Index

Abu-Zeid, M., 41-42 academic institutions, water management planning and role of, 264 $acequia\ madre$ (mother ditch), Rio Grande Basin, 184–186 Acquia Real canal (Spain), 222-223 Africa, interbasin water transfers in, 254-255 agriculture Colorado River Basin, 170-172 double-squeeze hypothesis on future of, 238-239 drought and climate change management and, 225-227 Euphrates-Tigris River Basin stakeholders in, 266 farm-level irrigation management, 240 global water demand and, 57–58 holistic approaches to, 61-63 integrated water, land and soil resource management, 60-61 irrigation efficiency initiatives and, 241-242 irrigation increase for, 220-221 Jucar River Basin, 225-227 Limarí Basin, 152-158 Murray-Darling River Basin, 121-124 in Nile River Basin, 82-85 productivity growth and water demand in, 58-60 Rio Grande/Río Bravo (del Norte) River Basin, 184-186, 201-203 São Francisco River Basin, 137-139 in Spain, 221-222 stakeholder participation in management of, 263-264 stakeholder water management in Rio Grande and, 261 sub-sectors, 59-60 Yellow River Basin, 112, 114-115 Agriculture Census (Chile), 157-158 agro-ecosystems sustainable development, 63 AGUA Project (2005) (Spain), 222 Alarcon reservoir (Spain), 222-223 Albiac, Jose, 220-229 Albuquerque basin aquifers and groundwater in, 190-191 groundwater management in, 205 physiography and geology, 189-190 All-American Canal, 241 allocation agreements. See water sharing arrangements Almagorda Dam, 195–199 alternative transfer methods (ATM), Colorado River Basin, 170-172 American Society of Civil Engineers, 279-280 Amistad reservoir, 72-74, 195-199 siltation challenges, 203-204 Anaya, R., 191, 202 Andes mountain range glacier melt and hydrology in, 259n.1 Limarí Basin and, 152-154 animal feed and fodder, water demand for, 59-60 Antarctica, ice mass decline in, 15-16 Antelope Valley, California, Aquifer Storage and Recovery technology in, 54 aquaculture, 59-60 Yellow River Basin, 112 aquifers Colorado River Basin, 170-172 depletion, 46

Jucar River Basin, 222-223 Limarí Basin, 152-154 Nile River Basin, 82-85 recharge, 52-54 Rio Grande/Río Bravo (del Norte) River Basin, 190-191, 202-203 withdrawal from, environmental flow alterations, 67-69 Aquifer Storage and Recovery (ASR), 52-54 arable farming, 59-60 aridity index (AI) precipitation and evaporation, 25-28 precipitation changes and, 27-29 arid lands environmental flow patterns, 66-68 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188 Nile River basin, 80-83 siltation in, 38-39 Aswan High Dam, 35-38, 82-85, 89-90 Aswan Low Dam, 5–7, 31 Ataturk Reservoir, 98–100 atmospheric circulation, Hadley cells, 24-26 Austin Dam (Colorado River), 38-39 Austin Workshop (2014), SERIDAS development and, 7 Australia government response to water crisis in, 125-126 reservoir siltation in, 38-39 water reforms in, 124-125 Avalon Dam, 184-186, 195-199 Azotea Tunnel, 194-195 Ba'ath Party, 97 Banerji, S., 38 Barbosa, J. M. C., 136–137 Barnes, J., 88 basin (bolsón) Rio Grande aquifers and groundwater, 190-191 Rio Grande physiography and geology, 189-190 water use and, 202-203 Basin Management Committees (BMCs) (Turkey), 265-266 Basin Study (Colorado Basin), 170-177 Bastiaanssen, W., 82-85 bathymetric surveys, siltation analysis and, 39-40 Bellagio Workshop (2017), 8 beneficial irrigation efficiency, promises and fallacies of, 40-42, 240-242 beneficial use doctrine, Colorado River Basin, 168-169 Berggren, John, 164-177 Beyond the Limits report, 278–281 Big Bend National Park, 73–74 Bilateral Agreement (1959), 85-88 Billy the Kid, 192–194 biochemical mobilization, water quality and, 37-38 biodiversity, environmental flow alteration and, 69-71 Birdlife, 267-268 Blake, E., 188

More Information

INDEX

Blue Nile discovery of, 79 physical characteristics, 80-83 tributaries of, 81-85 Blueprint for a National Water Plan, 125-126 'blue' water animal feed and fodder and demand for, 59-60 irrigated farming and, 59-60 Boulder Canyon Project Act of 1928, 169-170 BRACERO program, 4-5 Brazil IWRM practices in, 61-62 São Francisco River Basin geography in, 132-133 water laws in, 144 Brazilian Institute of Geography and Statistics (IBGE), 137-138 Brazilian Institute of Meteorology (INMET), 132-133 Brazilian National Water Agency (ANA), 132-133, 143-144, 276-277 Brown, C. J., 54 Brutsaert, W., 41–42 Bryan, K., 190-191 Buono, Regina M., 164-177 Bureau of Reclamation Australian Snowy Mountains Scheme and, 123 Basin Study (Colorado Basin), 170-177 Carlsbad Project, 192 establishment of, 199-200 Glen Canyon Dam and, 164-165 Grand Ethiopian Renaissance Dam and, 87-88 Law of the Rivers and, 166-170 Rio Grande/Río Bravo (del Norte) River Basin projects, 199-201, 203-205 San Juan-Chama Project, 181-184, 194-195 Burton, Richard Francis (Sir), 79 Caballo dam, 192-194 canal construction Jucar River Basin, 222-223 Rio Grande Basin, 184-186 Rio Grande/Río Bravo (del Norte) River Basin management and, 192-199 water storage and conveyance and, 40-42 Cap on extractions (Australia), 127-128 carbon dioxide increase exponential rise in, 13-15 planetary energy balance, 16–18 Carlsbad Project, 192 Carpenter, Delph, 169 Carrizo-Wilcox aquifer, 191 Casana, A. C., 252-253 catchment areas mountainous headwaters, 107, 152 Murray-Darling Basin, 126–129 Centrais Elétricas de Minas Gerais (CEMIG, Minas Gerais Power Plants), 133-134 Centre for Environmental Studies and Resource Management (CESAR) study, 101 Ceylanpinar aquifer, 97 challenge-and-response concept SERIDA research and, 3, 278-281 Changjiang (Yangtze) River water diversion project, 116, 256-257 channel erosion, reservoir impact on, 42 Chanson, H., 38-39 Chavimochic interbasin water transfer (Peru), 252-253 Chihuahuan Desert, 186-188 Chile IWRM policies in, 61-62 water governance in, 154–157, 277 Chilean Water Code (WC), 154–158, 277 China interbasin water transfers in. 256-257 Yellow River Basin engineering and, 108-109 circulation models, climate change and, 17-20 civil society organizations (CSOs), as Euphrates-Tigris stakeholders, 267-268 Clean Lakes Alliance, 63

climate change aridity, precipitation and evaporation, 25-28 in Chile, 152 Colorado Basin and, 173-174 cryosphere indicators, 15-16 Euphrates-Tigris River Basin and, 100-101 evaporation increases, 27-29 food production and, 58-60 forced change vs. natural variability, 20-23 forcings and feedbacks, 20-23 general circulation models, 17–20 global scale of, 23–24 groundwater management and, 46 Hadley cells and, 24–26 indicators of past changes, 13-15 Jucar River Basin, 225-227 Limarí Basin, 158 mountainous catchments, 152 Murray-Darling Basin, 127, 129-130 Murray-Darling Basin and, 121-123 Nile River Basin and, 79, 88-90 oceanography and, 19-21 planetary energy balance, 16-18 precipitation changes and, 27-29 reservoir construction and, 42 Rio Grande/Río Bravo (del Norte) River Basin, 204-205, 277 rivers and, 13-30 robust evidence of, 23-30 runoff and, 27-30 São Francisco River Basin, 147-149 sea level and acidity, 14-15 SERIDA research and impact of, 273-275 status of global research on, 16-21 water supply planning and, 238-239 Yellow River Basin and, 116 Climate Variability, Climate Change and Social Vulnerability in the Semi-Arid Tropics (Ribot, Magalhães and Stahis), 5 Club of Rome, 3-4 SERIDA research and, 278–281 Coca-Cola Company of North America, 265 Cogotí reservoir (Chile), 154–155, 160–161 Cohen, Michael, 164-177 Colorado Big Thompson Project (C-BT), 249-252 Colorado Plateau uplift, paleohydrology, Rio Grande Basin, 189 Colorado River Basin agriculture and energy production in, 241 arid lands environmental flow patterns, 66-68 climate change and drought and, 238-239 environmental crisis facing, 164 future management challenges, 172–174 future water supply and demand projections, 170-172 geography and hydrology, 164-166 institutional infrastructure, 166-170 interbasin water transfers and, 249-252 irrigation overuse and degradation in, 236 regulatory failures in management of, 238 structural deficit problem, 172-174 sustainable management enhancement in, 173-177, 277 water use in, 170-172 Colorado River Compact (1922), 169-170, 172-174, 194-195 Colorado River Delta, 166 Colorado River District, 170 Come On! report, 278-281 Comisión Nacional del Agua (Conagua), 199-202, 264 Committee of the Hydrographic Basin of the São Francisco (CBHSF) (Brazil), 138-139, 143-144 commodity-based agricultural policy, water supply and, 57-58 Commonwealth Scientific and Industrial Research Organization (CSIRO), 121-123 Company for Development of the São Francisco and the Parnaiba Valleys (CODEVASF), 138–139 Comprehensive Everglades Restoration Plan (CERP), 54 Confucian school of hydraulic engineering, 119

