

Water Resources Allocation and Agriculture: Transitioning from Open to Regulated Access

Water Resources Allocation and Agriculture: Transitioning from Open to Regulated Access

Edited by

Josselin Rouillard, Christina Babbitt, Edward Challies
and Jean-Daniel Rinaudo



Published by

IWA Publishing
Unit 104–105, Export Building
1 Clove Crescent
London E14 2BA, UK
Telephone: +44 (0)20 7654 5500
Fax: +44 (0)20 7654 5555
Email: publications@iwap.co.uk
Web: www.iwapublishing.com

First published 2022
© 2022 IWA Publishing

Apart from any fair dealing for the purposes of research or private study, or criticism or review, as permitted under the UK Copyright, Designs and Patents Act (1998), no part of this publication may be reproduced, stored or transmitted in any form or by any means, without the prior permission in writing of the publisher, or, in the case of photographic reproduction, in accordance with the terms of licenses issued by the Copyright Licensing Agency in the UK, or in accordance with the terms of licenses issued by the appropriate reproduction rights organization outside the UK. Enquiries concerning reproduction outside the terms stated here should be sent to IWA Publishing at the address printed above.

The publisher makes no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility or liability for errors or omissions that may be made.

Disclaimer

The information provided and the opinions given in this publication are not necessarily those of IWA and should not be acted upon without independent consideration and professional advice. IWA and the Editors and Authors will not accept responsibility for any loss or damage suffered by any person acting or refraining from acting upon any material contained in this publication.

British Library Cataloguing in Publication Data

A CIP catalogue record for this book is available from the British Library

ISBN: 9781789062779 (Paperback)

ISBN: 9781789062786 (eBook)

ISBN: 9781789062793 (ePub)

This eBook was made Open Access in August 2022

© 2022 The Editor(s).

This is an Open Access eBook distributed under the terms of the Creative Commons Attribution Licence (CC BY-NC-ND 4.0), which permits copying and redistribution for non-commercial purposes with no derivatives, provided the original work is properly cited (<https://creativecommons.org/licenses/by-nc-nd/4.0/>). This does not affect the rights licensed or assigned from any third party in this book.



Content

About the Editors	xv
Contributors	xvii
Foreword	xix
Acknowledgements	xxi

Chapter 1

Introduction	1
---------------------------	---

Josselin Rouillard, Christina Babbitt, Edward Challies and Jean-Daniel Rinaudo

1.1	Transitioning away from Open Access in the Use of Water Resources	1
1.1.1	The need to regulate water use	1
1.1.2	Water allocation as a strategy to regulate water use	2
1.1.3	Regulating agricultural water use through allocation policies	2
1.1.4	Challenges of establishing allocation policies in agricultural basins	3
1.2	Objective and Scope of the Book	4
1.3	Key Thematic Areas of the Book	4
1.3.1	The institutional framework	4
1.3.2	Setting allocation limits	5
1.3.3	Allocation rules	5
1.3.4	Compliance and enforcement	6
1.3.5	Performance of allocation regimes	6
1.4	Structure of the Book	7
	References	9

Chapter 2

The politics of groundwater allocation and the transition from open access	11
---	----

William Blomquist and Christina Babbitt

2.1	Introduction: The Importance of Establishing Groundwater Allocations	11
2.2	Opportunities and Difficulties in Allocating Groundwater	12

