

H96-2206/5

37

НА ДСИ НАВЫДАСТЯ

FAO
WATER
REPORTS

37

631.67

FAO

Irrigation in Southern and Eastern Asia in figures

AQUASTAT Survey – 2011

H13-00017



Irrigation in Southern and Eastern Asia in figures

AQUASTAT Survey – 2011

FAO
WATER
REPORTS

37

Edited by
Karen FRENKEN
FAO Land and Water Division

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views of FAO.

ISBN 978-92-5-107282-0

All rights reserved. FAO encourages reproduction and dissemination of material in this information product. Non-commercial uses will be authorized free of charge, upon request. Reproduction for resale or other commercial purposes, including educational purposes, may incur fees. Applications for permission to reproduce or disseminate FAO copyright materials, and all queries concerning rights and licences, should be addressed by e-mail to copyright@fao.org or to the Chief, Publishing Policy and Support Branch, Office of Knowledge Exchange, Research and Extension, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy.

© FAO 2012

Contents

Acknowledgements	xiv
Foreword	xv
Units	xvi
List of abbreviations	xvii
Section I – Presentation of the survey	1
Introduction	3
Country and river basin profiles	5
Data collection, processing and reliability	7
Glossary of terms used in this study	9
Section II – Regional analysis	21
Composition of the Southern and Eastern Asia region	23
Geography, climate and population	25
East Asia	26
South Asia	27
Mainland Southeast Asia	27
Maritime Southeast Asia	28
Economy, agriculture and food security	31
Water resources	33
Renewable water resources (primary freshwater)	33
Other sources of water	35
Dams	36
Transboundary waters	38
Water withdrawal	39
Water withdrawal by sector	39
Water withdrawal by source	40
The Water Indicator of the Millennium Development Goals	42
Evaporation losses from artificial reservoirs	43
Irrigation and water management	45
Irrigation potential	45
Typology of irrigation and water management	45
Full control irrigation techniques	47
Origin of water in full control irrigation	48
Scheme sizes	49

Cultivation in full control schemes	51
Level of use of areas equipped for full control irrigation	51
Cropping intensity	51
Irrigated crops in full control schemes	52
Trends in the last ten years	55
Water withdrawal by sector	55
Water withdrawal by source	56
Areas under irrigation	57
Irrigation techniques	58
Origin of water for irrigation	58
Irrigated crops	59
Use rate of areas equipped for irrigation	60
Legislative and institutional framework of water management	61
Environment and health	65
Water quality	65
Seawater intrusion	67
Salinization	67
Flooding and waterlogging	68
Drainage and flood control	68
Health and water-related diseases	70
Climate change	71
Prospects for agricultural water management	73
Main sources of general information	77
Summary tables	81
Explanatory notes	81
Regional figures	95
Explanatory notes	95
Section III – Transboundary river basins	109
Ganges-Brahmaputra-Meghna river basin	111
Geography, population and climate	111
Water resources	115
Water-related developments in the basin	118
Transboundary water issues	122
Main sources of information	127
Indus river basin	129
Geography, population and climate	129
Water resources	131
Water-related developments in the basin	133

Transboundary water issues	138
Main sources of information	141
Mekong river basin	143
Geography, population and climate	143
Water resources	146
Water quality, environment, fisheries and forest resources	148
Water-related developments in the basin	148
Transboundary water issues	152
Main sources of information	157
Salween river basin	159
Geography, population and climate	159
Water resources	161
Water quality and environment	161
Water-related developments in the basin	161
Transboundary water issues	162
Main sources of information	164
Section IV – Country profiles	167
Bangladesh	169
Geography, climate and population	169
Economy, agriculture and food security	172
Water resources and use	173
Irrigation and drainage development	175
Water management, policies and legislation related to water use in agriculture	180
Environment and health	182
Prospects for agricultural water management	183
Main sources of information	184
Bhutan	185
Geography, climate and population	185
Economy, agriculture and food security	188
Water resources and use	189
Irrigation and drainage development	191
Water management, policies and legislation related to water use in agriculture	194
Prospects for agricultural water management	195
Main sources of information	196
Brunei Darussalam	197
Geography, climate and population	197
Economy, agriculture and food security	199

