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The future of drylands
revisited, p. 2

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Greening **the deserts**

In the 1950s, a sense of great optimism prevailed that we could green the world's deserts. It was believed that techniques like cloud seeding could bring rainfall to dry areas; improved irrigation techniques could boost agricultural production in drylands; and selective breeding could create livestock less dependent on water. In short, we thought that poverty in the world's drylands could be reduced through technology.

Half a century later, that optimism has been replaced by realism and anxiety. The belief that we can control our climate has given way to concerns about the human impact on the environment, in particular global warming. Current climate scenarios predict that the driest regions of the world will become even drier.

Only last May, a study published in *Science* indicated that the tropical climate zone was expanding towards both poles. According to the study, which is based on satellite data from 1979 to 2005, the northern and southern hemispheres' jet streams – fast-flowing winds about 10 km above the Earth's surface which mark the limits of the tropics – have each moved about 1° of latitude (about 113 km) nearer the poles. 'If the jet streams move another 2–3° degrees poleward this century, very dry areas like the Sahara Desert could nudge farther towards the poles, perhaps by a few hundred miles,' predicts co-author John Wallace of the University of Washington (USA).

Despite technological advances in the genetic modification of organisms to make them drought- and pest-resistant, dryland countries are still among the poorest in the world; many also register high population growth.

As we shall see in this issue, the past 50 years have shown us that the ecological and socio-economic situation in drylands is not a simple equation governed by factors such as climate, soil, water and vegetation. Market speculation and enormous price fluctuations on commodities like cotton can affect the income of a rural farmer in a remote village in Mali, in the same way that droughts or floods will affect his or her harvest.

Policy choices also enter into play. Nearly one-fifth of China is desert. Last February, the government announced an ambitious plan to reclaim 250 000 km² of desert by 2020 by planting trees and grasses, banning land use and investing in sustainable energy and efficient water use.

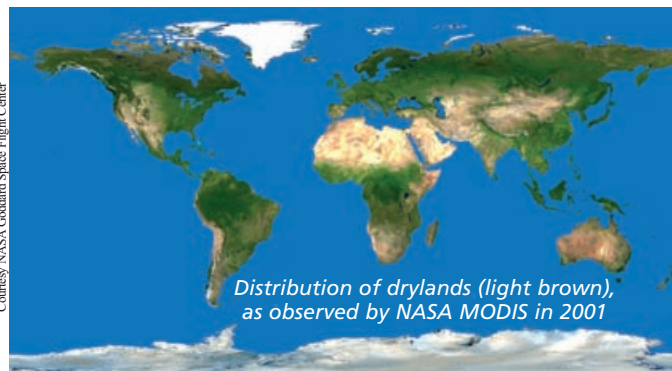
One thing we have learnt over the past 50 years is that, if drylands do not cover the globe, they are nevertheless a global problem. To cite the authors of *The Future of Drylands Revisited*, 'dust from central Asia causes health concerns not only in China and Japan but also in North America [and] dust from Africa may be contributing to the decline of coral reefs in the Caribbean.'

W. Erdelen
Assistant Director-General for Natural Sciences

The future of drylands revisited

Back in 1956, *The Future of Arid Lands*¹ predicted that drylands would receive renewed and sustained interest in coming decades. Drylands have been plagued by underinvestment ever since, regardless of the fact that advancing deserts continue to consume arable land at an alarming rate. Today, one-third of the Earth's surface is threatened by desertification and arable land is expected to shrink by two-thirds in Africa, one-third in Asia and one-fifth in Latin America by 2025 in relation to 1990.

A publication commissioned by UNESCO to mark the International Year of Deserts and Desertification, *The Future of Drylands – Revisited*, takes a critical look at the unintended consequences of past thinking on dryland ecosystems and the socio-economics of dryland development. What mistakes did we make and how can we learn from them? Due out in December, *The Future of Drylands – Revisited* argues for giving a new impetus to dryland research to fill the persistent gaps in our knowledge.



