Open Call for PhD Fellows
in Climate Change and Natural Resource Management

The **Regional Centre for Sustainable Adaptation to Global Change in the Middle East (SAGE)** invites applications for 16 PhD fellowships within their Graduate School on Climate Change Studies.

SAGE is one of four international Climate Centres funded by the German Academic Exchange Service (DAAD). It is coordinated by the University of Tübingen (Germany) and located at the University of Jordan (Amman) with a second hub at An Najah University (Nablus). The aim of the SAGE Centre is to empower societies in the Middle East to find **science-based solutions** to adaptive and sustainable management of natural resources in an era of global change. Based in the Jordan River region, SAGE will collect, assess and make available data about the current and future situation with regard to regional climate and natural resources. Furthermore, SAGE aims to contribute to **capacity building** and conduct multilateral and **interdisciplinary research** on areas of concern.

One of the **key measures** for achieving these goals is the establishment of a **Graduate School on Climate Change Studies**, delivered by a regional and international consortium of eminent scientists and hosted by the **University of Jordan**. Within this frame, we have designed several **PhD research projects** that address local stakeholder's interests, novel scientific problems and a transdisciplinary perspective that enables the PhD students to **receive an integral training**.

The SAGE PhD fellows will be associated to the University of Jordan and conduct their research in Jordan and/or Palestine, but aim for a double degree with one of several German partner universities. All fellows will be co-supervised by researchers from the study region and Germany.

The Fellowships shall **start between January and March 2022** and run for at least **three years**. An extension may be granted based on clear criteria related to the quality of the work. In addition to the fellowship, SAGE provides funds for the research and the annual stays aboard, as well as skills training within the SAGE Graduate School.

General requirements:

- MSc. degree or equivalent scientific university degree in a project-related field (see individual project descriptions).
- Excellent communication skills in written and spoken English and Arabic.
- High level of creativity, motivation and organization.
- Critical and analytical mindset.
- Experience or keen interest in working within an international and interdisciplinary team.

Application instructions:

A successful application requires the submission of a **motivation letter**, a **complete CV**, a **transcript of records** (Bachelor and Master degrees) and **two letters of reference**. Applications should be submitted to cornelia.claus@uni-tuebingen.de as a **single PDF document** until **20 October 2021**. Please make sure that the letters of reference are sent directly by the reference contact to the address above. Candidates may

apply to up to three different projects, given that their particular qualifications for each project are indicated separately.

We are committed to **diversity and equal opportunity** and therefore encourage female scientists and other underrepresented groups to apply. The positions are also open to candidates that come with their **own funds**. If this is the case, it should be indicated in the motivation letter.

The SAGE Projects

Global change – including climate-, land use-, and socio-economic change – is taking place rapidly and will have serious impacts on the world as a whole. **The Jordan River Basin is a region where climate change impacts on society and the environment are likely to be highly severe**. Thus, efficient mitigation and adaptation to climate change are urgently needed. This requires sound scientific knowledge and mechanisms to translate scientific findings into application. Furthermore, in order to plan effectively, the countries of the region need to **share their knowledge**, and look together at ways in which limited resources can be used most efficiently and fairly under conditions of global change. In order to help achieve these aims, we have established several PhD projects that belong to four research areas: A) Climate and Hydrology, B) Ecology, Biodiversity and Ecosystem function, C) Socio-Economy and Ecosystem Services, and D) Ethics and Governance.

Climate and Hydrology

Project 1: *Water productivity of rangelands under different climate and land use scenarios*

Water availability within the soil is the basis for the functioning of rangeland systems. Yet, it is poorly understood which factors promote and which factors prevent efficient green water use and storage. Therefore, a holistic view on the water balance of rangeland systems is required including all hydrological flux and storage components. This can only be achieved by a combination of on-site measurements (i.e. meteorological variables and soil moisture) and process-based hydrological modelling. With the help of this methodology, we aim to understand the water demand of different rangeland types, identify impacts of climate change and droughts on the water balance of rangelands and study transboundary rangelands and their hydrological characteristics. This project will collaborate with other projects working in tipping points in rangelands (e.g. Projects 6, 7, 8, 11, 12 and 15).