2.2.1 Opportunities 12

2.2.2 Difficulties 13

2.3 Managing the Transition to Groundwater Allocations 15

2.3.1 Examples of transitions away from open access 15

2.3.2 Recommended considerations for the transition process 16

2.4 Conclusions: Context and Variation in Groundwater Allocation Development 21

References 22

Chapter 3
Allocations and legal trends in the 21st century. 25

Rebecca L. Nelson

3.1 Introduction 25

3.2 The Global Growth and Development of Administrative Regimes for Allocating Water 26

3.2.1 Adoption of permitting and planning systems across more nations 26

3.2.2 Application of permitting and planning regimes to more water sources 27

3.2.3 Increasing complexity of permitting and planning 28

3.2.4 Implementation challenges to permitting and planning systems 28

3.3 Access to Water for More Water Users, and Participation by More Stakeholders 29

3.3.1 Human right to water 29

3.3.2 Water for environmental purposes 29

3.3.3 Transferring allocated water 31

3.3.4 Water for other consumptive users 31

3.3.5 Implementation challenges to facilitating access 32

3.3.6 More diverse participants in processes that influence allocations 32

3.4 Reflections and Conclusion 33

Acknowledgements 34

References 34

Chapter 4
Indigenous water and Mother Earth 37

Margot A. Hurlbert

4.1 Introduction 37

4.2 Ensuring the Place of Indigenous Water Rights: Parallelism and Pluralism 38

4.2.1 Inherent Indigenous water law 39

4.2.2 *Sui Generis* Indigenous rights 39

4.3 Indigenous Water Law in Canada and the United States 40

4.3.1 Indigenous water rights 40

4.3.2 Indigenous water rights on reserve 41

4.3.3 Indigenous water rights and treaties 41

4.3.4 Indigenous groundwater rights 41

4.4 Mother Earth, Relations, and Buen Vivir 42

4.5 Rights of Nature 43

4.5.1 Constitutional protection for Mother Earth 43

4.5.2 River rights 44

4.6 United Nations Declaration of the Rights of Indigenous Peoples 45

References 46

Chapter 5***Allocations and environmental flows* 49***Eric D. Stein, Michael E. McClain, Ashmita Sengupta, Theodore E. Grantham, Julie K. H. Zimmerman and Sarah M. Yarnell*

5.1	Introduction	50
5.2	Planning and Defining Environmental Flows: Emerging Science and Recommended Approaches	50
5.2.1	Increased focus on ecological functions	51
5.2.2	Recognizing connections between surface and groundwater management	53
5.2.3	Planning in an inclusive, consistent, structured, and transparent manner	54
5.3	Implementation of Environmental Flows: Tools and Approaches	55
5.3.1	Ecosystem water budgets	55
5.3.2	Innovative governance structure of water allocation	56
5.3.3	Holistic management by reducing silos between programs	57
5.4	Conclusions	58
	References	59

Chapter 6***Economics and water allocation reform* 63***C. Dionisio Pérez-Blanco*

6.1	Introduction	63
6.2	Economic Issues in Water Allocation Reform	64
6.2.1	Reforming allocation regimes results in large transaction costs	64
6.2.2	Water allocation reforms require compromises between economic efficiency, environmental performance, and social justice	65
6.2.3	Reallocations may result in externalities, which are poorly accounted for in conventional water policy	66
6.2.4	Reallocations must account for large uncertainties intrinsic to complex social-ecological systems	67
6.3	A Robust Basis for Economically-Sound Water Allocation Reform	68
6.4	The Role of Economic Instruments in Reforming Agricultural Water Allocations	69
6.4.1	Defining economic instruments	69
6.4.2	Designing appropriate economic instruments to support water allocation reforms	70
6.4.3	Economic instruments and water allocation reforms: some examples	74
6.5	The Way Forward: Actionable Science for Informed (Re)Allocations	74
	References	74

Chapter 7***England and Wales: countering ‘unsustainable abstraction’ with the catchment based approach* 79***David Benson, Hadrian Cook, M. Yasir Ak and Burcin Demirbilek*

7.1	Introduction	79
7.2	The Overarching Institutional Framework	80
7.2.1	The nature of water rights	80
7.2.2	Current legal and policy context	81
7.2.3	Controlling access to water: a catchment based approach	82

7.2.4	Permitting requirements	83
7.2.5	Collaborative programmes and decision-making.	83
7.3	Defining the Available Resource Pool.	84
7.3.1	Setting and meeting the volumetric cap in catchments.	84
7.4	Defining Allocation and Re-Allocation Rules	84
7.5	Monitoring and Compliance.	85
7.5.1	Hydrological monitoring.	85
7.5.2	Enforcement and ensuring compliance.	85
7.6	The Broader Policy Instrument Mix	85
7.6.1	Drought policy	85
7.6.2	Other regulatory instruments.	86
7.6.3	Economic instruments	86
7.7	Assessing Performance	86
7.7.1	Environmental effectiveness.	86
7.7.2	Economic efficiency.	87
7.7.3	Social equity	88
7.7.4	Climate resilience.	88
7.8	Conclusions	89
	References.	89

