



Food and Agriculture Organization  
of the United Nations

# Status of the World's Soil Resources

Main Report

Introductory  
information

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2015  
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Year of Soils

# Status of the World's Soil Resources

## Main report

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# Foreword

This document presents the first major global assessment ever on soils and related issues.

Why was such an assessment not carried out before? We have taken soils for granted for a long time. Nevertheless, soils are the foundation of food production and food security, supplying plants with nutrients, water, and support for their roots. Soils function as Earth's largest water filter and storage tank; they contain more carbon than all above-ground vegetation, hence regulating emissions of carbon dioxide and other greenhouse gases; and they host a tremendous diversity of organisms of key importance to ecosystem processes.

However, we have been witnessing a reversal in attitudes, especially in light of serious concerns expressed by soil practitioners in all regions about the severe threats to this natural resource. In this more auspicious context, when the international community is fully recognizing the need for concerted action, the Intergovernmental Technical Panel on Soils (ITPS), the main scientific advisory body to the Global Soil Partnership (GSP) hosted by the Food and Agriculture Organization of the United Nations (FAO), took the initiative to prepare this much needed assessment.

The issuance of this first "Status of the World's Soil Resources" report was most appropriately timed with the occasion of the International Year of Soils (2015) declared by the General Assembly of the United Nations. It was made possible by the commitment and contributions of hosts of reputed soil scientists and their institutions. Our gratitude goes to the Lead Authors, Contributing Authors, Editors and Reviewers who have participated in this effort, and in particular to the Chairperson of the ITPS, for his dedicated guidance and close follow up.

Many governments have supported the participation of their resident scientists in the process and contributed resources, thus also assuring the participation of experts from developing countries and countries with economies in transition. In addition, a Technical Summary was acknowledged by representatives of governments assembled in the Plenary Assembly of the GSP, signaling their appreciation of the many potential uses of the underlying report. Even more comprehensive and inclusive arrangements will be sought in the preparations of further, updated versions.

The report is aimed at scientists, laymen and policy makers alike. It provides in particular an essential benchmark against periodical assessment and reporting of soil functions and overall soil health at global and regional levels. This is of particular relevance to the Sustainable Development Goals (SDGs) that the international community pledged to achieve. Indeed, these goals can only be achieved if the crucial natural resources – of which soils is one – are sustainably managed.

The main message of this first edition is that, while there is cause for optimism in some regions, the majority of the world's soil resources are in only fair, poor or very poor condition. Today, 33 percent of land is moderately to highly degraded due to the erosion, salinization, compaction, acidification and chemical pollution of soils. Further loss of productive soils would severely damage food production and food security, amplify food-price volatility, and potentially plunge millions of people into hunger and poverty. But the report also offers evidence that this loss of soil resources and functions can be avoided. Sustainable soil management, using scientific and local knowledge and evidence-based, proven approaches and technologies, can increase nutritious food supply, provide a valuable lever for climate regulation and safeguarding ecosystem services.

We can expect that the extensive analytical contents of this report will greatly assist in galvanizing action at all levels towards sustainable soil management, also in line with the recommendations contained in the updated World Soil Charter and as a firm contribution to achieve the Sustainable Development Goals.

We are proud to make this very first edition of the Status of the World's Soil Resources report available for the international community, and reiterate once again our commitment to a world free of poverty, hunger and malnutrition.

JOSÉ GRAZIANO DA SILVA  
FAO Director-General

A handwritten signature in black ink, appearing to read 'J. Graziano da Silva', written in a cursive style.

# Acknowledgments

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Appreciation is expressed to many Governments who have supported the participation of their resident scientists in this major enterprise. In particular, our gratitude to the European Commission who financially supported the development and publication of this report.

