Tagungsbeitrag zu:
Jahrestagung der DBG
Kom. IV / V164
Titel der Tagung: Horizonte des Bodens

Veranstalter: DBG, September 2017, Göttingen
Berichte der DBG (nicht begutachtete online Publikation)
http://www.dbges.de

Von J. v. Liebig bis E. A. Mitscherlich. Die Grundlage ressourceneffizienter Pflanzenernährung

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ZUSAMMENFASSUNG/ SUMMARY

We share the visions of the originator of the modern soil science VV Dokuchaev and the great innovators of agrochemistry J v. Liebig, EA Mitscherlich, DN Pryanishnikov, UU Uspanov and others. Their visions were to eliminate hunger and poverty of the population by stable crop yields based on innovative site-adapted soil management and farming.

SCHLÜSSELWORTE/ Keywords: Land, soil, water, ecosystems, sustainability, research cooperation, monitoring, methods, soil quality, crop yield

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EINLEITUNG/ INTRODUCTION

The paper aims to initiate a sustainable use of soils in Eurasia by the application and transfer of novel scientific methods. We share the visions of the originator of the modern soil science **VV Dokuchaev and the great innovators of agrochemistry J v. Liebig, EA Mitscherlich, DN Pryanishnikov, UU Uspanov** and others. Their visions were to eliminate hunger and poverty of the population by stable crop yields based on innovative site-adapted soil management and farming.

In the post-war period of the 20th century great progress in science and agricultural practice enabled to make these visions reality in Europe and in the whole Soviet Union. Crop yields increased and hunger was eliminated. However, some progress achieved was on costs of sustainability. Soil degradation and loss of biodiversity became significant. In the 21st century the global struggle for resources, land and water included, and men-made climate change have created new threats for soils, ecosystems and inhabitants of rural areas. Thus, food security is not stable in Eurasia whilst the status of soils and water bodies remains endangered and not adequately monitored.

Science and technology may help to find solutions for sustainable use of soils. The awareness about limited and degrading natural resources have fired the energy and creativity of responsible and innovative people to develop and install monitoring systems and countermeasures. However, the access to modern monitoring systems and agri-environmental technologies is different over regions of Eurasia. Some regions of Central Asia and Asian Russia require modern monitoring systems for their land and water resources in order to avoid their accelerating degradation and maintain their productivity function and ecosystem services for the population.

SCHLUSSFOLGERUNG/ CONCLUSIONS

In the post-war period of the 20th century great progress in science and agricultural

practice enabled to make these visions reality in Europe and in the whole Soviet Union. Crop yields increased and hunger was eliminated. However, some progress achieved was on costs of sustainability. Soil degradation and loss of biodiversity became significant. In the 21st century the global struggle for resources, land and water included, and men-made climate change have created new threats for soils, ecosystems and inhabitants of rural areas. Thus, food security is not stable in Eurasia whilst the status of soils remains endangered and not adequately monitored. Why are these problems not yet basically resolved for the globe, Eurasia and even not yet for single highly developed countries? Lack of innovation, communication and application are important reasons. Already DN Pryanishnikov had recognized that testing, evaluation and monitoring the quality of agricultural soils is a precondition for an effective and sustainable land use. Consequently he created a basic monitoring system of agricultural research stations over the Soviet Union. This system has been completed and modernized but was not capable for an operational control of the soil´s performance. Other countries have acted in a similar way but their conceptions and solutions were different. Scientific innovations and international standards are required. However, the community of soil and agricultural scientists is still characterized by ineffective cooperation, a Babylonian confusion in soil classification and evaluation, a lack of innovation and a limited access to modern monitoring systems and agri-environmental technologies in some regions.

To improve this situation, we started a cooperation some years ago and created a network of scientists who have developed novel methods of agri-environmental monitoring. Meanwhile we can offer an array of methods of measuring, assessing, forecasting, utilizing and controlling processes in soils and agricultural landscapes. These are laboratory and field measurement methods, methods of functional mapping and risk assessment, and methods for monitoring and modelling large areas. Novel methods of data analysis and ecosystem modelling, field monitoring of soils, and methods and technologies for optimizing land use systems have been developed as well. Various tools are ready for immediate introduction into Eurasian landscapes in the framework of mutual pilot projects: state-of-the-science field monitoring technologies for soil hydrology, agro-ecological models and decision support systems, soil and land quality classification and evaluation tools, nutrient balancing tools, irrigation control systems, grassland evaluation methods, wind erosion monitoring systems. These are a few examples and showing their potential is a very first step towards their application.