Chapter 8

Water allocation in Spain. Legal framework, instruments and emerging debates 93

Carles Sanchis-Ibor, Manuel Pulido-Velazquez, Juan Valero de Palma and Marta García-Mollá

8.1	Introduction	93
8.2	The Legal Framework for Water	95
8.2.1	The double nature of water rights	95
8.2.2	Allocation of water rights	96
8.3	Water Allocation in Practice. Rules and Processes	98
8.3.1	The overallocation problem	98
8.3.2	Groundwater overexploitation.	99
8.3.3	Environmental flows	100
8.3.4	Water exchanges	100
8.4	Conclusions	102
	References.	102

Chapter 9

Managing a common resource in agriculture: an overview of the French nested water allocation system. 105

Josselin Rouillard and Jean-Daniel Rinaudo

9.1	Introduction	105
9.2	Legal and Policy Background.	106
9.2.1	The nature of water rights.	106
9.2.2	Water management planning instruments	106
9.2.3	The permitting regime.	107
9.3	Environmental Bottom Lines.	108
9.3.1	Minimum flows	109

9.3.2	Management targets	109
9.3.3	Alert and crisis flows	109
9.4	Defining the Allocable Resource Pool	109
9.5	Allocation Rules	110
9.5.1	Volumetric allocations between sectors	110
9.5.2	Allocating and reallocating water in agriculture	111
9.5.3	Drought restrictions	112
9.6	Compliance and Enforcement	112
9.7	The Broader Policy Instrument Mix	113
9.8	Conclusion	113
	References	114

Chapter 10

Turkey's water allocation regime under institutional change 117

M. Yasir Ak, Burcin Demirbilek and David Benson

10.1	Introduction	117
10.2	The Overarching Institutional Framework	119
10.2.1	Legal and policy background	119
10.2.2	The nature of water rights	119
10.2.3	Controlling access to water and collaborative decision-making	120
10.3	Defining the Available Resource Pool	120
10.4	Allocation and Reallocation Rules	121
10.4.1	Approach for allocating water between sectors	121
10.4.2	Economic and social performance of the current approach	122
10.5	Monitoring and Compliance	123
10.6	The Broader Policy Instrument Mix	123
10.6.1	Drought policy	123
10.6.2	Economic instruments	125
10.6.3	Awareness-raising	125
10.7	Conclusions	125
	References	126

Chapter 11

Water allocation in Aotearoa New Zealand: societal values and ecological bottom lines 129

Edward Challies, Stephen Fragaszy and Josselin Rouillard

11.1	Introduction	129
11.2	The Overarching Policy Framework	130
11.2.1	Constitutional and legal framework	130
11.2.2	RMA and regional councils	130
11.2.3	Controlling access to water	133
11.2.4	The nature of water rights	134
11.3	Defining The Available Resource Pool	135
11.4	Allocation and Reallocation Rules	136
11.5	Monitoring and Compliance	137
11.5.1	Monitoring of water abstraction	137
11.5.2	Compliance and enforcement	137
11.6	The Wider Policy Context	137

11.6.1	Devolved management and collaborative governance.	138
11.6.2	Māori rights and interests.	138
11.6.3	Land use change and water quality.	138
11.6.4	Climate change and hazards.	139
11.7	Conclusion	139
	References.	140

Chapter 12

Groundwater allocation in New South Wales, Australia 143

Joseph H. A. Guillaume, Alvar Closas and Andrew McCallum

12.1	Introduction	143
12.2	The Overarching Institutional Framework.	144
12.2.1	Water management as a state responsibility with federal engagements	144
12.2.2	Historical groundwater regulation in New south Wales.	145
12.2.3	Overview of current regulatory framework in NSW.	147
12.3	Defining the Available Resource	147
12.4	Defining Allocation and Reallocation Rules	149
12.5	Metering, Compliance and Monitoring.	150
12.6	The Broader Policy-Regulatory Mix	151
12.7	Discussion: Strengths and Weaknesses.	153
	References.	155

