

- A**
- Africa 39, 87, 91
 - agricultural productivity 63
 - biofuels 57
 - in situ* water conservation 31, 33
 - irrigation systems 22, 56
 - land degradation 12, 14, 55
 - land resource potential model 24
 - livestock farming 21
 - Mediterranean climates 89
 - population in drylands 9
 - production of cereals 18
 - qanats 49
 - soil organic matter 42–3
 - sustainable systems 70
 - water harvesting 35
 - watershed development projects 67
 - agricultural droughts 6
 - see also* droughts
 - agricultural productivity
 - current drylands scenario 62–3
 - investment evidence 53–5
 - land degradation 12–13
 - agrobiodiversity 47
 - agro-ecosystem sustainability 69–70
 - Amman area 15
 - Andhra Pradesh, India 66, 67
 - aquifers 9, 21
 - Argentina 11
 - arid regions 5–6, 83–6
 - groundwater mining 9
 - irrigation systems 22
 - land degradation 13–14
 - terraces 30
 - water harvesting 34
 - aridity 6–7, 84
 - Asia
 - biofuels 57
 - irrigation systems 22
 - land degradation 12, 14
 - Mediterranean climates 89
 - population in drylands 9
 - production of cereals 18, 23
 - qanats 49
 - water harvesting 34
 - watershed development projects 70
 - Asia-Pacific region 11
 - Australia 85, 89
 - irrigation systems 2
 - land use systems 11
 - mixed farming 21
 - production of cereals 18
 - water-use efficiency 27
- B**
- barley-based farming 89
 - basin irrigation 32
 - Bedouin people 11
 - bench terraces 30
 - biodiversity 47
 - biofuels 1–2, 18–20, 23, 44, 56–7
 - biomass production 26, 50–1, 54
 - blue water 28–9, 67
 - Brazil 23, 45
 - bunds 31–2, 34, 37–8, 49
 - see also* terraces
 - Burkina Faso 37, 91
 - Bushland, United States 96
- C**
- CA (conservation agriculture) 44–6, 62–3
 - Canada 2, 11, 18, 45, 90–1
 - canals 47
 - carbon cycle 45
 - carbon dioxide (CO₂) 15–16, 45
 - carbon sequestration 46, 58
 - carbon trading 58
 - catchment systems, water harvesting 36–7, 40
 - CBTs (conservation bench terraces) 31
 - CDM (Clean Development Mechanism) 58
 - Central America 12, 18
 - centralized water harvesting systems 35
 - cereals
 - consumption rates 1–2
 - production in drylands 17–51, 93–4
 - production maps 97–103
 - see also individual cereals*
 - chickpea sowing 46
 - China 85–7
 - groundwater mining 9
 - indigenous practices 49–50
 - investment constraints 54–5
 - irrigation systems 2, 21–2
 - land degradation 14
 - production of cereals 18–20, 23
 - terraces 30
 - water harvesting 34
 - water-use efficiency 27
 - Clean Development Mechanism (CDM) 58
 - climate change 15–16, 45, 63
 - clumping sorghum plants 42
 - CO₂ (carbon dioxide) 15–16, 45
 - collective action 54, 66
 - conservation agriculture (CA) 44–6, 62–3
 - conservation bench terraces (CBTs) 31
 - Conservation Reserve Program (CRP) 23
 - conservation tillage 44, 58, 91
 - see also* no-tillage farming
 - consumption of food 1–2, 18, 20
 - continental climates 7, 14
 - contour bunds 31–2, 34, 37–8, 49
 - contour furrows 31
 - corn *see* maize
 - costs
 - irrigation systems 26, 59–60, 87
 - runoff enhancement 41
 - water harvesting 26, 59–60
 - crop selection 46–7

- cropping systems 84, 89
see also individual crops and systems
- CRP (Conservation Reserve Program) 23
- cultivar selection 46–7
- D**
- Darewadi village, India 66
- deforestation 13
- degradation of land 9, 11–14, 20, 54–5, 57, 69
- desertification 12–13, 62
see also hyperarid zones
- developing countries
 cereal consumption 1–2
 climate change
- effects 15–16
 irrigation systems 21–2
 production of
- cereals 18–20, 24
see also individual countries
- development costs, water harvesting 59–60
- Dingxi County, China 50
- droughts 6–7, 62, 90
in situ water
- conservation 33–4
 land degradation 12, 14
 land use systems 10
 mixed farming 14–15
- dry farming *see* dryland farming
- dry subhumid regions 5–6, 21, 83–4
- dryland farming
 definitions 9–10, 34, 83–4
 regional variations 85–91
- drylands
 characteristics 5–9
 current scenario 62–3
 definitions 5, 83–4
 people of drylands 9
 wider water issues 65–7
