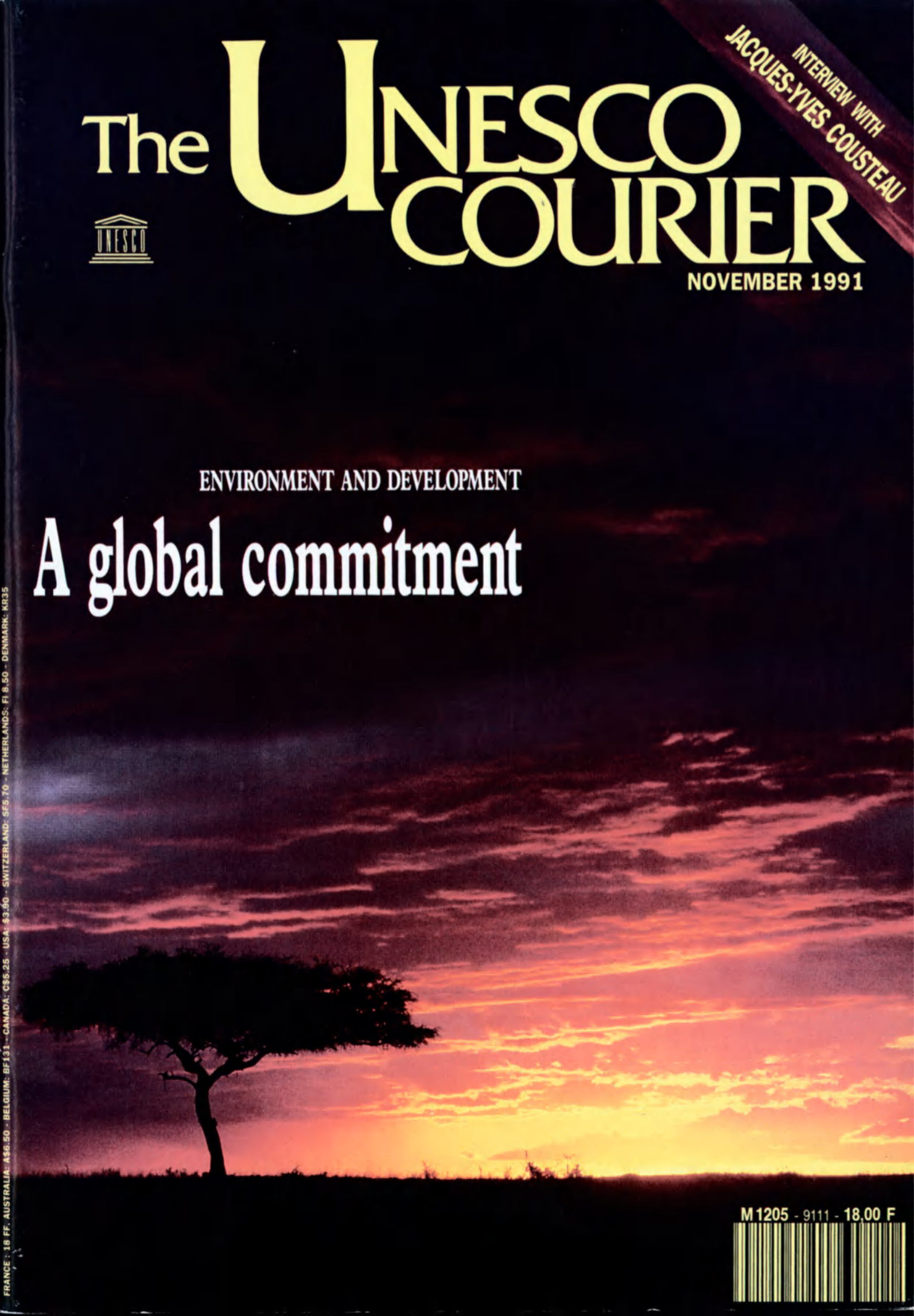
The UNESCO COURIER

NOVEMBER 1991

INTERVIEW WITH JACQUES-YVES COUSTEAU

ENVIRONMENT AND DEVELOPMENT

A global commitment



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encounters

We invite readers to send us photographs to be considered for publication in this feature. Your photo should show a painting, a sculpture, piece of architecture or any other subject which seems to be an example of cross-fertilization between cultures. Alternatively, you could send us pictures of two works from different cultural backgrounds in which you see some striking connection or resemblance. Please add a short caption to all photographs.



Masked Phantoms
1990, clay sculpture
(30.5 x 12 x 9 cm)
by Clara DeLamater

"I've come back from a long stay in Dogon country. The stone of the cliffs, the clouds in the sky: everything there is flesh and bone." Clara De Lamater is a French-American sculptor living in Paris. Her trip to Mali marked an important stage in the development of her work, already admired for its richness. Rhythmic, visionary and sensual, her Dogon-inspired sculptures forcefully express her desire to capture what one critic, referring to her work, described as "humankind's primary dance".

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JACQUES-YVES COUSTEAU





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Director-General
of UNESCO

The UNESCO COURIER

44th YEAR
Published monthly in 35 languages and in Braille

"The Governments of the States parties to this Constitution on behalf of their peoples declare,

"that since wars begin in the minds of men, it is in the minds of men that the defences of peace must be constructed...

"that a peace based exclusively upon the political and economic arrangements of governments would not be a peace which could secure the unanimous, lasting and sincere support of the peoples of the world, and that the peace must therefore be founded, if it is not to fail, upon the intellectual and moral solidarity of mankind.

"For these reasons, the States parties ... are agreed and determined to develop and to increase the means of communication between their peoples and to employ these means for the purposes of mutual understanding and a truer and more perfect knowledge of each other's lives..."

Extract from the Preamble to the Constitution of UNESCO, London, 16 November 1945

Cover: Masaï Mara (Kenya)

Back cover: members of Jacques-Yves Cousteau's first expedition to Antarctica (1972-1973), the start of the French explorer's campaign to protect the continent.

UNESCO's first 45 years

Early preoccupations

Development of educational structures
Free circulation of sources of knowledge
Copyright, standard-setting action
The struggle against racial prejudice

1950

General policy

■ Meeting in Florence, the General Conference defines a "basic programme" of 120 activities grouped under 10 major tasks.

■ The first UNESCO expert is sent into the field as part of the UN technical assistance programme on a scientific mission to Iran.

■ The first conference of representatives of international non-governmental organizations (NGOs) co-operating with UNESCO is held in Florence. Ever since its early days UNESCO has sought to collaborate with the NGOs, which constitute a precious link with specialists in UNESCO's fields of competence and help the Organization to accomplish its programme. In 1990, UNESCO was officially associated with 585 NGOs. In 1988-1989, from UNESCO's own resources, contracts amounting to almost $2.6 million were concluded with NGOs. During the same biennium subventions allocated by UNESCO to NGOs approached $4 million.

■ The first regional conference of UNESCO National Commissions is held at Havana. The National Commissions are bodies established by Member States, in accordance with UNESCO's constitution, in order to associate their major institutions in education, science, culture and communication with UNESCO's work. UNESCO is the only specialized agency of the UN which has this system.

■ UNESCO's Co-Action Programme is created to aid development projects in Member States. Between 1950 and 1990 $14,546,291 collected by national Co-Action partners, NGOs, schools, etc. have been allocated to several hundred projects.

Education

■ A joint UNRWA-UNESCO education programme on behalf of Palestine refugee children in the Middle East is launched (UNRWA: the United Nations Relief and Works Agency for Palestine Refugees in the Near East). In 1950-1951 there were 42,122 pupils in schools in refugee camps; today the figure is 370,600. 5,200 vocational and teacher training centres are involved in the programme.

Exact and natural sciences

■ The first issue of the quarterly *Impact of Science on Society* appears.

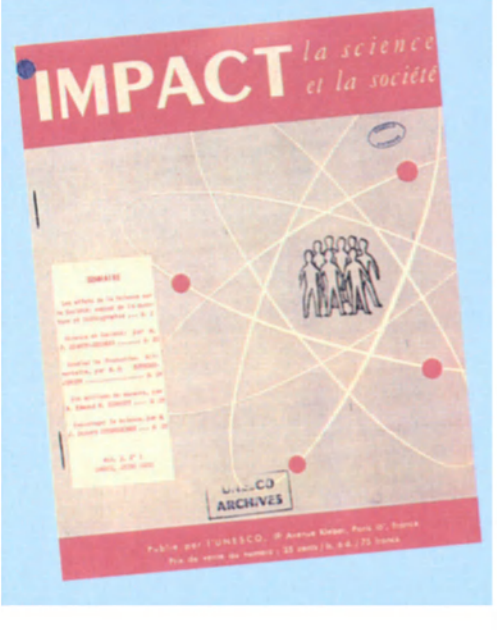
Impact, today published in English, French, Chinese, Russian, Arabic and Portuguese, presents to a wide audience the achievements of modern science and describes their impact on society, notably in the developing world.

Social sciences

■ The first studies on social tensions, stereotypes and their connection with international understanding are undertaken, and UNESCO produces its first publications in this field (by Otto Klineberg, Margaret Mead, J. Stoetzel and others).

Culture

■ *The History of Mankind: Cultural and Scientific Development* is launched under the responsibility of an international commission headed by P. de Berredo Carneiro. 6 volumes are published between 1963 and 1976 with the collaboration of a thousand specialists from over 60 countries. A new, updated edition is currently being prepared to take account of political changes and the latest historical research. The 48 quarterly issues of the *Journal of World History,* published as part of the project between 1953 and 1972, are still a valued information source.



Communication

■ The "Florence Agreement" for the abolition of customs duties on certain educational, scientific and cultural materials (including books), to which over 79 countries are today contracting parties, is signed. This agreement, which comes into force in 1952, extends and strengthens the Beirut agreement.

1951

Education

■ The UNESCO Institute of Education (UIE) is established in Hamburg. Today it is mainly concerned with research and documentation relating to lifelong education.

■ UNESCO sets up in Mexico a Regional Centre for Fundamental Education in Latin America (CREFAL).

The first regional centre of its kind, it is mainly concerned with drawing up strategies and methodologies in the fields of fundamental education, community development and literacy work, and with the implementation of pilot experiments and the production of teaching materials. It later plays an important role in the major project for education in Latin America and the Caribbean launched by the General Conference at the beginning of the 1980s.

Exact and natural sciences

■ The first session is held in Algiers of UNESCO's Advisory Committee on Arid Zone Research, which leads to the first development-oriented international scientific research programme. This is the first concerted attempt to combat desertification, a crucial problem in many Third World countries.



Clement Attlee, Prime Minister of the United Kingdom in 1945.



The French physicist Louis de Broglie, first winner of the Kalinga Prize (1952).



Luther H. Evans, Director-General of UNESCO in 1953.



Vittorino Veronese, Director-General of UNESCO in 1958.



Roger Caillois, founder of the review *Diogenes* (1952).

Social sciences

■ Mrs. Eleanor Roosevelt, a member of the US delegation to the General Assembly of the United Nations, takes part in an expert meeting at UNESCO on human rights, with René Cassin, Gianfranco Pompei, and Charles Malik.

Culture

■ Jawaharlal Nehru, Prime Minister of India, opens the first public library in Delhi, the result of a UNESCO pilot project.

1952

General policy

■ The Director-General, Jaime Torres-Bodet (Mexico), resigns because of disagreement over the budget. John W. Taylor (U.S.A.) is appointed Acting Director-General.

■ The Universal Copyright Convention is adopted at Geneva (revised 1971). In 1991, 84 States are Parties to the 1952 Convention, and 50 to the revised Convention.

■ Poland and Hungary (followed by Czechoslovakia in 1953) withdraw temporarily from UNESCO. They renew co-operation with UNESCO in 1954. Similar temporary decisions mark the relations between East European countries and other UN institutions in the early 1950s.

Education

■ The Arab States Fundamental Education Centre (ASFEC) is founded and established in Egypt.

■ The first regional conference on the development of compulsory free primary education is held in Bombay.

■ UNESCO provides the UN with the first statistics on women's education, covering 120 countries and territories.

■ The World Confederation of Organizations of the Teaching Profession (WCOTP) is founded in Copenhagen. The other leading federations of teachers with which UNESCO works closely are: the World Federation of Teachers' Unions, the International Federation of Free Teachers' Unions (IFFTU), and the World Confederation of Teachers (WCT).

Exact and natural sciences

■ Louis de Broglie wins the first Kalinga Prize for the Popularization of Science, created 2 years earlier by an Indian industrialist, Mr. B. Patnaik, and awarded each year by UNESCO.

Social sciences

■ The International Social Science Council (ISSC) is established at UNESCO's instigation. It currently groups 14 international social science associations and a federation of national and regional research bodies in the social sciences.

■ The first issue of *Diogenes* appears. This international review of the humanities, founded by Roger Caillois, is published under the auspices of the International Council for Philosophy and Humanistic Studies with UNESCO aid.

Since 1952 *Diogenes* has been published quarterly in English, French and Spanish, and, since 1986, in Arabic. Anthologies of *Diogenes* have been published for many years in Hindi, Japanese, Portuguese and, since 1985, in Chinese.

Culture

■ UNESCO convenes a conference in Venice to consider the situation of the artist in the modern world.

Communication

■ The first regional meeting of specialists on needs for communication training in Africa is held.



1953

General policy

■ Luther Evans (U.S.A.) is elected Director-General for a 6-year term.

■ A committee of U.S. delegates to the UNESCO General Conference is requested to appraise the Organization and its work ("the Saloman Report") following criticism of UNESCO in the American press.

Education

■ UNESCO sets up an associated schools programme.

In 1991 this network comprises over 2,550 establishments (pre-school, primary, secondary, colleges of education, technical and professional schools) in 101 countries.



St. Joseph's school in Ghana, a member of UNESCO's network of Associated Schools.

1954

General policy

■ At Montevideo, the 8th Session of the General Conference decides that members of the Executive Board, while they should necessarily be competent in UNESCO's fields of activities, will henceforth represent governments of the States of which they are nationals. It adopts as the emblem of UNESCO a temple in the image of the Parthenon, in which Phidias saw "proportions rather than dimensions"—a symbol of the balance between nations that inspires UNESCO's activities and of its cultural mission.

■ The USSR becomes UNESCO's 70th Member State, followed by the Ukrainian SSR and the Byelorussian SSR.

■ A first step is taken towards programme concentration. A distinction is made between general programmes (UNESCO's permanent and universal functions) and special activities (designed to meet specific needs of Member States).

■ The *UNESCO Courier* changes its format. The number of language editions later rises to 35 (1991) plus 4 Braille editions. The first non-headquarters edition is the Russian (Moscow, 1957). A German edition follows in 1960. Editions in Swedish and Basque are launched in 1985.

The magazine's current format dates from 1989, when the contents were also modified to concentrate on major themes designed to interest a wide public and treated from an increasingly cross-cultural viewpoint.

■ The European Centre for Nuclear Research (CERN), created with the participation of UNESCO, comes into operation.

Culture

■ The Convention for the Protection of Cultural Property in the Event of Armed Conflict is adopted at The Hague. In 1991 76 States are Parties to this Convention.

■ The International Association of Plastic Arts (now the International Association of Art) is created under UNESCO auspices. Its members are painters, sculptors, engravers and other practitioners of the visual arts working in over 80 countries. Its activities include: contributing to the development of art and of access to the arts in all world regions; communication between artists from different countries; documentation; defence of the material interests and moral rights of creators. Among its advisers (past and present) are Sonia Delaunay, Miró, Calder, Moore, Louise Nevelson, Matta, Schöffer, Vasarely.

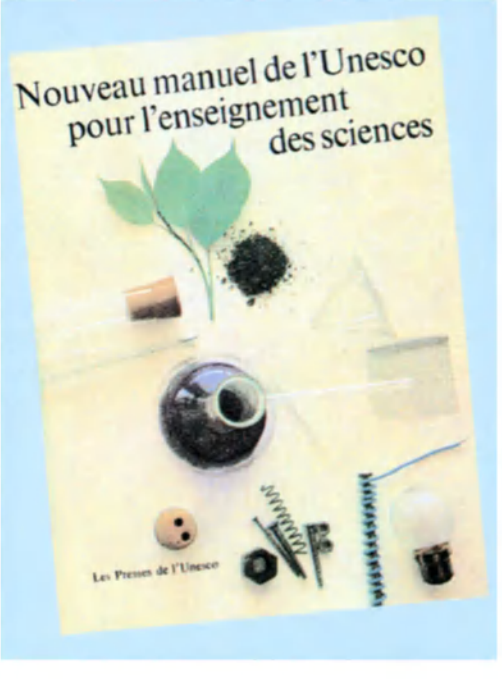
Communication

■ The Director-General is authorized by the General Conference to help Member States, at their request, to develop their communication and information media.

1955

General policy

■ A new programme, later known as the "participation programme", is launched. Financed from the UNESCO budget, it enables the Organization to contribute to certain activities carried out by Member States at the national or international level, connected with UNESCO's objectives.



Social sciences

■ Launch of the "associated youth enterprises system" designed to associate UNESCO with experimental initiatives serving the cause of international understanding and seeking to develop a sense of social responsibility among young people.

1956

General policy

■ At New Delhi, the General Conference approves UNESCO's first 3 Major Projects: on the extension of primary education in Latin America (teacher training), for 1957-1966; on scientific research on arid lands, for 1957-1962; on mutual appreciation of Eastern and Western cultural values, for 1957-1966.

■ South Africa withdraws from UNESCO.

■ UNESCO inaugurates a world anthology of treaties and laws on copyright, since then annually updated.

Education

■ A meeting of experts, then a working party of the General Conference, proposes a new definition of "fundamental education". The latter "aims to help people who have not obtained such help from established educational institutions to understand the problems of their environment and their rights and duties as citizens and individuals, to acquire a body of knowledge and skill for the progressive improvement of their living conditions and to participate more effectively in the economic and social development of their community".

Exact and natural sciences

■ The *UNESCO Source Book for Science Teaching* is published. A revised edition will be published in 1973 under the title *New UNESCO Source Book for Science Teaching.*

Many times reprinted and translated into some 30 languages, more than a million copies have today been sold.

Communication

■ UNESCO and the Indian Government cooperate in the Radio Forum pilot project for literacy and development in 150 villages around Pune. Similar projects are later established in Ghana, Senegal and Gambia.



An Indian school supported by UNESCO's Co-Action Programme.

