Contents

Part I  Environmental and Societal Framework for Monitoring and Management of Land and Water Resources

Land and Water Resources of Central Asia, Their Utilisation and Ecological Status ........................................... 3
Lothar Mueller, Mekhli Suleimenov, Akmal Karimov, Manzoor Qadir, Abdulla Saparov, Nurlan Balgabayev, Katharina Helming and Gunnar Lischeid

Soil Resources of the Republic of Kazakhstan: Current Status, Problems and Solutions ................................... 61
Abdulla Saparov

Long-Term Monitoring and Water Resource Management in the Republic of Kazakhstan ................................. 75
Tursun Ibrayev, Batyrbek Badjanov and Marina Li

Trends in the Agriculture of Central Asia and Implications for Rangelands and Croplands ............................... 91
Mekhli Suleimenov

Landscape Hydrology of Rural Areas: Challenges and Tools ................................................................. 107
Gunnar Lischeid

Productivity Potentials of the Global Land Resource for Cropping and Grazing ............................................ 115
Lothar Mueller, Uwe Schindler, Bruce C. Ball, Elena Smolentseva, Victor G. Sychev, T. Graham Shepherd, Manzoor Qadir, Katharina Helming, Axel Behrendt and Frank Eulenstein
Part II  Novel Methodologies for Measurement of Processes and Assessment of Resources

A Novel Method for Quantifying Soil Hydraulic Properties ........ 145  
Uwe Schindler

Advanced Technologies in Lysimetry ............................... 159  
Ralph Meissner, Holger Rupp and Manfred Seyfarth

Third-Generation Lysimeters: Scientific Engineered Monitoring Systems ............................................. 175  
Christian Hertel and Georg von Unold

A Field Method for Quantifying Deep Seepage and Solute Leaching  ..................... 185  
Uwe Schindler

Simple Field Methods for Measurement and Evaluation of Grassland Quality ............................... 199  
Lothar Mueller, Axel Behrendt, T. Graham Shepherd, Uwe Schindler, Bruce C. Ball, Sergey Khudyaev, Thomas Kaiser, Ralf Dannowski and Frank Eulenstein

Impact Assessment for Multifunctional Land Use .................. 223  
Katharina Helming

The Muencheberg Soil Quality Rating for Assessing the Quality of Global Farmland ............................... 235  
Lothar Mueller, Uwe Schindler, T. Graham Shepherd, Bruce C. Ball, Elena Smolentseva, Konstantin Pachikin, Chunsheng Hu, Volker Hennings, Askhad K. Sheudshen, Axel Behrendt, Frank Eulenstein and Ralf Dannowski

Use of Pedotransfer Functions for Land Evaluation: Mapping Groundwater Recharge Rates Under Semi-Arid Conditions ....... 249  
Volker Hennings

Nutrient Balances in Agriculture: A Basis for the Efficiency Survey of Agricultural Groundwater Conservation Measures ......... 263  
Frank Eulenstein, Marion Tauschke, Marcos Lana, Askhad K. Sheudshen, Ralf Dannowski, Roland Schindler and Hartwig Drechsler
Methods of In Situ Groundwater Quality Monitoring: Basis for the Efficiency Survey of Agricultural Groundwater Conservation Measures .............................................. 275
Ralf Dannowski, Roland Schindler, Nils Cremer and Frank Eulenstein

Methods in the Exploratory Risk Assessment of Trace Elements in the Soil-Groundwater Pathway .................................................. 289
Levke Godbersen, Jens Utermann and Wilhelmus H. M. Duijnisveld

Methods for Quantifying Wind Erosion in Steppe Regions ........... 315
Roger Funk, Carsten Hoffmann and Matthias Reiche

Generation of Up to Date Land Cover Maps for Central Asia ..... 329
Igor Klein, Ursula Gessner and Claudia Künzer

Estimating Black Carbon Emissions from Agricultural Burning .... 347
Vladimir Romanenkov, Dmitry Rukhovich, Polina Koroleva
and Jessica L. McCarty

Non-Linear Approaches to Assess Water and Soil Quality .......... 365
Gunnar Lischeid

Using Soil–Water–Plant Models to Improve the Efficiency of Irrigation ................................................................. 379
Rickmann Michel and Ralf Dannowski

MONICA: A Simulation Model for Nitrogen and Carbon Dynamics in Agro-Ecosystems ......................................................... 389
Claas Nendel