283

More Information

284

INDEX

conjunctive management principles, river basin management, 281 Connell, Daniel, 121-130 conservation agriculture, 59-60 Contreras reservoir (Spain), 222-223 conveyance systems, reservoirs and inefficiencies in, 40-42 cooperative framework, Nile River Basin development and, 90-91 Cooperative Framework Agreement (CFA) (2010), 85-88 Coriolis Forces, 17 Council of Australia Governments (COAG), 125-128 critical drawdown period, dependable yield data, 33-35 cryosphere indicators, climate change and, 15-16 Cubbie Station irrigation farm (Australia), 124-125 cyclones, hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 Cynthia and George Mitchell Foundation, 4, 7 Dahm, C. N., 73-74 dam construction Colorado Basin, 164-166 early Yellow River projects, 108-109 environmental flow alterations, 67-69 Euphrates-Tigris River Basin, 96-98 Jucar River Basin, 222–223 Limarí Basin, 154–155 modern Yellow River Basin projects, 109-110 Murray-Darling Basin, 121-123 Nile River basin, 81-85, 88-90 nutrient alteration and, 69-70 reservoirs and, 31 Rio Grande/Río Bravo (del Norte) River Basin, 184-186 São Francisco River Basin, 132–134, 136–137 Danjiangkou Reservoir, 256–257 Daoist school of hydraulic engineering, 119 Dartmouth Dam, 121-123 Daule River Basin, interbasin water transfer in, 253-254 deforestation, São Francisco River Basin, 136-137 degree of regulation, dependable yield data, 33-35 density/buoyancy gradients, ocean currents and, 19-21 Denver Water District, 170 dependable yield data, reservoir design, 32–35, 280–281 depletion/drawdown period, reservoir design and yield, 32–33 desalination Jucar River Basin, 224-225 Murray-Darling Basin, 123-124 Nile River Basin, 275 water supply management and, 52-54 Desert Landscape Conservation Cooperative, 265 DESO transposition, São Francisco River Basin, 141 detritus, environmental flow ecology and, 70–71 Devils River, 181–184, 198–199 "digital Yellow River" project, 111 Dingman, S. L., 41–42 Directorate for State Hydraulic Works (DSI) (Turkey), 101-102 Directorate of Hydraulic Works (DOH) (Chile), 155-157 disaster prevention, Yellow River engineering and, 109-110 dissolved oxygen t-z contours, water quality and, 36-38 diversion of sediment, 40 Dole, David, 128-129 Don Martín Dam, 195-199 Dovers, Stephen, 128-129 draft values, dependable yield data, 33-35 drip irrigation technology, 239-242 drought Colorado Basin agreements and, 169-177 environmental flow alteration and, 69-71 future Nile River basin dynamics and, 89 Jucar River Basin, 225–227 Limarí Basin, 160–161 Murray-Darling Basin management and, 124-125, 240 Rio Grande/Río Bravo (del Norte) River Basin, 204-205 São Francisco River Basin, 134-136 stakeholder participation in management of, 263-264 Drought Contingency Plans (DCPs), Colorado River Basin, 172-177

Drought of the Fifties dependable yield data based on, 34-35 Rio Grande engineering and, 195–199 drought records, dependable yield data based on, 34–35 Eastern La Mancha aquifer, 222-223 ecological effects Chavimochic interbasin water transfer (Peru), 252-253 El-Salam Canal in Sinai, 254-255 interbasin water transfers, 248-249 Lesotho Highlands Water Transfer, 255 in Rio Grande environmental flow case study, 73-74 riparian zones, 70-71 São Francisco River Basin, 142-143 São Francisco Water Transfer, 253 Snowy Mountains Hydroelectric Scheme, 251-257 South-to-North Water Transfer project and, 256-257 stakeholder participation in water management and, 263-264 Tagus-Segura IBWT, 254 Yellow River Basin, Water and Sediment Regulation Discharge project, 111 ecosystem degradation global trends in, 220–221 Yellow River Basin, 112 Ecuador, interbasin water transfer in, 253-254 Edwards-Trinity Plateau, 191 Eixo Oeste project, São Francisco River Basin, 141 Eixo Sul project, 237 São Francisco River Basin, 141 Elephant Butte Dam, 72–73, 192–194 Lower Rio Grande Valley (LRGV) and, 184 siltation challenges, 203–204 streamflow analysis for, 196–199 Elephant Butte Irrigation District (EBID), 241 El Niño-Southern Oscillation (ENSO) cycle climate change and, 19-21 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 natural fluctuations in, 30 Yellow River Basin closure and, 110-111 El-Salam Canal in Sinai (Egypt) IBWT, 254-255 energy budget global climate change and, 13 São Francisco River Basin, 138–143 energy imbalances, climate change and, 19-21 energy production, in Nile River Basin, 84-85 Engels, Hubert, 108 engineered rivers. See hydro-engineering environmental flows in arid lands, 66–68 biodiversity and alteration of, 69–71 Colorado River Basin, 166 connectivity and migratory alterations, 71 defined, 66-69 engineered alterations, 67-69 exotic species in reservoirs, 71 irrigation overuse and, 235-238 Jucar River Basin, 222-223, 226-227 in Nile River basin, 88-90 Nile River Basin, 275 nutrient and sediment alterations, 69-70 reservoir impacts on rivers and, 42 Rio Grande case study in decline of, 71-74 Rio Grande engineering and, 195–199 Rio Grande/Río Bravo (del Norte) River Basin, 184-190, 194-195 São Francisco River Basin streamflow analysis, 144-150 Spanish water use, 221-222 topography and habitat alteration, 70-71 Yellow River Basin closure and, 110–111 environmental goals, Murray-Darling Basin, 127–129 environmental impacts Chavimochic interbasin water transfer (Peru), 252-253 El-Salam Canal in Sinai, 254-255 interbasin water transfers, 248-249 Lesotho Highlands Water Transfer, 255

285

in Rio Grande environmental flow case study, 73-74 riparian zones, 70-71 São Francisco River Basin, 142-143 São Francisco Water Transfer, 253 Snowy Mountains Hydroelectric Scheme, 251-257 South-to-North Water Transfer project and, 256-257 stakeholder participation in water management and, 263-264 Tagus-Segura IBWT, 254 Yellow River Basin, Water and Sediment Regulation Discharge project, 111 epilimnion, thermocline and, 35-36 ESCWA-BGR survey, Euphrates-Tigris River Basin population data, 96–97 Esteban, Encarna, 220–229 Euphrates Dam, 98 Euphrates-Tigris Initiative for Cooperation (ETIC), 266-268 Euphrates-Tigris River Basin agricultural water stakeholders in, 266 climate change and, 100-101, 238-239 future challenges for, 100-102 geography, climate and hydrology, 94-96 groundwater system in, 97 history of, 94 municipal water stakeholders in, 266 national and regional sustainability management initiatives, 265-266 NGOs and civil society organizations as stakeholders in, 267-268 population and socioeconomy, 96-97 runoff depletion and irrigation overuse in, 236-237 SERIDAS research on, 8 stakeholder participation in sustainable management of, 265-268 sustainability challenges for, 102–104 transboundary systems and disputes, 97–100, 265–266, 275–276 water budget, 100-102 water development projects, 98 water quality issues, 101 Euphrates Valley Project, 97-98 European Union Water Framework Directive, 226, 265-266 eutrophic reservoirs, river water quality and, 42 evaporation aridity and, 25–28 hydrology and, 19–20 increases, 27–29 irrigation and, 235 Nile River Basin, 82-85 water storage and conveyance systems and, 41-42 evapotranspiration aquifers and groundwater, 190-191 climate change and, 225-227, 238-239 defined, 25-28 hydroclimatology and, 186–188 irrigation efficiency initiatives and, 241-242 Jucar Basin, 227-228 Nile River Basin, 82-85, 88 Rio Grande ecological effects and, 73-74 river ecologies and, 70-71, 235 Sobradinho Dam stream flow and, 145-150 Tigris-Euphrates and impact of, 100-101 Yellow River closures and, 110-111, 116 exotic species, in reservoirs, 71 Falcon reservoir, 72-73, 195-199 Falcón Reservoir, 181-184 Farahani, A., 38 Faraskur Dam, 254-255 feedbacks, radiative forcing and, 20-23 Fen He River, 112 Fernald, A. G., 241 first in time, first in right doctrine, Colorado River Basin, 168–169 fish and fisheries connectivity and migratory alterations, 71 in floodplains, 70-71 in Rio Grande environmental flow case study, 73-74 São Francisco River Basin, 142