Deliverables: This topic will deliver the physical basis of how much water (i.e. precipitation) is required for sustainable rangeland maintenance and how water fluxes are affected by climate change and rangeland management. With our model, we will finally assess water productivity and persistence of rangelands under different climate scenarios and management options.

Requirements: We expect the candidate to hold an above-average MSc (Master of Science) degree in hydrology, climatology, geo-ecology, agricultural- or environmental sciences / environmental engineering. Proven expertise in hydrological or climatological modelling, statistical data analysis and GIS are an advantage. Knowledge of an advanced programming language (e.g., Matlab/R, Python, Fortran) is an asset. We are seeking for an autonomous researcher with skills of independent and goal-oriented working who is at the same time a team player. Knowledge of the English language (written and oral) is a necessity for working and communicating in an international team.

Project 2: *Agricultural water demand under climate change*

Agricultural water demand will rise due to climate change but the expected amounts are unknown and depend on climatic conditions and cropping systems. Also, water resources are already overexploited, i.e. a rise in demand cannot be met in a sustainable manner. While water demand of specific single crops is known, how various systems (e.g. small-scale *vs*. large scale, traditional *vs*. industrial, low *vs*. large number of crop types). This study will quantify the water demand of different crops and assess the additional water amount required for irrigation. In a first step, the actual situation will be analysed. For this purpose, we will apply a process-based model, which will be calibrated and validated by on-site measurements of meteorological boundary conditions and soil moisture. Crops will be differentiated by crop-specific parameters. This model will be scaled-up from single plots up to entire agricultural regions and will be fed with climatic scenarios in a second step. Overall, this will yield location-specific estimates on agricultural potentials and required water for different crops, now and in future. On the long run, we aim at extrapolating the local scale data to a regional scale where scenarios of e.g. mixed cropping systems can be explored. The economic aspect of such land-use decisions will be addressed by the associated economic studies. This project will collaborate with other projects working in adaptive agriculture under climate change (e.g. Projects 9, 13, 14 and 16).

Deliverables: This topic will produce a spatially explicit overview on naturally available green water amount and additional irrigation demand for different types of crops, now and in future. This is the basis to assess agricultural potentials and improve food security in the region.

Requirements: We expect the candidate to hold an above-average MSc. degree in hydrology, climatology, geo-ecology, agricultural- or environmental sciences / environmental engineering. Proven expertise in hydrological or climatological modelling, statistical data analysis and GIS are an advantage. Knowledge of an advanced programming language (e.g., Matlab/R, Python, Fortran) is an asset. We are seeking for an autonomous researcher with skills of independent and goal-oriented working who is at the same time a team player. Knowledge of the English language (written and oral) is a necessity for working and communicating in an international team.

Project 3: *Droughts: occurrence, prediction, adaptation*

The SAGE-region has experienced a recent multi-year drought that posed challenges for natural ecosystems, agriculture and water supply. This topic aims to study recent and historic drought events in order to understand climatic boundary conditions that lead to the emergence of extreme droughts in the Middle East. Thereby, current extremes will be investigated by statistical tools. Among other things, initial land conditions and teleconnections to oceanic and atmospheric circulation patterns will be analysed and used for drought prediction. Drought events will be characterized by different indices (e.g. SPEI, PDSI) and spatio-temporal patterns of drought severity will be studied to identify most affected areas. Direct and indirect drought impacts (e.g. rangeland desertification, agricultural losses, wildfires, groundwater depletion, etc.) will be related to these patterns, jointly with the topics addressed under the we will work on improved subseasonal to seasonal (S2S) hydrometeorological prediction of droughts. This project will collaborate with other projects working in extreme events and climate change (e.g. Project 4).

Deliverables: This topic will assess areas that are particularly vulnerable to drought and identify changes of drought severity caused by recent and future climatic change. Moreover, most efficient techniques for drought prediction will be determined. This will serve as a basis for an efficient drought adaptation.