Chapter 13

Water allocation in Brazil: main strategies, learning and challenges 159

Guilherme F. Marques

13.1	The Brazilian Context on Agricultural Water Use: Supplies and Competing Demands	159
13.2	The Nature of Brazilian Water Rights: Past and Present	161
13.3	Legal and Policy Framework to Control Access to Water (Ground Rules).	162
13.3.1	Permits and concessions	162
13.3.2	Issuance of permits for surface water	163
13.3.3	Issuance of permits for groundwater.	163
13.3.4	Regulatory agreements	164
13.3.5	Strength and weaknesses of the current permitting regime	164
13.4	Defining Water Allocation Mechanisms: Major Categories and Examples	165
13.4.1	Collective water permits	165
13.4.2	Long-term, cyclical allocations for reservoir operations.	165
13.4.3	Short-term, event-based, water allocation mechanisms	166
13.5	Concluding Remarks	168
	References.	169

Chapter 14

What are we allocating and who decides? Democratising understanding of groundwater and decisions for judicious allocations in India. 173

Uma Aslekar, Dhaval Joshi and Himanshu Kulkarni

14.1	The Crisis of Groundwater Depletion and Contamination in India	173
14.2	Efforts to Address the Groundwater Crisis to Date.	175

14.3	Challenges in the Current Paradigm	177
14.4	Moving Beyond Techno-Managerial Solutions	178
14.5	Towards a Multidisciplinary and Participatory Framework	178
14.6	Participatory Mapping of Aquifers	180
14.7	Participatory Water Budgeting in Groundwater-Based Irrigation	183
14.8	Participatory Groundwater Management	183
14.9	Conclusions	184
	Acknowledgement	185
	References	185

Chapter 15

	<i>Legal frameworks for agricultural water use in Canada: a comparative study of Alberta and Québec</i>	189
	<i>Hugo Tremblay</i>	

15.1	Introduction	189
15.2	Background	190
15.2.1	Hydrological regimes	190
15.2.2	Agricultural water uses	190
15.3	Overarching Institutional Framework	191
15.3.1	Constitutional principles	191
15.3.2	Prior allocation in Alberta	193
15.3.3	Riparianism in Quebec	194
15.4	Administrative Frameworks for Agricultural Water Uses	195
15.4.1	Alberta	195
15.4.2	Quebec	197
15.5	Conclusion	199
	Acknowledgement	200
	References	200

Chapter 16

	<i>Idaho's Eastern Snake Plain Aquifer: cooperative water policy change for Idaho's groundwater farmers</i>	203
	<i>Katrina Running</i>	

16.1	Introduction	203
16.1.1	Idaho's water law and background	203
16.2	Institutional Change: The 2015 Water Settlement Agreement	206
16.2.1	Defining allocation and rules	206
16.2.2	The negotiation process and why it succeeded	208
16.2.3	Monitoring, compliance, and enforcement	210
16.2.4	Effectiveness	210
16.3	Results of The Camp Among Farmers	211
16.4	Conclusion: Strengths and Weaknesses of Idaho's Camp Experiment and Implications for and Future Resilience	211
	Acknowledgments	213
	References	213

Chapter 17***Polycentric governance in Nebraska, U.S., for ground and surface water 215****Theresa Jedd, Anthony Schutz and Mark Burbach*

17.1	Introduction	215
17.2	Federal Controls on Water Allocation.	217
17.3	State Institutions for Managing Water Allocations	217
17.3.1	Surface water administration	217
17.3.2	Groundwater administration	218
17.3.3	Water law and legal conflicts between ground and surface water users	218
17.4	Integrating Nebraska's Surface Water and Groundwater Institutions	219
17.4.1	Integrated management plans and basin-wide planning: accounting for cross-border challenges	220
17.4.2	Procedures for over-appropriated basins	222
17.4.3	Implementing controls: North Platte Natural Resources District	222
17.4.4	Advantages of the NRD model.	223
17.4.5	Limitations of the NRD model.	223
17.5	Conclusions	224
	References.	224

Chapter 18***Transboundary water allocation in the Amudarya Basin of Central Asia 227****Dinara Ziganshina*