flood control reservoirs and, 31 Rio Grande/Río Bravo (del Norte) River Basin, 191, 203–204 Rio Grande/Río Bravo (del Norte) River Basin management and, 192–199 São Francisco River Basin, 134-136 floodplains fish species in, 70-71 Rio Grande/Río Bravo (del Norte) River Basin, 190-191 Florida, Aquifer Storage and Recovery technology in, 54 flow-mass curve, dependable yield data, 33-34 food production integrated water, land and soil resource management and, 60-61 water consumption and, 58-60 food security endangerment Euphrates-Tigris River Basin stakeholders and, 266 water supply and, 57-58, 273-275 fossil water, 190-191 Fradkin, P. L., 168 Franzius, Otto, 108 Freeman, John, 108 Fruit Census (Catastro Fructícola), 157-158 GAP Project (Turkey), 98-100, 269n.2 Garrett, Pat, 192-194 General Circulation Models (GCMs), 18-19 Colorado River Basin supply and demand, 170-172 natural precipitation fluctuations and, 30 runoff and, 27-30 General Directorate of Water (DGA) (Chile), 155-158 geology, Rio Grande/Río Bravo (del Norte) River Basin, 188-190 Ghassemi, F., 249–252 Gila River (US), 166 glacier melt Andean hydrology and, 259n.1 Limarí Basin water supply and, 158 Rio Grande physiography and geology, 189-190 Glen Canyon Dam (US), 164-166 Glen Canyon Dam Adaptive Management Program, 166 Glenn, Stephanie, 46-55, 66-75 global average surface temperatures climate change and, 13-15 Colorado Basin and, 173-174 Global High-Level Panel on Water and Peace, 279-280 global land-surface water budget model, water storage and conveyance and, 40-42 Global Soil Partnership (GSP), 61 global warming, robust climate change evidence from, 23-24 Global Water Partnership, 61 González-Cebollada, C., 241–242 governance of water management in Chile, 154-157 Colorado River Basin, 166, 175 Euphrates-Tigris transboundary issues and, 99-100, 103-104 interbasin water transfers, 257-258 Jucar River Basin, 220-221, 227--229 in Limarí Basin, 152, 160–161 Murray-Darling Basin, 121-125, 127-129 OECD principles for, 4 regulatory failures in, 238 in Spain, 222 stakeholder participation and, 260-268 water shortages and policy responses in irrigation sector, 239-242 Yellow River Basin, 107-117 gradual approach, water supply management, 62 Grand Ethiopian Renaissance Dam (GERD), 84-85, 87-91, 275 Grand River Ditch Project, 249–252 Grande River (Chile), 152–154 gravity-irrigation systems, efficiency of, 240–242 Great Dividing Range (Australia), 121–123 Great Leap Forward (1958-1961) (China), 110 greenhouse gases, planetary energy balance, 16-18 Greenland, ice mass decline in, 15-16 Greenpeace, 267-268

More Information

286

INDEX

'green' water, rainfed farming and, 59-60 groundwater basic properties, 46 basin closures and depletion of, 238 Colorado River Basin, 170–172 engineered alterations and, 49-50 Euphrates-Tigris River Basin and, 97 future sustainability management issues, 52-54 Jucar River Basin management of, 228 land use impact on, 60-61 Limarí Basin, 152-154 Murray-Darling River Basin, 126-127 Rio Grande/Río Bravo (del Norte) River Basin, 190–191, 202–203, 205 São Francisco River Basin, 134–135 surface water interactions with, 50, 273-275 Texas management case study, 47-49 use and recharge, 47 water supply and, 51-52 withdrawal of, environmental flow alterations, 67-69 Yellow River Basin management of, 113-114 groundwater conservation districts (GCDs), Texas groundwater management case study, 47–49 Groundwater Management Act (Arizona), 170 groundwater-tracer techniques, 47 Guldan, S. J., 241 Gulf Coast Aquifer, 191 recharge rates, 47 Haase, C., 190-191 habitat alteration environmental flows and, 70-71 Rio Grande environmental flow case study, 72-73 Hadley Cells, 24-26 Hai River Basin (China), 109-110, 256-257 Hanover Workshop, SERIDAS development and, 7-8 Hawley, J. W., 190-191 HBV light rainfall-runoff model, 159 Herodotus, 79 Heron Reservoir, 194-195 Hess, S. L., 41–42 Hjulström, F., 38–39 Hjulström-Sundborg diagram, sediment modeling, 38-39 Hoover Dam (US), 164-166, 169 Horizontal Expansion development policy (Egypt), 254-255 Houston Advanced Research Center (HARC), 4, 261-263 Rio Grande/Rio Bravo Test Study, 4-5 Huai River Basin (China), 256–257 Hueco Bolsón, 190, 202–203 Humboldt Current, Limarí Basin, 152–154 Hume Dam, 121–123, 125 humidity, hydrology and, 19-20 hurricanes, hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 Hurtado River (Chile), 152-154, 159 hydro-economic model, Jucar River Basin, 225-227 hydro-engineering Chilean water governance and, 155-157 Chinese Communist Yellow River projects, 108–109 Colorado Basin, 164–166 environmental flow alterations, 67-69, 273-275 Euphrates-Tigris River Basin, 97 groundwater alterations and, 49-50 historical Yellow River engineering projects, 108-109 Jucar River Basin, 224-225 Limarí Basin, 154-155 modern Yellow River Basin projects, 109-110 mountainous catchments, 152 Murray-Darling River Basin, 121–123, 126–127 Nile River Basin and, 88-90 past, present and future trends in, 275-278 Rio Grande/Río Bravo (del Norte) River Basin, 184–190 São Francisco River Basin, 133-134 Yellow River Basin closure and, 110-111

hydrography, reservoir impacts on rivers and, 42 hydrology climate change and, 19-20, 238-239, 273-275 Colorado Basin, 166 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188 Jucar River Basin, 222–223 Limarí Basin, 152-154, 159-160 Murray-Darling Basin, 121-123 paleohydrology, Rio Grande Basin, 188-190 reservoirs and, 31 Rio Grande aquifers and groundwater, 190-191 Rio Grande environmental flow case study, 72-73 Rio Grande/Río Bravo (del Norte) River Basin, 184-190 hydropower development global increase in, 220-221 Murray-Darling Basin and, 121–123 Rio Grande/Río Bravo (del Norte) River Basin management and, 192-199 São Francisco River Basin, 133-134, 142 Yellow River Basin engineering and, 108-109 hypolimnion thermocline and, 35-36 warm-weather stratification and, 37-38 IBWC/CILA Rio Grand Basin management and, 206 stakeholder engagement in, 261-264 ice sheet decline, 15-16 Imperial Dam (US), 164-166 independent water monitoring and auditing, Murray-Darling Basin, 127-128 Industrial Revolution, 13-15 industrialization Rio Grande/Río Bravo (del Norte) River Basin, 184 São Francisco River Basin, 139-141 stakeholder participation in water management and, 263-264 information accessibility Colorado Basin management and, 177 Limarí Basin water management, 158-160 Murray-Darling Basin management, 127–130 São Francisco River Basin, 144, 149 stakeholder participation and, 261 transboundary water management, 90-91, 99-100 inland capture fisheries, water demand from, 60 institutional cooperation, water management and, 225 Instituto Mexico de Tecnología del Agua, 265 Instituto Tecnológico de Monterrey, 265 Integrated Catchment Management Policy Statement 2000 (Australia), 127-128 Integrated Landscape Management (ILM), 61 integrated surface-groundwater management, Murray-Darling River Basin, 126-127 Integrated Water Resources Management (IWRM), 57-58, 61, 260 early Yellow River basin projects, 108 Euphrates-Tigris transboundary issues and, 99-100 holistic principles and, 61-62 intelligent water transfers, 278 São Francisco River Basin, 149 intelligent water transfers, 278 defined, 247–248 intensive farming systems, water consumption and, 58-60 interbasin water transfers (IBWT). See also specific IBWT projects, e.g., Tagus-Segura IBWT in Africa, 254–255 alternatives to, 249 Asia, 256-257 assessment of results, 249-251 Australia, 251–257 Europe, 254 evaluation criteria for, 248-249 intelligent water transfers, 247-248, 278 needs assessment for, 248-259