Requirements: We expect the candidate to hold an above-average MSc (Master of Science) degree in hydrology, climatology, geo-ecology, agricultural- or environmental sciences / environmental

engineering. Proven expertise in hydrological or climatological modelling, statistical data analysis and GIS are an advantage. Knowledge of an advanced programming language (e.g., Matlab/R, Python, Fortran) is an asset. We are seeking for an autonomous researcher with skills of independent and goal-oriented working who is at the same time a team player. Knowledge of the English language (written and oral) is a necessity for working and communicating in an international team.

Project 4: *Flash floods: processes, regionalization and management*

Flash floods in ephemeral wadis are a natural phenomenon that, on the one hand, cause damage to infrastructure and endanger human life. On the other hand, river floods can partly be stored in reservoirs or used to artificially recharge alluvial aquifers. In the SAGE-region, existing data from river gauging stations is limited and fragmentary, and a systematic regional analysis is still pending. As a first step, this study aims at setting up a database of measured streamflow data. This database will be filled with existing information from universities, governmental organizations and research projects. Regions with missing information will be identified and temporary or permanent runoff gauging stations installed where possible. As a second step, contributing catchments will be characterized in terms of morphology, geology, soil and land use. This analysis will identify areas particularly prone to flash flood generation and produce a regional map of expectable surface runoff. As a third step, spatio-temporal patterns of rainfall during extreme floods will be analysed and used as an input for a process-based rainfall-runoff model. This way, climate change induced changes in rainfall characteristics can directly be translated into realistic predictions of flash flood magnitudes to be expected. This project will collaborate with other projects working in extreme events and climate change (e.g. Project 3).

Deliverables: This topic will produce a systematic multi-national database of measured streamflow records and assess spatio-temporal patterns of flash flood generation, now and in the future. This will serve as a basis for a better flash flood management.

Requirements: We expect the candidate to hold an above-average MSc (Master of Science) degree in hydrology, climatology, geo-ecology, agricultural- or environmental sciences / environmental engineering. Proven expertise in hydrological or climatological modelling, statistical data analysis and GIS are an advantage. Knowledge of an advanced programming language (e.g., Matlab/R, Python, Fortran) is an asset. We are seeking for an autonomous researcher with skills of independent and goal-oriented working who is at the same time a team player. Knowledge of the English language (written and oral) is a necessity for working and communicating in an international team.

Project 5: *Non-conventional urban water resources, water use and demand*

Accelerated by flows of refugees, urbanization is tremendous in the SAGE-region and more and more urban areas suffer from temporal water shortages. This topic evaluates the potential of non-conventional urban water resources and proposes avenues for more sustainable urban water use. Rainwater harvesting has been practised for millennia in the region and facilities exist up to the present day. However, potentials are rarely fully exploited, maintenance is often inadequate and official regulations as well as personal restraints prevent an efficient use of the harvested water. This topic aims at identifying existing potentials for urban roof rainwater harvesting and studies most efficient ways of water storage including optimized cistern capacities and materials. Here, also historic information (e.g. from the Nabateans) will be used. The possible volumes of harvested water will be calculated by a parsimonious hydrological model that uses rainfall intensity and roof layout as input. As such, also climatic change effects can be simulated. A special focus will be put on water quality aspects, both during water harvest and storage. For this

purpose, regular sampling for major ions, heavy metals and microorganisms will be conducted. Water quality also dictates possible types of water use, ranging from drinking water up to garden irrigation. Questionnaire surveys will determine, how much water is really needed and how much of this demand can be satisfied by roof rainwater harvesting. This project will collaborate with other projects working in sustainable urban water and land surface management (e.g. Projects 10, 18, 19).

Deliverables: This topic will assess and maximise existing and future potentials for rainwater harvesting from urban roofs. Appropriate types of urban water use will be outlined based on water quality aspects. Finally, the existing water demand and willingness to use non-conventional water resources for different types of uses will be determined.

Requirements: We expect the candidate to hold an above-average MSc (Master of Science) degree in hydrology, climatology, geo-ecology, agricultural- or environmental sciences / environmental engineering. Proven expertise in hydrological or climatological modelling, statistical data analysis and GIS are an advantage. Knowledge of an advanced programming language (e.g., Matlab/R, Python, Fortran) is an asset. We are seeking for an autonomous researcher with skills of independent and goal-oriented working who is at the same time a team player. Knowledge of the English language (written and oral) is a necessity for working and communicating in an international team.

