



## Workshop 3.1: Climate change: Agriculture, food security and human health

Convenors: Samsul Huda, Mel Taylor and Jo Luck

### Contribution of tillage practices on adaptation to climate change and variability on agricultural productions in semi-arid areas of central Tanzania

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and Amos E. Majule

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Unpredictability of onset rainfall and an increase in the mean temperature have affected the growth and crop yields. The consequences have been observed in reduced access to water resources, increase of diseases, frequency of food shortage and declining in soil moisture levels over much of semiarid area due to the prevailing dry conditions. Further decrease in soil moisture has favoured drying up of field crops that were at harvesting maturity. The use of proper tillage practices yield a positive effect on rain water harvest, improve soil moisture, soil fertility, crop production and adaptations capacity to drought and food insecurity in semi-arid areas

### Effects of temperature rising on soil hydrothermal properties, winter wheat growth and yield

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Chinese Academy of Sciences, China

The objective of this study is to analyse the effects of elevated temperature on soil hydrothermal properties during growth season of winter wheat and winter wheat growth and yield. The infrared radiators were used in field to rise temperature by 2-3°C. The results showed that the temperature of soil profile was increased in 0-40 cm and the difference was larger in night than in daytime. The elevated temperature changed water distribution and storage in soil profile. Warming accelerated winter wheat growth, shortened the growth season by about 10 days and reduced winter wheat yields by 25%.

### Food security and climate change in the Asia-Pacific region: Evaluating mismatch between crop development and water availability

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and X. Mei

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This paper illustrates an understanding of how the impact of climate shifts on key crops will enable the Asia-Pacific farmers, community workers and policy agencies to better prepare and adapt to climate change, through changes to existing policy and practices e.g. timing of planting, use of new varieties, changes to disease management protocols, alternate plantings and shift in geographic distribution of crops. Phenological development is the single most important attribute of crop adaptation to shifting climates. Our research combines a) new analysis of realized changes, and b) use existing and well accepted estimates from published work on future climates.

### Climate change mitigation via peatland management – Challenges for rural areas

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and Jochen Kantelhardt

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Our study introduces the prospects of climate change mitigation via adapted peatland management. On peatland sites, intensive agricultural use causes high trace-gas emissions. Less intensive management strategies are recommended. We analyse which factors influence changes of management, what microeconomic consequences affected farms will have to suffer and what influence social networks have on implementation. To approach our questions, stakeholder workshops, network analysis and farm surveys were carried out in representative German peatland regions. Results show that besides agriculture, management changes involve manifold fields of interest. Potentials of rearrangement are regionally variable and require implementation measures that are adapted to local conditions.



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#### **Effect of exposure to heat stress conditions on milk yield and quality of dairy cows grazing on Alpine pasture**

Manuela Renna, Carola Lussiana,  
Vanda Malfatto, Antonio Mimosi,  
and Luca Maria Battaglini

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Milk yield and composition of 14 Aosta Red Pied (ARP) and 14 Aosta Black Pied-Aosta Chestnut (ABP-AC) cows were investigated during the grazing seasons of the years 2003 (heat stress) and 2004 (thermoneutral conditions). In 2003 ARP suffered a significant drop in milk yield ( $P < 0.01$ ), and fat and protein yields ( $P < 0.01$ ). ABP-AC were able to maintain similar values of the above-mentioned parameters between years. In 2003 milk from both ARP and ABP-AC cows showed a healthier fatty acid (FA) composition (lower hypercholesterolemic saturated FA as well as higher mono- and polyunsaturated FA) with respect to 2004 ( $P < 0.001$ ).

#### **Greenhouse gas emissions of regionally produced alternative feedstuffs rich in protein for Austrian dairy production**

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and Werner Zollitsch

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The aim of this study was to analyse in a complete life-cycle chain the potential greenhouse gas emissions (GHGE) of regionally produced, alternative protein-rich feedstuffs and mixtures thereof. These can be utilised in dairy cattle feeding as a substitute to extracted soybean meal. In addition to GHGE from soil, from the production of mineral fertilizers and pesticides, industrial processes (oil milling, distillery, drying plant) and use of fuels, the effects of land use change were included in the estimation of GHGE. In conclusion, the utilisation of regionally produced alternative protein-rich feedstuffs shows clear advantages in terms of GHGE.

