

# An Integrated Compendium of Twenty Encyclopedias

The Largest Online Encyclopedia (EOLSS) A Virtual Dynamic Library Equivalent to about 235 themes at [www.eolss.net](http://www.eolss.net). EOLSS is chosen as the main vehicle for UNITED NATIONS OF EDUCATION FOR SUSTAINABLE DEVELOPMENT (2005 – 2014)



Human society and economy in interaction with nature.

This is the world's largest online publication, at [www.eolss.net](http://www.eolss.net), dedicated to the health, maintenance, and future of the web of life on planet Earth, focusing on the complex connections among all the myriad aspects from natural and social sciences through water, energy, land, food, agriculture, environment, biodiversity, health, education, culture, engineering and technology, management, development, and environmental security, carrying knowledge for our times.

“EOLSS has the goal to provide a firm knowledge base for future activities to prolong the lifetime of the human race in a hospitable environment”

Richard R. Ernst, Nobel Laureate in Chemistry



EOLSS





The Sciences in Support of Sustainable Development: Sustainability Science is the study of sustainable development from a multiple-scale perspective, in that it is necessary to consider issues at a micro-level as well as at a macro-level. It is the study of dynamic interactions between nature and human society.

*(A life support system is any natural or human engineered (constructed) system that furthers the life of the biosphere in a sustainable fashion. The fundamental attribute of life support systems is that together they provide all of the sustainable needs required for continuance of life.)*

January 16, 2008

# Contents

About the EOLSS

The EOLSS - an Integrated Compendium of Twenty Encyclopedias

Outlines of the Component Encyclopedias

EARTH AND ATMOSPHERIC SCIENCES

MATHEMATICAL SCIENCES

BIOLOGICAL, PHYSIOLOGICAL AND HEALTH SCIENCES

BIOTECHNOLOGY

TROPICAL BIOLOGY AND CONSERVATION

LAND USE, LAND COVER AND SOIL SCIENCES

SOCIAL SCIENCES AND HUMANITIES

PHYSICAL SCIENCES, ENGINEERING AND TECHNOLOGY RESOURCES

CONTROL SYSTEMS, ROBOTICS AND AUTOMATION

CHEMICAL SCIENCES, ENGINEERING AND TECHNOLOGY RESOURCES

WATER SCIENCES, ENGINEERING AND TECHNOLOGY RESOURCES

ENERGY SCIENCES, ENGINEERING AND TECHNOLOGY RESOURCES

ENVIRONMENTAL AND ECOLOGICAL SCIENCES, ENGINEERING AND TECHNOLOGY RESOURCES

FOOD AND AGRICULTURAL SCIENCES, ENGINEERING AND TECHNOLOGY RESOURCES

HUMAN RESOURCES POLICY, DEVELOPMENT AND MANAGEMENT

NATURAL RESOURCES POLICY AND MANAGEMENT

DEVELOPMENT AND ECONOMIC SCIENCES

INSTITUTIONAL AND INFRASTRUCTURAL RESOURCES

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AREA STUDIES (AFRICA, BRAZIL, CANADA AND USA, CHINA, EUROPE, JAPAN, RUSSIA)

FIVE Volumes in Print Introducing and Capturing the Perspectives of the EOLSS

EOLSS International Editorial Council (IEC)

UNESCO-EOLSS Joint Committee

*January 16, 2008*

# About the EOLSS

The EOLSS is a knowledge resource in support of sustainability of the Earth's life support systems. It is directed at all segments of society: governmental, industrial, academic, and so forth. It is especially directed at the higher education sector, as it is here that society should produce leaders capable of addressing our most pressing sustainability issues. It is a virtual dynamic library with contributions from well over 7000 scholars from over 100 countries and edited by hundreds of subject experts, for a wide audience: pre-university/university students, professional practitioners, informed specialists, researchers, policy analysts, managers, and decision makers. This archive is now available at <http://www.eolss.net> and is updated and augmented fortnightly.

In an era when many mainstream publications have a business-as-usual attitude, the EOLSS is an encyclopedia with a difference. It attempts to forge pathways between disciplines in order to show their interdependence and helps foster the transdisciplinary aspects of the relationship between nature and human society. It is a place where traditional disciplines are at their best and at the same time shake hands with other disciplines for meaningful answers to some of the most complex questions facing us today. For example, there is a lot of mathematics on its own and at the same time there are its applications to important sustainability issues. While investigating many subjects in great detail, it also attempts to provide a wide perspective and a holistic understanding of issues. It inspires thinking in which the natural environment joins humans at the center stage in an integrated fashion.