# List of abbreviations

<b>AAFC</b>	Agriculture and Agri-Food Canada
<b>ACSAD</b>	Arab Centre for the Study of Arid Zones and Dry Lands
<b>AD</b>	Anno Domini
<b>AEZ</b>	Agro-Ecological Zones
<b>AFES</b>	Association Française Pour L'étude Du Sol
<b>AFSIS</b>	African Soil Information Service
<b>AGES</b>	Austrian Agency for Health and Food Safety
<b>AGRA</b>	Alliance for a Green Revolution in Africa
<b>AKST</b>	Agricultural Knowledge Science and Technology
<b>ALOS</b>	Advanced Land Observation Satellite
<b>AMA</b>	Agencia De Medio Ambiente
<b>AMF</b>	Arbuscular Mycorrhizal Fungi
<b>ANC</b>	Acid-Neutralising Capacity
<b>AOAD</b>	Arab Organization for Agricultural Development
<b>AOT</b>	Aerosol Optical Thickness
<b>APO-FFTC</b>	Asian Productivity Organization- Food & Fertilizer Technology Center
<b>ARC</b>	Agricultural Research Council
<b>ASGM</b>	Artisanal and Small-Scale Gold Mining
<b>ASI</b>	Advanced Science Institutesseries
<b>ASP</b>	Asia Soil Partnership
<b>ASSOD</b>	Assessment of Human-Induced Soil Degradation in South and Southeast Asia
<b>AU</b>	African Union
<b>BASE</b>	Biome of Australia Soil Environments
<b>BC</b>	(1) Black Carbon; (2) Before Christ
<b>BD</b>	Biodiversity
<b>BDP</b>	Bureau for Development Policy
<b>BIH</b>	Bosnia And Herzegovina
<b>BMLFUW</b>	Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management
<b>BNF</b>	Biological Nitrogen Fixing
<b>BOM</b>	Bureau of Meteorology
<b>BP</b>	Before Present (1 January 1950)
<b>C:N</b>	Carbon To Nitrogen Ratio
<b>CA</b>	Conservation Agriculture
<b>CAAA</b>	Clean Air Act Amendments
<b>CAADP</b>	Comprehensive Africa Agriculture Development Programme



<b>CACILM</b>	Central Asian Countries Initiative for Land Management
<b>CAMRE</b>	Council of Arab Ministers Responsible For the Environment
<b>CAZRI</b>	Central Arid Zone Research Institute
<b>CBD</b>	Convention on Biological Diversity
<b>CBM-CFS</b>	Carbon Budget Model of the Canadian Forest Sector
<b>CCAFS</b>	Climate Change, Agriculture and Food Security
<b>CCME</b>	Canadian Council Of Ministers of the Environment
<b>CE</b>	Common Era (Also Current era or Christian era)
<b>CEC</b>	(1) Cation Exchange Capacity; (2) Commission of the European Communities
<b>CECS</b>	Chemicals of Emerging Concern
<b>CEPAL</b>	Comisión Económica Para América Latina Y El Caribe
<b>CF</b>	Commercial Farming
<b>CGIAR</b>	Global Agricultural Research Partnership
<b>CIAT</b>	International Center for Tropical Agriculture
<b>CIFOR</b>	Center for International Forestry Research
<b>CITMA</b>	Ministerio De Ciencia, Tecnología Y Medio Ambiente
<b>CLIMSOIL</b>	Review of Existing Information on the Interrelations between Soil and Climate Change
<b>CLM</b>	Contaminated Land Management
<b>CMIP 5</b>	Coupled Model Intercomparison Project Phase 5
<b>COM</b>	Commission Working Documents
<b>CONABIO</b>	Comision Nacional Para El Conocimiento Y Uso De La Biodiversidad
<b>CONAFOR</b>	Comisión Nacional Forestal
<b>COSMOS</b>	Cosmic-Ray Soil Moisture Observing System
<b>CRC</b>	Risk of Colorectal Cancer
<b>CRP</b>	Conservation Reserve Program
<b>CSA</b>	Climate-Smart Agriculture
<b>CSIF-SLM</b>	Country Strategic Investment Framework for Sustainable Land Management
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation
<b>CSM-BGBD</b>	Conservation and Sustainable Management of Below-Ground Biodiversity
<b>CSSRI</b>	The Central Soil Salinity Research Institute
<b>CSWCR&amp;TI</b>	Central Soil & Water Conservation Research & Training Institute (India)
<b>DAFWA</b>	Department Of Agriculture and Food, Western Australia
<b>DBC</b>	Dissolved Black Carbon
<b>DDT</b>	Dichlorodiphenyltrichloroethane
<b>DEA</b>	Deliberate Evacuation Area
<b>DECA</b>	Department Of Environment and Conservation, Australia
<b>DED</b>	Dust Event Days
<b>DENR</b>	Department Of Environment and Natural Resources