#### **Climate change: Building leadership capacity within a higher education institution**

A.K.S. Huda, J. Allen, C. Sinclair,  
T. Andrews, A. Lopes, F. Duarte,  
H. Bambrick, D. Craig, M. Jeffery,  
and S. Campbell

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This paper illustrates strategies that a team of interdisciplinary researchers at the University of Western Sydney (UWS) is currently undertaking as an illuminator case study in developing a university-wide approach to rapidly building capacity to proactively respond to climate change to address issues including the impact of climate change and climate variability on agriculture, food security and population health in the Greater Western Sydney (GWS) region. The process of our collaboration is informed by a large number of committed academics working on climate change through research and curricula development in a wide range of fields at UWS and other institutions.

#### **Wine production under climate change conditions: Mitigation and adaptation options from the vineyard to the sales booth**

Gerhard Soja, Franz Zehetner,  
Gorana Rampazzo-Todorovic,  
Barbara Schildberger, Konrad Hackl,  
Rudolf Hofmann, Eva Burger,  
and Ines Omann

Austrian Institute of Technology (AIT), Austria

Representative wine-growing farms in the Traisen valley of Eastern Austria were studied for their greenhouse gas emissions during production and processing of grapes and subsequent wine storage and marketing. Trend analyses of meteorological parameters and soil water relations during the past 38 years revealed increasing temperatures, constant seasonal crop evapotranspiration and decreasing soil water deficits. The main objective of the study was the identification of the most promising mitigation and adaptation measures to climate change. Reductions of soil tillage and shifts in wine packaging materials are the most promising measures to reduce greenhouse gas emissions along the wine production chain.



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### An integrative approach to understanding the pest and disease threats to agricultural biosecurity under future climates

Jo Luck, K. Finlay, J.-P. Aurambout, S. Chakraborty, D. Kriticos, H. Parry, W. Griffiths, G. O'Leary, A. Freeman, G. Hollaway, P. Trebicki, K. Powell, G. Fitzgerald, and P. De Barro

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Despite increasing knowledge of the predicted impacts of climate change to agriculture, the risks to crop biosecurity remain uncertain. In this study, models have been developed to predict the response of crop diseases to our changing climate. A spatial model has been developed using the aphid vector (*Rhopalosiphum padi*) and Barley yellow dwarf virus. In addition, field-based investigations of the effects of elevated CO<sub>2</sub> on wheat pathogens, *Puccinia striiformis* and *Fusarium pseudograminearum* was assessed under ambient and 550ppm CO<sub>2</sub>. Our integrated modeling and field based approach to resolving the likely effects of climate change to plant biosecurity will be presented.

### Community watersheds for food security and coping with impacts of climate change

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Community-based watershed management can become growth engine for sustainable development and building resilience against climate change in dryland tropics in Asia. This approach espouses the principle of collective action, convergence, cooperation and capacity building to address the issues of equity, efficiency, environment and economic gain. Efficient harvesting and use of rainwater enabled community to grow high-value crops. Microenterprises provided additional income to women and vulnerable groups. Increased agricultural productivity by two to three folds, doubling of income, reduced runoff and soil loss by 66% were recorded at benchmark sites in India, China, Vietnam and Thailand.

### How can sustainable agricultural systems promote food security in changing climate?

John Sumelius, Stefan Bäckman, Helena Kahiluoto, Reimund Rötter, Newton Nyairo, Joni Valkila, Tuulikki Parviainen, K.M. Zahidul Islam, Md. Motaher Hossain, Shimelles Tenaw and Rose Ingutia

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A theoretical framework of the link between climate change, rural development, sustainable agriculture, poverty, and food security is presented. Climate change is affecting food security, poverty, environmental sustainability and agricultural productivity. Mitigation and adaption offers strategies to handle consequences of climate change. Policies, financing possibilities, property rights and markets are in turn important instruments that affect climate change and adaptation and mitigation. Necessary conditions for successful adaptation include secured property rights to land, institutions that make market access possible and credit possibilities. The options of mitigation and enhanced adaptive capacity and the requirements for their implementation are discussed.