Integrated Decision Support for Sustainable and Profitable Land Management in the Lowlands of Central Asia ......................... 407
Nodir Djanibekov and Rolf Sommer

Efficiency of Duckweed (Lemnaceae) for the Desalination and Treatment of Agricultural Drainage Water in Detention Reservoirs ........................................................................ 423
Dagmar Balla, Mohie Omar, Sebastian Maassen, Ahmad Hamidov
and Mukhamadkhan Khamidov

Conservation Agriculture for Long-Term Soil Productivity .......... 441
Mekhlis Suleimenov, Zhekensenbai Kaskarbayev, Kanat Akshalov
and Nikolai Yushchenko
Modern Technologies for Soil Management and Conservation in Northern Kazakhstan ........................................ 455
Tobias Meinel, Lars-Christian Grunwald and Kanat Akshalov

Enhancing the Productivity of High-Magnesium Soil and Water Resources in Central Asia ......................... 465
Manzoor Qadir, Frants Vyshpolsky, Khamit Mukhamedjanov, Ussen Bekbaev, Saghit Ibatullin, Tulkun Yuldashev, Andrew D. Noble, Akmal Karimov, Alisher Mirzabaev and Aden Aw-Hassan

Advanced Technologies for Irrigated Cropping Systems ......... 475
Robert G. Evans

Multi-Species Grazing on Deer Farms ............................. 491
Axel Behrendt, Andreas Fischer, Thomas Kaiser, Frank Eulenstein, Sylvia Ortmann, Anne Berger and Lothar Mueller

Part III Applications and Case Studies

Assessing the Soil Quality and Crop Yield Potentials of Some Soils of Eurasia ............................................. 505
Elena Smolentseva, Boris Smolentsev, Konstantin Pachkin and Lothar Mueller

Soils of Kazakhstan, Their Distribution and Mapping ............. 519
Konstantin Pachkin, Olga Erokhina and Shinya Funakawa

Indicators of Land Degradation in Steppe Regions: Soil and Morphodynamics in the Northern Kulunda ............... 535
Vera Schreiner and Burghard C. Meyer

Erosion Rates Depending on Slope and Exposition of Cropped Chestnut Soils ............................................. 549
Dana K. Shokparova, Erkin K. Kakimjanov and Burghard C. Meyer

Methodology of Measuring Processes and Evaluation of Water Resources of the Republic of Kazakhstan .............. 563
Tursun Ibrayev, Batyrbek Badjanov and Marina Li

Model-Based Impact Analysis of Climate and Land Use Changes on the Landscape Water Balance ..................... 577
Marco Natkhin, Ralf Dannowski, Ottfried Dietrich, Jörg Steidl and Gunnar Lischeid
Biotechnological Restoration Methods of Technogenically Disturbed Soils in Kazakhstan ................................................................. 591
Farida E. Kozybayeva, Abdulla Saparov, Hasi Dzhamantikov, Gulzhan B. Beyseyeva and Valeria N. Permitina

Strategy of Sustainable Soil and Plant Resource Management in the Republic of Kazakhstan ................................................................. 611
Abdulla Saparov

The Effect of Applying the Microbiofertiliser “MERS” on the Soil Microbial Community and the Productivity of Winter Wheat Under the Conditions of Southeast Kazakhstan ......................... 621
Maira Kussainova, Marion Tauschke and Abdulla Saparov

Water Treatment Systems for Agricultural Water Supply ............ 631
Valeriy A. Tumlert

Concentration of Heavy Metals in Irrigated Soils in Southern Kazakhstan ................................................................. 641
Azimbay Otarov

Concept and Results of Soil Monitoring in North Kazakhstan .......... 653
Temirbolat D. Dzhalankuzov

Diagnosis and Optimization of Phosphorus Nutrition Conditions of Grain Crops in Northern Kazakhstan ................................. 667
Valentina Chernenok and Dietmar Barkusky

Part IV Executive Summary

Executive Summary and Conclusions ........................................ 683
Lothar Mueller, Abdulla Saparov and Gunnar Lischeid

About the Editors ................................................................. 715
Novel Measurement and Assessment Tools for Monitoring and Management of Land and Water Resources in Agricultural Landscapes of Central Asia
Mueller, L.; Saparov, A.; Lischeid, G. (Eds.)
2014, XXIII, 716 p. 309 illus., 255 illus. in color., Hardcover
ISBN: 978-3-319-01016-8