It should become a basis for more objective monitoring of global land quality, promoting sustainable land use and management, serving as one of the decision tools (decision support systems, impact assessment procedures) for economic trade-offs and land use planning. As a first concrete step, our available data and knowledge would allow us to create a crop yield potential map of Russia and neighbouring countries using the M-SQR methodology. This kind of soil characterisation meets both the basic conception of V.V. Dokuchaev and the requirements to soil classification systems of the 21th century. As a potential implement of a global agri-environmental monitoring system it does also meet the visions of DN Pryanishnikov and other outstanding scientists.

Russia has sufficient potentials for a high, stable and sustainable agriculture. Also, the agroclimatic potential will be enhanced by climate change. Utilization of this potential and avoiding negative impacts on the environment is a great challenge for researchers. It must be carefully planned, monitored and controlled. The view of scientists and decision makers should be directed beyond the fertile looking steppe and forest steppe. In Germany, highest crop yields of > 10 t cereal grain per hectare have been achieved not on soils of the forest steppe but in the forest zone. These are in terms of the Russian classification: Light Forest Soils, Derno-

Podsols and even Podsols. Not only an appropriate climate but also long-term cultivation and investments into soil fertility and into science and technology are a basis for this success.
We conclude that strengthening international and national research cooperation will be key for making novel methods for understanding, monitoring and controlling soil quality operational. Pilot projects, permanent think tanks, Scientific-Technical Education Centres, and Schools of Environment and Natural Resources are possible promoters who can carry innovative solutions into the heads and hearts of people in Eurasia. Significant progress towards food security over Eurasia and maintaining the functions of great landscapes for future human generations will be the reward of those efforts.

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In the following part we focus on the classification and evaluation of agricultural soils. A desirable global assessment framework of soil productivity potentials should meet the following requirements:

- Monitoring, controlling and modelling tool of the functional status of the soil resource for crop productivity
- Precise operation, based on indicators and thresholds of the most functionally relevant parameters
- Consistently applicable over different scales, from a field method to global overviews based on the soil map of the world
- Potential for use in suitability and capability classifications
- Straightforward use in extension and participatory assessments
- Relevant to crop performance, with potential as a crop yield estimator and thus acceptable to farmers and other stakeholders
- Compatible with existing FAO soil classifications and capable being integrated into new land evaluation frameworks of the 21st century.

The books „Novel Measurement and Assessment Tools for Monitoring and Management of Land and Water Resources in Agricultural Landscapes of Central Asia“ (Новые Измерительные и Оценочные Методы для Мониторинга и Управления Земельными и Водными Ресурсами Агроландшафтов Центральной Азии) (Springer 2014), and „Novel Methods for Monitoring and Managing of Land and Water Resources in Siberia” (Новые Методы для Мониторинга и Управления Земельных и Водных Ресурсов в Сибири) (Springer 2015, in print) provide details. The book contributors represent an immense innovation network which should be employed to achieve both significant disciplinary and synergetic outreach effects. This should be imbedded into more sustainable strategies aiming at research cooperation between partners from EU countries, the Russian Federation and countries of Central Asia. Pilot projects, permanent think tanks, Scientific-Technical Education Centres, and Schools of Environment and Natural Resources are possible promoters who can carry novel methods into the heads and hearts of people in Eurasia. Significant progress towards food security over Eurasia and maintaining the functions of great landscapes for future human generations will be the reward of those efforts.

More than 120 other scientists from more than 20 countries of the globe are part of our innovation network and have contributed to both books about the status and sustainable use of land and water resources of Central Asia and Siberia. Their names and affiliations are listed there. They are from leading research institutes, universities, departments of agriculture, cooperative group centres, state authorities, international research and funding bodies, private companies, practical farms and others. Authors of this paper thank them for their innovative contributions.

LITERATURE

Mueller L, Saparov A, Lischeid G (eds) (2014) Novel Measurement and Assessment Tools for Monitoring and Management of Land and Water Resources in Agricultural Landscapes of Central Asia, Springer Environmental Science, 716 p. ISBN: 978-3-319-01016-8 (Print) 978-3-319-01017-5 (Online) http://www.springer.com/us/book/9783319010168

Mueller L, Sheudshen AK, Eulenstein F (eds) (2016) Novel Methods for Monitoring and Managing Land and Water Resources in Siberia, Springer Water, 760 p. ISBN: 978-3-319-24407-5 (Print), http://www.springer.com/de/book/9783319244075