Water resources and use	200
Irrigation and drainage development	201
Water management, policies and legislation related to water use in agriculture	203
Environment and health	204
Prospects for agricultural water management	204
Main sources of information	204
Cambodia	205
Geography, climate and population	205
Economy, agriculture and food security	207
Water resources and use	208
Irrigation and drainage development	211
Water management, policies and legislation related to water use in agriculture	216
Environment and health	219
Prospects for agricultural water management	220
Main sources of information	221
China	223
Geography, climate and population	223
Economy, agriculture and food security	226
Water resources and use	227
Irrigation and drainage development	235
Water management, policies and legislation related to water use in agriculture	242
Environment and health	246
Prospects for agricultural water management	247
Main sources of information	249
Democratic People's Republic of Korea	251
Geography, climate and population	251
Economy, agriculture and food security	253
Water resources and use	254
Irrigation and drainage development	255
Water management, policies and legislation related to water use in agriculture	256
Environment and health	259
Main sources of information	259
India	261
Geography, climate and population	261
Economy, agriculture and food security	264
Water resources and use	264

Irrigation and drainage development	268
Water management, policies and legislation related to water use in agriculture	273
Environment and health	276
Prospects for agricultural water management	277
Main sources of information	278
Indonesia	281
Geography, climate and population	281
Economy, agriculture and food security	283
Water resources and use	284
Irrigation and drainage development	287
Water management, policies and legislation related to water use in agriculture	291
Environment and health	293
Prospects for agricultural water management	294
Main sources of information	295
Lao People's Democratic Republic	297
Geography, climate and population	297
Economy, agriculture and food security	297
Water resources and use	300
Irrigation and drainage development	303
Water management, policies and legislation related to water use in agriculture	306
Environment and health	309
Prospects for agricultural water management	309
Main sources of information	310
Malaysia	311
Geography, climate and population	311
Economy, agriculture and food security	313
Water resources and use	313
Irrigation and drainage development	316
Water management, policies and legislation related to water use in agriculture	318
Environment and health	321
Prospects for agricultural water management	321
Main sources of information	322
Maldives	323
Geography, climate and population	323
Economy, agriculture and food security	325
Water resources and use	326

Irrigation and drainage development	328
Water management, policies and legislation related to water use in agriculture	330
Environment and health	332
Prospects for agricultural water management	333
Main sources of information	333
Mongolia	335
Geography, climate and population	335
Economy, agriculture and food security	337
Water resources and use	338
Irrigation and drainage development	342
Water management, policies and legislation related to water use in agriculture	345
Environment and health	346
Prospects for agricultural water management	347
Main sources of information	347
Myanmar	349
Geography, climate and population	349
Economy, agriculture and food security	351
Water resources and use	351
Irrigation and drainage development	355
Water management, policies and legislation related to water use in agriculture	358
Environment and health	361
Prospects for agricultural water management	361
Main sources of information	361
Nepal	363
Geography, climate and population	363
Economy, agriculture and food security	365
Water resources and use	366
Irrigation and drainage development	368
Water management, policies and legislation related to water use in agriculture	371
Environment and health	373
Main sources of information	373
Pakistan	375
Geography, climate and population	375
Economy, agriculture and food security	378
Water resources and use	379
Irrigation and drainage development	382

Water management, policies and legislation related to water use in agriculture	388
Environment and health	390
Prospects for agricultural water management	391
Main sources of information	392
Papua New Guinea	395
Geography, climate and population	395
Economy, agriculture and food security	397
Water resources and use	398
Irrigation and drainage development	399
Water management, policies and legislation related to water use in agriculture	399
Environment and health	402
Prospects for agricultural water management	403
Main sources of information	403
Philippines	405
Geography, climate and population	405
Economy, agriculture and food security	408
Water resources and use	408
Irrigation and drainage development	411
Water management, policies and legislation related to water use in agriculture	416
Environment and health	419
Prospects for agricultural water management	419
Main sources of information	420
Republic of Korea	421
Geography, climate and population	421
Economy, agriculture and food security	423
Water resources and use	424
Irrigation and drainage development	426
Water management, policies and legislation related to water use in agriculture	428
Environment and health	430
Main sources of information	430
Sri Lanka	431
Geography, climate and population	431
Economy, agriculture and food security	433
Water resources and use	434
Irrigation and drainage development	436
Water management, policies and legislation related to water use in agriculture	440