 world distribution 7
- Dust Bowl disaster 41, 86, 88, 90
- E**
- economic aspects 53–63, 65
see also costs; investment
- environmental benefits of projects 53, 55, 65
- environmental services programs 58
- ephemeral streams 25, 37
- erosion of soil 14, 40–1, 54–5, 90–1
see also land degradation
- ethanol 1–2, 19–20, 56–7
- Ethiopia 31, 87
- Europe
 irrigation systems 2
 production of cereals 18, 20, 23
 soil organic matter 43
- evaporation
 reduction 39–42
 soil types 7
 water-use efficiency 28
- evapotranspiration 5–7, 9, 26–9, 41, 50, 61, 84
- exporting biofuels 57
- external catchments 36
- F**
- falaj system 47
- fallow systems 10–11, 41, 85–6, 89–91, 96
- FAO
 classification of drylands 5–6, 84
 land resource potential
- model 24
 water harvesting manual 58
- farmers
 field schools 47
 innovation 62
see also small-holders
- feedstock production 56–7
see also biofuels
- fertilizers 19, 43, 67
see also soil fertility
- first generation fuels 56
- flash floods 26
- flexible practices 48
- flood effects 26
- floodwater harvesting 36–7
- food security
 carbon sequestration 46
- cereal production 18, 20, 23
 water harvesting 39
- fossil water 9
- fuel systems
 biofuels 1–2, 18–20, 23, 44, 56–7
 first generation 56
 second generation 56–7
- furrow dyking 32–3
- furrows (contour furrows) 31
- G**
- geographical information systems (GISs) 50
- geomorphology of drylands 7
- GHGs (greenhouse gases) 15–16, 46
- GISs (geographical information systems) 50
- global food systems 19, 97–9
see also worldwide cereal production
- government agencies 66–7
- grains *see* cereals
- Great Plains, United States 26–7, 40–2, 84, 87–8, 90
- green water 28–9, 67
- greenhouse gases (GHGs) 15–16, 46
- groundwater resources 9, 21–2, 60, 66–7
- growing periods, dryland regions 5–6, 83
- H**
- harvesting *see* water harvesting
- high-yielding varieties (HYVs) 20
- household action 54
- humid regions 21
- hybrid crops 42
- hydrological droughts 6
- hyperarid zones 6, 22, 35, 83–4
- HYVs (high-yielding varieties) 20

- I**
- IFPRI (International Food Policy Research Institute) 55
 - imported grain 22
 - in situ* water
 - conservation 28–34
 - India 87–8
 - biofuel production 57
 - groundwater mining 9
 - in situ* water
 - conservation 29
 - indigenous practices 49
 - investment evidence 55
 - irrigation systems 2, 21
 - production of cereals 18
 - water harvesting 34–5, 37
 - watershed development
 - projects 66–7
 - indigenous practices 47–50
 - innovation 62
 - International Food Policy Research Institute (IFPRI) 55
 - introduced practices 47–50
 - investment
 - constraints 53–5
 - economic aspects 53–63
 - irrigation systems 3, 26
 - potential 55–6
 - social aspects 53–63
 - soil water conservation 49
 - Iran 13–14, 22, 35, 37, 49, 88
 - irrigation systems 2–3, 21–4
 - areas of land used 95
 - basin irrigation 32
 - blue/green water 29
 - costs 26, 59–60, 87
 - developing countries 19
 - Ethiopia 87
 - investment constraints 53
 - land degradation 13
 - rice 18
 - supplementary
 - irrigation 50–1, 56, 60–1
 - transfer of
 - technology 29–30
 - water harvesting 34, 38
 - watershed development
 - projects 66
 - J**
 - johads 35
 - Jordan 37
 - K**
 - Kenya 31
 - Kyoto Protocol, CDM 58
 - L**
 - LAI (leaf area index) 39
 - land degradation 9, 11–14, 20, 54–5, 57, 69
 - land levelling with lasers 32
 - land productivity
 - potential 97–103
 - land resource potential model (FAO) 24
 - land use systems 9–11, 12
 - laser-levelled basin
 - irrigation 32
 - Latin America 18, 57–8
 - see also* Central America; South America
 - leaf area index (LAI) 39
 - legumes 47
 - length of growing period (LGP) classification 5–6
 - livestock
 - cereal production role 20–1
 - regional variations 85, 89
 - resource base effects 14–15
 - ruff farming 35
 - soil organic matter 44
 - watershed development
 - projects 66
 - Loess Plateau, China 30, 34, 49–50, 54–5
 - lot feeding 15
 - Luvissols 33, 91
 - M**
 - macro-catchments 36
 - Madhya Pradesh, India 67