<b>DEST</b>	Australian Government Department of Education, Science and Training
<b>DGVMS</b>	Dynamic Global Vegetation Models
<b>DIC</b>	Dissolved Inorganic Carbon
<b>DLDD</b>	Desertification, Land Degradation and Drought
<b>DNA</b>	Deoxyribonucleic Acid
<b>DOC</b>	Dissolved Organic Carbon
<b>DOI</b>	Digital Object Identifier
<b>DPYC</b>	Dissolved Pyrogenic Carbon
<b>DSEWPAC</b>	Department Of Sustainability, Environment, Water, Population and Communities
<b>DSI</b>	Dust Storm Index
<b>DSMW</b>	Digital Soil Map of the World
<b>EA-20km</b>	Twenty Km Evacuation Area
<b>EAD</b>	Environment Agency Abu Dhabi
<b>EC DG ENV</b>	European Commission Directorate-General for Environment
<b>EC</b>	European Commission
<b>EEA</b>	European Environment Agency
<b>EEAA</b>	Egyptian Environmental Affairs Agency
<b>EEZ</b>	Exclusive Economic Zone
<b>ELD</b>	Economics of Land Degradation
<b>EM-DAT</b>	Emergency Events Database
<b>ENSO</b>	El Niño Southern Oscillation
<b>EOLSS</b>	Encyclopedia of Life Support Systems
<b>EPA CERCLIS</b>	United States Environmental Protection Agency, Comprehensive Environmental Response, Contamination and Liability Information System
<b>EPA</b>	United States Environmental Protection Agency
<b>ERW</b>	Explosive Remnants of War
<b>ES</b>	Ecosystem Services
<b>ESA</b>	United Nations Economic and Social Affairs Department
<b>ESAFS</b>	East and Southeast Asia Federation of Soil Science Societies
<b>ESCWA</b>	United Nations Economic and Social Commission for Western Asia
<b>ESDB</b>	European Soil Database
<b>ESP</b>	Exchangeable Sodium Percentage
<b>ESRI</b>	Environmental Systems Research Institute
<b>EU SCAR</b>	European Standing Committee on Agricultural Research
<b>EU</b>	European Union
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FAOSTAT</b>	Food and Agriculture Organization Corporate Statistical Database
<b>FAO-WRB</b>	Food and Agriculture Organization World Reference Base