18.1	Introduction	227
18.2	The Overall Legal and Institutional Framework	228
18.3	Water Allocation Arrangements	229
18.3.1	Water allocation rules and principles	229
18.3.2	Water allocation procedures.	230
18.4	Adjusting Water Allocation Under Different Hydrological Conditions.	231
18.5	Modification or Revision of the Current Water Allocation System	231
18.5.1	Water allocation practices over 1991–2015.	231
18.6	Water Delivery to the Aral Sea and Prearalie	234
18.6.1	Water allocation in high-water years.	235
18.6.2	Water allocation in low-water years.	237
18.7	Water Allocation in the Lower Reaches Between Turkmenistan and Uzbekistan.	238
18.8	Discussion: Strengths and Weaknesses.	238
18.9	Conclusion	240
	Acknowledgement	240
	References.	240

Chapter 19***Current challenges in the Rio Grande/Río Bravo Basin: old disputes in a new century . . . 243****Regina M. Buono and Gabriel Eckstein*

19.1	Introduction	243
19.2	Background	244
19.2.1	Geology and geography of the region	244
19.2.2	Legal structures and governance at the binational level.	245
19.2.3	Legal structures and governance at the national level	246

19.3	Current Challenges at the Border	248
19.3.1	Groundwater	248
19.3.2	Stakeholder involvement and transparency	250
19.3.3	Mexico's recurring water debt	251
19.4	Conclusions	252
	References	253

Chapter 20

Transitioning away from open access: lessons learnt from a comparative analysis of water allocation regimes worldwide 255

Josselin Rouillard, Christina Babbitt, Edward Challies and Jean-Daniel Rinaudo

20.1	Introduction	255
20.2	Establishing a Facilitating Institutional Framework	256
20.2.1	Overview of the main steps of institutional development	256
20.2.2	Formalising water use rights	257
20.2.3	The role of authorities and user communities in allocation decisions	258
20.2.4	Establishing a wider supportive policy framework	260
20.3	Setting the Allocation Cap	261
20.3.1	Integrating environmental needs	262
20.3.2	Addressing the temporal variability of the resource in the allocation cap	263
20.3.3	Accounting for connectivity between water resource types	263
20.4	Allocation and Reallocation Rules	264
20.4.1	Defining authorised users at initial implementation of the allocation cap	264
20.4.2	Adjusting individual allocations to the allocation cap	264
20.4.3	Accepting new users	266
20.4.4	Facilitating state, user or market reallocation	267
20.5	Compliance and Enforcement	267
20.5.1	Technology	267
20.5.2	Institutions	268
20.5.3	Enforcement strategy	268
20.5.4	Transparency	269
20.5.5	Social norms	269
20.6	Concluding Remarks	269
	References	271

Index	273
--------------	-----------	------------

About the Editors

Josselin Rouillard is Senior Fellow at the Ecologic Institute in Germany. He works on water governance and economics, with a background spanning both academic research and consultancy services. Josselin provides support to European institutions on the implementation of the Water Framework Directive. Between 2018 and 2020, he was on secondment at the French Geological Survey (Brgm) as part of a Marie-Sklodowska Individual Fellowship on sustainable groundwater management. Previously, he was a research associate for the IHP-HELP Centre for Water Law, Policy and Science at the University of Dundee. He also worked for the Centre for Ecology and Hydrology and the European Environmental Bureau in Brussels. His thesis from the University of Dundee was on flood risk management in Scotland. He holds an MSc in Environmental Change and Management from the University of Oxford and a BSc in Environmental Sciences from the University of Reading.

Christina Babbitt is a Director, Climate Resilient Water Systems, at Environmental Defense Fund, where she works at the intersection of water, climate, and agriculture to advance and scale water sustainability policies and practices across the western United States. Christina's research focuses on sustainable groundwater management and policy, water accounting, open-source data and tools, and water trading. Christina currently serves on the California Water Data Consortium steering committee; the Rosenberg International Forum on Water Policy advisory committee, and the board of the Aquaya Institute, a non-profit research and consulting organization dedicated to advancing global health through universal access to safe water and sanitation. She has previously worked on water issues in Europe and eastern Africa. Christina earned a PhD in natural resources from the University of Nebraska, Lincoln, an MSc in environmental science from Florida International University, a BA in international relations from Rollins College, and is currently an MBA candidate at the University of California, Berkeley.