 - Maharashtra, India 66
 - maize 2
 - ethanol production 20, 56–7
 - regional production
 - rates 93
 - water conservation 61–2
 - water-use efficiency 26–7
 - worldwide production
 - trends 17–19
 - management *see* water management
 - marginal environments 55–6
 - meat consumption 20
 - Mediterranean climates 7, 46–7, 85, 88–9
 - meteorological droughts 6
 - micro-catchments 36–7
 - milk consumption 20
 - millet production 94
 - minibenches 32
 - mining groundwater 9
 - mixed farming 14–15, 21, 85
 - monsoon season 88
 - Morocco 32
 - mulches 29, 41, 86–8, 96
 - N**
 - Niger 6
 - Nile River 38
 - no-tillage farming 62, 91
 - see also* conservation tillage
 - nomadic people 9–10, 35
 - North America *see* Canada; United States of America
 - O**
 - Oman 47
 - opportunity creation 56–7
 - organic matter *see* soil
 - organic matter
 - overgrazing 14–15
 - overuse of water 67
 - P**
 - P/PET (precipitation to potential evapotranspiration) 5–6, 84
 - Pacific region 11
 - participatory approaches 62, 66–7
 - pastoral systems 16, 83
 - see also* livestock
 - Payments for Environmental Services (PES) 58
 - per capita consumption of cereals 1

- perennial crops 60–1
 perennial streams 25
 PES (Payments for Environmental Services) 58
 Plan Vivo System 58
 plant species 17
 see also cereals
 plastic mulches 86–7
 ploughing effects 42, 45, 86
 population distribution in drylands 9–10
 population growth
 investment constraints 53–4
 land degradation 11–13
 land use systems 10
 production of food 1–2
 water resources 21–2
 poverty reduction 15–16, 53–5, 65
 poverty trap 10–11
 precipitation
 evaporation reduction 41
 geographical information systems 50
 in situ water conservation 29, 33
 monsoon season 88
 supplementary irrigation 51
 variability 25–6
 water harvesting 35
 water-use efficiency 27–8
 see also rainfall
 precipitation to potential evapotranspiration (P/PET) 5–6, 84
 production of food 1–2
 currently available land 100–2
 economic aspects 59–61
 enhancement 25–51
 expansion 23–4
 global land suitability 97–9
 investment evidence 54–5
 irrigation role 21–3
 land productivity potential 97–103
 livestock/cereal production 20–1
 regional variations 93–4
 worldwide trends 17–20
 productivity factors 12–13, 53–5, 62–3, 97–103
- Q**
- qanats 49
- R**
- rainfall
 climate change effects 15
 dryland characteristics 6–7, 9
 geographical information systems 50
 in situ water conservation 33–4
 land use systems 11
 Mediterranean climates 89
 partitioning effects 28
 runoff coefficients 38
 salt-affected soils 13
 storage systems 39
 variability 26
 water harvesting 35, 37, 60–1
 see also precipitation
 rainfed crop production 24, 29, 83, 97–103
 residues
 biofuels 44
 evaporation reduction 41
 resource poverty 10–12
 rice 2, 17–19
 risks of feedstock production 56–7
 river basins *see* watershed development projects
 rooftop water harvesting 36–7, 39
 runoff agriculture 7, 9, 28–9, 31, 33, 60
 see also water harvesting
 runoff coefficients 38–9, 41
- S**
- Sahel, Niger 6
 salinity 13, 20
 salt-affected soils 13–14
 seasonal shifting of crops 46–7
 seasonal water use 27, 50, 69
 second generation fuels 56–7
 sedentary populations *see* small-holders
 semi-arid regions 5–6, 83–6, 88
 evaporation reduction 39
 in situ water conservation 33
 land degradation 13–14
 livestock production 21
 soil organic matter 42–3
 supplementary irrigation 50–1, 56
 water harvesting 34
 water-use efficiency 26–8
 watershed development projects 66
 wheat water-balance values 95
 yield increases 61–2
 semi-nomadic people 9, 35
 sequestration of carbon 46, 58
 small-holders 9–10
 crop/cultivar selection 47
 evaporation reduction 42
 poverty reduction 16
 soil fertility improvements 44
 social aspects of investment 53–63
 socioeconomic droughts 6
 soil conservation *see* soil water conservation
 soil erosion 14, 40–1, 54–5, 90–1
 see also land degradation
 soil fertility 19, 42–6, 48, 67
 see also fertilizers
 soil management *see* soil water conservation