Ecology, Biodiversity, and Ecosystem function

***Project 6**: Developing indicators for tipping points of rangelands in the Jordan River region under climate and land use change*

Pre-emptive management requires that we have indicators for the functioning of rangelands that tell us whether a system is irreversibly degraded, whether it is in a 'healthy' state, or whether it is approaching a tipping point. In the latter case, we may still adopt the current management to a sustainable one. We believe that the combination of more extreme droughts and concurrent grazing regime may drive the system across a tipping point, where feed quantity and quality, soil and biodiversity is lost and cannot be restored. However, we do not know what are the thresholds of drought severity and grazing regime that may cause an irreversible regime shift. Here, we propose to use a region-wide experimental platform where rainfall and grazing regimes will be manipulated and the response of the ecosystem observed. Specifically, we will look at many aspects of productivity, feed quality, biodiversity (soil biota, plants, animals), and soil properties, and determine whether some of these characteristics may serve as indicators for a looming crash in rangeland functioning. This project will collaborate with other projects working in tipping points in rangelands (e.g. Projects 1, 7, 8, 11, 12 and 15). This PhD theme will ideally be addressed by two PhD students, one in Jordan, and one in Palestine.

Deliverables: This theme will deliver indicators related to soil, hydrology (jointly with Project 1), biodiversity, and ecosystem function that serve as early warning system for stakeholders to inform them about possible tipping points. Furthermore, we will develop management recommendations for a safe operating space of rangeland utilization in an era of climate change. These will be linked to the evaluation of ecosystem services (see Project 9).

Requirements: The students should possess a MSc. degree in ecology or related field, ability and willingness to work in teams, spend extended periods in the field, excellent knowledge of statistics and experimental design, as well as good knowledge of Middle Eastern flora and fauna. Fluency in English and Arabic is necessary.

Project 7: *Models for functioning and biodiversity of open space (especially rangelands) under climate and land use change*

Much is known from local-scale studies about how specific management regimes and local climate affect the functioning of rangelands. However, to which extent this knowledge can be generalized and applied to other locations is virtually unknown. Also, management goals differ largely across stakeholders, e.g. among herders, conservation people, or visitors to a landscape. Therefore, it would be desirable to have a tool that can identify the core relationships between climate, land use, and the benefits of rangelands delivered to different stakeholders. Here, we propose to utilize the existing knowledge as well as data obtained in the proposed field studies (Project 6) to parameterize models of (semi-)natural ecosystems. These models shall be developed in a manner that input variables can be flexibly controlled by an end-user, such that the result of a particular management strategy can be simulated. This project will collaborate with other projects working in tipping points in rangelands (e.g. Projects 1, 6, 8, 11, 12 and 15).

Deliverables: This theme shall develop a user-friendly decision-support tool that is based on sound scientific knowledge about climate-land use-biodiversity/ecosystem function relationships. On the long run, this shall be coupled to the economic assessments, as well as to the governance issues, such that feasibility of interventions as well as economic benefits can be simulated.

Requirements: The student should possess a MSc. degree in ecology or related field, ability and willingness to work in teams, and proven modelling skills. A good knowledge of Middle Eastern ecosystems is necessary.

Project 8: *Restoration of degraded rangelands by means of long-lived seed banks*

Rangelands in the region have been under grazing since millennia, and plants and animals have adapted to this long-term grazing pressure. A key adaptation of plants to such frequent disturbances are so-called dormant seeds, which can persist in a seed bank for many years and decades. These seed banks enable a plant population to persist in a given area even if there are incidents of overgrazing or extreme drought. Seed banks are also key to the resilience of rangelands to extreme events, because they can survive in the seed bank and then germinate ion times when rainfall is more plentiful or grazing pressure low. Therefore, grazing may be the best adapted agricultural practice under the current climate crisis. However, with increasing incidents of drought and especially with overgrazing, which leads to erosion of soil and the seeds within the soil, this high resilience potential of rangelands may be lost. Vice-versa, the addition of seeds to areas where rangelands are degraded, may serve as a possible restoration practice. Unfortunately, the specific manner by which such a practice can succeed, and the costs and benefits are unknown. Here, we propose to fill this knowledge gap by initiating detailed seed bank studies that characterize degraded *vs*. intact rangelands and that test various means of seed bank addition practices in the field. These experiments will be closely coordinated with local stakeholders to test feasibility and acceptance of such measures. This project will collaborate with other projects working in tipping points in rangelands (e.g. Projects 1, 6, 7, 11, 12 and 15).