The EOLSS is made available free of charge to universities in the UN list of least developed countries and disadvantaged individuals worldwide. Universities from developing countries also receive an appropriate discount. It is available to others at nominal subscription rates.

The EOLSS is the result of an unprecedented global effort and a decade of planning. Never before has a publication of this kind attempted to present integrated knowledge. The EOLSS is unique in that it comprehensively examines from their origins, the threats facing all the systems that support life on Earth—from the climate, the world's oceans, forests, water cycle, and atmosphere to social systems. It is becoming increasingly apparent that our complex industrial systems, both organizational and technological, need to be drivers of world sustainability and never become driving forces of global environmental destruction or major threats to the long-term survival of humanity. To build a sustainable society for our children and future generations—the great challenge of our time—we need to fundamentally redesign many of our technologies and social institutions. This means that organizations need to undergo fundamental changes, both in order to adapt to the new business environment and to become ecologically sustainable.

*"The EOLSS is not only appropriate, but it is imaginative and, to my knowledge, unique. Much of what we can write about science, about energy, about our far-ranging knowledge base, can indeed be found in major encyclopedias, but as I understand your vision, never as a central theme; the theme of humanity, embedded in nature and constrained to find ways of maintaining a relationship with nature based upon understanding and respect."*

Leon M. Lederman, Nobel Laureate in Physics

*"Pursuit of knowledge and truth supersedes present considerations of what nature, life or the world are or should be, for our own vision can only be a narrow one. Ethical evaluation and rules of justice have changed and will change over time and will have to adapt. Law is made for man, not man for law. If it does not fit any more, change it.... Some think that it is being arrogant to try to modify nature; arrogance is to claim that we are perfect as we are! With all the caution that must be exercised and despite the risks that will be encountered, carefully pondering each step, mankind must and will continue along its path, for we have no right to switch off the lights of the future.... We have to walk the path from the tree of knowledge to the control of destiny."*

Jean-Marie Lehn, Nobel Laureate in Chemistry

The contributions in the EOLSS offer step-by-step explanations on how to apply the abstract or the pure sciences such as mathematics, to assess environmental pollution or to predict food consumption patterns. However, technical solutions alone won't resolve the current ecological crisis. EOLSS therefore covers a diverse range of social issues—from human rights and poverty to psychology and anthropology.

The leading experts who have contributed to this state-of-the-art publication come from diverse fields such as: the natural sciences (e.g. chemistry and biology), social sciences (e.g. history, economics, law, etc.), humanities, engineering, and technology. EOLSS also deals with interdisciplinary subjects, like earth and atmospheric sciences, environmental economics and the most effective approaches for managing natural resources like renewable and non-renewable energy, biodiversity, and

January 16, 2008

agriculture. This approach is critical for managing life on Earth.

In view of the above the EOLSS body of knowledge is inspired by a vision that includes the following paradigm: the sciences should be at the service of humanity as a whole, and should contribute to providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations.

*“Ecotechnology involving appropriate blends of traditional technologies and the ecological prudence of the past with frontier technologies such as biotechnology, information technology, space technology, new materials, renewable energy technology and management technology, can help us to promote global sustainable development involving harmony between humankind and nature on the one hand and tolerance and love of diversity and pluralism in human societies on the other. We need shifts in technology and public policy. This is a challenging task to which the Encyclopedia of Life Support Systems should address itself.”*

M.S. Swaminathan, first World Food Prize winner

*“The population of our planet and its development over the ages sets the scene for considering all global problems and it is reasonable to begin their discussion with population growth. ... Thus we are dealing with an interdisciplinary problem in an attempt to describe the total human experience, right from its very beginning. But without this perspective of time it is not possible to objectively assess what is happening today and provide an objective view of the present state of development, the challenge now facing humanity.”*

S.P. Kapitza, UNESCO Kalinga Prize Winner

The Encyclopedia is designed to be a guide and reference for a wide range of users: from natural and social scientists to engineers, economists, educators, university students and professors, conservationists, entrepreneurs, law and policy-makers. The aim is not merely to provide raw information but to serve as a kind of expert advisor. The various chapters are divided into different levels of specialization to cater to a diverse readership. General readers might turn to the EOLSS for summaries on energy, for example, while university students may focus more on the explanations of the theoretical principles of energy, and policy makers turn to the future perspectives and related recommendations.

The EOLSS project is coordinated by the UNESCO-EOLSS Joint Committee and sponsored by Eolss Publishers, which is based in Oxford, United Kingdom. Through many and diverse consultation meetings around the world, the EOLSS has benefited immensely from the academic, intellectual, and scholarly advice of each and every member of the nearly 1000-strong International Editorial Council, which includes Nobel and UN Kalinga Laureates, World Food Prize Laureates, and several fellows of academies of science and engineering of countries throughout the world.