<b>FDNPS</b>	Fukushima Dai-Ichi Nuclear Power Station
<b>FFS</b>	Farmer Field School
<b>FIA</b>	Forest Inventory and Analysis
<b>FSI</b>	Forest Survey in India
<b>FSR</b>	Fund-Service-Resources
<b>GAP</b>	Southeast Anatolia Development Project Region
<b>GDP</b>	Gross Domestic Product
<b>GEF</b>	Global Environment Facility
<b>GEO</b>	Global Environmental Outlook
<b>GHG</b>	Greenhouse Gases
<b>GIS</b>	Geographic Information System
<b>GIZ</b>	Deutsche Gesellschaft Für Internationale Zusammenarbeit (GIZ) GmbH
<b>GLADA</b>	Global Land Degradation Assessment
<b>GLADIS</b>	Global Land Degradation Information System
<b>GLASOD</b>	Global Assessment of Human-Induced Soil Degradation
<b>GLC 2000</b>	Global Land Cover 2000 Project
<b>GLC-SHARE</b>	Global Land Cover SHARE
<b>GLRD</b>	Gender and Land Rights Database
<b>GRACE</b>	Gravity Recover and Climate Experiment
<b>GRID</b>	Global Resource Information Database
<b>GSBI</b>	Global Soil Biodiversity Initiative
<b>GSM</b>	Global Soil Map
<b>GSP</b>	Global Soil Partnership
<b>HORTNZ</b>	Horticulture New Zealand
<b>HTAP</b>	Hemispheric Transport of Air Pollution
<b>HWSD</b>	Harmonized World Soil Database
<b>HYDE</b>	History Database of the Global Environment
<b>IAASTD</b>	International Assessment of Agricultural Knowledge, Science and Technology for Development
<b>IAATO</b>	International Association of Antarctic Tour Operators
<b>ICAR</b>	Indian Council of Agricultural Research
<b>ICARDA</b>	International Center for Agriculture Research In The Dry Areas
<b>ICBA</b>	International Center for Biosaline Agriculture
<b>ICBL</b>	International Campaign to Ban Landmines
<b>ICRAF</b>	International Center for Research in Agroforestry
<b>IDP</b>	Internally Displaced Peoples
<b>IFA</b>	International Fertilizers Association
<b>IFAD</b>	International Fund for Agricultural Development

<b>IFADATA</b>	International Fertilizer Industry Association Database
<b>IFPRI</b>	International Food Policy Research Institute
<b>IGT-AMA</b>	Instituto De Geografía Tropical Y La Agencia De Medio Ambiente
<b>IIASA</b>	International Institute for Applied Systems Analysis
<b>ILCA</b>	International Livestock Centre for Africa
<b>IMAGE</b>	Integrated Modelling Of Global Environmental Change
<b>IMBE</b>	Mediterranean Institute of Biodiversity and Ecology
<b>IMF</b>	International Monetary Fund
<b>IMK-IFU</b>	Institute of Meteorology and Climate Research Atmospheric Environmental Research
<b>INIA</b>	Instituto De Investigaciones Agropecuarias (Chile)
<b>IPBES</b>	Intergovernmental Panel on Biodiversity and Ecosystem Services
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IRENA</b>	International Renewable Energy Agency
<b>IROWC-N</b>	The Indicator of Risk of Water Contamination by Nitrogen
<b>IROWC-P</b>	Indicator of Risk of Water Contamination by Phosphorus
<b>ISA</b>	Impervious Surface Area
<b>ISAM</b>	Integrated Impacts of Climate Change Model
<b>ISBN</b>	International Standard Book Number
<b>ISCO</b>	International Soil Conservation Organization
<b>ISCW</b>	Institute for Soil, Climate and Water
<b>ISFM</b>	Integrated Soil Fertility Management
<b>ISO</b>	International Standards Organization
<b>ISRIC</b>	International Soil Reference and Information Centre
<b>ISS-CAS</b>	Institute of Soil Science – Chinese Academy of Sciences
<b>ISSS</b>	International Society for the Systems Sciences
<b>ITPS</b>	Intergovernmental Technical Panel on Soils
<b>IUSS</b>	International Union of Soil Sciences
<b>IW</b>	International Waters
<b>JRC</b>	Joint Research Centre (European Commission)
<b>LAC</b>	Latin America and the Caribbean
<b>LADA</b>	Land Degradation Assessment in Drylands
<b>LCCS</b>	Land Cover Classification System
<b>LD</b>	Land Degradation
<b>LDCS</b>	Least Developed Countries
<b>LPFN</b>	the Landscapes for People, Food and Nature
<b>LPJ-GUESS</b>	Lund-Potsdam-Jena General Ecosystem Simulator
<b>LRTAP</b>	Long-Range Transboundary Air Pollution
<b>LS</b>	Topographic Factors