The first Major Projects

1957

Exact and natural sciences

■ Launch of the major project on arid lands, an extension of the Arid Zone programme launched in 1951, with increased resources and action concentrated on the region stretching from North Africa to Southern Asia.

■ An international conference on radio-isotopes in scientific research is held in Paris.

Social sciences

■ The Latin American Faculty of Social Sciences and the Latin American Centre for Social Science Research are established, initially for one country (Brazil) but later for the whole region.

Culture

■ The Major Project on mutual appreciation of Eastern and Western cultural values is launched (1957-1966)

This interdisciplinary programme covers the improvement of school textbooks, diffusion of literature and the plastic arts, exchange of researchers, awarding of scholarships, etc. A newsletter, *Orient Occident*, is published (52 issues).

Communication

■ UNESCO co-operates in the establishment at Strasbourg of the first International Centre for Higher Education in Journalism. A second institution of this kind is established at Quito in 1959.

Events

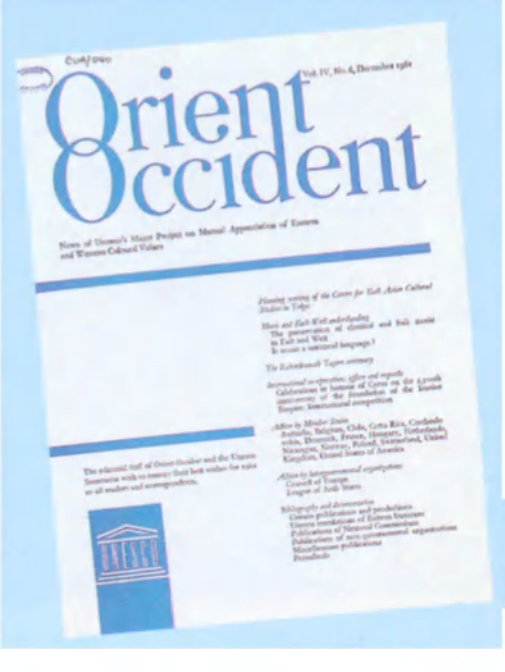
■ The International Catholic Centre for UNESCO launches its periodical *The Month at UNESCO*, published in English, French, Spanish and German. The Centre had been created 10 years before under the patronage of Mgr Roncalli, the future Pope John XXIII, then apostolic nuncio in France.

1958

General policy

■ UNESCO's new permanent headquarters building, designed by Marcel Breuer (U.S.A.), Pier-Luigi Nervi (Italy) and Bernard Zehrfuss (France), is inaugurated at Place de Fontenoy, Paris, in the presence of René Coty, President of the French Republic. Sarvepalli Radhakrishnan (India) is President of the General Conference.

■ Vittorino Veronese (Italy) is elected Director-General.



Education

■ The 21st International Conference on Public Instruction (later "Education") in Geneva examines the problem of access to education in rural areas.

Events

■ A Round Table of Nobel prizewinners is organized on the theme of the impact of science and technology on human life. Participants include John Boyd Orr, UK, and Nikolai Semenov, USSR.

1959

General policy

■ Technical assistance: UNESCO is assigned the responsibility for carrying out a number of United Nations Special Fund projects.

Culture

■ On the joint initiative of UNESCO and ICOM, the International Centre for Conservation (now ICCROM) is founded in Rome.

Communication

■ On the invitation of the Human Rights Commission, the United Nations and ECOSOC, UNESCO studies a programme for the development of the media in non-industrialized countries.

■ The International Film and Television Council (IFTC) is founded.

The IFTC groups 30 international organizations and is represented in most countries of the world. Its co-operation with UNESCO, especially through meetings of professionals organized at festivals, is mainly designed to encourage the circulation of audio-visual works and to stimulate creativity in this field, notably through co-productions. Special attention is given to the diffusion of audio-visual works from developing countries.

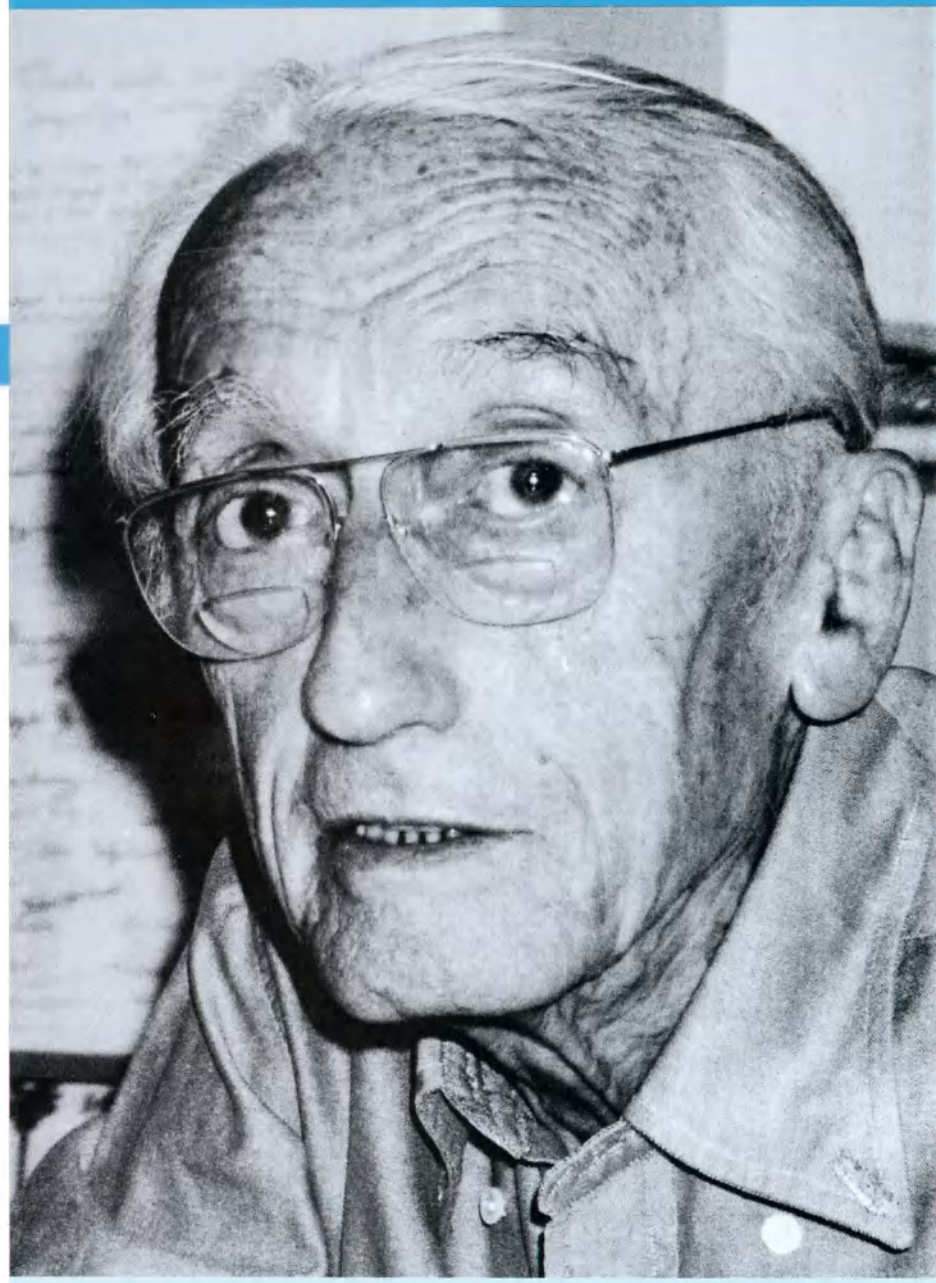
Michel Conil Lacoste ■

TO BE CONTINUED...

INTERVIEW

JACQUES-YVES COUSTEAU

The French oceanographer Jacques-Yves Cousteau is internationally renowned as a marine explorer and defender of the oceans. A pioneer of undersea investigation, he has sailed all over the world on oceanographic expeditions and has also written and produced films about the oceans which have attracted immense audiences. He is now preoccupied with the protection of the environment in an age of rapid economic expansion and population growth.



■ *How did you come to be interested in nature and particularly in nature in aquatic surroundings?*

—I have always been curious about things. When I was a child I used to go out bird-watching at night. I ran into a certain amount of opposition from my parents, who weren't very keen on curiosity if it exposed me to risks.

I first really started to learn about water when I was ten years old. I was in a holiday camp near a lake in the United States. We had to collect garbage from under the children's diving platform, and to do that I learned how to dive and swim under water. I had no goggles or any other special equipment and bringing the garbage to the surface was quite a job. I spent two or three weeks diving into that lake and eventually I learned how to hold my breath under water.

Later, when I was fourteen, I improved my underwater swimming techniques. There was a swimming pool at my school in Alsace, and I used all kinds of contraptions made from tubes and pumps in order to breathe under water. I wasn't trying to observe the natural world. I was imitating the James Fenimore Cooper heroes who hid under water and breathed through hollow reeds when trying to escape from their pursuers.

I slowly became convinced that I wanted to be a sailor. I passed my baccalaureate and

Interview by
Bahgat Elnadi and Adel Rifaat

then, when I was twenty, I won a place at the French naval academy. Two years later, during a round-the-world voyage on a training ship, the *Jeanne d'Arc*, I witnessed a scene that had a decisive impact on my life. At Cam Ranh Bay in Indochina, at the hottest time of day, between noon and two o'clock, I saw people diving from their boats and then surfacing with fish in their hands. They told me that while the fish were having their siesta they were very easy to catch! I thought that this was so extraordinary that I decided to improve my underwater swimming techniques further.

For the time being, however, I had no opportunity to do so. I was given command of the French naval base at Shanghai, providing supplies for ships which docked at the French concession. It was only later, when I returned to France and thought about the people of Cam Ranh Bay, that I came back to the idea of developing underwater swimming techniques. In the meantime I had become friendly with Frédéric Dumas and Philippe Taillez. We became the Three Musketeers of underwater adventure.

I became obsessed with the problem of breathing underwater. My friends and I tested all the breathing apparatus that existed at that time and found that none of it was satisfactory.

Then came the war and the occupation. That was when I met Emile Gagnan, an engineer with the Air Liquide company who had developed a motor vehicle powered by carbon dioxide produced from burning wood. The combustible gas reached the engine via a special feeder valve. This system is used in the underwater breathing device with which my name is associated, millions of which have been sold. In my device, which is entirely self-contained, the gas passing through the feeder valve is compressed air. Using this system, Dumas, Taillez and I were able to extend the possibilities of underwater swimming and start to make films.

The resources of our planet are finite. . . . . there is a limit that should not be exceeded, a habitability threshold that must not be crossed.

When the war was over, I told officials at the Navy Ministry about this entirely new system we had developed and suggested that a study centre be opened at Toulon. As a result, a centre for underwater study and research was created in the Arsenal at Toulon.

■ *You didn't stay there very long.*
— No. In 1949 I decided that it was time to apply what we had learned. To do this we needed a ship. Where was the money to come from? I opened my address book. Under the letter A, I saw the name Auniac. He was a charming fellow. I had met him and his wife at winter sports. He was the agent of Guinness which, among its other activities, controlled the shipyard at Antibes. After a meeting, Guinness opened credit facilities for 25 million francs and put the manager of the Antibes shipyard at my disposal.

■ *It sounds like a fairy tale.*
— Absolutely! With the manager of the Antibes shipyard we went to Malta where we found a converted minesweeper that was being used as a ferry between Malta and Gozo, the little island that is supposed to be the legendary Ogygia of the *Odyssey*. In fact that's why the minesweeper's owner had named his ferry the *Calypso*. We bought the ship for seven million francs. The *Calypso* was in perfect condition, but we had to use the rest of my credit to refit her and equip her with oceanographical research instruments.

Then we began our cruises. The credit from Guinness was used up and I had no more money. I joined the CNRS.* Since the war, France had had no oceanographic vessels, and so for a few years we served as a transport and liaison vessel for French oceanographers.

■ *Then came the great success of your film* The Silent World. . .
— *The Silent World* dates from 1956. The first *Calypso* expeditions, in the Red Sea, go back to 1951. We had already made some quite



Commander Cousteau and his son, Jean-Michel.

Conshelf II, an underwater colony in the Red Sea in which a group of oceanonauts lived for a month in 1963.

remarkable films, one of which won the Grand Prix at the Paris documentary film festival in 1951. We were making colour films as far back as 1953. Things were very difficult in those early days. Water tends to absorb colours and we had many lighting problems. We did a lot of work on the development of camera techniques, filters, optical and lighting systems, and so on. Gradually we were able to start using video up to professional standards, initially in black and white.

Around that time I constructed the first French underwater television cameras. Later, at Marseilles, I created the Centre d'Etudes Marines Avancées. It was at Marseilles that we built the first submarine for exploration, specially designed to carry out scientific observation at a depth of 350 metres. Then, for the French State, we made an observation submarine capable of going to a depth of 3,000 metres and, for the Americans, a third submarine capable of operating at 600 metres. I also built two one-man pocket submarines which are still in working order today. Finally we began to build a bigger submarine from which divers could emerge. When the hull was finished work had to stop because we had no more money. That's how things stand today, twenty years later.

In 1954 we carried out a mission for the Darcy Exploration Company. We had a very good contract which enabled us to install the radar and measuring equipment we lacked. We were the people who discovered oil in the Gulf! It was us who made the emirate of Abu Dhabi rich!

The Silent World brought in enough money to finance our work until 1972, virtually without any other source of income.

Since then we have made many films. In 1962 we also carried out experiments in which men lived and worked underwater at considerable depths. The first of these, known as *Conshelf I*, was carried out at Marseilles. Then came *Conshelf II*, in the Red Sea, and finally in 1965, *Conshelf III* off Cap Ferrat.

■ *How were these experiments carried out?*

— We used a spherical vessel within which the atmosphere, consisting of a mixture of oxygen and helium, was maintained at the surrounding water pressure. Six people lived in the sphere for three weeks, and when they emerged it took another week to gradually decompress them.

With this experiment we became the first people to do what is known as saturation diving. Since then, the offshore oil industry has gone in for this in a big way.

We made innovations in a wide variety of fields. We developed cameras which we have used as far down as 8,000 metres.

We have taken thousands of photos and made extraordinary films in a number of Atlantic trenches. We were also the first to dive in the Antarctic with a submarine and to carry out systematic exploration there in diving gear. We recently made the first diving equipment using plastic bottles filled to a pressure of 300 bars.

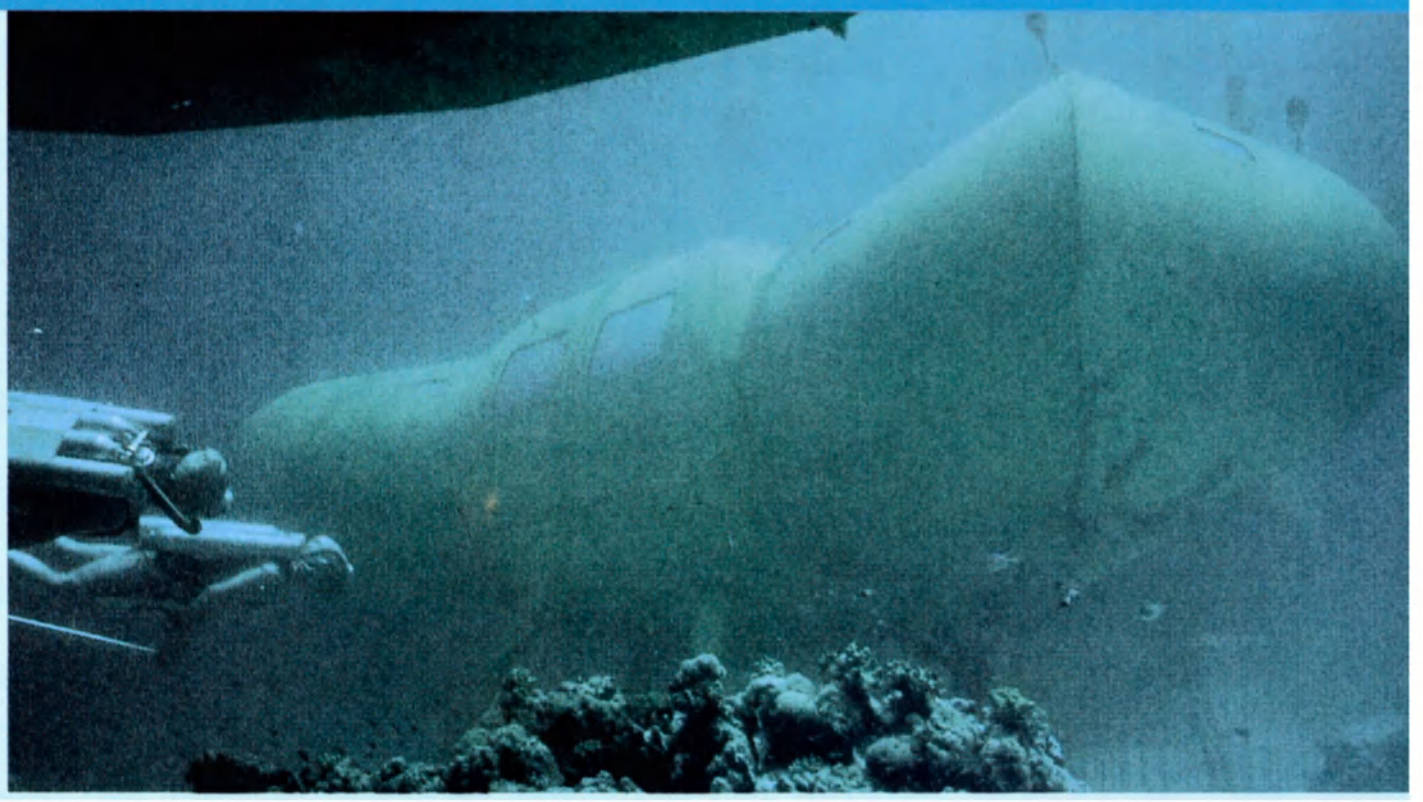
■ *How did you become interested in environmental problems?*

— It was an interest that developed slowly. Right at the start we coined a slogan: "Know, Love, Protect". That is exactly what happened to me! I began by exploring. When I saw all this beauty under the sea, I fell in love with it. And finally, when I realized to what extent the oceans were threatened, I decided to campaign as vigorously as I could against everything that threatened what I loved. My story forms a cycle. I hope my children can follow the same path.