From 1996 thousands of scientists, engineers and policy-makers began meeting just to define the scope of the project, before discussing the details of the contributions. Regional workshops were held in the Bahamas, Washington DC, Tokyo, Moscow, Mexico City, Beijing, Panama, Abu Sultan (Egypt), and Kuala Lumpur, to develop a list of possible subjects and debate analytical approaches for treating them.

The EOLSS can be used for a variety of purposes, thanks to its size, completeness, authoritative character, and the excellent search capabilities provided. Thus it can be used, for example, to prepare definitive reports on a variety of subjects or to establish a body of knowledge relative to some particular subject from this massive body of knowledge. The presentations in the EOLSS are devoid of rhetoric, make serious appeal to our logical thinking and provide support to our decision-making processes. Thanks to the advances in technology, this vast body of well-organized knowledge is now accessible from anywhere in the world with the touch of a button. The scope of the coverage that has been completed to date is outlined in Outlines of the Component Encyclopedias that follows in terms of the themes under each of the twenty encyclopedias. Within these twenty on-line encyclopedias, there are about 235 Themes, each of which has been compiled under the editorial supervision of a recognized world expert. Each of these 'Honorary Theme Editors' was responsible for selection and appointment of authors to produce the material specified by EOLSS. On average each Theme contains about thirty chapters. It deals in detail with *interdisciplinary* subjects, but it is also *disciplinary*, as each major core subject is covered in great depth by world experts. The virtual library is augmented and updated fortnightly (*augmenting refers to addition of new material and updating is the process of revising existing material to bring it up to date*).

*“EOLSS is concerned with the Life Support Systems... Each of these systems is a very complex one. ...we have to think of all these “systems” as closely related “subsystems” of the Planet Earth System. ...Rational decisions will be more and more possible to envision if one will be able to couple the physical modeling to economic and financial models and to human factors...”*

J.L. Lions, Japan Prize winner in Applied Mathematics

*“In the coming decades, the need for working together, across countries, is essential. We need to bring 3 billion poor into society and make it possible for them to lead healthy lives, to get the health interventions that we all take as something as self-evident. It can be done. It is within reach. We need to invest in the future. We need to invest in the health of all people worldwide.”*

Gro Harlem Brundtland, Director General, WHO, in an interview with Patricia Morales

*“We must learn to live at one with nature. Nature does not bear grudges, but it must not be brought to the point where it can no longer sustain human society and the continuance of humankind on Earth. I believe that one of the most important things is the shaping of a new value system, because nature can live without us, but we cannot live without nature. Instead of a hedonic approach, we should promote an approach that reasonably limits consumerism and which promotes the virtue of enoughness. If we insist on consumerism as the new utopia, nature will reject such a system, as surely as cultural diversity rejected the totalitarian system. Our generation has to face a difficult challenge, but as recent history has proven, walls of difficulty, like the Berlin Wall, can fall.”*

Mikhail Gorbachev, Nobel Laureate in Peace, in an interview with Patricia Morales