overview of, 246 recommendations for future projects, 257–258

socioeconomic pressure for, 246-247 South America, 252–254 United States, 249–252 interest group politics, Jucar River Basin management and, 228 Intergovernmental Panel on Climate Change (IPCC) integrated water, land and soil management and, 61 reports from, 18-19 Rio Grande/Río Bravo (del Norte) River Basin analysis, 204-205 Intergovernmental Technical Panel on Soils (ITPS), 61 Interim Shortage Guidelines (2007), Colorado Basin management, 173-177 International Amistad Reservoir, 181-184 International Boundary and Water Commission (IBWC), 170, 199-200 stakeholder participation in, 261–264 International Center for Agricultural Research in the Dry Areas, 101 International Commission on Large Dams (ICOLD), 31 international humanitarian law, Euphrates-Tigris sustainability and, v, 104 International Union for Conservation of Nature (IUCN), 63 International Water Management Institute, environmental flow patterns research, 66-68 intra-annual water supply, reservoirs and, 31 Iraq Euphrates-Tigris sustainability initiatives and, 102-104 Euprates-Tigris River Basin in, 96-97 transboundary water disputes and, 98-100 water development projects in, 98 Iraq Salinity Assessment, 101 Iraqi Marshes, 103-104 irrigation basin closures and, 235-238 Colorado River Basin, 170-172, 176-177 demand management policies for, 240-242, 278 double-squeeze hypothesis on future of, 238-239 Euphrates-Tigris River Basin, 96–98 farming and, 59-60 geopolitical issues in, 242 global increases in, 220-221 investment subsidies for, 226-227 Jucar River Basin, 222–225, 228 Limarí Basin, 152, 154–160 modernization and water savings promises and fallacies, 40-42, 240-242, 278 Murray-Darling Basin, 124-125, 127 Rio Grande environmental flow case study, 71-72 Rio Grande/Río Bravo (del Norte) River Basin, 184-186, 201 Rio Grande/Río Bravo (del Norte) River Basin management and, 181-184 São Francisco River Basin, 138-139 in Spain, 221-222 water demand and supply augmentation, 239-240, 278 water shortages and policy responses for, 239–242, 278 water storage and conveyance and, 40–42 Yellow River Basin, 107-111, 114-115 Islamic State (IS), Euphrates-Tigris sustainability initiatives and, 103-104 Israelson, O. W., 40-42 Itaparica Dam (Brazil), 133-134 Jägermeyr, J., 40-42 Japanese Yellow River Investigation Commission, 108 Jemez Reservoir, 194-195 Jemez River, 181-184 Jia. S., 114 Joint Economic Commission (Turkey & Iraq), 99-100 Joint Technical Committee on Regional Waters (JTC), 94, 99-100, 275-276 stakeholder participation in, 265-266 Jucar Basin Authority, 224, 227-228 Jucar River Basin climate change and drought and, 238-239 conversion to closed basin, 222-223 drought and climate change management, 225-227 hydro-engineering in, 224-225 institutional approach in, 224

water resources in, 221-223 water scarcity management in, 223-227 Jucar-Vinalopo interbasin water transfer, 224-225, 227-228 Kahlil, Taher, 220-229 Kangera river basin, sustainable development and, 62 karst aquifers, 50, 97 Karun River, 96 Karvas, M. K., 96 Kates, Robert, 7 Kay, Melvin, 57-64 Keban Reservoir, 98-100 Kelley, P., 190–191 Kenney, Doug, 164–177 Khabour River, 97 Khalifa, Muhammad, 79–91 Kibaroglu, Aysegül, 94–104, 260–268, 273–281 King, Alexander, 3-4 knowledge projects, Murray-Darling Basin, 127-128 Kondolf, G., 38 Kurdistan Workers' Party (PKK), 98-100 La Boquilla Reservoir, 42, 192-199 Lake Alamosa (Mexico), 190 Lake Cabeza de Vaca, 190 Lake Corpus Christi model, dependable yield data, 34-35 Lake Mead (US), 164-166, 170-177 Lake Nasser, 82-85 water temperature data from, 35-36 Lake Powell (US), 164-166, 170-177 Lake Victoria (Australia), 121-123 Lal, V., 38 land use and availability holistic management of, 61-63 integrated water, land and soil resource management and, 60-61 Limarí Basin lack of data on, 158-160 Nile River basin, 80-85 Rio Grande/Río Bravo (del Norte) River Basin, 184 sustainable development and, 62 water supply management and, 57-58 Yellow River Basin, 113–114 La Paloma System (Chile), 154-158, 160-161 Laramide/Hidalgoan orogeny, paleohydrology, Rio Grande Basin, 189 Las Vegas, Nevada, Aquifer Storage and Recovery technology in, 52-54 Law of the River, Colorado River Basin, 166-170 Lee's Ferry (Colorado River), 166 Lesotho Highlands Revenue Fund, 255 Lesotho Highlands Water Transfer (LHWT), 255 Lester, R. James, 66-75 Lima, J. E. F. W., 136-137 Limarí Basin agriculture, 152-158 climate change and drought and, 238-239 future recommendations and issues for, 160-161 information gaps in management of, 158-160 lack of data and monitoring in, 158 modeling and scenario development for, 159-160 regulatory failures in management of, 238 socioeconomic development, 155-158 sustainable management of, 277 Limarí River Basin biophysical and hydro-climatic characteristics, 152-154 economic activities and, 154-155 irrigation infrastructure in, 152, 154-155 mountainous catchments and, 152 sustainable water management challenges, 155–160 water management in, 155–157 water rights and water markets in, 154-155 The Limits to Growth (King), 4 Limits to Growth report, 278-281 Limits to Growth: The 30-Year Update, 278-281 Liu, J., 113

irrigation efficiency initiatives in, 241

irrigation growth and runoff depletion in, 238

sustainable management initiatives for, 227-228, 278

More Information

INDEX

livestock farming, 59-60 Rio Grande/Río Bravo (del Norte) River Basin, 184 São Francisco River Basin, 138-139 Living Murray First Step project, 127–128 Loess Plateau, Yellow River Basin and erosion of, 113–114 Longyangxia Reservoir, 111 Low Aswan Dam, 31 Lower Colorado River Multi-Species Conservation Program, 166 Lower Euphrates Project (Turkey), 97 Lower Rio Grande Valley (LRGV) conservation and irrigation efficiency in, 201 geography, 181-184 hydro-engineering in, 192 management of, 277 modern engineering in, 195-199 population data, 184 siltation challenges, 203-204 water budget analysis, 217-219 water use categories, 202-203 Lynch, B., 252-253 Machette, M., 190 Madden-Julian oscillation (MJO), hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 Madison Metropolitan Sewerage District, 63 Magalhães, Antônio, 5, 132, 246-258 Mahmood, K., 38 Mansur, Eduardo, 57-64 manufacturing, Rio Grande/Río Bravo (del Norte) River Basin, 184 Marshall Plan, SERIDAS and, 3-4 Martins, Eduardo Sávio P. R., 132, 246-258 Matorral (dry steppe), Limarí Basin, 152–154 McAdie, C., 188 McCarteny, M. P., 89 McMillan Dam, 192-199 MDB Commission, 126, 128-129 Mediterranean climate, Limarí Basin, 152-154 memoranda of understanding (MOUs), Euphrates-Tigris River Basin transboundary issues, 100 Menindee Lakes (Australia), 121–123 Mesilla Bolsón, 202–203 metalimnion, water quality and, 35-36 Mexican monsoon, hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188, 190 Mexico Colorado Basin agreements and, 169-170, 172-174 Colorado Basin water use in, 170-172 conflicts over Rio Grande/Río Bravo (del Norte) River Basin, 205 International Boundary and Water Commission and, 199-201 Rio Grande/Río Bravo (del Norte) River Basin management and, 181-184 Mid-Brunhes Event, 190 midlatitude synoptic-scale storm systems, hydroclimatology of Rio Grande/ Río Bravo (del Norte) River Basin, 186-188 migratory patterns, environment flows and alteration of, 71 Millennium drought (Australia), 124-125, 240-241 mining Colorado River Basin, 168-169 Limarí Basin, 154–155 Rio Grande/Río Bravo (del Norte) River Basin, 192–194 São Francisco River Basin, 137-141 in Yellow River Basin, 115–116 Ministry of Agriculture and Environment (Spain), 222 Ministry of Ecology and Environment (China), 108-109 Ministry of Water Resources (China), 108-109 Minute Treaties (US-Mexico) (1944), 169-170, 173-177 groundwater management in, 205 stakeholder participation and, 264 Mitchell, George P., 4 Mitta Mitta River (Australia), 121-123 M&I water transfers, Rio Grande/Río Bravo (del Norte) River Basin, 202 mixing ratio, greenhouse gases, 16-18 mobilization, water quality and, 37-38 Molle, François, 235-242