■ *What are the main dangers that threaten the Earth today?*

— After travelling the world as I have for years on end, and seeing it from helicopters, as a diver, from on board ship . . . I would sum up my feelings by saying that the resources of our planet are finite, that there is a limit that should not be exceeded, a habitability threshold that must not be crossed.

We should ask ourselves how many animals and people our planet can continue to support before the quality of life deteriorates, before all Earth's beauties fade. Fifteen years ago, when I was in the United States, I tried to construct a mathematical model to find out how many people our planet could support with the income, purchasing power, and amenities enjoyed by the average American at that time. The data at my disposal were not very precise and right from the start I knew that the approximation would be of the order of 40 to 50 per cent. At that time I was friendly with the director of the Oceanographic Laboratory of the University of Southern California, whose researchers served my colleagues and myself as advisers. With the parameters I had at my disposal, I came up with the figure of 700 million. Seven hundred million people enjoying a standard of living comparable to that of the average American! Fifteen years ago our planet was unable to provide an agreeable life for more than 700 million people! World population was then four billion!



I was alarmed by the results of my research and told the laboratory director about it. Do you know what he said? That my results were highly optimistic. He had constructed the same model as I had and had come up with a figure far lower than mine! Since then I have been obsessed by the problem of the habitability of the planet.

World population currently stands at 5.7 billion, a figure that is rising at dizzying speed. Every six months, a population equal to that of France is added to the current figure. And every ten years a population equal to that of China is added to that of our human ant-hill.

Everyone is convinced that population growth cannot go on in this anarchic, cancerous way. But when the question arises as to what should be done, nobody wants to know. People make out that nothing can be done, that it's all too complicated, that things are even more difficult because of ingrained habits, religions and whatever. In fact, religion has nothing to do with it. Italy is the world's most Catholic country and yet it has the world's lowest birth-rate. Spain, which is also Catholic, is in a similar position. Its birth-rate is dropping vertiginously. In Indonesia, the world's biggest Islamic country, a birth control campaign in the last ten years has reduced the birth-rate by almost 50 per cent.

So religion shouldn't be held responsible. Fear of the future may be, however. In the so-called developing countries there is no insurance for old age. Retirement pensions, if they exist, do not even provide for basic needs. Even when they are young people panic when they think about their old age, especially since they grow old quickly because of poor sanitary and other conditions. To care for them in their old age they need a male child they can rely on. And since they have to take account of their chances of having daughters as well as sons, of mortality rates, and of the possibility that some of their children are not going to be interested in looking after them when they get old, they need to have six offspring before they can be sure of having a dependable male child. Six children to be sure of having three boys. Three boys to be sure of having two who survive. And two living boys to be sure of having one who will look after his parents.

In addition to the insecurity factor there is the factor of female illiteracy, which is also a result of poverty. In the developing countries education has made great strides but there are still not enough schools. Selection is thus made on the basis of sex. Boys take priority over girls when it comes to enrollment in school.

Why? My answer may make you raise your eyebrows, but the fact is that little girls do not go to school because there is no safe drinking water. When there is no drinking water in the vicinity the girls have to go and fetch it from the spring. I have seen adolescent girls fetch drinking water from twenty and sometimes thirty kilometres away, which takes a whole day. By the time they are fourteen or fifteen years old, these girls whose lives are geared to meeting the urgent need for water have never been to school, have never learned anything. How can they use contraception or even know that contraception exists?

Some people even try to explain excessively high birth-rates by the fact that for hundreds of millions of people love is the only source of happiness. Contraception neither prevents nor reduces happiness. The contraceptive pill is distributed freely in many poor countries and yet the women do not take it. Why? Because they have had no education and are subjected to the will of the men who either do not care about the consequences or want children to look after them in their old age.

Overpopulation is our planet's number one problem. Of the 5.7 billion people on Earth, less than 2 billion live in decent

conditions. This figure will soon double. Perhaps we shall manage to feed the expected 10 or 12 billion. But that's just about all we shall be able to do.

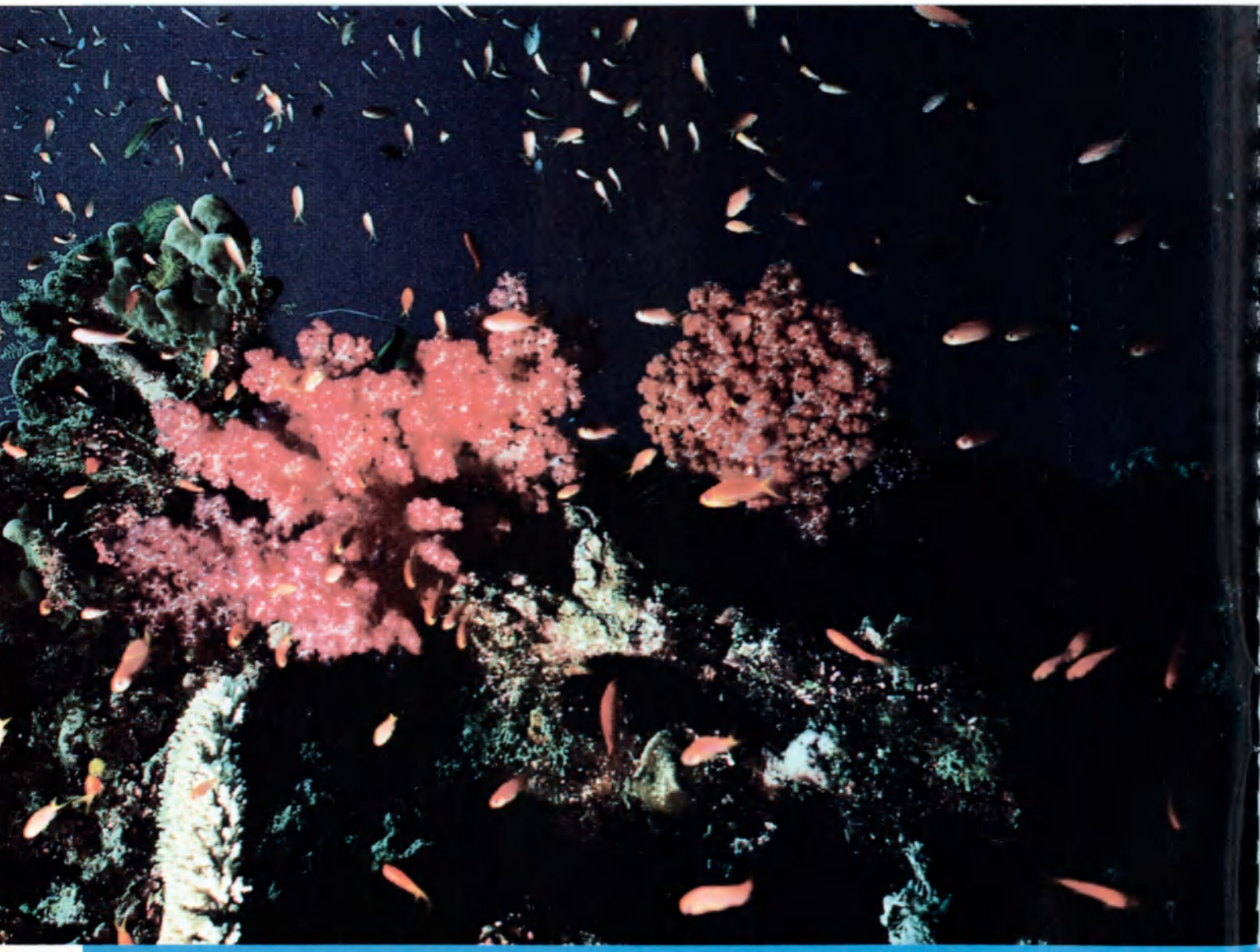
■ *Some people believe that the sea can be a rich source of food. . . .*
— That is a ridiculous idea. The sea's resources are diminishing. There is far too much overfishing already. And even if we manage to keep on harvesting the same quantity of protein from the sea, this quantity is bound to diminish as a proportion of consumer needs. I remember that at the beginning of my career 10 per cent of the protein consumed came from the sea. Today the proportion is of the order of 4 to 5 per cent. Tomorrow, when the population has doubled, it will fall to 2 per cent. Here too, productivity has a ceiling which cannot be exceeded. We are already in the overfishing zone.

■ *And yet we can increase productivity on land. Why can't we do the same with the sea?*
— The rates of return are not at all the same.

In the Antarctic, for example, it takes ten tons of microscopic algae to form a ton of krill—krill are tiny shrimps . . . and it takes one ton of krill to produce 20 kg of whale. This is a transformation factor of 40 to 1. To produce a cow on land, the transformation factor is ten to one.

■ *What about desertification? Isn't it true that whereas the desert has been invading agricultural land it may now be retreating.*
— The information on which this view is based is too recent and needs to be confirmed. All the same, I am willing to accept that the Sahara was created by human beings and that it may consequently be unmade by them. If the Sahara were to become cultivable, its output would be far higher than that of the sea.

■ *What about pollution?*
— Global warming and the increasing rarity of water are far more serious and urgent threats than the chemical pollution we hear so much about. There is less and less water



"When I saw the beauty of the underwater world, I fell in love with it."

because water is squandered, and this too goes hand in hand with overpopulation. Water is being wasted at a terrific rate. In the West, farmers water their crops in such a way that 90 per cent of the water evaporates. We draw on groundwater and then let it evaporate! This year, in spite of abundant rainfall, France will be facing drought problems. Why? Because in the last three years we have wasted much of the water we have drawn.

The damage caused to the planet is a function of demography but also of levels of development. One American tires the planet far more than twenty Bangladeshis. Damage is also linked to consumption. Our society is geared to increasingly useless consumption. It's a vicious circle which I compare to a cancer.

■ *Some snakes, mosquitoes and other animal species pose threats or dangers for humankind. Can they be eliminated like the viruses that cause certain diseases?*

— Getting rid of viruses is an admirable idea, but it raises enormous problems. In the first 1,400 years of the Christian era, population numbers were virtually stationary. Through epidemics, nature compensated for excess births by excess deaths.

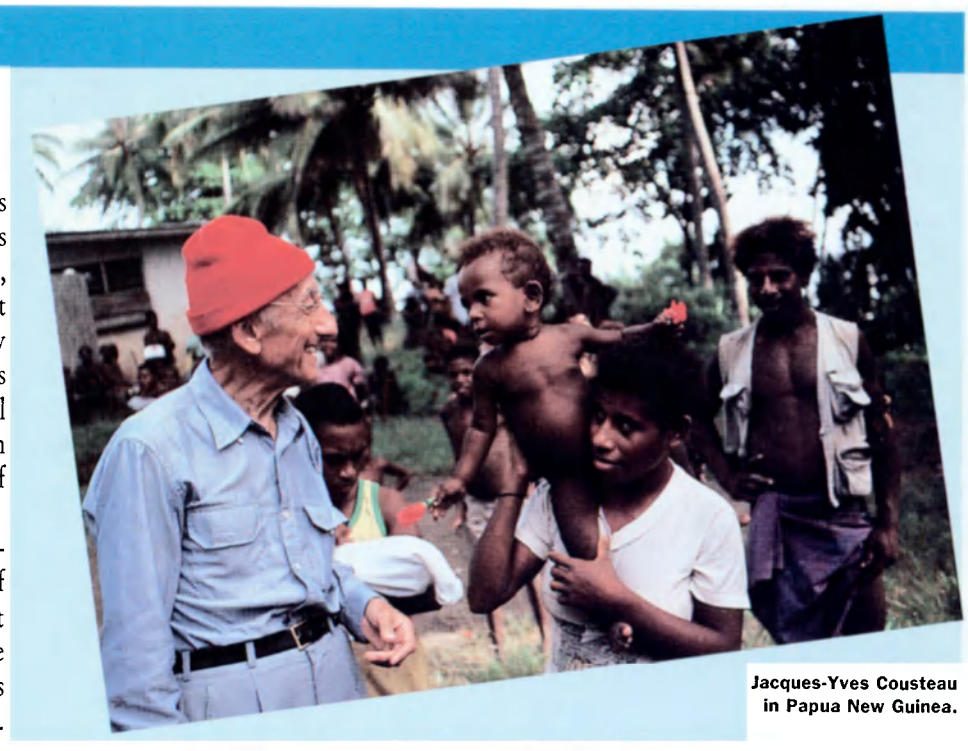
I talked about this problem with the director of the Egyptian Academy of Sciences. He told me that scientists were appalled to think that by the year 2080 the population of Egypt might reach 250 million.

What should we do to eliminate suffering and disease? It's a wonderful idea but perhaps not altogether a beneficial one in the long run. If we try to implement it we may jeopardize the future of our species.

It's terrible to have to say this. World population must be stabilized and to do that we must eliminate 350,000 people per day. This is so horrible to contemplate that we shouldn't even say it. But the general situation in which we are involved is lamentable.

■ *And yet solutions must exist. . . .*

— It's a question of cost. We need $400 billion a year for fifteen years. To provide people with safe drinking water. To provide schooling for girls and low pensions for the elderly. With $4 billion over fifteen years we can not only reduce demographic pressure but halt population growth.



Jacques-Yves Cousteau in Papua New Guinea.

■ *Is there anything we can do to control industrial pollution?*

— Not much. Carbon dioxide is the big problem. We are going to suffocate because of carbon dioxide. As you know, it stimulates breathing, and we shall all end up panting to death if amounts of carbon dioxide continue to increase. This increase is the result of a misguided energy policy. What's more, we have preferred to invest enormous sums in nuclear energy produced by fission rather than by fusion, which is clean. But nuclear energy produced by fusion makes it possible to have the bomb!

There are other, more "picturesque" forms of pollution. Planet Earth is now surrounded by a girdle of fragments of broken satellites which move at the speed of a bullet and will eventually prevent any attempt to reach outer space.

To manage nature a certain amount of wisdom is needed. Perhaps one day, taking long-term factors into account, we shall succeed in managing nature as we now do when we create a pretty garden. But let's get back to the mosquitoes. For the last ten years I have owned a house in the country. When I first went there, there were swallows, robins and mosquitoes. Today the mosquitoes have gone, but so have the swallows, the grasshoppers and the butterflies. The crops have been sprayed with pesticides from the air, and so the insects have been almost totally wiped out. If we carry on like this, children will never see a swallow, a dragonfly or a butterfly. Well done!

■ *Perhaps you could find a more hopeful note on which to end this conversation?*

— Real interest in environmental problems began in 1988 when the American magazine *Time* featured planet Earth on its cover, and titled it "Planet of the Year" instead of its usual "man of the year".

In July 1989, the leaders of the seven great industrial nations devoted a third of the time at their annual summit and twenty-three pages of the report to environmental problems. Later a meeting was held at The Hague and there were others too. At long last people were realizing that the danger was global and that everyone was threatened.

This realization on the part of world leaders has been encouraged by powerful pressure from public opinion all over the world. The combination of these two forces, at the top and at the grassroots, should lead to the beginning of a solution. I hope that this is a sufficiently hopeful note on which to conclude! ■

* The French National Centre for Scientific Research. *Editor*

A partnership with nature

by Michel Batisse

Five centuries ago, the discovery of the New World proved that the Earth is round. And therefore finite. Paradoxically, the immense extent of the lands thus revealed enabled human beings to persist until our own times in the mistaken belief that the wealth of nature was inexhaustible and that they could continue with impunity to increase their numbers and multiply their needs indefinitely.

The truth is that the Earth's resources are still considerable, but the race is on between these needs—vital or superfluous—and the means of satisfying them. In spite of scientific breakthroughs and the wonders of technology we are far from sure of winning this race. The rampant population growth that is still going on, especially in the poor countries, and the frenetic consumption of material goods and energy, especially in the rich countries, combine in a model of economic development which weighs too heavily on all the components of our environment and is not "sustainable".

This issue of the Courier, by seeking to provide some insights into the manifestations of this environmental crisis, shows that the latter is equally a crisis of development. Environment and development: the two faces of a single dilemma in the pursuit of human destiny, the subject of the United Nations Conference which will be held at Rio de Janeiro in June 1992.

This is a subject UNESCO knows well and one with which it has been concerned since its inception. It was under UNESCO's auspices that the International Union for the Conservation of Nature was founded in 1948. Around the same time UNESCO launched a scientific programme for the study and use of arid regions. In 1961 the Intergovernmental Oceanographic Commission was established in UNESCO in order to promote worldwide co-operation in the study of the seas, their resources, their protection and their influence on the life of the planet. At the same time study was organized on the Earth's crust, its wealth and the natural hazards associated with it. In 1964 the International Hydrological Decade was launched to further knowledge and management of the water resources of all countries. Finally, in 1968, UNESCO organized a conference on the rational use and conservation of the resources of the biosphere, from which sprang the interdisciplinary programme on Man and the Biosphere (MAB) which is today at the centre of UNESCO activities related to the environment.

In 1972 the United Nations Conference at Stockholm created a new wave of interest in environmental questions, both in public opinion and in governments, encouraging UNESCO to persevere with its international scientific programmes. It also invited UNESCO to promote and strengthen environmental education in schools and universities. At the same time, the adoption of the Convention on the Protection of the World Cultural and Natural Heritage affirmed the dual nature of our common heritage and the indispensability of international co-operation in conserving the great symbols of this heritage.

UNESCO has thus long been a place of convergence for all those approaches which attempt, through education, science and culture, to reconcile development and environment, and to restore the original partnership between man and nature.

However, the efforts made so far, both at the national and the international level, have proved less than adequate. The enterprise will need time to bear fruit. It calls for a thorough revision of ways of thinking and economic mechanisms which are deeply entrenched in the industrialized countries and more or less accepted as models in the others, as well as a radical change in habits and attitudes which will be felt by many as a sacrifice. It prescribes that short-term preoccupations should no longer obstruct long-term imperatives, and involves taking as precautionary measures unpopular decisions which are not based on absolute certainties. It calls for the reshaping of over-compartmentalized institutions and far-reaching changes in investment priorities. It means the rich countries agreeing to increase their aid to the poor countries for taking the environment into account (what is known as "additionality"), and the latter agreeing in exchange to change the direction of certain development projects to protect the environment (the principle of "conditionality"). It requires the adoption of a new form of economic accountancy which takes into account hitherto ignored values such as pure air, clean water, wild animals and landscapes. It requires that each of us should realize what is at stake, examine our behaviour and set an example. Without delay. ■

Dust-storm in Ethiopia.