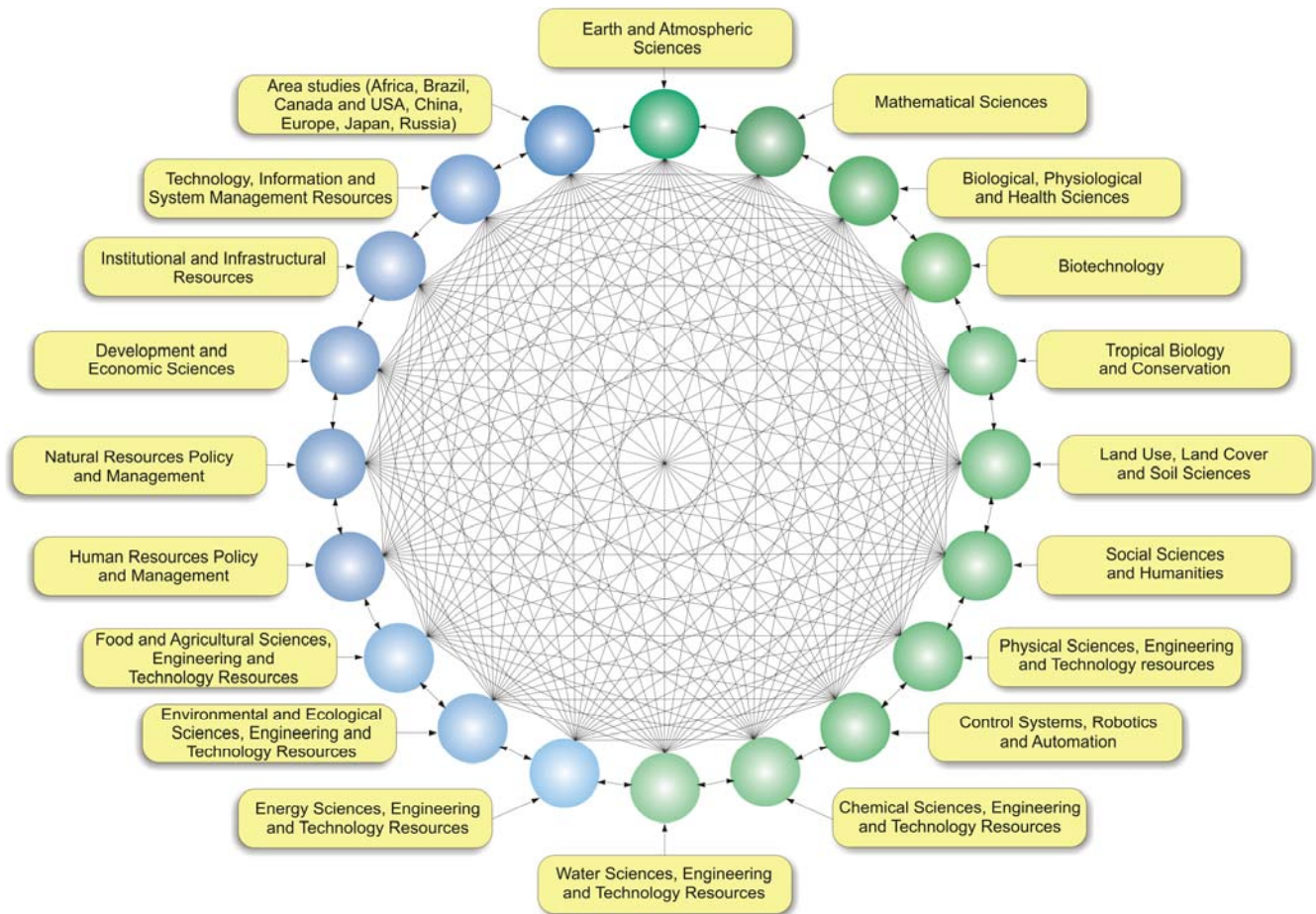
*“We live in an increasingly interdependent world. As a result, we must cooperate together across all boundaries of nation, culture, faith, and race, and at all levels—locally, nationally, regionally, and globally— if we are to achieve our basic environmental, economic and social goals. Furthermore, if we are to make wise choices and to cooperate together effectively, we urgently need a shared vision of fundamental ethical values to guide us. In other words, the development of global ethics is essential. Our very survival as a species is in doubt if we cannot clarify our ethics and develop common values around such basic issues as environmental protection, justice, human rights, cultural diversity, economic equity, eradication of poverty, and peace.”*

Steven C. Rockefeller, Earth Charter Commissioner, in an interview with Patricia Morales



# The EOLSS

## An Integrated Compendium of Twenty Encyclopedias



The above figure illuminates the interconnectedness of the twenty component encyclopedias of EOLSS. In the real world, the various knowledge domains do not exist in isolation from each other. They form an integrated whole, with links in all directions. It is well known that all forms of human knowledge are inter-connected and inter-related. EOLSS recognizes this complexity, the inter-connectedness of the various subject categories facilitating navigation automatically through the vast landscape of EOLSS knowledge. This provides the user with an effective and efficient tool to search, navigate and browse through each of the component encyclopedias, through any combination of the twenty, or through the whole of EOLSS.

This rich resource may be explored at  
**[www.eolss.net](http://www.eolss.net)**.