Deliverables: Practical recommendations for restoration of degraded rangeland.

Requirements: The student should possess a MSc. degree in ecology or related field, ability and willingness to work in teams, spend extended periods in the field, excellent knowledge of statistics and experimental design, as well as good knowledge of Middle Eastern flora and fauna.

***Project 9**: Agriculture-nature interactions*

Many crops rely on a variety of services that are delivered by ecosystems, such as soil fertility, water retention, or pollination services. At the same time, current intensive agricultural practices have been identified as the main reason for the deterioration of ecosystem services by polluting and eroding soil and by having detrimental effects on (insect) biodiversity due to the use of pesticides and the loss of habitat. Many studies exist in Europe that have looked at the reciprocal interactions between agriculture and 'nature', and agro-environmental schemes have been developed that are partly subsidized by EU regulations. Some of such schemes are adopted in the region by so-called 'ecological farming', but there is no systematic assessment about the efficiency of particular measures for protecting ecosystem services and biodiversity. Furthermore, 'biological products' such as generated in traditional agriculture may have difficulties in marketing which differ among regions and consumers. Here, we aim at an integrated assessment of the effect of various agricultural practices on ecosystem functioning with a focus on pollination services, soil erosion, and biodiversity. These practices include large-scale vs. small-scale farming practices, traditional vs. intensive, and irrigated vs. rainfed agriculture. Additionally, we will implement experiments to test classical agro-environmental schemes (e.g. flower strips, intercropping, biological pest control) for their efficiency in enhancing yield and biodiversity simultaneously. This project will collaborate with other projects working in adaptive agriculture under climate change (e.g. 2, 13, 14 and 16).

Deliverables: In combination with the economic assessments, this topic will deliver costs and benefits of different agricultural practices as well as agro-environmental schemes.

Requirements: The student will possess a MSc. degree in ecology, agronomy, environmental sciences or related field. The applicant should have experience in ecosystem functioning research, excellent knowledge of statistics and experimental design, the ability and willingness to work in teams, spend extended periods in the field, as well as good knowledge of Middle Eastern flora and fauna. Fluency in English and Arabic is necessary.

***Project 10:** Urban green space management under climate change*

Urban green space such as parks, private gardens, or rooftop green, play an important role in a changing climate. On the one hand, they represent the only place where city-dwellers encounter nature and where some level of biodiversity is maintained. Another important aspect related to climate change is that urban green improves the microclimate and buffers extreme heat waves. Unfortunately, much urban green is a large consumer of water because many private gardens and public parks depend on irrigation, especially in summer when water is scarce. This topic addresses, in an interdisciplinary manner, the 'quality' of urban green space from several different perspectives. These quality aspects will be assessed in cities/towns of different structure (size, social structure) in terms of a) biodiversity, b) cultural ecosystem services (e.g. perception by inhabitants), c) provisioning services (e.g. cooling, water retention), and d) water demand. This assessment will enable to do a cost-benefit analysis that goes way beyond a simple economic assessment and includes several aspects of human well-being. This project will collaborate with other projects working in sustainable urban water and land surface management (e.g. Projects 5, 18, 19).

Deliverables: This topic will can provide recommendations for the management of urban green space for maximizing the benefits for people.

Requirements: The student will possess a MSc. degree in ecology, agronomy, environmental sciences or related field. The applicant should have experience in ecosystem services research, excellent knowledge of statistics and experimental design, the ability and willingness to work in teams, spend extended periods

in the field, as well as good knowledge of Middle Eastern flora and fauna. Fluency in English and Arabic is necessary.