The citizen and the environment

by Claude Villeneuve

What the individual can do to help maintain the planet's life-support systems



THE scientific community today produces a flow of reports, hypotheses and observations which show that our constant assaults on the environment are jeopardizing the world's potential for development. It is even said that the survival of the human race is threatened. Faced with these planetary problems, it is hard for the ordinary citizen not to feel in the presence of the Four Horsemen of the Apocalypse.

We are starting to feel the effects of the by-products of the very same technologies that have enabled us to increase our lifespan and improve our quality of life. Both the causes and the victims of environmental degradation, we are learning with amazement that we live in an increasingly complex and fragile world.

The transformations we have imposed on the biosphere are so far-reaching that immediate action must be taken to prevent their catastrophic effects from posing insoluble problems for the next generation. What can ordinary people do in the course of their daily lives to help solve these problems instead of making matters worse?

WHAT IS SUSTAINABLE DEVELOPMENT?

Many environmental problems are becoming increasingly global in scale, transcending frontiers and national jurisdictions and eluding the responsibility of individuals and nations.

Today's technologies are far more advanced than those of a few decades ago, but we are getting dangerously close to the limits of technological efficiency. Greater and greater efforts are required to make relatively insignificant progress, both in the production of goods and in the fight against pollution.

Furthermore, world population is rapidly increasing, and under the influence of the mass media consumer expectations are getting much higher. Although the resources of the biosphere still have considerable potential for development, the limits of its productivity will be reached in the foreseeable future.

Sustainable development is based on responsible management of resources so that the interests of future generations are protected while current needs are met. This is a stimulating challenge both for individuals and communities and it must be accepted immediately, for the longer the necessary decisions are put off, the harder they become.

BUILT-IN OBSOLESCENCE

The spectacular increase in industrial production that followed the Second World War improved living conditions around the world but also whetted appetites for material goods of all kinds. Industry provided a mass market with manufactured products at affordable prices. More and more goods were turned out at lower and lower prices, creating jobs and enabling people to buy more. Supply encouraged demand.

This situation could not last for ever. To sustain demand, products had obsolescence built into them. Advertising and marketing techniques that associated such goods with an image of happiness proved exceptionally successful. Unfortunately,



Below, precious metals extracted from industrial wastes at a refinery in Shanghai (China).



This mass of used tyres at a dump at Westley, California (USA) will be used as fuel to produce electricity. One tyre can serve the energy needs of the average Californian household for a day.

however, accumulation of possessions does not guarantee contentment, nor is it an end in itself.

On the other hand, the production of goods that are not intended to last is a waste of energy and natural resources, and creates volumes of waste that are harmful to the environment. Every American citizen, for example, throws away a ton of domestic garbage each year. In highly developed consumer societies, this refuse, which consists mainly of useless packaging, constitutes one of today's most critical environmental problems.

It is perhaps in the handling of domestic waste that the individual can be most effective in the struggle against environmental degradation. By choosing products that are either less packaged or less polluting, he or she can influence the attitudes of industry.

Cars are among the most important of the ephemeral products of the consumer society, and many environmental problems are linked to their excessive production and use. In North America, for example, it is estimated that they account for nearly 40 per cent of total energy consumption. Using the car less is one of the first suggestions to make to the citizen to reduce pressure on the environment.

World population is currently growing at the rate of 170 persons a minute, the equivalent of the population of Canada every three months. Environmentalists are alarmed by the increase, and with good reason.

First of all there is an ethical obligation to feed, clothe and house all these new citizens of the world. At present we do this rather badly, because of inequalities in the distribution of natural resources. Second, everyone in the planetary village wants to enjoy the benefits of the consumer societies of the industrialized world. Unfortunately, in the present state of ecological knowledge, high North American and European levels of consumption of natural resources do not seem accessible to everyone in the world.

Many writers, including the French agronomist René Dumont, point out that for all the planet to consume energy at North American rates, we should have to increase oil production threefold, natural gas production sevenfold, and coal output tenfold, as well as multiplying the



Children at Honduras' National School of Forestry Science at Chagüite Grande learn about tree planting and conservation. The School was founded in 1969 with aid from the United Nations Development Programme and the Food and Agriculture Organization of the UN.

current number of nuclear power plants by sixty. This prospect, which would cause us to revise estimates of how long reserves of fossil fuels will last, is terrifying from an environmental point of view. The pollution caused by the production and use of the necessary energy resources would increase amounts of acid rain, greenhouse gases and nuclear wastes to intolerable levels.

Yet every human being ought to have the right to live in comfort and security. Sustainable development therefore involves reducing birth-rates, where these are high, both in rich and poor countries.

Controlling the birth-rate is first and foremost a matter for individuals, but it must also be supported by society as a whole, and the community should invest in the education and welfare of children who have already been born before encouraging parents to bring others into the world.

THE CHALLENGE OF ENVIRONMENTAL LITERACY

Finally, an unprecedented effort must be made at local, regional and global levels to teach people about the environment so that all the citizens of the world can assume the responsibilities incumbent on them in maintaining the planet's life-support systems.

The fact is that we are all educated ignoramuses. Instead of the well-formed mind praised by the essayist Michel de Montaigne, most educational systems, under the constraints of competition, turn out well-stuffed brains. Our knowledge is increasingly specialized and fragmented among individuals who may be competent in one field but are virtually ignorant in others. Most of today's decision-makers are produced by educational systems that leave little space for extra-curricular discovery. Citizens too know little of the processes that provide them with the means to survive.

Yet informed action on environmental matters demands at least some basic knowledge of the way in which ecosystems work and an awareness of man's place in the biosphere. Environmental education is one of the keys to sustainable development. A pathway to environmental literacy, it is also the vector of the new ethic needed to redefine the relationship between humankind and the biosphere.

Environmental education must therefore be made generally available in schools and other educational institutions, so that citizens and officials can introduce an ecological dimension into decision-making.

It must start with the fact that there are limits to the capacity of the biosphere, and that human actions can alter it both at the local and the global levels in ways that are harmful to our health and safety. Teachers must also point out that the development of every human being depends on the state of his or her environment, and that no generation can arrogate to itself the right to destroy elements necessary for the survival of the next.

The challenge of sustainable development may well be the most important we have ever had to face. We now have extraordinary scientific instruments for predicting the evolution of the environment. Will we be wise enough to avoid catastrophe while continuing to improve the quality of life for humankind as a whole? Or will we be led to crisis by economic models that encourage us to believe that the infinite exists in a finite world?

These are questions science cannot answer. It is up to each of us to take up the cause. ■

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of Canada, is a biologist at the Centre Ecologique du Lac Saint-Jean, in Quebec. He has worked with several ecological organizations and written a number of works on animal life and the environment, environmental education, sustainable development and global warming.

Rwanda: land of a thousand hills

by Charles Jeanneret

How a small country in the heart of Africa is safeguarding the natural capital on which its survival depends



Harvesting tea in Rwanda.

SITUATED in the heart of Africa, Rwanda is a relatively small country (26,338 square kilometres), yet with nearly eight million inhabitants it has the highest population density of any nation in Africa south of the Sahara.

The relief of the land is uneven. A chain of volcanoes in the north gives way in the east and south to wooded savannah and plateaux dotted with innumerable hills. The west is dominated by the Zaire-Nile watershed, a group of rugged mountain ranges dissected by deep valleys. It is hardly surprising that Rwanda is known as the land of a thousand hills.

Demographic pressure, the smallness of the country and the growing scarcity of land combine with a shortage of natural resources and a land-locked position to make Rwanda a test-case for all the knottiest problems of sustainable development. The principal objectives of this largely agricultural country have always been to achieve self-sufficiency in food while also creating jobs and wealth by encouraging the production of goods to increase national purchasing power.

THE ENVIRONMENT: A NATIONAL PREOCCUPATION

Even though Rwanda lives under the constant threat of food shortages, more than 10 per cent of its territory is given over to nature reserves of great importance. These include the Virunga National Park in the north of the country, the home of the last mountain gorillas, and in the south the Nyungwe Forest, which besides providing a habitat for certain rare species of monkey is also the largest stretch of high primary forest left in Africa—and now one of the last.

Protecting these reserves is vital for Rwanda's ecological and hydrological balance, as well as for the biological diversity of its ecosystems. But a policy of conservation can also be justified economically in terms of the potential it creates for an intelligently-run tourist industry that will not harm the nation's extraordinary flora and fauna.

As a result of the soaring population, the borders of the reserves are being steadily infiltrated by poachers and people seeking food. Measures envisaged to protect the ecological heritage include plans to create natural barriers of vegetation as well as to increase research, improve surveillance and launch publicity campaigns to make people aware of the need to preserve areas vital to the nation's ecological survival.

Big efforts are being made to improve and restore the ecological heritage. A reforestation campaign launched over twenty-five years ago won widespread popular support and has been an undeniable success. Since 1973 a National Tree Day, marked by plantings across the country, has also reflected the need for a reforestation strategy. The planting of new forests has provided Rwanda with an important renewable resource, supplying the materials for a timber industry that, although still small and decentralized, has great potential for the future.

Other year-long campaigns have also been launched in support of agriculture. There has been a Soil Conservation Year, an Organic Manure Year, a Year of the Struggle against Erosion—all of them aimed at boosting efforts to achieve self-sufficiency in food.

THE THREAT TO AGRICULTURE

The agricultural sector, which employs 93 per cent of the working population, consists primarily of highly productive smallholdings, three-quarters of which are less than one and a half hectares. Rwanda has neither large estates nor the rural proletariat that goes with them, and most agricultural products, even the so-called industrially produced commodities such as coffee, tea and pyrethrum, are grown on these small family properties. One side-effect of this is that income in the rural areas is relatively evenly distributed.

Until quite recently, Rwanda produced agricultural surpluses, thanks to a policy that guaranteed minimum prices for foodstuffs, the introduction of new plant varieties and species, accelerated crop rotation, and a highly effective saving and loans system.

Other factors also played a part. The climate of Rwanda usually permits two and sometimes even three harvests a year. The country is socially and linguistically homogeneous, and has no geopolitical commitments to distract it from the problems of its own survival. There are no natural resources to attract speculation. The farming population firmly resists any threats to its livelihood, while not being averse to innovation. Politically, the nation is enviably stable.

Unfortunately, however, in the last few years things have taken a turn for the worse. Accelerating population growth is partly responsible, but a growing number of external factors have also been to blame.

Unusual weather conditions, including drought and torrential rain, have exposed the fragility of Rwanda's overburdened agricultural system, which now seemingly exploits every square metre of available land. Disaster is never far away. Overintensive farming and the lack of new land are the principal constraints that, under the pressure of an expanding population, have pushed Rwandese agriculture towards breaking-point. Several parts of the country suffered food shortages in 1989.

One of Rwanda's advantages has actually become a handicap. The widespread dispersal of the population, which helped save the country from rampant urbanization and the proliferation of shanty-towns, is now synonymous with waste. Sub-divided into ever tinier plots as a result of the prevailing system of inheritance, the smallholdings have become too small to produce reasonably large surpluses. Systematic overcropping has reduced soil fertility, which had previously remained high thanks to a carefully supervised system of fallowing. Worse still, successive falls in the price of coffee—the nation's principal export crop, providing the foreign currency needed to pay for imports—have reduced



Stacks of bricks made by Rwandese craftsmen.



A soap statue made by a Rwandese soap manufacturing company to demonstrate its support for the protection of gorillas.



the country's purchasing power and deprived it of the means to maintain its level of economic activity and modernize its agriculture.

NEW ECOLOGICAL IMPERATIVES

Without an effective demographic policy that would combine family planning with a programme to optimize land use, the existing system may eventually break down. In any case, will it be possible to increase agricultural production substantially and permanently without harming the environment?

Various factors could help. New chemical fertilizers and other products must be introduced to replace essential minerals the soil has lost. Liming will be a priority, since Rwanda possesses important lime deposits. The import of inorganic fertilizers is a recent innovation, and remarkable efforts are being made to optimize their use, notably by applying them in conjunction with organic manure.

Rwanda's only unused land consists of marshes which play a fundamental role in regulating the country's hydrological system. Developing this marshland will pose complex technological, social, economic and institutional problems, but it offers the prospect of substantially increasing food supplies without harming the environment.

The fact that half Rwanda's agricultural land slopes at an angle of 25 degrees or more raises a particularly serious problem. The most widely used techniques of soil conservation, such as planting hedges or digging ditches to counter erosion, do not work on terrain where the angle of declivity exceeds 21 degrees. Consequently much hope and enthusiasm have been invested in a new system of "radical" terracing whereby the slopes are transformed into horizontal platforms which

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slope slightly against the hillside and thus intercept drainage water and encourage it to soak into the soil. This reduces and in some cases even eliminates land-loss and provides crops with maximal nutrition.

Besides rehabilitating land that was previously either badly eroded, under-exploited or even regarded as unusable, the terraces also maintain soil fertility. Consequently, agricultural output rises almost immediately. A property at Kisaro that formerly produced one ton of potatoes yielded a bumper crop of 25 tons after terracing. Plots where wheat would not grow now yield two tons per hectare. These cases may be exceptional, but there is general agreement that terracing on average doubles the harvest without diminishing the precious natural capital of the soil.

ENVIRONMENTALLY SOUND INDUSTRIALIZATION

Bringing industry to Rwanda constitutes a real challenge, in view of the fragility of the environment, which could be disastrously affected by certain kinds of pollution. Even so, industrialization is a priority, not just to add value to the nation's resources by turning them into finished products but also to absorb the surplus labour of the rural areas and to create additional purchasing power to buy the foodstuffs and other commodities produced there. Even so, it has taken considerable inventiveness to identify genuinely promising opportunities.

Because importing raw materials for manufacture is prohibitively expensive for this landlocked country, priority has been given to small and medium-sized enterprises that are considered ecologically safe, such as timber and agro-business.

Other industries are also concerned with the need to safeguard the environment. The Ruliba brickworks at Kigali uses dried papyrus reed and coffee-bean casings as fuel. Rwanda will soon be producing corrugated sheets of tarred papyrus to serve as roofing. Not only will these last longer than imported tiles, they also consume a locally grown raw material that is indefinitely renewable, and will thus save a considerable amount of foreign currency. Rwanda's national brewery uses methane gas from Lake Kivu as its energy source. Other industries, notably cement manufacture, are expected to follow suit.

Can Rwanda be described as a success-story of sustainable development? It is still too early to say. But the country is moving in the right direction by seeking the tools of development in its own environment and ensuring that its natural capital remains entirely in its own hands. ■

Energy for a sustainable world

by José Goldemberg

The search for new energy sources to replace exhaustible and environmentally harmful fossil fuels

THE concept of sustainability is a highly complex one, particularly where energy matters are concerned. We can only hope to approach anything like absolute sustainability by the use of renewable energy resources such as hydro-electricity; but even hydro-electricity involves problems such as the silting up of dams or the secondary environmental damage dams can cause, which makes it less than a hundred per cent sustainable.

On the other hand, some fossil fuels, such as coal, are quite abundant and even at their present rate of consumption will last for several centuries, when other sources of energy might become available.

The Report of the World Commission on Environment and Development (1987) defined sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs". And this, perhaps, contains the hint that we need to introduce the notion of "depletion rates" into any discussion of sustainability. This opens the way to the establishment of compromises between what is desirable in principle and what is practical in terms of the realities of everyday life. Such compromises are unavoidable when a choice has to be made between preserving resources and the needs of survival and development.

If energy use were to be considered in conformity with the strict definition of sustainable development, this would mean that man should rely exclusively on renewable sources of energy. This was the case before the industrial revolution, when fuelwood, used in a renewable fashion, was basically the only source of energy.

With population growth and increased demand for energy, however, exhaustible fossil fuels came into use and became the predominant energy source. In the industrialized countries today, fuelwood represents less than one per cent of total energy consumption, the remaining demand being met basically by fossil fuels—coal, oil and gas.



The dam at the Tucuruí hydro-electric power station on Brazil's Tocantins river.

This is clearly an unsustainable form of development, since the depletion of existing reserves of fossil fuels is proceeding at a fast pace and will certainly "compromise the ability of future generations to meet their own [energy] needs."

Depletion, and eventual exhaustion, of stocks of fossil fuels are not the only problems. Their use entails other problems which affect the sustainability of the system in which we live—the emission of carbon dioxide and other gases is the major cause of atmospheric pollution and global warming and thus poses a threat to the way of life of future generations.

In the less developed countries, fuelwood still represents an appreciable fraction of total energy consumption. If this resource were properly managed, by the systematic planting of trees to replace those cut down, it could become an inexhaustible energy source. This is far from being the case and we are witnessing intensive deforestation which is consuming more than ten million hectares of forest—mainly tropical forest—every year. The problem is most acute in Africa, but is also very significant in south-east Asia and Latin America.

On a worldwide scale, only hydro-electricity can today be considered a sustainable energy resource—it cannot be depleted and it does not produce greenhouse gases. However, only ten per cent of the total energy used in the world comes from this source and, although the potential of existing untapped sites is considerable, they are unevenly distributed around the world.

Three approaches can be adopted to attain energy sustainability:

- extend the life of existing fossil fuels as much as possible by wise use;
- increase the use of other, little-used renewable energy sources such as wind power, solar thermal power, solar thermo-electric power, photovoltaics and biomass;
- increase the use of nuclear power.

Before the two oil crises of the 1970s, growth in energy consumption, based on the use of fossil fuels, seemed to be part of the way of life of developed countries and an example to be copied and a goal to be attained by all. The projection of future energy consumption reflected those expectations and predicted a sustained growth of at least three per cent a year, which meant that total energy consumed would quadruple in less than fifty years.

The two oil crises led to a re-examination of the situation and to moves to reduce what was seen as a dangerous over-reliance on oil. Two major energy studies were conducted during the 1970s—one by the Energy Research Group,

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Cambridge, England, for the World Energy Conference, the other by the International Institute for Applied Systems Analysis, Vienna. Both studies had one long-term objective in common—to shift from oil to more abundant energy resources such as natural gas, coal and nuclear energy while maintaining a significant growth in energy consumption.