 soil organic matter (SOM)
 carbon trading 58
 conservation agriculture 62–3
 dryland characteristics 7, 9
 increasing 42–6, 69
 land degradation 14
 runoff potential 29
 soil water conservation (SWC) 3, 22, 65–7

- indigenous practices 49
- investment evidence 54–5
- rained crop production 24
- regional variations 88
- soils
 - Australia 85
 - Brazil 23
 - carbon content 45
 - dryland characteristics 7–9
 - erosion 14, 40–1, 54–5, 90–1
 - fertility 19, 42–6, 48, 67
 - India 88
 - livestock effects 14
 - salt-affected soils 13–14
 - water-storage
 - characteristics 33, 96
 - West Africa 91
- SOM *see* soil organic matter
- sorghum
 - contour bunds 31
 - evaporation
 - reduction 39–42
 - regional production rates 94
 - semi-arid regions 26–7, 50
 - water conservation 61–2
 - water-storage efficiency 96
- South Africa 39
- South America 9, 18, 23
 - see also* Latin America
- steppes region 11, 84
- stone fields 49
- storage of water 33, 39, 60, 96
- straw mulches 96
- streams 7, 25, 37
- stubble mulching 41, 86
- sub-Saharan Africa 91
 - see also* Africa
- subhumid regions 5–6, 21, 83–4
- Sudan 13, 38
- summer fallow systems 11
- supplementary
 - irrigation 50–1, 56, 60–1
- surface treatments for runoff 40–1
- sustainable systems 43–4, 69–70
- SWC *see* soil water conservation
- Syrian Arab Republic 30, 37, 46
- T**
 - tanks for water storage 39
 - terraces 30–1, 36–8, 49, 54–5
 - Texas state 26–7, 33, 42
 - tied ridging 31–3
 - tillage 44–6, 69
 - conservation tillage 44, 58, 91
 - furrow dyking 32–3
 - no-tillage farming 62, 91
 - regional variations 86
 - transfer of technology
 - models 29–30, 47
 - transhumant
 - populations 9–10
 - transpiration 26, 28, 41, 50
 - see also* evapotranspiration
 - tropical climates 7, 84
 - tubewells 60
 - Tunisia 13, 36
- U**
 - UNCCD classification of drylands 5–6
 - United States Department of Agriculture (USDA) 90
 - United States of America 86–8, 90–1
 - Bushland sorghum 96
 - cropping systems 84
 - evaporation reduction 40–2
 - in situ* water
 - conservation 31–3
 - irrigation systems 2
 - land use systems 11
 - Mediterranean
 - climates 88–9
 - mixed farming areas 85
 - production of cereals 18, 20, 23
 - soil organic matter 43
 - water-use efficiency 26–7
 - USDA (United States Department of Agriculture) 90
- V**
 - Vertisol soils 33, 85, 88
- W**
 - water-balance values of wheat 95
 - water conservation 3, 11, 28–35, 48–9, 61–2
 - see also* soil water conservation; water management
 - water harvesting (WH) 3, 34–40, 65–7, 69
 - costs 26, 59–60
 - definitions 28, 34
 - economic aspects 58–61
 - indigenous practices 48, 9
 - Tunisia 13
 - water management
 - aims 67
 - irrigation systems 2–3
 - plans 69–70
 - rained crop production 24
 - see also* water conservation
 - water resources
 - cereal irrigation
 - systems 21–2
 - dryland characteristics 9
 - overuse 67
 - runoff agriculture 60
 - watershed development
 - projects 66
 - water-spreading schemes 38
 - water-storage
 - mulches 96
 - soils 33, 96
 - structures 39, 60
 - water-use efficiency 25–8
 - definition 26
 - economic aspects 61
 - fertilizers 43
 - runoff coefficients 38
 - supplementary
 - irrigation 51
 - West Africa 91
 - waterlogging 61
 - watershed development
 - projects 65–7, 70
 - West Africa 91
 - see also* Africa

- WH *see* water harvesting
- wheat 2, 38, 61–2
 ethanol production 20
 investment potential 55–6
 Mediterranean climates 89
 regional production
 rates 93
 water-balance values 95
 water-use efficiency 27
 worldwide production
 trends 17–19
- Widstoe, John A. 83
- wind erosion 14, 40–1, 90–1
wind patterns 7
winter crops 18
world distribution of
 drylands 7
worldwide cereal
 production 17–20
 see also global food systems
- Y**
- Yemen 30–1, 34
yield increases
- economic aspects 61–2
evaporation reduction 42
marginal
 environments 55–6
 regional variations 87–8
 seasonal water use 50, 69
 water-use efficiency 26–8
- Z**
- zai system 91
zero grazing systems 15
Zingg terraces 31