Courtesy NASA Goddard Space Flight Center

Paradoxically, the dryland climate in the low latitudes has much to recommend it as a place to live and a place to grow crops: clear skies, warm temperatures and long growing seasons. The key to making the desert bloom has always been finding water. With water at such a premium in drylands, the pursuit of new sources has been intense and unrelenting.

Cloud seeding and other schemes

In the 1950s, there was a great belief in what future technology might deliver. The 1950s were the dawning of the era of large dam-building, whereas little attention was paid to groundwater as a major water resource. Water was to come from existing surface sources, from augmenting existing sources through cloud seeding (see photo) and other measures, or from 'new' water originating from

untapped sources, such as the desalinization of brackish water and seawater.

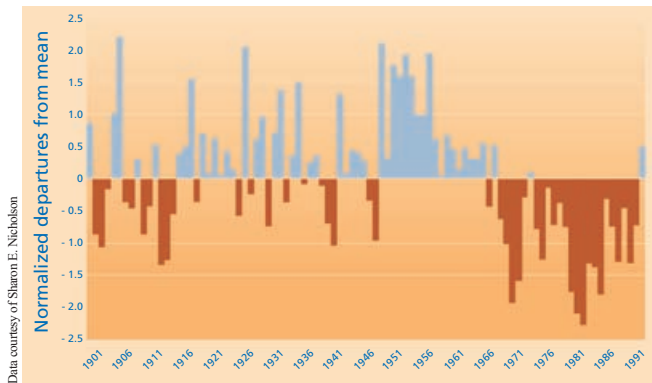
The intervening years have seen much of what was discussed then play out. Inevitably, though, many things have happened that were not foreseen. The 1950s marked the beginning of a period of unanticipated growth in water consumption in the agricultural sector in particular that has continued until today. Perhaps as a consequence of this rapid growth in consumption, there have also been some fundamental changes in the general perception of water development. While cost-benefit analysis was, and is, done for most water development projects, the scope of what is included among both costs and benefits has been broadened significantly since then from strictly economic costs to incorporate environmental and social costs as well.

Despite the fact that groundwater was largely dismissed as a major option in 1956, exploitation of groundwater resources developed rapidly from the 1950s onward, with most development taking place between 1960 and 1980. This development was mostly concerned with immediate returns on investment and not sustainability. Now, as the value of water is increasingly realized, markets have emerged as a mechanism for addressing inequities in the distribution of water through its direct sale and through the trade of commodities that represent water, or "virtual water."



Courtesy NASA Goddard Space Flight Center

Repeat satellite images of Almeria in southern Spain in January 1974 (left) and April 2000



Rainfall index showing standardized departures from mean annual rainfall compiled from meteorological stations in the West African Sahel between 1901 and 1994

In considering water development and water use as a whole, the most fundamental difference between 1956 and today is that focus has shifted from developing new water supplies to a more comprehensive effort to manage all water from an integrated perspective, both on the supply and the demand sides, and from a quality point of view.

Modifying the weather and climate change

In drylands, where rainfall is often scarce but always variable, there has been a keen interest in understanding and being able to predict this variability and in finding ways to ‘make it rain’ when natural rainfall is inadequate. By the time *The Future of Arid Lands* was published, techniques for modifying the weather, like cloud seeding, were just emerging. Significantly, these were paralleled by the beginnings of numerical weather modelling using computers. The general view held that modifying weather and climate was a promising and appropriate means of furthering societal and even military goals. It proved to be possible to induce rainfall in very restricted situations over small areas but this technique was of such limited and often unpredictable value that it was largely sidelined after a good deal of research. However, it is still routinely pursued in some areas with the hope of marginally increasing water supplies, such as in the Colorado River basin in the USA.

Some 50 years on, the optimism that once surrounded our emerging ability to control climate and create more favorable weather in the drylands has largely given way to concern about undesired human impacts on global climate, such as global warming. Scientific and political discourse that once focused on purposeful weather modification has been replaced by debate over strategies for mitigating the impacts of inadvertent climate change and adapting to its consequences.