Socio-Economy and Ecosystem Services

***Project 11**: Economic valuation of rangeland-based ecosystem services*

An assessment of the value of ecosystem services (ESS) provided by rangelands or, vice versa, an assessment of the forgone benefits (costs of policy inaction) if ecosystems are degraded, can help policy-makers to implement a sustainable management, i.e. a management suitable to avoid reaching tipping points. Therefore, the objective of this PhD-project will be to estimate the economic value of (selected) ESS provided by rangelands in the Jordan River Region, focussing on often non-market values, such as water retention and the provision of recreational space. Different rangeland management options affecting the provision of these ESS will be compared in terms of costs in maintaining them versus their benefits. Also, the willingness of the population to contribute to preserving rangelands will be estimated. This project will collaborate with other projects working in tipping points in rangelands (e.g. Projects 1, 6, 7, 8, 12 and 15).

Deliverables: This project will deliver an assessment on the potential economic costs of rangeland degradation. It will valorise the different rangeland management options in order to provide a better basis for political decision making with respect to rangeland management.

Requirements: A MSc. in general economics, agricultural economics, environmental economics or a related field. Excellent knowledge of statistics and experience in applying cost-benefit analysis and stated-preference methods such as choice experiments are an advantage. Good knowledge of Middle Eastern communities.

***Project 12**: Economy-wide modelling of rangeland related ecosystem services*

In order to comprehensively evaluate different rangeland management and policy options, all direct and indirect effects need to be considered. Economy wide simulation models are a well-established tool in policy analysis, as they depict the linkages between all economic agents and sectors within an economy and thus, also capture indirect effects of policy changes or exogenous shocks, e.g. resulting from climate change. So far, ecosystem services (ESS) have been rarely analyzed in an economy-wide context. The collaboration with the other PhD-projects under this research-theme will make it possible to integrate empirical data on the multifold rangeland-related ESS, including relationships affecting productivity and economic valuation of ESS, as well as factors influencing households' perception towards ESS. This project will collaborate with other projects working in tipping points in rangelands (e.g. Projects 1, 6, 7, 8, 11 and 15).

Deliverables: This PhD-project will develop a comprehensive economy-wide model enhanced with multiple rangeland-related ESS, considering relationships between different land tenure and management systems, changes in biodiversity and their effects on land productivity and groundwater recharge. The model will be useful for the analysis of the economy-wide costs of crossing tipping points with respect to rangeland management on a national level, but also can be used to analyze different policy options for a more sustainable rangeland management.

Requirements: A MSc. in economics or a related field. Experience in using quantitative economic methods, simulation modelling and/or the programming language GAMS would be an asset.

Project 13: *Economic evaluation of water and land management options in agriculture under climate change*

Climate change will lead to more frequent and intense droughts, which will have a severe impact on agriculture in the Middle East. As a consequence, there is a need to consider different alternative water management options to deal with increasing water scarcity. The proposed PhD-project will carry out a cost-benefit analysis of the different options, taking into account the private costs and benefits of farmers, but also the costs and benefits for society at large. One part of the cost-benefit analysis will be an assessment of farmers' willingness-to-pay for different water management alternatives including different water qualities. The PhD-project is suitable for an assessment of the situation in one country in the Middle East and, potentially, in different countries to allow for cross-country comparisons. This project will collaborate with other projects working in adaptive agriculture under climate change (e.g. Projects 2, 9, 14 and 16).

Deliverables: This PhD-project will provide an analysis of the economic feasibility of different water management options including different water qualities (fresh water, brackish groundwater, reclaimed wastewater, mixed water).

Requirements: A MSc. in general economics, agricultural economics, environmental economics or a related field. Excellent knowledge of statistics and experience in applying cost-benefit analysis and stated-preference methods such as choice experiments are an advantage.

Project 14*: Economy-wide analysis of climate change adaptation measures in crop production*

To get more sustainable under climate change, crop production in the Jordan River Region needs to become less dependent irrigation using fresh water. This can be achieved either by switching to less water intensive cropping systems (e.g. production of less water demanding crops, use of adapted varieties), by using alternative water sources for irrigation (e.g. brackish groundwater, reclaimed wastewater) or by substituting domestic crop production by imports. All these adaptation strategies have diverse implications for the profitability of farming and beyond the agricultural sector (e.g. on food security, trade-balance, employment, household welfare). This project aims at analysing these effects using an economy-wide simulation model. The model will focus on the water sector and crop production but will also capture other economic sectors, factor markets, households and the government. This will allow for an analysis of welfare implications and policy measures to promote an adaptation of the cropping system. This project will collaborate with other projects working in adaptive agriculture under climate change (e.g. Projects 2, 9, 13 and 16).