<b>LU</b>	Land Use
<b>MA</b>	Millennium Ecosystem Assessment
<b>MADRPM</b>	Ministère De l'Agriculture Du Développement Rural et Des Pêches Maritimes
<b>MAF</b>	New Zealand Ministry of Agriculture and Forestry
<b>MAFF</b>	Ministry of Agriculture, Forestry and Fishery of Japan
<b>MDBA</b>	Murray–Darling Basin Authority (Australia)
<b>MDGS</b>	Millennium Development Goals
<b>MENARID</b>	Integrated Natural Resources Management in the Middle East And North Africa
<b>MGAP</b>	Ministry of Livestock, Agriculture and Fisheries
<b>MNP</b>	Netherlands Environmental Assessment Agency
<b>MODIS</b>	Moderate Resolution Imaging Spectroradiometer
<b>NAAS</b>	National Academy of Agricultural Sciences of India
<b>NAIP</b>	National Agricultural Investment Plan
<b>NAMA</b>	Nationally Appropriate Mitigation Action
<b>NAP</b>	(1) National Action Programme; (2) National Action Plan
<b>NAPA</b>	National Adaptation Programme of Action
<b>NBSAP</b>	National Biodiversity Strategy and Action Plan
<b>NBSS&amp;LUP</b>	National Bureau Of Soil Survey And Land Use Planning
<b>NDVI</b>	Normalized Difference Vegetation Index
<b>NENA</b>	Near East And North Africa Region
<b>NEPAD</b>	The New Partnership for Africa's Development
<b>NEST</b>	Nigerian Environmental Study Action Team
<b>NGO</b>	Non-Governmental Organization
<b>NISF</b>	National Institute for Soils And Fertilizers
<b>NLWRA</b>	National Land and Water Resources Audit
<b>NOAA AVHRR</b>	National Oceanic and Atmospheric Administration - Advanced Very High Resolution Radiometer
<b>NPK</b>	Nitrogen (N), Phosphorus (P) and Potassium (K)
<b>NPL</b>	National Priorities List
<b>NRC</b>	National Research Council USA
<b>NRCAN</b>	Natural Resources Canada
<b>NREL</b>	National Resource Ecology Laboratory
<b>NRI</b>	National Resources Inventory Program
<b>NRM</b>	Natural Resources Management
<b>NRSA</b>	National Remote Sensing Agency (India)
<b>NSW</b>	New South Wales
<b>NT</b>	No-Tillage
<b>NUE</b>	Nitrogen Use Efficiency

<b>OECD</b>	Organization for Economic Co-Operation And Development
<b>OM</b>	Organic Matter
<b>ÖNORM</b>	National Standard Published By the Austrian Standards Institute
<b>ÖPUL</b>	Austrian Environment Programme for Agriculture
<b>ORNL-CDIAC</b>	Oak Ridge National Laboratory-Carbon Dioxide Information Analysis Center
<b>OSWER</b>	Office of Solid Waste and Emergency Response
<b>PAH</b>	Polycyclic Aromatic Hydrocarbon
<b>PAM</b>	Polyacrylamide
<b>PCB</b>	Polychlorinated Biphenyl
<b>PCM</b>	Pyrogenic Carbonaceous Matter
<b>PEA</b>	Participatory Expert Assessment
<b>PHC</b>	Petroleum Hydrocarbon
<b>PL</b>	Plastic Limit
<b>PLAR</b>	Participatory Learning-Action-Research
<b>PMID</b>	Pubmed Identifier
<b>PNUD</b>	Programa De Las Naciones Unidas Para El Desarrollo
<b>POC</b>	Particulate Organic Carbon
<b>POP</b>	Persistent Organic Pollutant
<b>PVC</b>	Polyvinyl Chloride
<b>Radar-AMEDAS</b>	Radar-Automated Meteorological Data Acquisition System
<b>RAPA</b>	Regional Office for Asia and the Pacific
<b>RELMA</b>	Sida's Regional Land Management Unit
<b>ROTAP</b>	Review Of Transboundary Air Pollution
<b>RSN</b>	Residual Soil Nitrogen
<b>RUSLE</b>	Revised Universal Soil Loss Equation
<b>SAGYP-CFA</b>	Secretaría De Agricultura, Ganadería Y Pesca – Consejo Federal Agropecuario
<b>SAV</b>	Submerged Aquatic Vegetation
<b>SCAN</b>	Soil Climate Analysis Network
<b>SCARPS</b>	Salinity Control and Reclamation Projects
<b>SCWMRI</b>	Soil Conservation and Watershed Management Research Institute
<b>SD</b>	Soil Degradation
<b>SDGS</b>	Sustainable Development Goals
<b>SEC</b>	Staff Working Documents of European Commission
<b>SEEA</b>	System of Environmental Economic Accounting
<b>SEED</b>	Sustainable Energy and Environment Division
<b>SF</b>	Subsistence Farming
<b>SFR</b>	Stock-Flow-Resources