With the growing awareness of the connectedness of large-scale atmospheric, oceanic and terrestrial systems, the focus of scientific interest has shifted from local and regional impacts to changes on a global scale. Increases in temperatures threaten the modest water resources of drylands in several ways. Clearly, increases in evaporation rates as a function of higher temperatures not only threaten reserves stored in reservoirs and soils but also increase

water demand by plants. A more ominous threat for many regions may be that, as minimum temperatures rise, lesser amounts of water will be stored in snowpack in the mountains surrounding many of the world’s drylands.

The balance of nature versus the flux of nature

Ecology, maybe more than any other discipline, can be taken as an example of how paradigms develop. The process is not necessarily chronological with a new paradigm replacing an older one. Rather, schools of thought, or paradigms, fall into and out of favour with communities of practice. In ecology, the two most prominent paradigms are represented by the equilibrium (balance of nature) and the non-equilibrium (flux of nature) models of ecosystem behavior.


Ecological thinking in *The Future of Arid Lands* was dominated by the equilibrium paradigm, a model of ecological dynamics based on assumptions conceived in the context of northern temperate zones that had emerged early in the preceding century. Its validity as a framework for thinking about dryland environments was challenged almost from the very beginning, yet it came to dominate policy thinking for most of the 20th century. Today, though, dryland ecosystems are better described by non-equilibrium models, with disturbance, variability and unpredictability as accepted drivers. However, the equilibrium model persists institutionally and management in many drylands still follows an equilibrium approach.

The development of dryland ecology has further benefited from the emergence of, and advances, in complex systems science. Focus has now shifted from the study of individual components of dryland ecosystems – such as soil, water, vegetation and herbivores – to relationships and interactions among them.

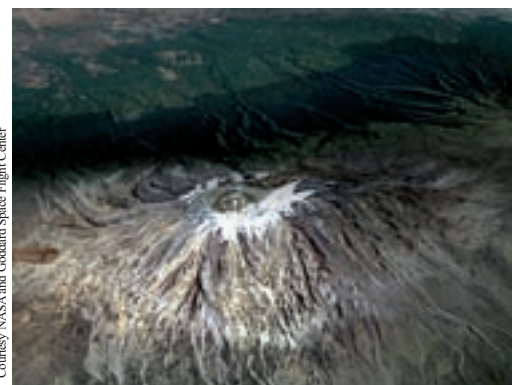
Plant and animal alternatives

The primary focus of *The Future of Arid Lands* was plant and animal agricultural production. Only a handful of strategies were envisioned for improving drylands agriculture:

Cloud seeding in New Mexico (USA) undertaken by Project Cirrus (1947–1952). Cloud seeding attempts to induce precipitation (rain or snow) by dispersing tiny particles such as silver iodide and frozen CO₂ (dry ice) as condensation nuclei into the air. This stimulates the formation of water droplets or ice crystals in the cloud. While cloud seeding with dry ice required an aircraft as seeding platform, silver iodide could be vaporized from the ground and borne up by air currents (photo: mobile silver iodide smoker mounted on an Oldsmobile). Cloud seeding is effective in reducing cloud cover but its capacity to increase precipitation is controversial. How can one know, for example, how much precipitation would have fallen from a cloud had it not been seeded?



Repeat satellite images showing glacier retreat on Mount Kilimanjaro in the United Republic of Tanzania in 1993 (left) and in 2000. Last July, UNESCO's World Heritage Committee adopted a strategy for predicting and managing the effects of climate change on both natural and cultural sites, including Mount Kilimanjaro



Courtesy NASA and Goddard Space Flight Center

exploiting existing plant and animal resources; introducing crops and/or animals from other similar regions that might perform better than natives; or creating 'better' crops or animals through breeding or more advanced forms of genetic manipulation.

Some argued that larger animals were inherently more efficient than smaller breeds and favoured the camel as being 'ideal'; but the difficulty of expanding the market for camel products outside their traditional range was not discussed. It was generally agreed that more and better forage was the most critical element for livestock production. Thus, plant production became the primary focus both for rangelands and in agricultural fields.

Exotic plant species were seen as having great potential. A century or so of unwitting introductions had established that many plant species performed much better when introduced into areas outside their native range, particularly in areas with homologous climates. By 1956, there were programmes to reseed burned or degraded rangelands with exotic grasses.