Their approach was to estimate future energy demand on the basis of assumptions about future demographic and economic trends, to make historical correlations between such trends and energy demand, and to match this demand to a new mix of energy supplies. However, the scenarios they produced had the defect of projecting a perpetuation of the energy consumption imbalance between the developed and the developing world and thus of implying containment of the legitimate development expectations of the less developed countries.

In 1988, in his book *Energy for a Sustainable World*, the author of this article explored the possibilities of modern, energy-efficient technologies for meeting the energy needs of the world population in the year 2020. This study concluded that widespread use of new technologies could enable people in the developing world to attain a level of amenities comparable to that of the countries of Western Europe in the middle of the 1970s and the industrialized countries to reduce their per capita energy consumption by almost half. Taken all together he foresaw total energy consumption in the year 2020 remaining approximately the same as in 1980, but with a much higher level of comfort for the great majority of the world population.

Unfortunately, this projection did not really correspond to a sustainable situation because fossil fuels still represented the great majority of the energy needed and carbon dioxide emissions would continue to poison the atmosphere significantly. It did, however, demonstrate that it was possible to stabilize energy consumption at existing levels while extending considerably the life of fossil fuel resources.

A more recent study by R.H. Williams, of the Center for Energy and Environmental Studies, Princeton University, published in 1989, is more optimistic about the possibility of greater use of renewable fuels which evolving technologies seem to be making both feasible and economically viable.

More efficient methods of using fuelwood and of converting other biomass fuels (basically vegetation and crop residues) into electricity through gasification and the use of modern gas turbine generators, are rapidly being introduced. The conversion of sugar-cane into ethanol as an energy source for electricity generation is gaining ground and there are important new developments in wind, solar thermo-power and photovoltaics.

Re-examination of all these possibilities in the Williams study led to the conclusion that by the year 2025 renewable energy sources could account for more than half the energy used in developing countries.

THE NUCLEAR OPTION

Finally, we have to consider the possible contribution of nuclear energy to the establishment of a sustainable world energy system. Nuclear energy does not emit carbon dioxide and with the development of breeder reactors sufficient nuclear fuel for the operation of thousands of nuclear power plants is guaranteed for centuries to come. Here theoretically is an ideal sustainable energy source.

The problem with nuclear energy lies elsewhere. Even with the use of the most advanced technology, accidents do happen, as the Chernobyl disaster so tragically demonstrated. In addition, there seems to be no solution to the problem of disposing of radio-active waste in a manner compatible with maintaining a "clean" environment. These problems, coupled with the danger of nuclear proliferation for military purposes, make the nuclear solution unacceptable to public opinion in many countries. ■



Children planting tree seedlings in Sri Lanka.



Hungary: the pitfalls of growth

by István Láng

Since 1990 Hungary has been trying to redress an economy long tilted in favour of pollution-prone heavy industry

Above, a petro-chemical works emitting pollutants at Kazincbarcika in Hungary.

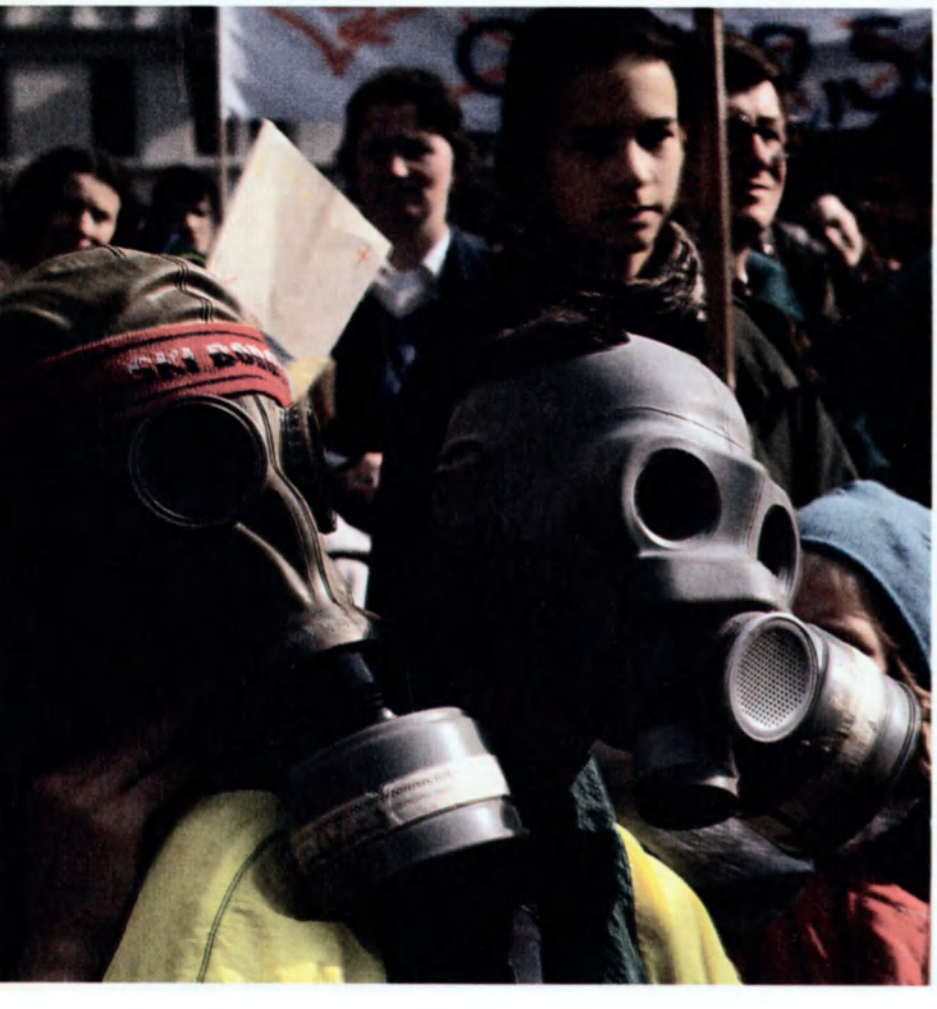
At the end of World War II, Hungary found itself politically and economically attached to the Communist bloc. From the beginning of the 1950s, a system of central planning and management was gradually developed. Companies came into State ownership, co-operative farms were formed and most of the service sector was brought under the control of the State or of co-operatives.

Quantitative growth at all costs became the watchword of industrial production. The development of heavy industry was given priority, energy-intensive technologies spread and raw materials were used with scant regard for economy. Nevertheless, the quantitative growth that occurred between 1950 and 1975 made it possible to raise the standard of living and well-being of the population as compared to the levels of the pre-war period.

After the first oil crisis, however, the limitations of the centrally planned system, its inability to adapt and its lack of competitiveness, soon became apparent. Failure to modernize the infrastructure and to introduce computer technology meant that Hungary, like the other countries of Eastern Europe, began increasingly to lag behind Western Europe. The position was made even worse by increasing external debts and the slowing down of economic development.

This falling behind in the economic field was matched by a delay on the part of political leaders in East European countries, including Hungary, in recognizing the importance of environmental protection. Although Hungarian scientists participated in UNESCO's Man and the Biosphere programme from its inception, government agencies took six to seven years to react to the environmental challenges raised.

During the 1980s, Hungary faced growing economic difficulties. During the decade 1977 to 1987 the country's external debt grew from $43 million to $18,957 million. Various economic reforms were carried out and central control of planning and management was gradually reduced, but this was not sufficient to lead to a smoothly functioning, market-oriented economy. So when



A demonstration of environmentalists in Budapest.

the importance of environmental protection was finally recognized, Hungary was already in a period of economic decline and it was not possible to make the big investment needed to replace polluting technologies or the energy-intensive and raw-material-intensive structure of industry.

The period 1989-1990 saw the beginning of radical, but peaceful, political change. In spring 1990, free elections were held and with a new Parliament and a new government Hungary has set out on the road to parliamentary democracy, with a multi-party system, a market-oriented economy and independence from military blocs.

However, the new government inherited the old environmental problems and it takes a long time to change old production structures. Nevertheless, data on the state of the environment have been made public and municipalities and voluntary environmental groups are being encouraged to play a larger part in pollution control by means of public debates and hearings.

Preparations for the 1992 United Nations Conference on Environment and Development have begun. A National Commission has been set up, and an action programme for the solution of local and national environmental problems has been drawn up with the aim of arousing public awareness. A panel of high-ranking experts has been formed with the task of working out, on the basis of the recommendations of the Rio Conference, a Hungarian strategy for the attainment of sustainable development.

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What, then, is the present position in key policy sectors and what changes can be expected?

ENERGY POLICY

Energy policy is a key issue in the Hungarian debate on environmental protection. For decades, energy has been wasted on a vast scale in Eastern Europe, including Hungary. Owing to the use of out-of-date technologies, energy consumption per unit of product (e.g. per ton of steel or per ton of wheat) is on average 40 to 50 per cent higher than in the Western European countries and the proportion of energy-intensive sectors within industry is high. Energy consumption per capita, for example, in Austria and Hungary is practically the same, but, in relation to Gross National Product, Hungary consumes five times as much energy as Austria.

Energy policy for the future has two main objectives: to increase the efficient use of energy and to reduce dependence on external sources of energy. At present there is intense public debate as to whether or not a second nuclear power plant should be built, and if not, on what primary fuel additional electrical energy will be based. This is a matter of great public concern because, although technological reconstruction of some existing power plants has led to some improvement with regard to the emission of pollutants, 44 per cent of the population live in areas where, at certain times of the year, the quality of the air does not meet minimum health standards.

INDUSTRY

Transition to sustainable industrial development and to market mechanisms entails considerable economic and social change. One example of this is that the previously established principle that "the polluter pays" seems to be being replaced by the new principle that "the polluter pays and the consumer pays". Another is that because of rising prices of raw materials and energy, coupled with decreasing government support, heavy industry is in crisis, with the unfortunate social consequence that unemployment has increased to an unprecedented degree. Paradoxically this is also an environmentally favourable phenomenon, since it means a decline in a sector of industrial activity which pollutes the environment the most.

Privatization of Hungarian companies has begun, mainly with the help of foreign capital. This will have a positive effect on the modernization of technological processes and thus will benefit the environment. Some environmentalists, however, are worried about this, since they fear that polluting processes that are no longer permitted in the European Community countries will be transferred to Hungary. It is the generally accepted opinion in Hungary that industrial development must be judged on the basis of European norms.

AGRICULTURE

Hungary's climate and soil are suitable for intensive agricultural production. In the 1980s, two-thirds of the country's agricultural produce was sold on the internal market, ensuring an ample

food supply (exceptional in Eastern Europe), while one third was exported. However, intensive soil cultivation and the use of large amounts of artificial fertilizers and pesticides, as well as concentrated animal husbandry, have led to some degradation of the environment. Damage caused by wind and water erosion affects some 40 per cent of the land, a significant part of the groundwater contains an excess of nitrates, acidification of the soil can be observed on one third of the arable land and, as a result of irrigation, salinization has developed in many areas.

Privatization of the land has begun and there will be considerable decentralization in both land use and animal husbandry in the coming years. On the whole this is expected to have favourable environmental effects, but problems may arise in ensuring the proper use of agro-chemicals.

When Hungary joins the European Community (this is thought likely to occur in the second half of the 1990s), Hungarian agricultural exports will probably decrease. This will make it possible to shape the model of a low-energy-input agriculture.

TRANSPORT

Transport is one of the biggest sources of pollution in Hungary. Some 45 to 50 per cent of the carbon monoxide, 40 to 45 per cent of the nitrogen oxides and 90 per cent of the lead emitted into the air come from transport. Road transport has the greatest share in this emission with more than 85 per cent, the railways being responsible for 12 to 13 per cent and air transport for one to two per cent. The development of the means of mass transport is being given priority in the plans of both national and municipal authorities.

NATURE CONSERVATION

Some 626 hectares of Hungary's total territory of 93,000 square kilometres are protected. Altogether there are four national parks, 44 protected regions and 137 nature conservation areas. All the 2,500 caves, 415 plant species and 619 animal species are protected. In addition there are 877 locally protected areas.

The national parks have been established partly in forest areas and partly in lands which are very valuable for nature conservation but not easily usable for agriculture. Some problems have arisen because the national parks are not all fully owned by the State authorities responsible for conservation. With the privatization of land, this problem is growing more acute. The general trend, however, is for protected nature conservation areas to remain under State ownership and for their exploitation (for logging, grazing, fishing, etc.) to be fully controlled by the nature conservation service.

As can be seen from this short review, Hungary has inherited an onerous legacy from earlier regimes. Under new circumstances the intention is to adopt new methods to achieve sustainable development. Environment and development will figure jointly in the government's programme and an environmentally aware public will be there to encourage action and to ensure that the proper decisions are made. ■



An avocet, a bird which nests by the lakes of Hungary.

A world fit to live in

by Lester Brown
Christopher Flavin
and Sandra Postel



In 40 years' time, solar panels may be as familiar a part of the urban landscape as TV aerials are today

BUILDING a more environmentally stable future clearly requires some vision of that future. If not fossil fuels to power society, then what? If forests are no longer to be cleared to grow food, then how is a larger population to be fed? If a throwaway culture leads inevitably to pollution and resource depletion, how can we satisfy our material needs? In sum, if the present path is so obviously unsound, what picture of the future can we use to guide our actions towards a global community that can endure?

A sustainable society is one that satisfies its needs without jeopardizing the prospects of future generations. Unfortunately there are no existing models of sustainability. For the past several decades, most developing nations have aspired to the automobile-centred, fossil fuel-driven economies of the industrial West. But from the localized problems of intractable air pollution to the global threat of climate change, it is now clear that these societies are far from durable; indeed they are rapidly bringing about their own demise.

If the world is to achieve sustainability, this will have to be done within the next forty years. If we have not succeeded by then, environmental deterioration and economic decline are likely to be feeding on each other, pulling us into a downward spiral of social disintegration. Our vision of the future therefore looks to the year 2030.

One assumption we make about the future concerns population size. Current United Nations projections have the world headed for nearly nine billion people by the year 2030. This figure implies a doubling or tripling of the populations of Ethiopia, India, Nigeria and scores of other countries where human numbers are already over-taxing natural support systems. We, however, assume a population of at most eight billion that will either be essentially stable or slowly declining towards a number the Earth can support comfortably and indefinitely. Either societies will move quickly to encourage smaller families and bring birth-rates down, or rising death-rates from hunger and malnutrition will check population growth.

The humane path to sustainability by the



Taksang monastery, one of the oldest in Bhutan, is equipped with solar cells which provide electricity for lighting.



A wind generator in Australia

year 2030 therefore requires a dramatic drop in birth-rates. More countries will do as China and, most recently, Thailand have done—cut their population growth rates by half in a matter of years. As of 1990, thirteen European countries have stable or declining populations; by 2030, most countries are likely to be in that category.

THE DAWN OF THE SOLAR AGE

The world of 2030 will not be powered by coal, oil and natural gas. It is now well accepted that continuing heavy reliance on fossil fuels will cause catastrophic changes in climate. Avoiding this and eventually stabilizing the climate depend on cutting global carbon emissions to two billion tons, about one third of the current amount. Given projected population growth, the world in 2030 will therefore have per capita carbon emissions that are one-eighth of the level of those in Western Europe today.

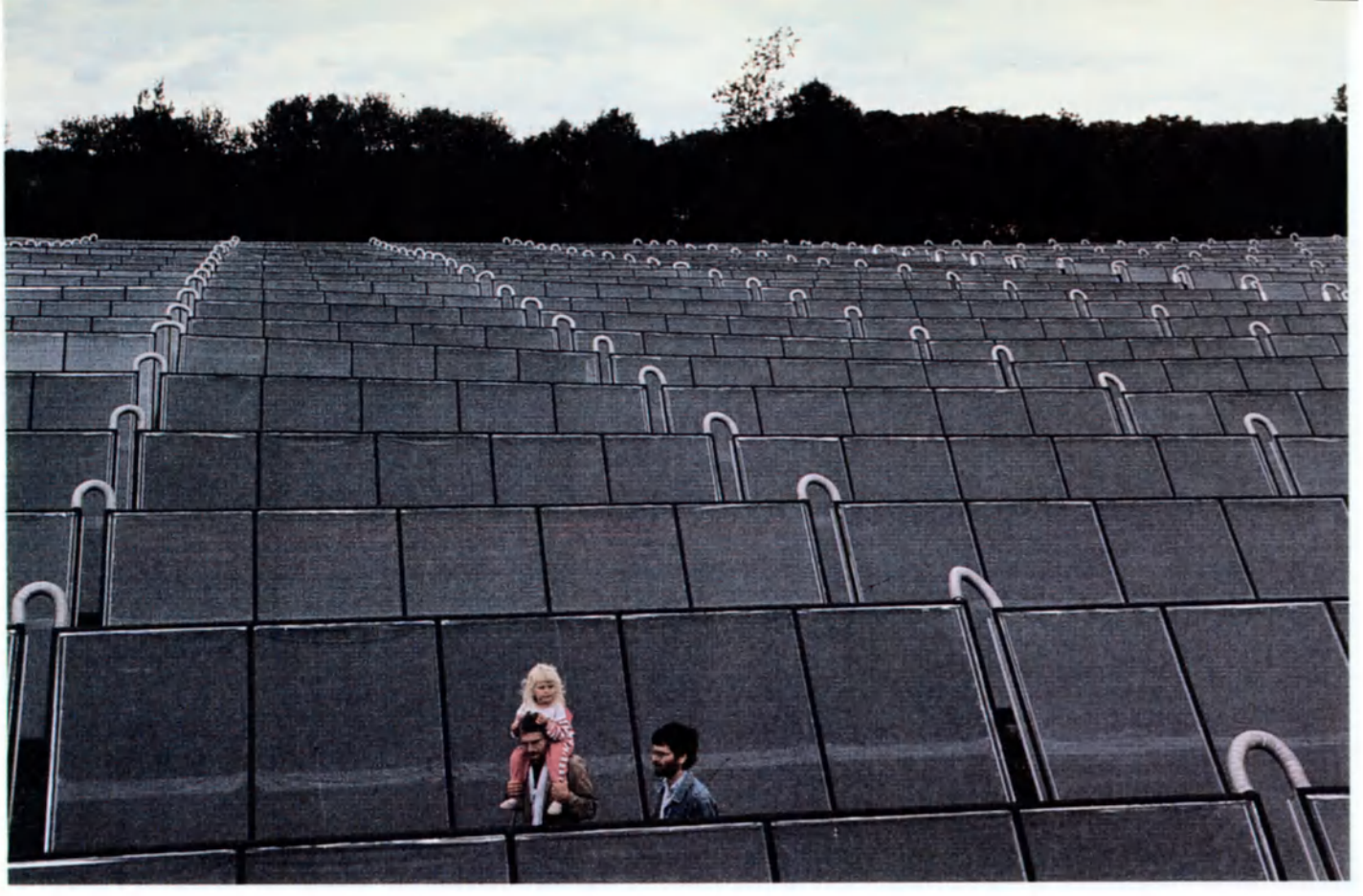
The choice then becomes whether to make solar or nuclear power the centrepiece of energy systems. We believe societies will reject nuclear power because of its long list of economic, social and environmental liabilities.