Deliverables: Policy makers can make use of the simulation model developed in this project to analyse and compare the economy wide implications of changes in the cropping system. It can also be used to estimate the economic losses due to climate change. Finally, the model can be used to analyse a wide range of policy measures intended to directly or indirectly provoke a more water efficient and sustainable crop production, such as adjustments in the water pricing or trade policy.

Requirements: A MSc. in economics or a related field. Experience in using quantitative economic methods, simulation modelling and/or the programming language GAMS would be an asset.

Governance and Ethics

***Project 15**: Social drivers of tipping points in rangelands*

This project will aim to provide a systematic account of the social drivers of environmental and/or social tipping points in rangeland degradation and of related ethical attitudes from a transboundary perspective. The overarching question is how socio-political factors and ethical values, human well-being and ecosystem functions are related, with a particular focus on conflict and cooperation. More specifically, the project will ask how human values, attitudes and behaviors interact with (de)escalation dynamics and (de)securitization processes in changing eco-systems (i.e. rangeland degradation), and how changes in environmental regimes are linked to socio-political and/or ethnic conflicts and social survival. The PhD will use qualitative methods (interviews, focus groups, observation, ethical analysis) and include stakeholders directly as participants. This project will collaborate with other projects working in tipping points in rangelands (e.g. Projects 1, 6, 7, 8, 11 and 12).

Deliverables: In particular, the project will provide answers to the following questions: 1) Which ethical-normative stances (normative reasons, values, conceptions of justice, religious attitudes, etc.) of local stakeholders are in place, and which ones possibly are in conflict with each other, when it comes to (a stronger) protection and pre-emptive threshold-based management of rangelands in the region, that includes three socially and culturally different entities (Jordan, Palestine)? 2) In what way are normative stances of stakeholders impacted by the perceived closeness or distance of a critical tipping point, and *vice-versa*, how do the normative stances of the regional stakeholders influence what counts as a tipping point, and where are critical threshold values?

Requirements: Two PhD students will work on this project, one from philosophy/ethics and one from political or social science. The students should possess a Master degree and proved experience in these science fields.

***Project 16**: Perceptions of risks and vulnerabilities*

Agriculture is the most vulnerable sector regarding climate change and increasing incidents of droughts and possibly also extreme flooding/erosion events. Individuals, communities and governmental institutions develop and apply a variety of responses to such events; some are adaptation oriented, while others are more focused on mitigation. In both cases, responses depend on how risk is perceived and what shapes this perception. At the heart of this PhD project is the question of what constitutes a disaster in agriculture. How has this definition changed over time, which actors and which underlying variables have shaped this definition? This PhD will explore these questions in three intersecting dimensions. The first one will explore perceptions of risks among communities under different climatic, political and economic scenarios. The second dimension will explore how institutions construct a disaster definition and their subsequent policies. The third dimension includes examining the impact of such policies on the wellbeing of individuals and on the strategic responses of individuals to these so-called "disasters". This study will explore several themes for which the "disasters" definition matters, including issues of crop insurance and earthquakes. Data sets could be built from legislative documents, contracts, interviews (with farmers). This project will collaborate with other projects working in adaptive agriculture under climate change (e.g. Projects 2, 9, 13 and 14).

Deliverables: The study will provide a comparative perspective of the social construction of "disasters" between topics, between regions, between states, and over time.

Requirements: The PhD candidate will have a Master degree and strong background in communication studies, ethics, political science, resource economics or legal studies.