Since then, exotic species use has been very controversial. In many areas, such as the Sonoran Desert of northern Mexico, large areas of native vegetation have been cleared and reseeded with exotic grasses (see photo). Many ranchers like their ability to colonize disturbed areas, outcompete native species and survive drought; they feel their land can now support more cattle. However, these very characteristics make these exotics undesirable in other parts of the region, where they are seen as a distinct hazard because they replace native species and introduce fire where it was previously unknown.

Many conventional crops are prodigious water users. There is a long history of seeking 'new' crops better adapted to arid conditions. Two different approaches to this search were discussed in 1956. One was to exploit native drylands plants with unique properties, like jojoba, a source of high-quality wax. The other was to selectively breed or engineer conventional crops for specific features, such as improved yield, drought tolerance, or disease resistance.

The camel farm

Camels are often kept in excessive numbers in the open desert, putting a strain on desert vegetation. Camel farms may be the answer. By feeding camels farm-grown native desert plants, camel farms would enable the ecosystems of grazing rangelands to recover.

Camel farms could also reduce the amount of freshwater needed for milk production and save on electricity. Camel's milk does not need to be produced in an air-conditioned environment and a camel produces four times more milk per day (8 litres) in the open desert than a cow. (Cows can produce 25 litres of milk per day but only in an air-conditioned environment.) Producing native desert plants and halophytes as camel fodder would also use less freshwater than growing the *Alfa alfa* or Rhodes grass that camels currently eat.

One camel farm already exists in the United Arab Emirates, in Dubai. UNESCO's Doha office is developing a research project to study the pros and cons of establishing other camel farms.

Scientists working on the project will study such aspects as the nutritional and medicinal (dis)advantages of camel's milk versus cow's and goat's milk and the

quantity of water needed to produce one litre of camel's milk in comparison to one litre of goat's and cow's milk. The project will also study public attitudes to camel milk.

Scientists will study whether camel fodder can reduce the production of freshwater-dependent Rhodes grass and *Alfa alfa* by using the full range of farm-produced native desert plants (*Cenchrus*, *Pennisetum*, *Panicum*, *Rhanterium*, etc.), which will also be studied to determine how each influences the taste of the milk.

They will also study the genetic variety of camels in different parts of arid lands to ascertain whether (and which) camels can be fed with indigenous or halophytic (salt-tolerant) plants and still produce milk that is of good quality and plentiful.

The availability of oil and water has changed the way of life of the Arab *bedu* in both desirable and undesirable ways. Camel farming could help not only to rehabilitate the desert they call home but also to pull them out of poverty.



Camels grazing rangelands in Qatar

© Henning Schwanze/World Habitat Society

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The green revolution

Beginning in Mexico in the late 1940s, a host of advances were made in the development of improved crop varieties that were higher-yielding, more consistent in production and more resistant to pests. This led to the 'Green Revolution' in the 1960s, which helped to prevent famine in some parts of the developing world, including India. It did not benefit all people or all regions equally however. The Green Revolution has also drawn criticism for its focus on hybrid and genetically modified crops and the resulting loss of biodiversity, as well as for the health risks associated with the use of chemical pesticides.

In drylands, the first waves of the Green Revolution only reached areas that could be irrigated. Much of sub-Saharan Africa was largely bypassed. Part of this has been attributed to unreliable climate and lack of irrigation but also the inability of poor farmers to invest in the inputs, like fertilizers, that modern crop varieties demand. It has also been suggested that the late penetration of the Green Revolution into many of the world's drylands was due to a failure to invest in the exploration of local plant resources and establish appropriate local plant breeding programmes suited to marginal dryland environments.

Newer centres – such as the International Center for Agriculture in Dry Areas (ICARDA) and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) – confronted these specific obstacles. In sub-Saharan Africa, improvements in crops like millet, sorghum and cassava began to produce results in the 1990s. However, the modest gains experienced in many dryland areas were offset by general decreases in major grain prices, placing many dryland farmers in a double bind. It has been argued that continued investment in research by the international community is the only way for these farmers to 'catch up' eventually.