The late twentieth century is the dawn of the solar age. When it comes to solar technologies, today's political leaders, still captivated by coal and nuclear power, are like those who in the eighteenth century were sceptical about the future of the steam engine. The glimmerings of the new age are already giving the lie to such sceptics. Some nations—Norway and Brazil, for example—already obtain over half their energy from renewable energy resources. And these resources are available in immense quantity. The United States Department of Energy estimates that the annual influx of currently accessible renewable resources in the United States is 250 times the country's annual use of energy.

Solar power is by nature diverse; the mix of energy sources will reflect the climate and natural resources of each particular region. Northern Europe, for example, is likely to rely heavily on wind and hydropower. The economies of northern Africa and the Middle East may instead use direct sunlight. Japan and the Philippines will tap their abundant geothermal energy. And Southeast Asian economies will be powered largely by wood and agricultural wastes, along with sunshine.

Due to the abundance of sunlight, direct conversion of solar energy will be the corner-stone

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Solar panels in Sweden.

of a sustainable world energy system. Not only is sunshine available in great quantity, it is also more widely distributed than any other renewable resource. By 2030, solar panels will heat most residential water around the world, following the model of Japan and Israel, which already use them extensively. A typical urban landscape will have thousands of collectors sprouting from roof-tops, much as television aerials do today. And passive solar architecture may by then cut artificial heating and cooling needs to virtually zero in millions of buildings.

Photovoltaic cells are a semi-conductor technology that converts sunlight directly into electricity without the use of the mechanical processes involved in solar thermal conversion. As they become economical, the completion of the solar revolution will be possible. All Third World villages could be electrified with this renewable source, with battery storage for lighting and other uses in the dark evening hours.





Prototypes of a solar-powered car and aircraft.

Wind power is an indirect form of solar energy, generated by the Sun's differential heating of the Earth's atmosphere. The cost of wind energy fell by about 70 per cent during the 1980s, making it at least 40 per cent cheaper than power from new nuclear plants in the United States and almost competitive with energy from new coal-fired power plants.

Engineers are confident that they will soon have improved wind turbines that are economical not just in California's blustery mountain passes, where some wind farmers are already generating $30,000 worth of electricity per hectare annually, but also in vast stretches of the US northern plains, on the North Sea coast of the United Kingdom and in central Europe. Among the other regions where major wind farm projects are now on the drawing boards are Germany and the State of Gujarat, in India.

For hydropower, which now supplies 19 per cent of the world's electricity, prospects for future growth are most promising in the Third World, where the undeveloped potential is still large. Small-scale projects are likely to be more appealing than the massive projects favoured by governments and international lending agencies in recent decades.

ENERGY FROM PLANTS

Plants provide another means of capturing solar energy. Through photosynthesis they convert sunlight into biomass that can be burned. Until the industrial revolution, wood supplied most of the world's energy. Today it still provides 12 per cent of the total, chiefly in the form of firewood and charcoal in developing countries.

One promising approach to augmenting biomass energy capacity is to grow energy crops on marginal lands not currently used for food. Land that is too steeply sloping or not sufficiently fertile or well watered for crops might support trees that could be harvested periodically. The wood could then be burned directly in a wood-fired power plant or converted to ethanol. The Solar Energy Research Institute has already developed a process that brings the cost of wood-derived ethanol down to $1.35 per gallon.

Virtually all Pacific rim countries, as well as those along East Africa's Great Rift and the Mediterranean Sea, are well endowed with geothermal energy. Iceland, Indonesia and Japan are among the nations with the greatest potential. Geothermal energy can provide not only electricity that can be transmitted over long distances, but also direct heat for industries sited near the Earth's major heat reservoirs.

Getting global carbon emissions down to two billion tons a year requires vast improvements in energy efficiency. Fortunately, many of the technologies to accomplish such reductions are already at hand and cost-effective. No technical breakthroughs are needed, for example, to double automobile fuel economy, triple the efficiency of lighting systems, or cut typical heating loads by 75 per cent. Technologies developed in the decades ahead will undoubtedly allow even greater gains.

By the year 2030, a much more diverse set of transportation options will exist. The typical European or Japanese city today is probably fairly indicative of this future. Highly developed rail and bus systems move people efficiently between home and work. In Tokyo, only 15 per cent of commuters drive cars to the office.

Automobiles will undoubtedly still be in use four decades from now, but they will be fewer in number and their role will be smaller. Within cities, only clean hydrogen-powered vehicles are likely to be permitted and most of these will be highly efficient "city cars". The energy to run them may well come from solar power plants. Families might rent efficient larger vehicles for vacations.

The bicycle will also play a major role, as it already does in much of Asia and in some industrial-country towns and cities. There are already twice as many bicycles as cars worldwide. In the bicycle-centred transport system of the year 2030, the ratio could easily be as high as ten to one. ■



Reconstitution of a forest of conifers north of Tokyo.



What future for Amazonia?

by Ignacy Sachs

MANY people in the industrialized countries would like Amazonia to be preserved exactly as it is, and transform it into a vast nature reserve.

Some of these advocates of the non-development of Amazonia attach the highest priority to safeguarding planet Earth and at the same time contrive to regard human beings as parasites. Others point out that the Amazonian forest plays a major role in counteracting the greenhouse effect, and wish to see it act as a gigantic filter so that 500 million cars can continue to consume fossil fuels.

THE CURRENT CONTEXT

The non-development of Amazonia is totally unacceptable both to the people who live in the region and to Brazilians in general. The gratuitous advice handed out to the people on the spot may well be seen as a kind of ecological colonialism as long as the industrialized countries of the North refuse to change their ways of life and patterns of consumption.

Let these countries prove their sincerity by proposing to the United Nations Conference on Environment and Development a specific programme for the reduction of energy consumption in industrial societies.

Let them also provide the countries of the South with access to the scientific and technical knowledge that is needed to develop the immense biological heritage of the Amazonian forest within a framework of sound ecological principles. For this long-term task, Brazil and the other countries of Amazonia need the capacity to carry out their own *in situ* research.

For tropical countries biotechnology opens up considerable possibilities based on progress in the production of biomass and the range of products that can be derived from it. Eventually we may see the emergence of a new "plant-based industrial civilization", a particularly interesting prospect for tropical countries. Mr. Monkombu

S. Swaminathan, a former President of the International Union for Conservation of Nature and Natural Resources, believes that a new form of civilization based on the sustainable use of renewable resources is not only possible but essential. The vision of this Indian scientist coincides with the intuitions of the Brazilian sociologist Gilberto Freyre, who in the 1960s founded a seminar on tropicology at Recife.

However, at present biotechnology seems to be so effectively shielded by a wall of patents that people in many developing countries are wondering whether it will not become an instrument for the recolonization of the South by the North. The industrialized countries would provide another token of their disinterestedness if they were to relax their position on patents and intellectual property rights, and establish more open forms of access to science and technology.

In 1989 Mr. Rajiv Gandhi, then Prime Minister of India, suggested that a 0.1 per cent tax be levied on world revenue and its yield of $18 billion used to establish a world fund to finance research into environment-friendly technologies, their purchase and their free distribution to all interested countries. However, nothing came of this proposal, which relaunched the debate on the financing of environmental protection and development.

Another possible course of action would be to create a network linking Asian and African researchers to Brazilians and other Latin Americans who are seeking to harness the renewable resources of humid tropical forest ecosystems to development, a process that should harmonize three objectives of what is known as ecodevelopment:

- the promotion of greater social justice in the name of the ethical principle of synchronic solidarity, with development being regarded as a civilization based on the equitable sharing of possessions;
- self-development in harmony with nature rather than through domination of nature, in the name of the ethical principle of diachronic solidarity with future generations;
- the pursuit of these two goals through a search for a kind of economic efficiency that is not restricted to a concept of business profitability which often takes no account of ecological and social costs.

In addition to such measures, however, international co-operation must primarily be directed at improving the general economic environment of Latin American countries. In other words solutions must be found to the problems of debt, terms of trade, and the reduction of protectionist barriers in the industrialized countries.



A painting by pupils of the Usko-Ayar School of Painting and Nature at Pucallpa in Peruvian Amazonia. The school was founded in 1988 to encourage young artists to observe the Amazonian environment and portray its plant and animal life.



A timber company plants native trees in a heavily logged area of Peruvian Amazonia.

The internal challenges posed by the development of Brazilian Amazonia are as vast as the size of this immense area which has captured the imagination of so many and inspired so many exaggerations.

DREAMS AND REALITIES

There is a golden legend which portrays Amazonia as a region of fabulous wealth, a mirage which has lured generations of adventurers. A variant of this legend, inspired by the philosophy of the Enlightenment and the expiatory inclinations of our ethnologists, paints a picture of noble savages living happily in perfect harmony with nature.

There is also a black legend which describes Amazonia as a green, impenetrable hell, protected by tropical diseases which afflict all intruders.

These contradictory pictures are reflected in opposing conceptions of the region's future. Some see Amazonia as the world's last great economic frontier, a place of incalculable mineral, hydraulic and plant wealth. Others believe that the abundance of its vegetation is an illusion and that its soils are poor and subject to erosion as soon as the forest is felled. Haphazard exploitation of Amazonia's mineral wealth and the growing number of big dams, combined with chaotic colonization leading to massive deforestation, will rapidly turn Amazonia into a desert.

What are the facts?

A precondition for successful development is the abandonment of the dominant model of predatory exploitation of the region's natural resources, a model which takes no account of social and environmental costs. The random pursuit of growth is just as unacceptable as non-development.

For twenty years or more, several factors combined to accelerate deforestation. These factors were:

- geopolitical imperatives leading to the settling of Amazonia along purpose-built roads;
- the idea that Amazonia could absorb rural refugees displaced by the modernization of agriculture in southern Brazil and by the persistence of anachronistic land-ownership structures in the northeast;
- the decision to favour large-scale animal husbandry, which is quite unsuited to the natural conditions of Amazonia and leads to frenetic speculation in land, as well as hopes that the region's mineral wealth could be used to alleviate the burden of debt;
- the establishment in the duty-free zone at Manaus of a great industrial centre.

As a result of these policies, now revised, Amazonia has lost between 300,000 and 400,000 square kilometres of forest.

There has also been rapid urbanization. Ten million of Amazonia's 17 million population today live in cities (Manaus and Belém each have over 1 million inhabitants). There are many shanty-towns which are so exposed to the risk of epidemics that the living conditions of the people who live in them and in the cities undoubtedly constitute Amazonia's most acute environmental problem today.

Outside the urban centres the population

lives in widely scattered settlements along the banks of streams and rivers and practises a subsistence and gathering economy. The creation of "extractive reserves" has brought a measure of relief to the *caboclos* and *seringueiros* (peasant farmers who tap rubber), whose existence is threatened by land speculators. These people live in extremely precarious conditions which could be improved by more rational exploitation of the forest's natural products, but this can only be envisaged as part of a long-term solution for the whole region. The *seringueiros* want their share of economic, social and cultural progress, which implies a dynamic vision of the transformation of the extractive reserves into poles of ecodevelopment.

The indigenous populations, long the victims of adventurers and colonists, enjoy considerable rights under the Brazilian Constitution, and the Government has promised to earmark 80 million hectares of land for 250,000 of them throughout Brazil between now and 1993.

A NEW STRATEGY

The aim of Brazil's current environmental policy is to promote a strategy of ecodevelopment rather than a strategy of development at all costs. This is a laudable goal, but it will not be easy to achieve, either in Brazil or in the other Amazonian countries.

It must be accepted that ecodevelopment in Amazonia depends on policy changes outside the region. Land reform and reform in agricultural policy must be carried out in the rest of Brazil in order to reduce the flow of migrants to Amazonia. Likewise, forest resources must be protected by an ambitious reforestation programme elsewhere than Amazonia—the FLORAM Plan prepared by the Institute of Advanced Studies of the University of São Paulo proposes that 20 million hectares of forest be planted outside Amazonia in thirty years, at a cost of $20 billion.

Within Amazonia, the first step is to divide this far from homogeneous region into some twenty sub-regions, each with its own strategy. The global problems of Amazonia call for solutions adapted to local ecological and cultural conditions. Social diversity is a counterpart to biological diversity.

The main thrust of these efforts must be directed towards the rehabilitation of already deforested land and, as far as possible, to increasing the density of the population in these areas, so as to halt the advancing frontier of colonization and prevent further deforestation. Efforts must be made to create an archipelago of connected "development reserves" so as to guarantee the protection of virgin forest and the habitat of the indigenous population. Such an approach presents many difficulties, but it still seems more realistic than creating a proliferation of natural reserves.

Agroforestry which makes judicious use of local plant species (especially the enormous potential of fruit trees), aquaculture, high-yield agriculture and horticulture in the *varzeas* (highly fertile floodland), and small-scale animal husbandry are promising techniques. Knowledge of the environment acquired in the course of the centuries by local populations may provide a useful starting point, whence the importance of ethno-ecological studies.

Technical skills based on the know-how of local populations and inputs from modern science can meet the needs of small modern family farms. The use of local energy sources exploited on a limited scale would also make possible the gradual development of small packaging and transformation industries.

An efficient network of production and marketing co-operatives would provide an institutional framework for these ecodevelopment strategies. In the medium term, such co-operatives would make it possible to provide decent living conditions for a much larger population, while respecting the vulnerable ecosystems of Amazonia. They would also slow down the exodus to the shanty-towns and the proliferation of uncontrolled gold mining.

The objective must be to make Amazonia habitable, by abandoning the colonial vision of an area producing resources which are then drained away to the outside world. There remain the far more difficult problems of reducing the social and ecological costs of mining and hydropower, improving the living conditions of the urban masses, and controlling tropical diseases, starting with malaria.

Contrary to a widespread prejudice, enough is already known about Amazonia for us to advance along the road of ecodevelopment, without neglecting the research which is anyway necessary. Successful projects and promising local initiatives can be found in the interstices of the predatory development model. These solutions, which for the time being lie outside the dominant paradigm, may be seen as the precursors of a new paradigm of development. ■



Harvesting nuts from an andiroba tree in Brazil. The nuts yield an oil with medicinal properties.

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No room in the Ark

by Bernd von Droste

'The destruction of natural ecosystems and the extinction of plant and animal species is becoming one of the crucial factors limiting economic growth'

'THE scale of the human economy has grown so large that there is no longer sufficient room for all species in the Ark." These recent words from a World Bank official are a striking warning that the world is becoming so full of human beings and their socio-economic systems that other, often priceless, irreplaceable species and their natural systems are being displaced and destroyed at a rate never before experienced. The human population of the world is now projected to double within thirty-nine years, from five billion to ten billion, but the issue is not just numbers, but how those numbers relate to available resources. The destruction of natural ecosystems and the resulting extinction of plant and animal species is becoming one of the crucial factors limiting economic growth. Indeed, the diversity of life on Earth is being rapidly diminished as uniform production systems replace cultural and natural diversity.

The diversity of species, however, is essential to the normal functioning of ecosystems and therefore to the biosphere as a whole. Apart from the moral, cultural, aesthetic and purely scientific reasons for conserving wild species, the genetic material they supply already makes a huge contribution to the world economy in the form of improved crop species, new drugs and medicines and raw materials for industry. It also promises to become even more important in the future as our understanding of genetic processes is steadily increasing.

Economic logic tells us that we ought to maximize the productivity of the scarcest factors and try to increase their supply. Economic policy should be directed towards the conservation of remaining natural stocks, increasing their sustainable use and, where still possible, restoring lost natural assets. In other words, we need to undertake a huge programme of investment in biological diversity.

Three kinds of investment are needed: first, scientific investment for enlarging our knowledge base; second, investment in the sound management and restoration of our often degraded natural heritage; and third, investment in international instruments for world conservation of biodiversity.

INVESTMENT IN THE KNOWLEDGE BASE

Lack of knowledge is a major obstacle to the conservation of biological diversity. What better illustration of our lack of knowledge than the widely different estimates of the present number of living species—they range from three million to one hundred million—to be found in scientific literature? Even less is known about the interaction of species, the precise role of species diversity, or how to achieve sustainable development in sensitive, species-rich areas.

It is often assumed that the establishment of a system of protected areas will fulfil conservation needs. The fact is, however, that we do not have species inventories for most protected areas

Right, *Noah's Ark* (1978), a photomontage by the Japanese artist Tsunehisa Kimura.

Elephants in Kenya's Amboseli National Park.



and even less so outside them. We therefore do not even know what we are aiming to conserve or which areas to concentrate on. Under-investment over past decades in taxonomic training and research, as well as in surveys of biological diversity, means that we simply cannot complete a world inventory of biota within the foreseeable future. At the very best, it is estimated that only some 10 to 15 per cent of all species have been identified so far.

A start has been made. The International Union of Biological Sciences (IUBS) and the Scientific Committee on Problems of the Environment (SCOPE), in conjunction with UNESCO's Man and the Biosphere (MAB) Programme, are preparing a large research programme on biological diversity. A series of meetings is being arranged to lay down a basis for international comparative research relating to the three main levels of biodiversity—at the molecular and cellular level, at the organism and population level and at the ecosystem and landscape level. MAB has also launched a co-operative research and training programme with the Smithsonian Institution to help train taxonomists and to undertake biological surveys in the tropics.

It is in the tropics, and in particular the world's remaining tropical forests, that the biggest effort to achieve sustainable development is needed. Already 55 per cent of the world's tropical forests, the planet's richest species habitat, have been destroyed, yet hardly any studies have been carried out on the relationship between forest destruction and species loss.

Given their crucial role in the conservation of biological diversity, it is essential to establish a scientific basis for the sustainable development of tropical forests. With this in mind, MAB has joined in international efforts to develop sustainable tropical forest management regimes. To achieve this, MAB is applying the "critical mass strategy".