Moore, S. M., 112 Morelos Dam (US), 164-166 Mosul Dam, 103-104 mountainous headwaters Colorado Basin, 164-166 Limarí Basin, 152 Rio Grande/Río Bravo (del Norte) River Basin management and, 181-184 Tibetan Plateau, 107 Mukherjee, B., 38 municipal water use agro-ecosystems approach and, 63 Colorado River Basin, 166, 168-170, 173-177 environmental flow alterations, 67-69 Euphrates-Tigris Basin stakeholders in, 266 groundwater management and, 46, 51-52 hydro-engineering and, 67-69 inter-basin water transfers, 249-252, 256-257 Jucar River Basin, 224-225 Nile River Basin, 80-85 nutrient and sediment alterations and, 69-70 Rio Grande Basin management and, 71-73, 181-184, 192-199, 203 Rio Grande environmental flow case study, 71–72 São Francisco River Basin, 132–139, 141, 149 stakeholder participation management of, 261 storage and conveyance inefficiencies, 41-42 Yellow River Basin, 114 Murray-Darling Basin agricultural irrigation management in, 240 arid lands environmental flow patterns, 66-68 consequences of modification to, 123-124 government response to crises in, 125–126 history of water management, 124–125 human factors in sustainability management of, 128-129 hydrological/infrastructure features of, 121-123 interbasin water transfers and, 251-257 international community and, 129-130 irrigation efficiency promises and fallacies and, 240-242 irrigation overuse and environmental flow data for, 235-236 physical setting, 121-124 regulatory failures in management of, 238 sustainable management of, 121–122, 126–129, 276 water markets and, 127, 225 water policy and management in, 124-126 Murray-Darling Basin Authority (MDBA), 121-123, 126, 128-129, 276 Murray-Darling Basin Plan (MDBP), 125-130, 238-239, 276 Murrumbidgee River, 251-257 Namibia, sustainable development in, 63 National Academy of Sciences (NAS), 4, 7 National Agency on Electric Energy (ANEEL) (Brazil), 136–137 National Environmental Policy Act (NEPA), 176-177 National Irrigation Commission (CNR) (Chile), 155-157 National Irrigation Plan (2002) (Spain), 222 Nationally Determined Contribution (NDC) Partnership Plan (Namibia), 63 National Oceanic and Atmospheric Administration (NOAA), 188 National System for Water Resources Management (SINGREH) (Brazil), 144 National Water Initiative (NWI) (Australia), 127-128 National Water Resources Council (CNRH) (Brazil), 144 National Water Resources Policy (PNRH) (Brazil), 144 Native American tribes Colorado Basin management and, 169-170, 175 Rio Grande hydro-engineering and, 184-186 natural flow regime Colorado River Basin, 166 topography and habitat alteration and, 70 natural lakes, Nile River Basin, 82-85 Natural Resources Management Strategy (Australia), 127–128 nature-based solutions (NBS), sustainable development and, 63 Nauditt, Alexandra, 152–161 Nava, Luzma, 263–264 navigation, São Francisco River Basin, 142

Nero (Emperor), 79 New Mexico State Engineer, 264

Newton's Second Law of Motion, 17 nexus approach Euphrates-Tigris River Basin, 102-104 water supply management, 62 Nickum, James E., 107–117, 246–258 Nile Basin Cooperative Framework, 85-88 Nile Basin Initiative (NBI), 85-88 Nile River Basin agriculture and energy production in, 84–85 future dynamics for, 88–90 historical overview of, 79 interbasin water transfers in, 254-255 irrigation efficiency initiatives in, 201 220 irrigation growth and runoff depletion in, 237–238 physical setting, 80-83 population data for, 80-83 transboundary conflicts in, 85-91 upstream-downstream issues in, 275 water resources and use patterns, 81-85 nitrogen budget, water quality and, 37-38 nonconsumptive water use basin closure and, 238 São Francisco River Basin, 142 nongovernmental organizations (NGOs) as Euphrates-Tigris stakeholders, 267-268 as stakeholders in regional sustainability, 264 North, Gerald, 13-30 North American Free Trade Agreement (NAFTA), 205 North Atlantic Oscillation (NAO), 19-21 Northern Song dynasty (China), 107, 119n.4 North of Sinai development project, 254–255 North Pacific Oscillation, hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 Nuaimiyah Dam, 103-104 nutrient alterations, environmental flow alterations, 69-70 ocean-atmosphere system, climate change and, 19-21 Oceanic Nino Index (ONI), Limarí Basin, 154 oceanography, climate change and, 19-21 ocean water acidity, climate change and, 14-15 oil and fossil fuels in Iraq, 97 Rio Grande/Río Bravo (del Norte) River Basin, 184 in Syria, 97-98 Turkish dependence on, 97 Yellow River Basin and, 107-108, 115-116 Onencan, A., 88 Orange/Sengu Basin, 255 Organization for Economic Cooperation and Development (OECD), 3–4, 260 food demand research by, 58-60 Orontes River, 100 Our Common Journey (NAS), 7 outflow, basin closure and, 128 out-of-basin water use, Colorado River Basin, 170-172 Pacific Dacadal Oscillation, 19-21 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 São Francisco River Basin streamflow analysis, 144–150 Padilla, R., 72-73 Paez, Pedro, 79 paleohydrology, Rio Grande/Río Bravo (del Norte) River Basin, 188-190 Paloma System (Chile), 154-155 Panagides, Stahis, 5 Paris Agreement on Climate Change, nature-based solutions and, 63 Parral mining operations, 192-194 particle-size scales, sedimentation modeling, 39–40 Paso del Norte. *See* Upper Rio Grande Paso del Norte Watershed Council, 262–263 Paso del Norte Water Task Force, 261-264 Paulo Afonso Hydroelectricity Complex, 133-134, 144-150 Pecci, Aurelio, 3-4 Pecos Irrigation and Investment Company, 192-194

Pecos River Basin, 181-186, 198-199 aquifers and groundwater, 191 hydro-engineering in, 192 water quality in, 205 Peixe Vivo Agency (Brazil), 138-139 Penedo-Julien, S., 159 People's Victory Canal (China), 109-110, 114-115 perimeters of irrigation projects (Brazil), 138-139 period-of-record (POR) dependable yield data, 32-35 reservoir design, 280-281 Peru, interbasin water transfer in, 252-253 phosphorus, water quality and, 37-38, 69-70 Pietz, D. A., 108 planetary energy balance, climate change and, 16-18 political and regional stability Chinese provincial rivalry and, 108-109 Euphrates-Tigris sustainability initiatives and, 102-104 Euphrates-Tigris transboundary water issues and, 99-100 interbasin water transfers and, 246-247 irrigation water demand and supply augmentation and, 239-240 Jucar River Basin management, 228 Murray-Darling Basin, 128 Murray-Darling Basin water management and, 124-126 in Nile River basin, 85-91 South-to-North Water Transfer project and, 256-257 Yellow River Basin closure and, 110-111 opulation data Euphrates-Tigris River Basin, 96-97 Murray-Darling Basin, 121–124 Nile River Basin, 80–83 Rio Grande/Río Bravo (del Norte) River Basin management and, 184 São Francisco River Basin, 137-138, 147-149 Yellow River Basin, 115 potential evaporation, hydrology and, 19-20 potential evapotranspiration (PET), 25-30 precipitation aridity and evaporation, 25-28 changes in, 27–29 Colorado Basin decline in, 173–174 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188 hydrology and, 19-20 Limarí Basin water supply and, 158 natural fluctuations in, 30 Nile River basin, 80-83 reservoirs and, 31 prior appropriation doctrine Colorado Basin, 168-169 Texas groundwater management case study, 47-49 private water development Brazil, 139 Chile, 154-157 irrigation water demand and supply augmentation and, 239-240 Projeto Áridas, SERIDAS development and, 5 Projeto de Interligação do São Francisco (PISF), 141 proportions-of-available flow water sharing approach, Murray-Darling River Basin, 127 Protocol between Turkey and Iraq (1946), 99-100 Protocol on Economic Cooperation (1987), 99-100 public consultation, Murray-Darling Basin, 127-128 public institutions, Chilean water management, 155-157 public subsidies, Jucar River Basin management, 224-227 public water buyback programs, Jucar River Basin, 226-227 Public Water Registry (Chile), 155-157 pulse flow analysis, Colorado Basin, 166 quagga mussels, 71 Quantification Settlement Agreement (OSA), 176-177 Queimados reservoir (Brazil), 134-136 radiation streams, global climate change and, 13