Sorghum farmer in Burkina Faso

By 1956, the work of the International Maize and Wheat Improvement Center (CIMMYT) had made Mexico self-sufficient in wheat production; this success spurred even greater interest in the genetic approach to increasing crop production (see box above).

Both these approaches have their limitations. During photosynthesis, plants take up CO₂ from, and give up water to, the atmosphere. This presents two constraints. Firstly, while plants can be engineered to be more water-efficient, there are fundamental limits to what can be achieved. Secondly, the adaptations many dryland plants have to reduce water loss also restrict their ability to take up CO₂: many desert plants are not particularly water-efficient. Furthermore, some dryland plants, such as jojoba, will not produce fruit during drought; if a crop is desired every year – something farmers expect – the plants must be irrigated often, thus negating some of their presumed drought-adapted advantage.

A third approach to using dryland plants was discussed in 1956 but has only really emerged over the past few decades. Dryland plants produce unique chemical compounds to deal with competition, heat, drought stress and predation. There are now programmes to discover and characterize compounds produced by dryland plants and associated microbes, to determine whether they have value for treating diseases such as cancer and HIV/AIDS.

Discussion in 1956 focused on identifying one crop, or some small suite of crops, that might transform dryland agriculture. Since then, research and development have come to focus not only on improving the plant and its environment through irrigation, fertilization and pest management but also on improving rural livelihoods and the physical, social and economic well-being of households and communities.

Greening the desert

In 1956, the dominant strategy was to 'green the desert' by developing primarily surface water resources and extending large-scale irrigation systems to all lands that could be economically included. There was little concern with environmental and social impacts or water use efficiency. Maximizing the area under rainfed agricultural production was also a priority. However, it was understood that, because of climate variability, extending rainfed cropping into lands that had been previously devoted to grazing was risky.

There was a great deal of concern in 1956 over possible negative impacts of traditional land use systems on drylands, particularly in developing countries. Livestock production, especially pastoralism, was clearly considered less desirable than cultivation and needed to be made more productive through the use of modern range management techniques. This, however, might involve 'improvement'



Santa Rita Experimental Range, University of Arizona

Repeat photography showing increasing abundance of mesquite on the Santa Rita Experimental Range in the Sonoran Desert in Mexico in 1902 (left) and 2003



Scientists pick priorities for curbing desertification

Each year, US\$2.4 billion is spent fighting land degradation in the world's drylands, a problem experts believe is likely to worsen.

On 21 June, 400 scientists, experts and decision-makers from these regions identified research priorities in the *Tunis Declaration*. The *Declaration* was adopted at the close of a three-day meeting co-organized by UNESCO on *The Future of Drylands*, a landmark in the International Year of Deserts and Desertification.

Areas of research singled out by the *Declaration* include: the interdependence and conservation of cultural and biological diversity, integrated management of water resources, the identification of sustainable livelihoods for the inhabitants of drylands, renewable energy suitable for dryland development, coping with and management of natural and man-made disasters and the costs related to inaction in fighting land degradation.

Read the *Tunis Declaration*: www.unesco.org/mablecosyst/futureDrylands.shtml



Courtesy of Chris Reiff

Tourist accommodation in Dana Biosphere Reserve (Jordan) at dusk. Ecotourism is one of several income-generating activities being fostered by the Sustainable Management of Marginal Drylands (SUMAMAD) project run by UNESCO-MAB and the UNU. Other activities in Dana Biosphere Reserve involve the production of olive oil soap and jewellery-making for women specifically. In parallel, the project is improving the way in which irrigation is managed

by removing undesirable vegetation through mechanical or chemical means and/or a reduction in stocking rates so that vegetation might recover. Either alternative was, and still is, expensive and probably not suited to developing countries.

Since then, strict distinctions among agricultural land uses have blurred. Agricultural research and development has focused increasingly on each use as one part of a larger system, thus exploiting synergies among these, such as agro-silvo-pastoralism. The value of land has also come to be determined by other considerations, including environmental, historical, social, cultural and spiritual values.