Edward Challies is Senior Lecturer with the Waterways Centre for Freshwater Management at the University of Canterbury in Christchurch, New Zealand. His work focuses on environmental policy and governance, with particular attention to collaborative governance and collective management of land and water. His research has been funded by the European Research Council (ERC), the German Research Foundation (DFG), the New Zealand Endeavour Fund, and Our Land and Water National Science Challenge. Edward was previously Senior Research Associate with the Institute of

Sustainability Governance at Leuphana University in Lüneburg, Germany. He holds a PhD in human geography from Victoria University of Wellington.

Jean-Daniel Rinaudo is a researcher at Brgm, Montpellier University, where he coordinates the scientific programme on environmental and risk economics. Initially trained as an agricultural engineer (Montpellier SupAgro, 1994), he specialized in agricultural and resource economics (PhD University of Auvergne, 2000). Prior to joining Brgm, he worked for the International Water Management Institute in Pakistan, where his research focused on the political economy of irrigation management reforms. His current research mainly focuses on the institutional economic dimension of groundwater management. Most of his research is conducted in France, but he also works in Morocco and Chile. He is currently developing research activities in the field of natural disaster economics, focusing on the methods for assessing economic vulnerability and resilience. Dr. Jean-Daniel Rinaudo is also a member of the Scientific Council of the Adour Garonne River Basin Agency.

Contributors

Ak, Yasir M. University of Exeter, Department of Politics and International Relations, Penryn, Cornwall, United Kingdom

Aleskar, Uma Advanced Center for Water Resources Development and Management, Pune, India

Benson, David University of Exeter, Department of Politics and International Relations, Penryn, Cornwall, United Kingdom

Blomquist, William Indiana University, Indianapolis, United States

Buono, Regina M. Center for Energy Studies, Baker Institute for Public Policy, Rice University, Houston, Texas; Principal, Aither, United States

Burbach, Mark University of Nebraska-Lincoln, School of Natural Resources, United States

Closas, Alvar Water group, Department of Planning and Environment, Parramatta, New South Wales, Australia

Cook, Hadrian Harnham Water Meadows Trust, Harnham, Salisbury, United Kingdom

Demirbilek, Burcin Faculty of Economics and Administrative Sciences, Department of Political Science and Public Administration, Çankırı Karatekin University, Çankırı, Turkey

Eckstein, Gabriel Texas A&M University School of Law, Fort Worth, Texas, United States

Fragaszy, Stephen Independent consultant; at the time of writing, Ministry for the Environment, Wellington, New Zealand

García-Mollá, Marta Universitat Politècnica de València, Centro Valenciano de Estudios del Riego (CVER), València, Spain

Grantham, Theodore E. University of California, Berkeley, United States

Guillaume, Joseph H. A. Institute for Water Futures and Fenner School of Environment & Society, The Australian National University, Canberra, Australia

Hurlbert, Margot A. Canada Research Chair, Climate Change, Energy and Sustainability Policy; Johnson Shoyama Graduate School of Public Policy; University of Regina, Saskatchewan, Canada

Jedd, Theresa Technical University of Munich, School of Governance, Germany

Joshi, Dhaval School of Geosciences, University of Edinburgh, United Kingdom

Kulkarni, Himanshu Advanced Center for Water Resources Development and Management, Pune, India

Marques, Guilherme F. Institute of Hydraulic Research, Federal University of Rio Grande do Sul, Porto Alegre, Brazil

McCallum, Andrew Water group, Department of Planning and Environment, Parramatta, New South Wales, Australia

McClain, Michael E. IHE Delft Institute for Water Education; Delft University of Technology, The Netherlands

Nelson, Rebecca L. Melbourne Law School, University of Melbourne, Melbourne, Australia

Pérez-Blanco, Dionisio C. Universidad de Salamanca, Spain & Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy

Pulido-Velazquez, Manuel Universitat Politècnica de València, Institute of Water Engineering and Environment (IIAMA), València, Spain

Running, Katrina Idaho State University, Pocatello, United States

Sanchis-Ibor, Carles Universitat Politècnica de València, Centro Valenciano de Estudios del Riego (CVER), València, Spain

Schutz, Anthony University of Nebraska-Lincoln, College of Law, United States

Sengupta, Ashmita CSIRO, Black Mountain, ACT, Australia

Stein, Eric D. Southern California Coastal Water Research Project, California, United States