The "critical mass strategy" offers a way of convincing developers that the sum of sustainable activities can exceed the profits obtainable from the sum of non-sustainable activities. It is a strategy which requires making full use of the range of products and resources that tropical forests can provide. Major components of this strategy include:

- new logging and extraction techniques, such as the use of newly-designed airships for timber hauling;
- expansion in the use of non-timber products, including the introduction of food species such as gaur cattle, mouse deer and chestnuts;
- the development of nature tourism.

INVESTMENT IN THE NATURAL HERITAGE

The problem of protecting the natural heritage, and thus of maintaining biodiversity, is particularly difficult in developing countries. How can



A Tunisian poster urging farmers to plough along contour lines in order to prevent soil and water loss.

in situ conservation of genetic resources be achieved in the interest of mankind as a whole and of future generations when the rural poor have few means of satisfying their basic needs other than to exploit the last intact wild lands?

In 1987, the report of the World Commission on Environment and Development, often referred to as the Brundtland Commission, urged the establishment of more non-conventional protected areas, along the lines of the international network of Biosphere Reserves established by MAB over the past fifteen years and consisting of 300 protected areas in seventy-five countries.

Biosphere Reserves consist of a central "core" area set aside for strict genetic resource conservation and monitoring, and an outer "buffer" zone in which only restricted exploitation is permitted. In most developing countries, international assistance in achieving sustainable development in a buffer zone or other mechanisms for transfer of material benefits have to be mobilized as a compensation for non-use of core areas. This often involves considerable investment of human and other resources to enhance productivity and to improve local services such as health care and education.





Above: the extinct crater of Ngorongoro (United Republic of Tanzania) is one of the world's vastest reserves of animal life.
Left: crops are grown on reclaimed desert land in Egypt.

Environmental awareness and education programmes are essential if the Biosphere Reserve concept is to obtain the full participation and support of the local population.

INVESTING IN INSTITUTIONAL INNOVATION

There is an urgent need for institutional innovation, that is, for the adoption of effective international legal instruments for the protection of the global commons—those features of the planet that are of universal interest, such as the atmosphere, the oceans and the diversity of species. These innovative instruments should lead to responsible world governance and greater solidarity and equity. Among innovative concepts and instruments to emerge during recent years are the World Heritage Convention, debt-for-nature swaps and the Global Environment Facility.

In 1972, faced with the increasing threat to humanity's cultural and natural heritage, UNESCO led the way to the establishment of the World Heritage Convention. The Convention is innovative in several respects. First, it links what were traditionally regarded as two quite different fields —the protection of both the cultural and the natural heritage. Second, it achieved a conceptual breakthrough by recognizing that there are cultural and natural properties of such outstanding or unique value that they are truly part of the heritage not only of individual nations but of all mankind. Third, it has established a World Heritage Fund made up of contributions by States Parties to the Convention to be used for the protection of the world heritage. Today, having been adopted by 115 States, the World Heritage Convention is the world's most universal international legal instrument for conservation, with 337 properties inscribed on the World Heritage List.

Debt-for-nature exchanges (or swaps) are another way of investing in conservation and sustainable development. The roots of the mechanism lie in Third World debts that can be bought at a discount on the international debt market. The first swap was made by Conservation International to help develop the Beni Biosphere Reserve in Bolivia.

By mid-1991, some $16 million had been invested by industrialized nations and conservation groups in purchases of Third World debts with a face value of almost $100 million. These have subsequently been exchanged for sustainable development funds and bonds to the value of

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about $60 million to support various conservation and development programmes in a dozen countries.

Established by the World Bank, the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP), with funding of $1.5 billion, the Global Environment Facility is the latest innovative conservation initiative. Its funds are to be used for the reduction of greenhouse gas emission, conservation of biological diversity, protection of international water resources and protection of the ozone layer.

MEETING FUTURE NEEDS

The international conventions and funding mechanisms mentioned above constitute an important advance in the financing of biological diversity conservation; but far more funds and innovative instruments are needed. The capital for conservation investment could be mobilized through new forms of international solidarity, such as the replacement of military expenditure by investment in environmental safeguards. Global taxes on the production and consumption of environment-damaging goods could also be introduced.

A major breakthrough would be the establishment of a global fund under a convention for the protection of the atmosphere, based on taxes on carbon release or the emission of greenhouse gases. With the help of such a fund more sustainable patterns of energy use could be achieved and the costs of environmental protection and repair, including the protection of biological diversity, could be more equitably shared. ■

The first Earth Summit

TWENTY years after the first World Conference on the Environment, held in Stockholm in 1972, the international community is faced with a serious dilemma. On the one hand it is more necessary than ever to increase economic activity in order to meet basic needs and ensure the well-being of a rapidly growing human family. On the other, human activities are making an unprecedented impact on the natural environment and on the global systems which sustain life on Earth, as is demonstrated by air and water pollution, the massive degradation of land resources, the destruction of landscapes, climate changes induced by the wasteful use of energy, the rapid disappearance of animal and plant species, and the depletion of the ozone layer.

In face of problems of such magnitude, inaction is out of the question. The General Assembly of the United Nations has thus decided to convene a new United Nations Conference, this time on Environment and Development (UNCED), which will be held in Rio de Janeiro (Brazil) from 1 to 12 June 1992. Many Heads of State and Government are expected to attend this first "Earth Summit".

■ WHAT IS AT STAKE

The problem facing the Rio Conference is how to maintain the quality of the environment and to achieve environmentally sound, sustainable development in all countries. The following questions will be among those addressed:

- protection of the atmosphere (climate change, depletion of the ozone layer, transboundary air pollution);
- protection of land resources (combating deforestation, soil loss, desertification and drought);
- conservation of biological diversity;
- protection of freshwater resources;
- protection of oceans, seas and coastal areas, and the rational use and development of their living resources;
- environmentally sound management of biotechnology and hazardous wastes (including toxic chemicals);
- prevention of illegal traffic in toxic products and wastes;
- improvement in the quality of life and human health;
- improvement in living and working conditions of the poor by eradicating poverty and stopping environmental degradation.

The developing countries stress the vital importance of the problems associated with poverty, inappropriate patterns of growth and development, the external debt crisis and the deterioration of terms of trade.

■ POSSIBLE RESULTS

The results of the Conference may include:

1. The adoption of an "Earth Charter" or declaration of basic principles for the conduct of nations and peoples in relation to the environment and

development, to ensure that the Earth is a hospitable home for human and other forms of life;

2. Agreements on specific legal measures, notably conventions for the protection of the atmosphere and biological diversity, both currently being negotiated;

3. An agenda for action, "Agenda 21", establishing an agreed work programme of the international community for the period from 1992 into the 21st century, setting priorities, targets, cost estimates and modalities, and assigning responsibilities.

UNESCO'S ROLE

At the crossroads of education, science, culture and communication, UNESCO offers a unique institutional framework for dealing with environmental and natural resource management problems that are so complex that only integrated and interdisciplinary approaches are appropriate for tackling them.

Most of the principal environmental issues identified for UNCED are central to three of UNESCO's major and longstanding international scientific programmes:

- The Man and the Biosphere (MAB) programme for the protection and management of land resources and ecosystems, and the conservation of biological diversity. In this field MAB is a particularly valuable tool because of its international network of biosphere reserves;
- The International Hydrological Programme (IHP) for the study of freshwater resources and their rational use;
- Programmes of the Intergovernmental Oceanographic Commission (IOC) and related activities in the marine sciences, for the protection of coastal areas, the rational use of marine resources, and the study of the relationship between the oceans and climate.

UNESCO is also directly concerned with environmental problems through another of its main areas of competence, education. It has played an active role in encouraging the incorporation of environmental education into national education policies and curricula. The UNESCO-UNEP International Environmental Education Programme (IEEP), launched in 1975, is preparing new materials for teachers and schools in the form of teaching modules and other materials relating to environmental education and is participating in the training of teachers in this field.

UNESCO's Social and Human Sciences Sector is also contributing to environmental programmes through study of the interrelationships between population, environment, natural resources and development, and of the decision-making process related to environment and development.

Finally, UNESCO is closely involved with the protection of the cultural as well as the natural heritage, notably within the framework of the World Heritage Convention. It is also concerned with analysis of the cultural dimension of development, without which environment and development would be difficult to reconcile. ■

From left to right, logos of the International Oceanographic Commission, the International Hydrological Programme, the International Environmental Education Programme, the Coastal Marine Sciences Programme, and the Programme on Man and the Biosphere.



Above, luxuriant tropical vegetation in Sri Lanka. Below, the remains of spruce trees devastated by acid rain in the Karkonosze National Park in Poland.





Time to act

by Francesco di Castri

ENVIRONMENTAL problems have been a major international preoccupation ever since the United Nations Conference on the Environment was held in Stockholm in June 1972. That Conference took place in a climate of optimism and determination to act.

Action was indeed taken: international organizations such as the United Nations Environment Programme (UNEP) were created; Ministries of the Environment came into being; and ecologically-minded political movements emerged. The results, judged in terms of the volume of publications that have appeared, the knowledge that has been acquired, and the number of reforestation and drainage projects that have been carried out in the newly-established protected zones, have undeniably been important. And yet, paradoxically, our environment has continued to deteriorate. Local successes have been recorded here and there, but the current situation is much more critical than it was twenty years ago.

In the industrialized countries, water is contaminated by chemicals, soils are degraded by excessive use of pesticides and fertilizers, coastlines are disfigured by ill-planned urbanization, forests are destroyed and lakes made sterile by acid rain, health is threatened by the accumulation and transport of toxic wastes, cities are choked with traffic and asphyxiated by air pollution. The developing countries are confronted with problems of desertification, the erosion and salinization of soils, floods, the extinction of animal and plant species, particularly in tropical regions. Shanty-towns proliferate, with their attendant poverty, disease and delinquency.



All these problems, both in the North and in the South, are linked by a common thread. They arise from inappropriate development choices. Of course, the problems are far more flagrant in the South, because demographic pressure there is far higher than in the North. But the true origin of these problems is planetary in nature, and is connected with the interdependence of economies, the competitive interactions of international markets, monetary disorder, and the thorny issue of foreign debt.

Some thirty years from now, the human race, whose numbers will by then have reached ten or twelve billion, will be affected by the emergence of environmental problems which will also be of a global nature: probable disturbance of the climate owing to the greenhouse effect (caused by the increase in the amounts of trace gases, especially carbon dioxide and methane, in the atmosphere),



Drought and desertification in the African Sahel.

the depletion of the ozone layer in the upper atmosphere, and the irreversible impoverishment of biological diversity.

We are thus faced with extremely complex issues, in some cases uncertain and unpredictable, all highly dependent on one another, and changing rapidly on a planetary scale. And yet our institutions of education, research, administration and management have not been designed to face problems of this type. Even with a considerable increase in funds, it is unlikely that we shall be able to solve them immediately. The key to a solution is not conjunctural but structural.

To tackle the crucial problems of the environment effectively calls for an interdisciplinary approach which few institutions can provide at the present time. Research bodies and universities are in thrall to evaluation systems strictly compartmentalized according to discipline, and there is a widening gap between university training and research on the one hand and the real needs of society on the other. Very little current research in this field has an effective application, either because in most cases it does not address the true problems, or because it is not integrated into the decision-making and management processes, or because it is not adapted to the compartmentalization of administrative structures.

No discipline, not even ecology, can claim alone to apprehend all the planetary economic and social ramifications of environmental problems, no research body or administrative service can consider itself to be self-sufficient in this field. No country, not even the most powerful, can claim to resolve problems whose causes and effects lie in other countries, nor prevent their repercussions on its territory. Yet most disciplines ignore one another or are rivals in the search for research funding. The professions withdraw into their traditional corporatism, ministries are divided into sectors virtually impermeable to interaction, and countries only agree on insufficient norms for protection.

In these conditions it is easier to solve a few immediate or partial problems than to succeed in establishing institutions really capable of managing and overcoming what has to be called the environmental crisis.

MUST THERE BE AN ECOLOGICAL CATASTROPHE BEFORE WE ACT?

Technical solutions exist for most of the problems, even if they meet psychological and structural resistance and clash with powerful and contradictory economic interests. Perhaps we shall take the necessary measures in time, as public opinion and economic and political circles gradually become aware of what is at stake. It is more likely, however, that we shall wait until a far greater shock occurs than any we have yet known. It would be most regrettable if our collective instinct for survival could only be aroused in the face of a major ecological catastrophe.

Let us hope that this will not happen. It is particularly important that partial lack of results or precise data should not provide an excuse for inaction, both by decision-makers and by each and every one of us. Delay would be terribly costly and some forms of environmental damage may be irreversible. It takes only a few hours to cut down a forest, a few months to cause erosion and desertification, a few years to change world climate. But a species that disappears never reappears, tens or hundreds of years are required for a forest to regenerate, a thousand years to restore eroded soil.

Let us hope that the environmental crisis, with all its gravity and complexity, may ultimately act as a catalyst for better communication in our laboratories, for greater flexibility in our administrative structures, and above all for greater equity between countries rich and poor, and towards the future generations to which we owe responsibility for the Earth which has been entrusted to us.

A change in behaviour by each individual, each institution and each State is the only basis from which an acceptable future can emerge from the constraints of the environmental crisis. Let us hope that this change can take place without being provoked by a major ecological catastrophe from which no-one would be secure. ■

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■ ■ ■

UNESCO's new *Dialogue*

Dialogue, a quarterly review produced by UNESCO's Office of Public Information for Latin America and the Caribbean, appeared in April, providing the Organization with a new means of publicizing its activities in the region. The magazine also examines, through a main theme and interviews, different aspects of Latin American life. The third (October 1991) issue of *Dialogue* analyses current thinking in the new world geopolitical context and looks at the situation of Latin American youth today. *Dialogue*, which now also appears in English and French, is distributed free by the UNESCO Bureau in Caracas, Box 68394, Caracas 1062-A, Venezuela.

■ ■ ■

A 4,000-year-old iceman

The perfectly preserved corpse of a Bronze Age man was found last September in a glacier 3,200 metres up in the mountains of the Austrian Tyrol. The discovery of the corpse, together with weapons and other objects found in the vicinity, may shed light on little-known aspects of life in Europe 4,000 years ago. Carbon-14 dating should make it possible to definitely establish the age of the iceman, even if the reasons for his presence so high up in the hills remain a mystery.

■ ■ ■

A prize for peace

The UNESCO Prize for Peace Education for 1991 has been awarded to Ruth Leger Sivard of the United States and to the Cours Sainte-Marie de Hann in Senegal, one of UNESCO's Associated Schools. The prize, which was established in 1980 by UNESCO's Executive Board thanks to a donation from the Japan Shipbuilding Industry Foundation, is awarded annually by an international jury of intellectuals, religious figures, educators and statesmen. It rewards individuals and institutions that have achieved distinction through actions aimed at mobilizing opinion in the cause of peace.

■ ■ ■

UNESCO issues directory of children's institutions

To encourage contacts between organizations and individuals around the world working to improve the condition of young children, UNESCO has published an *International Directory on the Young Child and the Family Environment*. It contains entries on 670 institutions in 116 countries, and also includes basic economic and demographic data about each nation, covering such subjects as the infant mortality rate, the female illiteracy rate, the fertility rate, gross national product, the level of access to local health care and the number of underweight children under the age of 5. The Directory can be obtained free from the Director of the Young Child and the Family Environment Project, UNESCO, 7, Place de Fontenoy, 75700 Paris, France.

■ ■ ■

Reporting on the environment

Last August UNESCO launched the first of a series of brochures entitled "Environment and Development Briefs" with a report on "Debt for Nature" swaps, designed to finance conservation projects by renegotiating Third World debts. Illustrated with colour photos and high-quality graphics, the brochures are written by specialists but in non-technical language. They are targeted primarily at policy- and decision-makers in business and government who need an authoritative overview of global environment and development issues and possible strategies for action. Themes of upcoming Briefs include ocean observation, long-term monitoring of ecological change, water management in urban areas, mitigation of natural hazards, and the sustaining of tropical soil fertility. Further information can be obtained from the Bureau for the Co-ordination of Environmental Programmes, UNESCO, 7, Place de Fontenoy, 75700 Paris, France.

■ ■ ■

Dido honoured

A sculpture of Elyssa, the model for the Dido of Virgil's *Aeneid*, will be unveiled to mark the inauguration of an arts festival to be held at Carthage (Tunisia), in June 1992. A sister of King Pygmalion of Tyre, Elyssa was, according to legend, the founder of Carthage, originally a Phoenician settlement. The festival, the "Journées Internationales des Arts Plastiques de Carthage", will include round-table discussions, seminars; conferences of artists and archaeologists, music recitals, dance and poetry performances and other events designed to evoke the Mediterranean cultural heritage and the affinities between the countries of the region. The long-term objective of the festival is the establishment at Carthage of an international arts centre and a museum of daily life.

■ ■ ■

Commemorating American Indian culture

In 1998 the National Museum of the American Indian is scheduled to open its doors in Washington D.C. The new museum's collections will be managed in a way designed to meet criticisms made over the years by Indian communities about the presentation of their culture by anthropologists. The treatment accorded to human remains and to ritual and funerary objects dug up accidentally or during archaeological excavations has been particularly controversial, and in future these will be returned to the communities that ask for them.

■ ■ ■

Fishing for medicines

The first stage of a lengthy "pharmaceutical fishing" project has recently been completed off the Tunisian coast. Twenty-five scientists and divers aboard the ketch *Fleur de Passion* collected about a hundred specimens of sponges, algae and phytoplankton for laboratory examination. All of these organisms are known to secrete chemicals to defend themselves against predators or pathogenic agents, and it is thought that these substances could have medicinal uses. In the course of the project, which is expected to last until 1994, the boat will also travel to the Indian Ocean and to Southeast Asia.

■ ■ ■

Children's tales

The 7th Salon du Livre de Jeunesse—a children's book fair—will be held in the Paris suburb of Montreuil from 28 November until 2 December. It will be preceded by an international symposium on the traditional tales that still inspire many contemporary writers for children and young people. One talking point will be how, at a time of increasing cultural uniformity, to preserve the diversity of the cultures in which traditional tales are valued.