Attention has also been drawn to the negative consequences of some of the modern methods put in place decades earlier. The potential of salt accumulation in the soil was well recognized in the 1950s and the basic concepts of salinity management were known but solutions, such as drainage systems, were expensive. It was also believed that the process was easily reversed. Salinity management continues to be the main challenge facing irrigated agriculture. Furthermore, as concern grows over land degradation and desertification, large irrigation schemes are often viewed

sceptically for their high financial, social and environmental costs and their potential to damage other sectors like fisheries, particularly in developing countries.

Considerable progress has been made in increasing the efficiency of water use. Centre-pivot irrigation spread quickly from the 1960s onwards. In this system, sprinklers positioned on pipes rotate around fixed points (pivots) to irrigate circular fields. This technology allowed comparatively inexpensive irrigation virtually anywhere

where water was available. It also allowed irrigation of a wide variety of terrains. Other advances have been made in conventional irrigation. On large scales, land levelling has greatly increased water use efficiency. On small scales, the development of small portable pumps has allowed many farmers to ensure production during dry spells and to increase the number of cropping seasons per year. Development of drip irrigation has also increased water use efficiency, particularly in developed countries.

More recently, micro-irrigation techniques, which involve drip irrigation using buckets and inexpensive tubing, offer multiple potential benefits for small farmers in developing countries in terms of increasing yields while decreasing water, fertilizer and labour requirements.

In developing countries, rainwater harvesting through low-cost hand-constructed water control structures (see photo) is also receiving renewed attention as a means of promoting local self-sufficiency, reducing poverty and increasing food security where irrigated agriculture is not feasible. Such solutions are seen as potentially more sustainable, being based on local technologies and materials and generally requiring little cash investment.



Rainwater harvesting in Burkina Faso using low-cost hand-constructed structures

©Méchior Lambert



*This plant in flower in Qatar is a *Limonium axillare*, also known as beach lavender. It has a high salinity tolerance, making it a 'halophyte'. Scientists are studying ways of breeding halophytes and turning certain halophytes into agricultural crops. UNESCO's Doha office supported the publication this year of *Biosaline Agriculture and Salinity Tolerance in Plants* (see page 24)*

©UNESCO

As our skill in near-future weather prediction improves, more adaptive management policies will probably be required. For example, if we can predict good or bad growing seasons six months into the future, mechanisms must be in place to advise and allow farmers and livestock operators to adjust their cropping or stocking strategies accordingly.

The primary objective in 1956 was to do 'better.' This implied more water and more agricultural production. Many development threads pursued after 1956 were clearly unsustainable, such as the exploitation of fossil groundwater in North America, North Africa and the Arabian Peninsula. Much of the improvement in system performance over the past 50 years may be technical, such as improved crop varieties but a great deal may also be related to policy, including trade, subsidies and tariffs.

Why invest in drylands research?

Firstly, the problem described by Malthus² 200 years ago has not gone away. Over the next 40 years, the world's population will increase by 50% to 9 billion. Drylands constitute about

41% of the Earth's surface and will have to play a greater role in meeting these growing demands over the long term.

Most population growth will occur in developing countries, much of that in drylands and the bulk in urban areas. The challenge will be to develop safe, secure urban water supplies without causing undue harm to the agricultural sector – which would further encourage urban migration – or damaging the ability of the environment to provide goods and services for future generations. One opportunity is the reclamation and use of urban wastewater streams. Policy must acknowledge wastewater and stormwater as increasingly important resources.

Secondly, from a more immediate environmental perspective, it can be argued that significant parts of the world's drylands are the source of potentially serious global problems. Dust from the Saharo-Sahelian region of Africa and the drylands of central Asia is transported over continental scales and is of global concern. Dust from central Asia causes health concerns not only in China and Japan but also in North America. Dust from Africa may be contributing to the decline of coral reefs in the Caribbean.

Quranic botanical gardens for the Arabian Peninsula

Botanical gardens are lacking in the Arabian Peninsula, despite their obvious value for conserving plant species *ex-situ* and the centuries-old Islamic tradition of botanical studies.

