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Agriculture of the Future: New Bioeconomic Possibilities Due to Digitalisation

Bioeconomy is the knowledge-based production and use of biological resources to provide products, processes and services in all economic sectors within the frame of a sustainable economic system (Definition of the Bioeconomy Council). Agriculture is an important component of bioeconomy and to shape it more sustainable considering the agroecological complexity is the highest challenge we face. Agricultural landscape does not only produce food, feed, fibre and fuel, but it produces clean air, clean water and biodiversity. The advantage of those ecological functions are called “ecosystem services (ESS) ” and are becoming more and more important to maintain and improve (Wolters et al. 2014). The multiplicity of purposes increases pressure on agricultural lands and can potentially give rise to conflicts between the profitability of farming and the provision of biodiversity and ESS such as erosion control, climate regulation, or recreation. Obtaining spatially and functionally diversified agricultural systems can consolidate diverse targets within agricultural landscapes (Hertel et al.2021).

Spatially diversified systems must take into account the landscape specifications and soil-climatic conditions of agricultural lands. The ESS highly varies according to time and space and the same management practices in agriculture can benefit or damage the ESS at different place and timing. Site-specific information is necessary to make wise decision what to do, which is in reality hard to obtain. Sometimes, small scale variation of land use can make high benefit for ESS and biodiversity (Oppermann et al. 2018), however the implementation of small site specific management differences is laborious and not realistic.

For such complex systems to be sustainable from both an environmental and a socio-economic perspective, opportunities offered by digital technologies need to be harnessed in a holistic and harmonized manner, encompassing farm economics, societal demands, and potentials for the provision of ecosystem services and biodiversity. The utilisation of digital smart technologies, such as sensors, artificial intelligence, and online communication platforms, offers new ways towards monitoring and adapting to the status of, and demands from, agricultural lands (Ingram and Maye 2020).

In the project “Digital Agricultural Knowledge and Information System (DAKIS)” offers a digital knowledge-based tool to provide famers with recommendations on how to design their cropping systems to optimize their incomes and improve the sustainability of agricultural landscapes (https://adz-dakis.com/). With the help of digital technologies, it enables site-adapted small-scale agriculture, where plants are grown where optimal conditions prevail and resources are being used only where and when they are needed. At the same time, it indicates

to its users where ecosystem services are demanded and can be specifically promoted. (Ses also DIE BIOPIONIERE | Sonoko Bellingrath-Kimura: https://youtu.be/BaUxl62Upi8)

References:

Bioeconomy Council: https://www.biooekonomierat.de/en/
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Wolters V. et al. (2014) Journal f. Kulturpflanzen. 66, 225–236, DOI: 10.5073/JFK.2014.07.01

CV

(Geb 25.8.1976, Nagoya)

Working Carrier

05/2018 up to now W3 Professor for “Land Use Systems” Humboldt University Berlin, Germany

01/2018 up to now Co-Head of Research Area 2, Land Use and Governance,
Leibniz Centre for Agricultural Landscape Research (ZALF), Germany

09/2015 to 04/2018 W2 Professor for “Land Use Systems”
Humboldt University Berlin, Germany

04/2015 to 12/2017 Institute head, Institute of Land Use Systems
Leibniz Centre for Agricultural Landscape Research (ZALF), Germany

10/2014 to 03/2015 Visiting Professor
Institute of Plant Nutrition, Technical University Munich, Germany

04/2009 to 03/2015 Associate Professor (Tenure, achieved at half time)
Tokyo University of Agriculture and Technology, Japan
Graduate School of Agriculture,
Department of International Environmental and Agricultural Science

10/2006 to 03/2009 Associate Professor (Tenure Track)
Tokyo University of Agriculture and Technology, Japan
Graduate School of Agriculture,
Department of International Environmental and Agricultural Science

10/2004 to 09/2006 Assistant Professor
Tokyo University of Agriculture and Technology, Japan
Graduate School of Bio-Applications and Systems Engineering

Degrees 03/2005 Ph.D. Hokkaido University, Japan (Soil Science)
03/2002 M.Sc. Hokkaido University, Japan (Crop Science and Plant Nutrition)

03/2000 B.Sc. Hokkaido University, Japan (Crop Science and Plant Nutrition)

Awards (selected)
- “JaDe Preis 2022” (02/2022) https://www.jadestiftung.org/jade-preis/2022
- Young Scientist award, by the Japanese Society of Soil Science and Plant Nutrition (04/ 2009) „Eco-balance model to optimize the nitrogen cycle in regional scale“

Committee Member (Selected)

- Member of commission for soil protection at the German Environment Agency (KBU) (2021-2023)
- Associate Editor of CABI Agriculture and Bioscience (2020-)
- Vice Chair of Commission 4.3– Soils and land use change International Union of Soil Science (2018-2022)
- Board member of German Society of Agronomy (since 2017-)