radiative forcing, 20-23

289

More Information

INDEX

rainfall climatology Hadley cells, 24–26 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188 in Limarí Basin, 159-160 Nile River basin, 80-83 Rio Grande aquifers and groundwater, 190-191 São Francisco River Basin, 132-133 rainfed farming, 59-60 ranching practices, Rio Grande/Río Bravo (del Norte) River Basin, 184 Ras El Ain karstic springs, 97 recharge technology groundwater management, 47 Rio Grande aquifers and groundwater, 190-191 water supply management, 52-54 Recoleta reservoir (Chile), 154-155, 159 Red Bluff Dam, 195-199 regional climate models, São Francisco River Basin streamflow analysis, 145-150 regional sustainability planning, stakeholder participation in, 264 - 265Reisner, M., 242 Reisner, Marc, 164 removal of sediment, 40 Renault, D., 59-60 Report Number Five (IPCC), 18-19 reservoirs Colorado Basin, 164-166 demands and conflicts in construction of, 42 dependable yield data, 32-35 design and performance, 32-35, 273-275 environmental flow alterations, 67-69 Euphrates-Tigris sedimentation and, 101-102 Euphrates-Tigris transboundary water issues and, 98-100 exotic species in, 71 importance of, 31 Jucar River Basin, 222–223 Nile River Basin, 81-85 nutrient alteration and, 69-70 Rio Grande/Río Bravo (del Norte) River Basin management and, 181-184, 192-199 river impacts of, 42 São Francisco River Basin, 134-136 sedimentation challenges, 38-40, 101-102 storage and conveyance inefficiencies of, 40-42 sustainable management of, 280-281 water-balance modeling, 32-33 water quality and, 35–38 return flow, irrigation systems and, 240–242 Ribbe, Lars, 79-91, 152-161 Ribot, Jesse, 5 Richter, Brian, 279-280 Río Bravo (del Norte). See Rio Grande/Río Bravo (del Norte) River Basin Rio Chama, 190 Río Conchos, 181-186 conflicts over, 205 hydro-engineering on, 192, 198-199 La Boquilla Reservoir and, 42 paleogeology of, 190 water quality in, 205 RIo das Velhas (Brazil), 136-137 Rio Grande Citizens' Forum, 261-263 Rio Grande Compact, 199-201 Rio Grande/Río Bravo (del Norte) River Basin agricultural water stakeholders, 261 aquifers and groundwater, 190–191 climate change impacts, 204–205, 238–239, 277 conflicts involving, 205 conservation and efficiency increases on, 201 drought and, 238-239 ecological effects on, 73-74 environmental flow case study, 71-74

future recommendations for, 206, 277 geology and paleohydrology, 188–190 groundwater management, 190–191, 202–203, 205 hydroclimatology of, 186–188 hydrology and engineering, 184-190 institutional infrastructure for management of, 199-201 irrigation efficiency initiatives in, 241 irrigation overuse and runoff depletion in, 236 land use data, 184 laws, agreements and treaties involving, 201 modern engineering and management system, 192-199 physical geography of, 71-72 population data, 184 siltation challenges, 203-204 socioeconomic development, 184 stakeholder participation in management of, 261-265 stem diagram of, 192 sustainable management recommendations, 277 topography and habitat changes, 72-73 tributaries of, 181-184 water-budget analysis, 202 water consumption and use, 202-203 water planning initiatives, 201–202 water pricing and, 201 water quality in, 205 water use categories, 202-203 Rio Grande/Rio Bravo Test Study, 4-5 SERIDAS research on, 8 water supply and groundwater management in, 51–52 Rio Grande Water Forum, 265 Rio Paraopebas (Brazil), 136-137 Rio Puerco, 181-184 riparian zones environmental flow ecology and, 70-71 in Rio Grand environmental flow case study, 73-74 river basin management. See also water management; specific river basins, e.g., Murray-Darling Basin arid lands, environmental flows in, 66-68 basin closures, 235–242 best practices, 281 environmental flows in, 66–69 global climate change and, 13-30 historical overview of, 273 interbasin water transfers, 248-259 irrigation and, 235-242 regulatory failure and, 238 reservoir impacts on, 42 sediment load correction in, 69-70 stakeholder participation in, 260–268 River Basin Management Plans (RBMPs), 265–266 River Basin Protection Action Plans (Turkey), 265-266 "River Chiefs" system (China), 112 River Murray Commission, 126-129 River Murray Water, 128-129 river shrimp species, environment flows and alteration of, 71 river sub-basins, definition and management of, 260-265 Roman, P., 253 Rosenberg, K. V., 168 RSF Basin Committee, 237 Ruleman, C., 190 rule of capture, Texas groundwater management case study, 47-49 runoff General Circulation Models, 27-30 HBV light rainfall-runoff model, 159 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188 hydrology and, 19-20 irrigation overuse and depletion of, 235-238 Limarí Basin water supply and, 158–160 SERIDAS research and, 27–30 Yellow River Basin, 113-114, 237

"run of the river" principle, Texas groundwater management case study, 47-49

291

salinity Colorado River Basin, 172-174 Nile River basin, 237-238 Salinity and Drainage Strategy (Australia), Murray-Darling Basin, 127-128 salinity issues Euphrates-Tigris River Basin, 101 Murray-Darling River Basin, 121-123 Yellow River Basin, 109–110 Salton Sea, 170, 176-177 Samarra Dam, 98 Sanchez-Ibor, C., 242 Sandia National Laboratory, 204-205 San Juan-Rio Chama Project, 181-184, 194-195 San Juan River Basin Recovery Implementation Program, 166 Sanmenxia Dam, 110 Santa River Basin, 252-253 São Francisco Canion (Brazil), 133-134 São Francisco Hydroelectricity Company (CHESF), 133-134 São Francisco Integration Program, 237 São Francisco River Basin climate change scenarios for, 238–239 droughts and floods, 134–136 ecological effects, 142–143 groundwater management, 134-135 hydropower development, 142 industry and mining, 139-141 interbasin water transfer in, 253 irrigation and runoff depletion in, 237 nonconsumptive water use, 142 sedimentation and siltation, 136-137 sustainable management of, 276-277 water balance, 143-144 water quality, 143 water rights, 143 São Francisco River Basin, 107 climate change and population growth in, 147–149 engineering on, 133–134 future management issues for, 144-150 institutional arrangements in, 144 IWRM practices in, 61-62 physical geography, 132-133 recommendations for management of, 149 socioeconomic aspects of, 137-138 streamflow analysis, 144-150 water transfers, 141 São Francisco River Basin Committee, 61-62 São Francisco Water Transfer, 253 Scheumann, W., 99–100 Schmandt, Jurgen, 181–206, 260–268, 273–281 Schuyler, J. D., 38–39 Seager, R., 190 sea level rise, climate change and, 14-15 sea surface temperatures, São Francisco River Basin streamflow analysis, 144-150 Secretary of the Interior (US), Colorado Basin management and, 169-170 sedimentation aridity and, 38-39 basin closure and, 238 Colorado Basin, 164–165 environmental flow alterations, 69-70 in Euphrates-Tigris River Basin, 101-102 Nile River Basin, 81-85 physics of, 38-39 reservoirs and challenge of, 38-40 reservoir siltation and, 38-39 Rio Grande aquifers and groundwater, 190-191 São Francisco River Basin, 136–137, 276–277 water quality and, 37–38 Yellow River Basin, 276 Yellow River Basin and, 110-111, 113-114 sediment-control reservoir, 40 sediment starvation, channel erosion and, 42 Segura Basin, 254