Together with a team of architects, botanists, engineers, phytochemists and Muslim scholars, UNESCO's Doha office has designed a project to create a network of botanical gardens which will pay tribute to ancient regional traditions and cultures. These botanical gardens will display living plants mentioned in the Holy Quran, such as date palms, pomegranates, figs and grapes. They will also exhibit plants of importance to Islam, such as the medicinal plants used by the Prophet Mohammed and cited in his Sayings.

The gardens will educate the public about the need to preserve biological diversity. The victim of habitat loss, oil spills and inadequate livestock management practices, the flora of the rapidly developing Arabian Peninsula is in dire need of better protection from human influences.

The plans for the botanical gardens will respect the two major landscaping concepts of the Islamic gardening cultures. The first is based on typical desert environments, such as the Arabian concepts of *wadi*, *baadiya*, *raudhas*, sandy area and oasis. The second is characterized by planned gardens, such as the Persian

concepts of sunken flowerbeds, *gulistan* (flower garden), *bustan* (orchard) or the quadripartite *chahar bagh*.

The core of the gardens will feature an orderly display of plants arranged in four quarters and divided by water canals, with a water fountain or basin at its centre. The plan of this core will be enriched by sunken flowerbeds, an ingenious traditional system motivated by the need for irrigation to reduce soil evaporation and plant transpiration.

Around the core, each garden will conserve plants from different regional ecosystems. It will grow plants found on the coast, in mountainous regions, sandy areas, gravel deserts, the *wadis*, oases and aquatic habitats, as well as agricultural plants and halophytes (salt-tolerant plants).

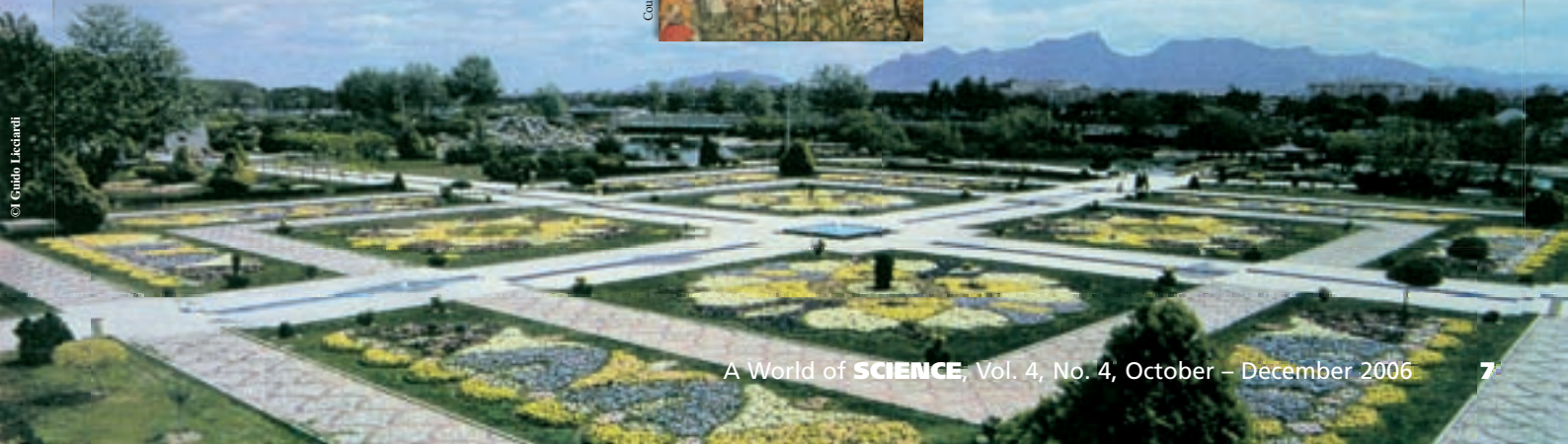
The project will be implemented over the coming year. Funds in trust agreements and workplans for each of the gardens are currently being discussed with potential donors.