■ ■ ■

Galileo rediscovered

Thirty-four letters sent by Galileo from Florence to an unidentified correspondent were revealed for the first time in September at a seminar held in Venice under UNESCO auspices to mark the 400th anniversary of the great Italian astronomer's acceptance of the chair of mathematics at the University of Padua. Written during the eight years preceding Galileo's condemnation by the Inquisition in 1633, the letters show the astronomer under great stress and gradually giving way to pessimism. The correspondence was rediscovered by researchers in the library of the Bishops of Bologna.



The stones of Aachen

by Herta Lepie and Roland Wentzler

AACHEN cathedral, which incorporates the Palatine Chapel of Charlemagne, is the most beautiful surviving example of Carolingian architecture. On 31 March 1978 it became the first German monument to be inscribed on UNESCO's World Heritage List.

A living monument

Situated at the westernmost tip of Germany, close to the frontiers of The Netherlands and Belgium, Aachen once symbolized the political and cultural unity of the Carolingian empire. Today it is the European city *par excellence*. Its principal attraction is the Palatine Chapel, a remarkable monument rich in art and history, which attracts more than a million visitors each year. Besides its historical and cultural interest, Aachen cathedral is also a place of pilgrimage, just as it was in the Middle Ages, when it vied in importance with Rome and Santiago de Compostela. Besides a venerated image, Our Lady of Aachen, the cathedral houses Charlemagne's tomb and, among other sacred objects, a reliquary containing four particularly remarkable pieces of material: the robe of the Virgin Mary, the swaddling clothes of the Infant Jesus, the garment that girded the loins of Christ on the Cross, and the cloth used at the beheading of St. John the Baptist.

These great biblical relics have been solemnly displayed every seven years since

HERTA LEPIE, German art historian, is head of the jewellery and precious metal workshop of Aachen cathedral. She is the author of many publications on the cathedral and religious pilgrimages to it.
ROLAND WENTZLER is a German art historian who is chief public relations officer for the cathedral and other churches in the city of Aachen.



1349, and it is expected that in June 1992 countless pilgrims will again gather at Aachen to join fervently in the procession held in their honour.

The Palatine Chapel

The region of Aachen, in the central part of the Frankish kingdom, was rich in game and possessed hot springs whose beneficial properties were already known to the Romans. It was in fact on the ruins of the ancient Roman baths that Charlemagne built his palace, a building whose function was political, economic and religious as well as residential. Not much survives to recall its political role, originally embodied in the Throne Room, except the foundations of the tower known as the *Granusturm*, whose stones were used to build the city's Gothic town hall. The residential quarters and storehouses have disappeared without trace. But the church that Charlemagne dedicated to the Virgin and chose as his final resting-place has stood the test of the centuries.

The building was probably completed around the year 800. Two years previously, the theologian Alcuin had announced in a letter to the Emperor that the columns of the chapel were being built. Originally, the Palatine Chapel consisted of three elements: the central building, with a rectangular choir to the east and an entrance porch to the west. The peripheral chapels and the Gothic choir with its stained-glass windows are later additions.

Built on an east-west axis, the church followed the plan of early Christian basilicas, an atrium surrounded by colonnades. Traces of it can still be seen in the parvis.

The way into the building is through a combined porch and belltower, flanked by two towers with staircases in them. The effect is one of fortress-like bulk. The two brass doors of the main portal were cast in Aachen in Charlemagne's time. Four other doors and eight grilles from the same workshop are decorated with motifs recalling Roman Antiquity. There are two artefacts from Roman times in the narthex: a brass she-wolf and a bronze pine cone that may once have decorated a fountain in the atrium.

The chapel itself is clearly modelled on the architecture of Ravenna and of Byzantine basilicas. It consists of a two-storey-high octagonal rotunda encircled by a sixteen-sided ambulatory. Heavy polygonal pillars support

Opposite page, Aachen cathedral, an engraving by Abraham Hogenbergh (1632). One of the cathedral's 4 great relics, the robe of the Virgin Mary, is being shown to a gathering of pilgrims. Above, the octagonal Palatine Chapel, built in Carolingian times. In the upper storey are ancient marble columns brought by Charlemagne from Rome and Ravenna. At centre, a copper chandelier presented by the emperor Frederick Barbarossa in 1165.

the eight arcades of the upper storey, which are flanked by bronze grilles from the Carolingian period. Within the arcades are the famous marble columns brought by Charlemagne from Rome and Ravenna to stress the continuity of his project with the architecture of the Roman empire.

This imposing edifice is topped by a dome of a type which had never previously been constructed north of the Alps. To support the weight of so large a structure, Charlemagne's architect divided the calotte of the vault into eight sections, allowing him to distribute the weight equitably across eight pillars. A ring of metal dating from Carolingian times helps to support the base of the dome. The roof is decorated with a mosaic representing the twenty-four elders of the Apocalypse. The height of the building (32 metres) exactly corresponds to the diameter of the church's outside wall, so the building would fit perfectly into a cube, thereby respecting the proportions attributed in the Bible to the Tower of Babel and the Heavenly Jerusalem.

The high altar, the oldest in Germany, is situated in the western part of the aisle, on the site of an earlier altar. Its marble had already been used previously. On it were crowned twenty-five of the thirty German emperors, from Otto the Great in 936 to Ferdinand I in 1531.

The altar is decorated with seventeen golden bas-reliefs dating from the early eleventh century, which were probably commissioned by Otto III and completed in the reign of his successor, Henry II. Christ the Redeemer is shown in the centre, flanked by the Virgin Mary and the Archangel Michael, both intercessors for the human race. Four medallions representing the symbols of the Evangelists surmount scenes from Christ's passion.

Below left, the high altar adorned with gilt bas-reliefs (1020) before which the Germanic emperors were crowned.
Right, mosaics in the vault of the Carolingian chapel.
Opposite page, the gilt pulpit studded with precious stones (11th century), a gift of emperor Henry II.





The gilded archbishop's throne presented to the cathedral by emperor Henry II also dates from the same period. At first installed in the octagonal chapel, it was moved to the southern wall at the time of the construction of the Gothic choir in the fifteenth century. It is splendidly decorated with sixth-century Coptic ivory plaques carved to represent mythological scenes, and with bas-reliefs of the four Evangelists.

The cathedral contains the remains of two German emperors: Charlemagne himself, who died in 814, and Otto III, who died in 1002. The exact location of Charlemagne's original tomb is no longer known. Otto III discovered it in the year 1000 and removed some relics. In 1165, Frederick I moved the emperor's bones to a temporary cenotaph, and since 1215

they have lain in a shrine restored to its full splendour by the patient efforts of the cathedral's conservators.

The Palatine Chapel soon became a place of pilgrimage, but unlike the ancient basilicas it had not been built with that purpose in mind. That was why the cathedral chapter decided in 1355 to construct the Gothic choir, which was completed in 1414, exactly 600 years after Charlemagne's death.

The Carolingian edifice is surrounded by a crown of Gothic chapels, on two levels like the central octagon. A staircase dating from Carolingian times provides access to the upper storey. There stands the marble throne of the German emperors. Impressively sober and massive, it is made of four slabs of marble from the eastern Mediterranean, set on four blocks of stone; six steps lead up to it. A tenth-century chronicler informs us that the throne was set between two marble columns so that the sovereign "could see everything and be seen by everyone".

No building north of the Alps so powerfully evokes the new Rome that Charlemagne dreamed of founding. The choice of architectural models from the fifth and sixth centuries was intended to indicate to contemporaries that he considered himself as the heir of the Western Empire. Columns brought from over the Alps, brass doors and grilles bearing Roman motifs: these and other details were meant to give visible expression to the enduring link between the ancient world and the medieval West. The Palatine Chapel was originally conceived as an image of the heavenly Jerusalem as described by St. John the Divine in the Book of Revelations. And it is true that the magnificence of its gold and precious stones and the mysterious harmony of its architecture do bring to mind the splendours of the heavenly city.



A masterpiece in peril

The people of Aachen have always done their best to maintain their cathedral, but historical events have often come close to destroying it, notably during the Second World War. Once hostilities were over, the demanding task began of making good the considerable damage done to the building. The roof had to be repaired, stained-glass windows to be replaced, the entry to the choir to be restored. The chapel in the tower had been completely destroyed and needed to be rebuilt.

One problem that still remains is the cleaning of the Carolingian masonry. Preliminary work is now virtually completed, and tests are currently being carried out to establish the best method of treatment. Other future projects include the restoration of the Hungarian chapel and the chapels of St. Anne and St. Matthew, as well as repair work on the roof, particularly over the octagonal chapel.

It would be impossible to restore and conserve the cathedral and its treasures without outside help. Although the cathedral benefits from generous public funding, private initiatives have also played a part. The earliest dates back to 1847, when citizens of Aachen formed the first association dedicated to preserving the site, the *Karlsverein*. Part of this tradition is the "Aachen Cathedral, masterpiece in peril" campaign, which was launched in 1988 and has received an encouraging response from the business community and from private individuals.

Good works do not exclude good humour, to judge from the many unusual ideas the campaign has sparked. A circus put on a special performance, a brass band gave a charity concert, a modelling club contributed a competition prize, and newly-weds have asked for contributions to be made to the cathedral instead of wedding presents. Banks and savings banks have provided sponsorship; a colouring book has been produced to reveal the cathedral to children; local newspapers keep their readers informed on the state of the restoration work; the 400-odd participants of a world conference of iron-smiths offered hand-crafted work for sale at auction.

The results of these and other activities are swelling the funds already available from official sources, proving that the cathedral can also count for its survival on the people of the city. ■

On the occasion of the twenty-sixth session of

Interview with



■ The current session of UNESCO's General Conference is taking place at an exceptional moment in world history. In the last two years we have seen radical changes in the order established by the victors of the Second World War. Are UNESCO's activities going to change as a result?

— Of course they are adapting to these changes. Paradoxically, UNESCO is thus returning to its original mission. The United Nations Organization was created to maintain world peace. The Charter of the United Nations defined several major principles: respect for justice, the rule of law, human rights and fundamental freedoms for all without distinction of race, sex, language or religion. UNESCO's mission is to develop intellectual co-operation in the fields of culture, education, science and communication.

For over forty years its effectiveness was limited, for two reasons. Four-fifths of humanity lived in colonized and dependent countries where the basic principles of the United Nations Charter could hardly be applied. The bipolar division of the world had provoked the cold war and ideological opposition between East and West. UNESCO's initiatives were confronted and very often paralyzed by this situation. The UN itself could only play a limited role in the prevention and solution of conflicts. The situation today is totally new. Most of the former colonies have become independent and their voices are starting to be heard on the world stage. In the last two years the totalitarian regimes of eastern and central Europe and the Balkans have fallen. The USSR itself has begun a long journey towards democracy and respect for human rights. South Africa is attempting to put an end to apartheid.

The conditions now exist in which ideological confrontations and fear of the Other can disappear. The principles of the United Nations Charter can be taken into account by humanity without the arrière-pensées and manipulations we have known for forty-five years.

■ Does this mean that from now on everything is for the best in the best of all possible worlds?

— Certainly not. But I wanted to make these observations which allow us to be more optimistic today than ever before in the past. The problems to be solved today and tomorrow are enormous but we can try to solve them by talking the same language and with a greater chance of success.

There are two things I would like to add. Firstly, although these principles are accepted by everyone, they are not respected by everyone. In its capacity as the intellectual component of the United Nations system, UNESCO has a duty to identify the obstacles which prevent their application and to help to overcome them. Secondly, the principles themselves must be further refined. We live in an inegalitarian world. Below a certain level of poverty and deprivation, freedom loses its substance, civic equality becomes an abstraction. If they are to be given tangible form, these universal values must be accompanied by real acts of solidarity, by an ethic of sharing. If some people enjoy prosperity, knowledge and culture in a rich world while others are deprived of these benefits of civilization, the

UNESCO's General Conference

Federico Mayor

Director-General

world cannot be at peace. The duty of fraternity is an ethical imperative, for humanity is one and indivisible in its diversity.

■ We are still far from this state of solidarity.

— That is why we are going through an uncertain transitional period in which the best and the worst exist side by side, in which the highest expectations are accompanied by terrible risks. It would be more accurate to talk in terms of several transitions, taking place in different time-scales and at different rhythms, yet linked to one another, inextricably intertwined. In some cases national sovereignty and independence are leading to extremes of nationalism based on exclusivity and rejection. Alas, from the blossoming of cultural identities in a framework of freedom it is possible to take a pathological course which leads to the exclusion of others. When there is a rapid recrudescence of nationalism which has been repressed for dozens of years, only democracy can peacefully reconcile the active coexistence of all cultures and languages.

The transition between totalitarianism and democracy is not easy. It implies the passage from a war economy to a peace economy, and above all from a war culture to a peace culture. Our models of economic development have led to the sacrifice of the environment and the human condition to the requirements of productivity. Man and nature share an indivisible destiny.

All these changes vary according to places and situations, but today everything is changing rapidly as developments in communications and the media shrink the planet. Humanity has some interests and hopes that are held in common and others that differ and are even contradictory. UNESCO must in its thinking and in its action take account of this "living matter".

■ Could you explain what you mean by different time-scales, rhythms, interests and hopes?

— Look at a world map. Africa, Asia, Western Europe, North America, Latin America, Eastern Europe, the Arab world. The configuration of problems and priorities differs widely from one cultural region to another.

In Africa demands for democratization are making themselves felt. Regional and international co-operation is necessary to make possible an economic take-off based on the realities, the genius, and the creativity of the African peoples.

In Eastern Europe the fall of totalitarianism is opening the way to freedom and national self-determination but also to distrust and prejudices which are rooted in a more or less distant past and which must be overcome because they threaten peace and risk fomenting clashes between peoples.

In Latin America a common trend has become apparent among the peoples of Latin culture since the fall of the dictatorships. These peoples are tackling the problems posed by the modernization of their societies, while at the same time bearing a very heavy burden of external debt.

In Asia, modernization is already under way, but it is accompanied by demographic pressure that is giving rise to new contradictions in a world whose time-honoured cultures must integrate the latest technological and scientific advances.

In Western Europe and North America, where the privileges of wealth, knowledge and power are concentrated, questions are asked about the meaning and use of these advantages. Even there inequality is increasing and leading to turmoil as Western societies search for values adapted to new conditions of life, work and leisure. In a world that is both increasingly united and increasingly inegalitarian, the need for solidarity and sharing is very strong.

■ What can UNESCO do in face of all these transitions?

— It alone can help to encourage in the international community a meeting of minds based on the universal values defined in the United Nations Charter—especially since it has had forty-five years of unique experience.

There is an alchemy of intellectual co-operation, of the gradual coming together of ideas, just as there is an alchemy of incomprehension, discrimination and discord. The former can only prevail if there is a relentless determination to defend everything that brings people together and unites them. Clearly this does not mean suppressing originality in the interests of a generalized uniformity. Respect for differences is of vital importance, for unity can only be achieved in a debate which takes account of the individuality of each person, the specific features of each culture, the flowering of each people.

Culture, the cultural dimension of peace and of sustainable development with a human face, will be at the top of the political agenda, at the national and global levels. It has too often been treated as ornamental in bilateral accords, as the cherry on the cake, added for the sake of decoration without anyone really believing in it.

■ Are there rules of emulation in creativity just as there are rules for economic competition and rules for road traffic?

— Yes. UNESCO has a duty to serve two complementary purposes: individuality and universalism. I must repeat that the defence of one's own identity should not lead to the rejection of other people's. We know, however, that this can happen and we must fight against this perversion. It is thus of crucial importance to respect the universal values and rules without which communication and exchange would be impossible.

■ **How can UNESCO help this process?**

— By increasing awareness of what is involved in making choices, by extending the range of intellectual discussion, UNESCO's programmes aim to put the experience of the international community at the disposal of those States that wish to profit from it when they take decisions on matters which fall within the Organization's fields of competence. Some of the main priority areas are: the generalization of basic education; higher education; protection of the environment and management of natural resources; improving the flow of information; encouraging freedom of creativity; taking into account the cultural aspects of all forms of development.

We must give support to decision-makers as they face different choices and encourage them to act; we must offer structures and means of co-operation; we must provide international legal instruments. We can, for example, help to further the advance of knowledge through our oceanographic programmes and through the programme on Man and the Biosphere. We can bring together intellectuals and creative people from all regions to discuss the major problems of our time, as we did recently in Prague, where the theme of the meeting was Culture and Democracy. The positive developments of the past few years are helping to bring about an entirely new openness in the East, the West, the South.

***The Peace Fountain*, a copper sculpture created by Charles Eugene Gagnon for the Peace Plaza at Rochester, Minnesota (U.S.A.)**



■ **Do fields such as science and culture lend themselves to government action?**

— That question was asked when UNESCO was created. As far as science is concerned, there can be no doubt. Without international co-operation, it is not possible to study the oceans, the atmosphere, space, watercourses, deserts, ecology and so on. The fallout from Chernobyl did not respect frontiers.

The situation with regard to culture is more complex. Intellectuals and creative artists need to be independent from political pressure. They have said "No" to dictators, colonizers, arms dealers, polluters. With the end of the bipolar world and the resurgence of democracy, this distrust is tending to diminish, and will continue to do so, even if the duty of intellectuals to criticize is in a sense sacred as a protection against the excesses and distortions of our society. UNESCO has valuable experience of projects that bring together governments, decision-makers and individuals, intellectuals and creators.

■ **Is there a particular image or priority which you would like to mention in conclusion?**

— The culture of peace seems to me to be of primordial importance today. We need to work on this concept. We are intoxicated by our culture of war, often without even realizing that we are. Rejection of other people is accompanied by recourse to violence. We know the cost of war, but we don't know the cost of peace: an active, speedy and respectful justice; an environment protected by the conscious attitudes of everyone; sufficient food and a decent system of health care; but above all an unfettered spiritual framework in which everyone can find fulfilment. On the philosophical level as well as in more mundane ways, we must explore the values and customs that encourage the culture of peace.

It is in this spirit that the United Nations system must evolve without delay. Substantial differences separate the United Nations Organization of 1945 from that of 1995, when it will be celebrating its 50th anniversary.

The new world we are entering needs ideas and values.

A debate at both local and global levels should help the transition from the bipolar world of the Second World War to the new world born of decolonization and the fall of the Berlin Wall. ■

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The time: over a thousand years ago.
Three cultures—Islamic, Christian and Jewish—flourished together and enriched each other at a unique moment in world history between Greek Antiquity and the European Renaissance.

Also featuring an interview with
Melina Mercouri

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