Barriers
<ul style="list-style-type: none"> ➤ Focus on applied sciences in the training curriculum 	<ul style="list-style-type: none"> ➤ Shortage of financial resources ➤ Shortage of expertise in specific subject areas