Environment and health	445
Prospects for agricultural water management	445
Main sources of information	445
Thailand	447
Geography, climate and population	447
Economy, agriculture and food security	447
Water resources and use	449
Irrigation and drainage development	453
Water management, policies and legislation related to water use in agriculture	456
Environment and health	458
Prospects for agricultural water management	459
Main sources of information	459
Timor-Leste	461
Geography, climate and population	461
Economy, agriculture and food security	463
Water resources and use	464
Irrigation and drainage development	465
Water management, policies and legislation related to water use in agriculture	468
Environment and health	470
Prospects for agricultural water management	470
Main sources of information	471
Viet Nam	473
Geography, climate and population	473
Economy, agriculture and food security	475
Water resources and use	476
Irrigation and drainage development	479
Water management, policies and legislation related to water use in agriculture	481
Environment and health	484
Prospects for agricultural water management	486
Main sources of information	487

List of figures in Section II

1. Regional distribution of areas and population	26
2. Regional distribution of area and water resources	35
3. Regional division of the world adopted by AQUASTAT	96
4. Regional division of Southern and Eastern Asia	97
5. Average annual precipitation	98
6. Population density	99
7. Internal renewable water resources	100
8. Total renewable water resources per inhabitant	101
9. Transboundary river basins	102
10. Annual water withdrawal per inhabitant	103
11. Annual fresh water withdrawal as a percentage of total actual renewable water resources: Millennium Development Goal Water Indicator	104
12. Area equipped for irrigation	105
13. Area equipped for irrigation as percentage of country area	106
14. Area equipped for irrigation as percentage of cultivated area	107

List of tables in Section II

1. Regional distribution of total cultivable and cultivated areas	25
2. Regional distribution of area and of population	26
3. Regional distribution of the water resources	34
4. Countries with internal renewable water resources (IRWR) of less than 1 700 m ³ /inhabitant per year	35
5. Produced, treated and directly used wastewater	36
6. Regional distribution of dams	36
7. Dams in the Southern and Eastern Asia region with a reservoir capacity larger than 5 km ³	37
8. The four most important transboundary river basins in the Southern and Eastern Asia region	38
9. Regional distribution of water withdrawal by sector	39
10. Regional distribution of water withdrawal by source	41
11. Millennium Development Goal Water Indicator by country	42
12. Evaporation losses from artificial reservoirs	43
13. Regional distribution of areas under water management	46
14. Regional distribution of areas equipped for irrigation	47
15. Regional distribution of full control irrigation techniques	48
16. Regional distribution of the origin of water used in full control irrigation (primary and secondary water)	49
17. Scheme sizes in some countries	50
18. Distribution of actually irrigated areas in some countries	51
19. Cropping intensity over area actually irrigated	52
20. Cropping intensity over area actually irrigated in some countries	53
21. Regional distribution of harvested irrigated crop areas under full control irrigation	54
22. Regional trends in water withdrawal by sector	55
23. Regional trends in water withdrawal by source	56
24. Regional trends in the areas under irrigation	57
25. Regional trends in the irrigation techniques in the full control irrigation areas	58
26. Regional trends in the origin of water used in full control irrigation	59
27. Salinization in irrigation areas in some countries	67
28. Drainage in some countries	69
29. Land use and irrigation potential by country	82
30. Population characteristics by country	83
31. Renewable water resources by country	84
32. Water withdrawals by sector by country	85

33. Water withdrawals by source by country	86
34. Area under irrigation by country	87
35. Water managed area by country	88
36. Full control irrigation techniques by country	89
37. Origin of full control irrigation water by country	90
38. Harvested irrigated crops on full control areas by country	91
39. The Southern and Eastern Asia region compared to the world	93