<b>SKM</b>	Sinclair Knight Merz
<b>SLAM</b>	Sustainable Land and Agro-Ecosystem Management
<b>SLC</b>	Soil Landscapes of Canada
<b>SLM</b>	Sustainable Land Management
<b>SMAP</b>	Soil Moisture Active Passive
<b>SMOS</b>	Soil Moisture Ocean Salinity
<b>SOC</b>	Soil Organic Carbon
<b>SOE</b>	State of the Environment
<b>SOER</b>	European Environment State and Outlook Report
<b>SOLAW</b>	State Of Land and Water
<b>SOM</b>	Soil Organic Matter
<b>SOTER</b>	Soil and Terrain Database
<b>SOW-VU</b>	Centre for World Food Studies of the University Of Amsterdam
<b>SPARROW</b>	Spatially Referenced Regressions on Watershed Attributes
<b>SPC</b>	Secretariat of the Pacific Community
<b>SPI</b>	Science-Policy Interface
<b>SRI</b>	Salinity Risk Index
<b>SSA</b>	Sub-Saharan Africa
<b>SSM</b>	Sustainable Soil Management
<b>SSR</b>	Shift Soil Remediation
<b>SSSA</b>	Soil Science Society of America
<b>ST</b>	Soil Taxonomy
<b>STATSGO 2</b>	Digital General Soil Map of the United States
<b>STEP-AWBH</b>	Soil, Topography, Ecology, Parent Material – Atmosphere, Water, Biotic, Human Model
<b>SWC</b>	Soil and Water Conservation
<b>SWSR</b>	Status of the World's Soil Resources
<b>TEEB</b>	Economics of Ecosystems and Biodiversity
<b>TEOM</b>	Tapered Element Oscillating Microbalances
<b>TOC</b>	Total Organic Carbon
<b>TOMS</b>	Total Ozone Mapping Spectrometer
<b>TOT</b>	Transfer of Technology
<b>TSBF</b>	Tropical Soil Biology and Fertility
<b>UN</b>	United Nations
<b>UNCCD</b>	United Nation Convention to Combat Desertification
<b>UNCED</b>	United Nations Conference on Environment And Development
<b>UNDCPAC</b>	United Nations Desertification Control Program Activity Center
<b>UNDESA</b>	United Nations Department of Economic And Social Affairs
<b>UNDP</b>	United Nations Development Program

<b>UNEP DEWA</b>	United Nations Environment Programme and Department of Early Warning and Assessment
<b>UNEP</b>	United Nations Environment Programme
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNFPA</b>	United Nations Population Fund (Formerly the United Nations Fund for Population Activities)
<b>UNISDR</b>	United Nations Office for Disaster Risk Reduction
<b>UNSO</b>	United Nations Development Programme - Office to Combat Desertification and Drought
<b>USDA</b>	United States Department Of Agriculture
<b>USEPA</b>	United States Environmental Protection Agency
<b>USGS</b>	United States Geological Survey
<b>USLE</b>	Universal Soil Loss Equation
<b>UXO</b>	Unexploded Ordnance
<b>WANA</b>	West Asia-North Africa
<b>WCED</b>	World Commission on Environment and Development
<b>WFP</b>	United Nations World Food Programme
<b>WMO</b>	World Meteorological Organization
<b>WOCAT</b>	World Overview of Conservation Approaches and Technologies
<b>WOTR</b>	Watershed Organization Trust
<b>WRB</b>	World Reference Base for Soil Resources
<b>WRI</b>	World Resources Institute
<b>WWF</b>	World Wildlife Fund