# Outlines of the Component Encyclopedias

## ENCYCLOPEDIA OF EARTH AND ATMOSPHERIC SCIENCES

- Environmental Structure and Function: Earth System  
Editor: Nikita Glazovsky Institute of Geography, RAS, Russia n  
Nina Zaitseva, Department of Earth Sciences, Russia Academy of Sciences, Moscow, Russia
- Environmental Structure and Function: Climate System  
Editor: George Vadimovich Gruza Institute of Global Climate and Ecology, RAS, Russia
- Geography  
Editor: Maria Sala University of Barcelona, Spain
- Geology  
Editors: Benedetto De Vivo Universita di Napoli "Federico II", Italy  
Bernhard Grasemann University of Vienna, Austria  
Kurt Stüwe Universitaet Graz, Austria
- Geophysics and Geochemistry  
Editor: Jan Lastovicka Institute of Atmospheric Physics, Academy of Sciences of the Czech Republic
- Oceanography  
Editors: Jacques C.J. Nihoul University of Liege, Belgium  
Chen-Tung Arthur Chen National Sun Yat-Sen University, Taiwan
- Tropical Meteorology  
Editor: Yuqing Wang, Department of Meteorology and International Pacific Research Center, School of Ocean and Earth Science and Technology University of Hawaii at Manoa
- Advanced Geographic Information Systems  
Editor: Claudia Maria Bauzer Medeiros Universidade Estadual de Campinas (UNICAMP), Brazil
- Natural Disasters  
Editor: Vladimir M. Kotlyakov Institute of Geography, RAS, Russia
- Geoinformatics  
Editor: Peter M. Atkinson University of Southampton, UK

## ENCYCLOPEDIA OF MATHEMATICAL SCIENCES

- Mathematics: History, Concepts, and Foundations  
Editor: Huzihiro Araki Kyoto University, Japan
- History of Mathematics  
Editors :Vagn Lundsgaard Hansen, Department of Mathematics, Technical University of Denmark, Denmark  
Jeremy Gray, Centre for Mathematical Sciences, Open University, UK
- Mathematical Models of Life Support Systems  
Editors: Valeri I. Agoshkov Institute of Numerical Mathematics, RAS, Russia
- Computational Methods and Algorithms  
Editors: Vladimir V. Shaidurov Institute of Computational Modeling of the RAS, Russia  
Olivier Pironneau Universite de Paris 6, France
- Optimization and Operations Research  
Editor: Ulrich Derigs University of Cologne, Germany
- Probability and Statistics  
Editor: Reinhard Viertl Technische Universität Wien, Austria
- Mathematical Models  
Editor: Jerzy A. Filar University of South Australia, Australia ,  
Jacek B. Krawczyk, Victoria University of Wellington, New Zealand
- Mathematical Physiology  
Editor: Andrea de Gaetano, CNR IASI Laboratorio di Biomatematca, Roma , Italy
- Cryptography and Network Security  
Editor: Jintai Ding, Department of Mathematical Sciences, University of Cincinnati,Cincinnati, USA  
Moti Young, Columbia University, USA
- Biometrics  
Editors: Susan R. Wilson The Australian National University, Australia  
Conrad Burden The Australian National University, Australia
- Environmetrics  
Editors: Abdel H. El-Shaarawi National Water Research Institute, Burlington, Ontario, Canada

January 16, 2008



Jana Jureckova Charles University Sokolovska, Czech Republic

- Systems Science and Cybernetics  
Editor: Francisco Parra-Luna Universidad Complutense de Madrid, Spain
- Environmetrics  
Editors: Abdel H. El-Shaarawi and Jana Jureckova  
National Water research Institute, Burlington Ontario Canada ,Department of Probability and Mathematical Statistics, Charles University Sokolovska, Czech Republic
- Mathematical Models in Economics  
Editor: Wei-Bin Zhang ,Ritsumeikan Asia Pacific University, Japan

## ENCYCLOPEDIA OF BIOLOGICAL, PHYSIOLOGICAL AND HEALTH SCIENCES

- Biological Systematics  
Editors: Alessandro Minelli Department of Biology, University of Padova, ItalyGiancarlo Contrafatto University of Natal, South Africa
- Extremophiles (Life under extreme environmental conditions)  
Editors: Charles Gerday University of Liege, Belgium  
Nicolas Glansdorff Vrije Universiteit Brussel, Belgium
- Fundamentals of Life (Biochemistry, Cell Biology, Bioenergetics, Microbiology, Biophysics)  
Editors: Ralph Kirby Rhodes University, South Africa
- Physiology and Maintenance  
Editors: Osmo Otto Päiviö Hänninen and Mustafa Atalay University of Kuopio, Finland
- Fundamentals of Biological Science: An Evolutionary Approach  
Editor: Rem V. Petrov Presidium of the RAS, Russia
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Editor: Kohji Hasunuma Yokohama City University, Japan
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Editor: Boutros Pierre Mansourian World Health Organization (WHO), Switzerland
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January 16, 2008

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January 16, 2008

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## ENCYCLOPEDIA OF CHEMICAL SCIENCES, ENGINEERING AND TECHNOLOGY RESOURCES

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- **Chemical Engineering and Chemical Process Technology**  
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January 16, 2008



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January 16, 2008

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January 16, 2008

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*January 16, 2008*

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*January 16, 2008*

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- Desert Ecosystems (DE)
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