Tremblay, Hugo Associate Professor, Faculty of Law, University of Montreal, Canada

Valero de Palma, Juan Acequia Real del Júcar, Valencia, Spain

Yarnell, Sarah M. University of California, Davis, United States

Ziganshina, Dinara Scientific Information Center of Interstate Commission for Water Coordination in Central Asia; Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Tashkent, Uzbekistan

Zimmerman, Julie K. H. The Nature Conservancy, Sacramento, CA, United States

Foreword

Lucia De Stefano¹ and Ariel Dinar²

¹*Universidad Complutense de Madrid, Spain*

²*University of California, Riverside, USA*

The days of disparate water allocation arrangements and of free, unregulated access to groundwater are over. Past decades when water resources were appropriated by humans only with socioeconomic development goals in mind and when groundwater was available to any user with capacity to drill and pump, have led to significant water quantity and quality degradation in many locations around the world. This has had consequences not only on freshwater ecosystems, traditional water-dependent livelihoods, or spiritual water uses, but also on the viability of economic uses themselves. The increasing costs of ensuring good-quality drinkable water, and water tables plummeting to depths that make groundwater pumping uneconomical, are just two of many signals that things have to change in the water world. And such change has to be real.

This book is timely and appropriate since allocation is at the very heart of any water management system. If water allocation is not revisited and substantively revised to adjust to present goals and challenges, it is highly unlikely that the water management system will be able to reverse unsustainable trends. This book explores water allocation strategies covering a large array of water sources and also considers water users that for quite some time have rarely been incorporated into existing water allocation systems. It reflects on the theory of water allocation and presents a number of diverse actual experiences, thus constantly reminding the reader that in water allocation schemes the interaction between humans, nature and rules rarely – if ever – happens exactly as planned by the policymaker.

Over recent years we have seen several attempts by scholars from different disciplines to contribute to the challenges posed by water allocation. Among others, we have seen innovative institutional arrangements at various levels, including institutional frameworks for joint water management by user groups, moving to decentralized water management based on local allocation mechanisms rather than on central government-led ones. We have also seen the reconsideration and modification of indigenous water allocation arrangements to face emerging water problems and conflicts. Recent years have brought works highlighting the importance of environmental flows and the usefulness of looking at the water system as a pool of highly interconnected water resources—groundwater, surface water, reclaimed water, desalinated water. This book covers and illustrates both methodologically and empirically the role and usefulness of those approaches and several others, including economic instruments such as water pricing and quantity and quality regulations.

As water scarcity and deteriorated quality endanger sustainability of water resources and water-dependent ecosystems, a holistic approach, as advocated in the book, might be proven as the most adequate and effective way forward. Managing water in a scarcity context will necessitate the

combination of several approaches, the inclusion of several types of water, and the consideration of interests of and impacts on different types of sectors and users.

The larger and more complex the web of water users, the more urgent is the need to approach water allocation with sound, data-based science and with conflict-management techniques that can help stakeholders move from entrenched positions to options that can be agreeable by all. With the current advances in data collection methods and the still partially unexplored potential of Artificial Intelligence in water management, practitioners and stakeholders have an unprecedented opportunity to better understand natural and human systems and make truly informed decisions. With the current improved calculation and modeling capacity, policy interventions and interactions among water sectors and water users can be better understood by applying methods from disciplines such as Experimental Economics, Game Theory, Computable General Equilibrium models, and Hydro Economic modeling, to mention a few.

The cumulative knowledge contributed by science, however, does not produce by itself any durable change on the ground. The awareness of the need for both hard, data-based science, and soft, human-centered approaches, is key to learn from the various perspectives discussed in this book and to transition to a better and more sustainable allocation of scarce water.

Acknowledgements

We would like to warmly thank Aleksandra Lempp (Ecologic Institute) for her support in editing the book. The Editors collectively acknowledge financial support for open access publication from: German Unlatched, Germany; Ecologic Institute, Germany; Environmental Defense Fund, USA; the University of Canterbury (Library Open Access Fund), New Zealand; and the French Research Agency grant to the Belmont Forum INCLUSIVE project « Stakeholder-supported decision making for sustainable conjunctive management of soil and groundwater » (ANR-21-SOIL-0004-01).