semi-arid regions biophysical and hydro-climatic characteristics, 152-154 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188 mountainous catchments and, 152 semi-distributed hydrological model (SWAT), Limarí Basin modeling, 159 Sese-Minguez, 241-242 sewage management São Francisco River Basin, 139 São Francisco River Basin, 149 Shah, M., 62 Shaofeng, Jia, 107–117 Shatt Al-Arab, 94–96 Sheppard, P., 186–188 short-wave disturbance, hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 186-188 siltation bathymetric surveys of, 39-40 remedies for, 40 of reservoirs, 38-40 Rio Grande/Río Bravo (del Norte) River Basin, 203-204 São Francisco River Basin, 136-137 Yellow River Basin, 107-108, 110, 113-114, 276 Siqueira, R., 149 Smith, N., 38 Snowy Mountains Hydroelectric Scheme (SMS) (Australia), 121-123, 251-257 Snowy-Murray Diversion, 251-257 Snowy-Tumut Diversion, 251-257 Sobradinho Dam (Brazil) construction of, 133–134 environmental flow data for, 144–150 fish and fisheries and, 142 flood control and, 134-136 irrigation and runoff depletion and, 237-239 siltation and sedimentation and, 136-137 socioeconomic development Chavimochic interbasin water transfer (Peru) and, 252-253 El-Salam Canal in Sinai, 254-255 Euphrates-Tigris River Basin, 96–97 interbasin water transfers and, 246–249 irrigation and, 242 Lesotho Highlands Water Transfer, 255 Limarí Basin, 155-158 Nile River Basin, 85-88 Rio Grande/Río Bravo (del Norte) River Basin, 184 São Francisco River Basin, 137-138 São Francisco Water Transfer, 253 Snowy Mountains Hydroelectric Scheme, 251–257 South-to-North Water Transfer project and, 256–257 Tagus-Segura IBWT, 254 soil resources holistic management of, 61-63 integrated water, land and soil resource management and, 60-61 Rio Grande geology and paleohydrology, 188-190 water supply management and, 57-58 solar radiation, water quality and, 35-36 South American, interbasin water transfers in, 252-254 South Central Climate Science Center, 265 Southeastern Anatolia Project (Turkey), 63 *South-North Water Diversion project (Yellow River Basin), 116 *South-to-North Water Transfer projects (SNWT), 256-257 Souvignet, M., 159 Spain irrigation efficiency initiatives in, 241-242 reservoir siltation in, 38-39 water consumption increase in, 221-222 water governance institutions in, 222 water management and utilization in, 220-221, 228-229 water resources in, 221-223 species connectivity Colorado River Basin, 166

environment flows and alteration of, 71

292

INDEX

Speke, John Hanning, 79 spills data, reservoir design and yield, 32-33 Stakeholder Engagement for Inclusive Water Governance (OECD), 260 stakeholder participation academic institutions and, 264 Colorado Basin sustainability management and, 176-177 Euphrates-Tigris Initiative for Cooperation, 266-267 Euphrates-Tigris River Basin, 265-268 information and communication, 261 Jucar River Basin management, 224, 228 NGOs and civil society organizations as stakeholders, 267–268 regional sustainability planning and, 264–265 Rio Grande/Río Bravo (del Norte) River Basin management, 261–265 river basin management, 260–268 river sub-basin definition and management, 260-265 SERIDAS recommendations for, 268, 278 surveys of stakeholders and, 263-264 'The State of World Fisheries and Aquaculture in 2018' report, 59-60 State Water Plan for Texas, 201-202 storage systems, reservoirs and inefficiencies in, 40-42 streamflow analysis Colorado River Basin, 166 Limarí Basin modeling, 159 mountainous catchments, 152 Rio Grande aquifers and groundwater, 190-191 Rio Grande engineering and, 195-199 Rio Grande/Río Bravo (del Norte) River Basin, 181-186 São Francisco River Basin, 144-150 Spanish water use, 221-222 Yellow River Basin, 276 streamflow record, reservoir design and yield, 32-33 Sundborg, A., 39-40 surface temperatures evaporation increases, 27-29 hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 surface water Colorado River Basin, 170-172 Euphrates-Tigris River Basin, 98 groundwater interactions with, 50, 273-275 Jucar River Basin management of, 228 Rio Grande/Río Bravo (del Norte) River Basin, 190–191 storage issues with, 52-54 Sustainability Criteria for Water Resource Systems (ASCE), 279-280 sustainability management climate change impact on food production and, 58-60 Colorado Basin, 173-177 Euphrates-Tigris River Basin, 102-104 future groundwater, 52-54 human factors in Murray-Darling Basin, 128–129 Jucar River Basin, 227–228 Limarí Basin, 155-160 Murray-Darling Basin, 127 Murray-Darling River Basin, 121-122, 126-129 regional sustainability planning, stakeholder participation in, 264-265 Rio Grande/Río Bravo (del Norte) River Basin, 206 water conflicts, 281 Yellow River Basin, 108, 113-114 Sustainability of Engineered Rivers in Arid Lands (SERIDAS) agriculture and irrigation data from, 57–58 challenge-and-response concept, 3 challenges in research by, 273-275 characteristics of rivers in, 5-7 environmental flow patterns, 66-68 evolution of, 3-4 future groundwater management initiatives, 52-53 future research and initiatives, 278-281 groundwater extraction data, 46 mid-term review of, 7–8 models for, 5 policy recommendations, 8 prelude to, 3 research methodology for, 7, 273 reservoir design and yield, 32-33

rivers selected for research, 273 runoff research and, 27-30 stakeholder participation and, 260-268 supporting activities, 8 water supply and groundwater management in, 51-52 sustainability science, evolution of, 4, 7 sustainable development agro-ecosystems approach to, 63 integrated water, land and soil resource management and, 60-61 IWRM approach to, 61-62 landscape approach, 62 nature-based solutions and, 63 regional projects, 63 water supply management and, 57–58 Sustainable Development Goals (SDGs), 279–280 holistic principles and, 61-62 water supply management and, 57-58 sustainable diversion limits (SDLs), 238-239 Sustainable Land Management (SLM), defined, 61 Sustainable Rivers Audit, 127-128 Sycz, Justyna, 152-161 Syria Euphrates-Tigris sustainability initiatives and, 102-104 NGOs and civil society organizations as stakeholders, 267-268 population and socioeconomic development in, 97 transboundary groundwater resources, 97 transboundary water disputes and, 98-100 water development projects in, 98 Syria-Iraq bilateral protocols, 99-100 Tabga Dam, 98-100 Tagus-Segura Interbasin Water Transfer, 254 Technical Cooperation Committee for the Promotion of Development and Environmental Protection of the Basin (TECCONILE), 85-88 technology development Jucar River Basin, 224–225 Nile River Basin and, 90-91 recharge technology, 47, 52-54 tectonic episodes, paleohydrology, Rio Grande Basin, 188-190 temperature change Limarí Basin water supply and, 158 water quality and, 35-36 Tennessee Valley Project, 63 terraced landscaping, Yellow River Basin, 113-114 Texas Aquifer Storage and Recovery technology in, 52-54 engineered alterations in, 49-50 groundwater management case study, 47-49 Texas State Water Plan, 47–49 Texas Water Development Board (TWDB), 191, 262–264 Aquifer Storage and Recovery technology and, 54 Tharthar Canal, 95, 98 Tharthar Reservoir, 98 thermal pollution, river water quality and, 42 thermocline warm-weather stratification and, 37-38 water quality and, 35-36 thermocline layer, water quality and, 35–36 Thermohaline Circulation, 19–21 Thomas, Sephra, 79–91 "Three Red Lines" criteria, Yellow River Basin management, 111-112 Three-Stage Plan (Turkey), 99-100 Tibetan Plateau, 107 Tigris River. See Euphrates-Tigris River Basin topography alteration environmental flows and, 70-71 Rio Grande environmental flow case study, 72-73 tourism, São Francisco River Basin, 142 Tous reservoir (Spain), 222-223 Toynbee, Arnold, 3 transboundary systems