Project 17: *Diffusion of innovative technology in times of climate change*

Rooftop solar energy is already a major source for sustainable energy and water supply in the region where electric supply is not reliable. This is also an enabler for other uses, e.g. water availability through solar pumps. It is also discussed in the literature as a game changer in the power relations between the state and the individual, as a consumer can become a producer. Yet, while in some places the photovoltaic (PV) revolution has kicked in strongly (exceeding expectations), in other places it is still underdeveloped. The goal of this project is to: A) Explore the extent of the PV revolution in several cities and regions in the Middle east. This will require both a remote sensing approach and a door to door survey among households. It will allow to assess the diffusion of this technology in time and space; B) Explore what shapes the rate and nature of diffusion among households. Among the variables to be explored are levels of income, alternative energy sources (e.g. the availability of diesel generators), problems of collective action (as rooftops are shared among tenants), land use competition, and finally incentives given by the community, the state and the donor community. This stage requires both a remote sensing approach and more importantly a door to door survey among users. C) Explore the impact of this revolution on community welfare, including economic welfare. It will also explore how it creates and overcomes inequalities between areas, as not all households have the same opportunity to adopt this technology. This project will collaborate with other projects working in climate change and urban management.

Deliverables: The study will provide an analysis of the state, perspectives, and challenges of the PV revolution in the area in an interdisciplinary perspective.

Requirements: The PhD candidate requires to prove technical skills, including in remote sensing and GIS. The candidate will have good statistical background and willingness to work with communities in door-to-door survey.

Project 18: *The use, abuse and misuse of intangibles in contested water projects*

Beyond being a material resource of multiple functions (drinking water, irrigation, etc.), water also relates to so-called intangibles. Intangibles are benefits and costs that are more subjective and not quantifiable, but often hinder effective and sustainable adaptation to a changing environment. One prominent example is when mega projects like dams or water canals are presented as a “contribution to the Peace Dividend” or to "national identity", while local-scale adaptive measures and cooperation, which have been shown to be crucial for sustainable resource management and the avoidance of tipping points, do not receive the same attention and often remain invisible and underfunded. The aim of this project is to examine if, when and how intangibles are instrumentalized for overcoming opposition to contested water projects in a context of a rapidly changing climate. To this end, this PhD topic will explore questions like how intangibles are communicated and framed; which kinds of underlying values – and value conflicts – are embedded in these narratives? Methodologically, this study could build on media analysis or analyse planning and building protocols. This project will collaborate with other projects working in sustainable urban water and land surface management (e.g. Projects 5, 10, 19).

Deliverables: This PhD topic shall provide an in-depth analysis of intangibles in water conflicts and have a comparative angle of contrasting how the use of intangibles changes over time and between water-related projects.

Requirements: The PhD candidate will have a Master degree and attested background in communication studies, ethics, political science or linguistics.

Project 19*: The social construction of water demand and supply: the underlying normative and strategic use*

What constitutes sustainable water demand and supply is essential for infrastructure planning and pricing, especially under conditions of climate change. Moreover, it is crucial for understanding conflict dynamics in a region suffering from severe water scarcity. Yet, what is sufficient and sustainable may differ across individuals, institutions, and governments. This extremely contested topic needs some careful ethical and political exploration. The PhD will be taking critical stock of demand and supply and will explore how both are narrated and framed by whom, for what purpose, when, and in which ventures. How does this frame affect decision-making? The PhD candidate will explore these questions in three intersecting dimensions: The first one will survey perceptions of demand and supply among communities in Jordan and Palestine and under different climatic, political and economic scenarios from a comparative angle. How are these consumption patterns justified under different principles of sufficiency, and which conflicts arise from them? The second dimension will explore how institutions in different states construct water scarcity or water abundance and for what purpose. This dimension includes a discursive angle of media analysis supported by personal interviews. The third dimension includes capturing how this strategic use of demand and supply shapes decision making. This project will collaborate with other projects working in sustainable urban water and land surface management (e.g. Projects 5, 10, 18).

Deliverables: The study will provide a critical, institutionally focused analysis of how (the discourse on) water demand and supply is socially constructed and strategically governed by whom, when and why, to better understand conflict escalation and de-escalation dynamics in the region.

Requirements: The PhD candidate will have a Master degree and strong background in communication studies, ethics, political science or linguistics, should ideally be familiar with forecasting approaches, and should be open to studying all entities in the Jordan basin.