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# Preface

The main objectives of **The Status of the World's Soil Resources** are: (a) to provide a global scientific assessment of current and projected soil conditions built on regional data analysis and expertise; (b) to explore the implications of these soil conditions for food security, climate change, water quality and quantity, biodiversity, and human health and wellbeing; and (c) to conclude with a series of recommendations for action by policymakers and other stakeholders.

The book is divided into two parts. The first part deals with global soil issues (Chapters 1 to 8). This is followed by a more specific assessment of regional soil change, covering in turn Africa South of the Sahara, Asia, Europe, Latin America and the Caribbean, the Near East and North Africa, North America, the Southwest Pacific and Antarctica. (Chapters 9 to 16). The technical and executive summaries are published separately.

In Chapter 1 the principles of the World Soil Charter are discussed, including guidelines for stakeholders to ensure that soils are managed sustainably and that degraded soils are rehabilitated or restored. For long, soil was considered almost exclusively in the context of food production. However, with the increasing impact of humans on the environment, the connections between soil and broader environmental concerns have been made and new and innovative ways of relating soils to people have begun to emerge in the past two decades. Societal issues such as food security, sustainability, climate change, carbon sequestration, greenhouse gas emissions, and degradation through erosion and loss of organic matter and nutrients are all closely related to the soil resource. These ecosystem services provided by the soil and the soil functions that support these services are central to the discussion in the report.

In Chapter 2 synergies and trade-offs are reviewed, together with the role of soils in supporting ecosystem services, and their role in underpinning natural capital. The discussion then covers knowledge- and knowledge gaps - on the role of soils in the carbon, nitrogen and water cycles, and on the role of soils as a habitat for organisms and as a genetic pool. This is followed in Chapter 3 by an overview of the diversity of global soil resources and of the way they have been assessed in the past. Chapter 4 reviews the various anthropogenic and natural pressures - in particular, land use and soil management - which cause chemical, physical and biological variations in soils and the consequent changes in environmental services assured by those soils.

Land use and soil management are in turn largely determined by socio-economic conditions. These conditions are the subject of Chapter 5, which discusses in particular the role of population dynamics, market access, education and cultural values as well as the wealth or poverty of the land users. Climate change and its anticipated effects on soils are also discussed in this chapter.

Chapter 6 discusses the current global status and trends of the major soil processes threatening ecosystem services. These include soil erosion, soil organic carbon loss, soil contamination, soil acidification, soil salinization, soil biodiversity loss, soil surface effects, soil nutrient status, soil compaction and soil moisture conditions.

Chapter 7 undertakes an assessment of the ways in which soil change is likely to impact on soil functions and the likely consequences for ecosystem service delivery. Each subsection in this chapter outlines key soil processes involved with the delivery of goods and services and how these are changing. The subsections then review how these changes affect soil function and the soil's contribution to ecosystem service delivery. The discussion is organized according to the reporting categories of the Millennium Ecosystem Assessment, including provisioning, supporting, regulating and cultural services.

Chapter 8 of the report explores policy, institutional and land use management options and responses to soil changes that are available to governments and land users.

The regional assessments in Chapters 9 to 16 follow a standard outline: after a brief description of the main biophysical features of each region, the status and trends of each major soil threat are discussed. Each chapter ends with one or more national case studies of soil change and a table summarizing the results, including the status and trends of soil changes in the region and related uncertainties.