More Information

INDEX

Euphrates-Tigris River Basin, 94-100, 275-276 Euphrates-Tigris sustainability initiatives and, 102-104 Nile River Basin, 85-91 Rio Grande/Río Bravo (del Norte) River Basin, conflicts involving, 205, 277 São Francisco River Basin, 141 stakeholder participation and conflicts over, 261-263, 265-266 Trasvaase Daule-Santa Elena (Ecuador) interbasin water transfer, 253-254 Treaty of 1944 (US and Mexico), 201 Três Marias Dam (Brazil), 133-134, 136-137, 142, 145-150, 238-239 tribal water rights, Colorado Basin management and, 169-170, 175 Trondalen, J. M., 101 Tropical Storm Alice, Rio Grande hydrology and, 196-199 tropical storms, hydroclimatology of Rio Grande/Río Bravo (del Norte) River Basin, 188 Turkey agricultural water stakeholders in, 266 Euphrates-Tigris River basin geography in, 94-96 Euphrates-Tigris sustainability initiatives and, 102-104 NGOs and civil society organizations as stakeholders, 267-268 population and socioeconomy, 96-97 stakeholder participation in sustainable basin management in, 265–266 transboundary groundwater resources, 97 transboundary water disputes and, 98-100 water development projects in, 98 Turkey-Syria bilateral protocol (1987), 99-100 2030 Agenda for Sustainable Development, 279-280 United Nations 2030 Sustainable Development Agenda, 57-58 United Nations High-Level Panel on Water, 279-280 United States annexation of New Mexico by, 184-186 interbasin water transfers in, 249-252 United States-Mexico Transboundary Aquifer Assessment Act (2006), 205 Unver, Olcay, 57-64 Upper Colorado River Commission, 170 Upper Colorado River Endangered Fish Recovery Program, 166 Upper Rio Grande hydro-engineering of, 192, 196-199 irrigation efficiency initiatives in, 241 management of, 277 water budget analysis, 213-216 upstream sediment retention, 40 urbanization Rio Grande/Río Bravo (del Norte) River Basin, 184 São Francisco River Basin, 137-138 Vaal River System, 255 Valdinfierno Dam (Rio Guadalentin), 38–39 Vicuña, S., 157–159 volcanism, paleohydrology, Rio Grande Basin, 189 Volkswagen Foundation, 7-8 Wang, D., 113-114 Ward, George H., 31-42, 181-206, 273-281 wastewater treatment plants Jucar River Basin, 224-225, 228 Rio Grande basin, 205 São Francisco River Basin, 139 in Spain, 222 Yellow River Basin construction of, 112 Water Act 2007 (Australia), 125-126, 276 water agencies, water management planning and role of, 264 "Water and Sediment Regulation Discharge Project," 111 Water Audit 1995 (Australia), 126 water balance Colorado River Basin, 177 Jucar Basin Authority, 227–228 São Francisco River Basin, 143-144 water-balance modeling, reservoir design and yield, 32-33 water budget analysis dependable yield data, 32-35 Lower Rio Grande basin, 217-219

reservoir design and yield, 32-33 Rio Grande/Río Bravo (del Norte) River Basin, 202 Upper Rio Grande, 213-216 water consumption and use agricultural productivity and growth in, 58-60 arid lands environmental flow patterns, 66-68 Colorado Basin, 170-172 global projections of, 220-221 irrigation and augmentation of, 239-240 Murray-Darling Basin, 124-126 Nile River basin, 81-85 Rio Grande environmental flow case study, 71-72 Rio Grande/Río Bravo (del Norte) River Basin, 202-203 São Francisco River Basin, 138-143 in Spain, 221-222 water supply imbalances and, 238-239 water demand. See water consumption and use water development projects Euphrates-Tigris River Basin, 98 Nile River Basin, 90–91 water-energy-food (WEF) nexus, Euphrates-Tigris River Basin, 102–104 Water Evaluation and Planning (WEAP) tool, Limarí Basin modeling, 159 water extraction data Australian cap on extractions, 127-128 global extraction increase, 220-221 in SERIDAS research, 46 'Water for the Future' campaign (Australia), 240-241 water management. See also river basin management in Chile, 154–157 Colorado River Basin, 166–170 in Jucar River Basin, 223–227 Murray-Darling Basin, 127-129 regulatory failure and, 238 Rio Grande/Río Bravo (del Norte) River Basin, 181-184, 201-202 in Spain, 222 water markets groundwater management and, 51-52 Jucar River Basin, 225-227 Limarí River Basin, 152, 154-158 Murray-Darling River Basin, 127 Rio Grande/Río Bravo (del Norte) River Basin, 201 water pricing Jucar River Basin, 225-227 Rio Grande Basin, 201 water quality dissolved oxygen t-z contours, 36-38 Euphrates-Tigris River Basin, 101 reservoir design and, 35–38 Rio Grande/Río Bravo (del Norte) River Basin, 205 in rivers, reservoir impact on, 42 São Francisco River Basin, 143 in Spain, 221-222 Yellow River Basin, 112 Water Resource Research Center, 205 Water Resources Plan for 2016-2025 (Brazil), 143-144, 237 water rights Chilean Water Code, 154-155 Colorado River Basin, 166-170, 177 Rio Grande/Río Bravo (del Norte) River Basin, 184, 201 São Francisco River Basin, 143 water supply and resources Aquifer Storage and Recovery technology and, 54 Colorado River Basin, 170-172 demand imbalances and, 238-239 Euphrates-Tigris River Basin, 98, 101 food security endangerment and, 57–58 global projections of, 220–221 groundwater management and, 51-52 holistic management of, 61-63 increased demand for, 52-54 integrated water, land and soil resource management and, 60-61 irrigation and augmentation of, 239-242

293

More Information

294

INDEX

water supply and resources (cont.) Limarí Basin, 158 Murray-Darling Basin, 124-126 Nile River basin, 81-85 Rio Grande/Río Bravo (del Norte) River Basin engineering and, 192-199 São Francisco River Basin, 138-144 in Spain, 221-223 technology innovations for, 52-54 wasteful irrigation practices and, 59-60 water table, Yellow River Basin management of, 114 Water Ten Law (China), 112 water towers (mountainous headwaters), 107, 152 water trading Colorado Basin and, 176–177 Murray-Darling Basin, 128 São Francisco River Basin, 141 water transfers. See also interbasin water transfers (IBWT) alternatives to, 249 assessment of results, 249-251 Colorado Basin, 166-170 intelligent water transfer initiatives, 247-248 Jucar River Basin, 224–225 Limarí Basin, 159–160 Murray-Darling River Basin, 127 overview of, 246 Rio Grande/Río Bravo (del Norte) River Basin, 202 São Francisco River Basin, 141 water user associations (Chile), 155-157 Watt, James, 13-15 wavelets analysis, São Francisco River Basin streamflow analysis, 144-150 wetlands groundwater over-pumping and, 50 in Rio Grand environmental flow case study, 73-74 Yellow River Basin, 112 White, I., 257–258 White Nile discovery of, 79 physical characteristics, 80-83 tributaries of, 81-85 Winter Garden irrigation, 181-184 withdrawal permits in Spain, 221–222 Texas groundwater management case study, 47-49 Yellow River Basin, 114 Yellow River Basin closure and, 110-111

World Economic Forum (WEF), water supply data, 57–58 World Soil Charter, 61 World Wide Fund for Nature (WWF), 267–268 World Wildlife Fund Australia, 125–126 Worster, D., 242 *Wyoming v. Colorado*, 169

Xia Dynasty (China), 107 Xiaolangdi Reservoir and Dam, 111, 237 Xingó Dam (Brazil), 133–134, 145–150, 238–239

Yahara Pride Farms, agro-ecosystems approach at, 63 Yellow River Basin agricultural irrigation management in, 240 arid lands environmental flow patterns, 66-68 basin closure and river decline, 110-111 Chinese Communist engineering projects and, 108-109 Chinese provincial rivalry and, 108-109 climate change and, 116 current use data for, 114 future stressors and relievers for, 114-116 historical hydraulic engineering projects on, 108–109 history and geography, 107–108 irrigation and, 107–111, 114–115, 237 irrigation efficiency initiatives in, 241 irrigation growth in, 237 mining and fossil fuels in, 115-116 modern engineering projects, 109-110 population demographics and, 115 runoff and sediment load declines, 113-114, 237 south-north water diversion project, 116 South-to-North Water Transfer project and, 256-257 sustainability issues for, 276 transbasin diversions, 109-110 urbanization and, 115 water quality and ecosystem degradation, 112 Yellow River Conservancy Commission (YRCC), 108-111 water quality and ecosystem degradation research, 112 Yellow River Water Allocation Scheme, 110-111 Young, C., 72-73 Yü the Great, 107

zebra mussels, 71 Zellhuber, A., 136–137 Zhou dynasty (China), 107 Zimmer, D., 59–60