For details, contact in Doha: h.al-hammami@unesco.org

(Left) The Emperor Babur supervising the construction of a garden illumination in the Baburname scroll
(Below) Modern garden in Isfahan (Iran) based on the traditional quadripartite concept (chahar bagh)



Courtesy of the Victoria and Albert Library, London



Fighting desertification with solar power



Girl selling coal at a market in Ougadougou (Burkina Faso) in 2005

© B. Benchikh/UNESCO

Firewood remains the main source of energy (80%) in sub-Saharan Africa, where it is used primarily for cooking, lighting and heating water. People used to collect deadwood but, with the decline in tree cover, they are now having to resort to living trees. This practice, combined with the pressures of population growth, slash and burn land-clearing for agriculture and recurrent drought, is decimating Africa's forests, 10% of which are expected to disappear within the next 20 years.

In the Sahelian zone, the wind easily erodes the soil today because there is little vegetation to anchor the soil. The Eden Foundation, a Swedish NGO active in Niger, has observed that sand dunes can even be found in villages 200 km south of the Sahara, not because they have blown in from the north but because they have formed locally from eroded soil in places where trees have been felled to make way for annual crops like millet. The Director of the Department of the Environment in Niger was cited by the Eden Foundation in 1992 as saying that '250 000 hectares (equivalent to an area the size of Luxembourg) are being lost each year in Niger through desertification'. The Director added that 'firewood destined for the town of Zinder is collected up to 200 km away.'

Pilot projects have been run in recent decades to heighten awareness of the benefits of substituting wood for sustainable forms of domestic energy. In Africa, UNESCO's Renewable Energy Programme is supporting pilot projects to create 'solar villages'. Last year, UNESCO helped the Governments of Burkina Faso and Mali to install solar electricity in public facilities in remote villages, including rural health care centres and maternity hospitals. Particularly needed in the maternity hospitals was solar water heating to improve hygiene and thereby protect mothers and their newborn babies from life-threatening infections.

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Women in Mauritania using a solar cooker outdoors. In harnessing the sun's energy to cook food, solar cookers do away with the need to burn wood. They also save lives; every year, thousands of women die from inhaling poisonous carbon monoxide fumes given off by wood-burning in poorly ventilated dwellings

© B. Benchikh/UNESCO

There is growing concern among researchers about potential effects of dryland dust on global climate as a result of reflection, scattering and absorption of solar radiation, and on cloud formation and precipitation.

Thirdly, from a global economic perspective, drylands have largely been marginalized. This is partly due to their physical isolation but is also a function of their lack of economic, political and social leverage within their respective countries. In some drylands that possess energy or other mineral resources necessary for global industry, this is not the case. In the future, due to their favourable location, climate, lack of competing land uses and correspondingly low land prices, drylands may also play a central role on the renewable energy stage as solar technology improves and costs decline. It is conceivable that drylands may enjoy other increasingly competitive advantages as suppliers of specialty crops or tourist destinations. Perhaps most importantly, it has now been shown that potential returns on investment in drylands are higher than in more humid areas.

Lastly, globalization is about more than just economics. There are issues of equity. Currently, 20% of the world's population consumes 85% of the world's resources. Many of the problems enumerated here are rooted, at least

partially, in poverty. Between 1997 and 2020, a combination of poverty and a deteriorating environment are expected to drive 60 million people from the desertic areas of sub-Saharan Africa towards northern Africa and Europe. Both environmental sustainability and the eradication of extreme poverty and hunger are Millennium Development Goals.

Charles F. Hutchinson and Stefanie M. Herrmann³

1. In 1956, the American Association for the Advancement of Science (AAAS) published *The Future of Arid Lands*. Edited by Gilbert White, it contains papers presented to international meetings of experts in New Mexico in 1955 to develop a research agenda on arid lands. The meetings were organized by the AAAS and sponsored by UNESCO with support from the Rockefeller Foundation
2. Thomas Robert Malthus was an English demographer and political economist best known for *An Essay on the Principle of Population* (1798). He predicted that population would outrun food supply on the basis of the idea that, if unchecked, population increases at a geometric rate (i.e. 2, 4, 8, 16, 32, etc.), whereas food supply grows at an arithmetic rate (i.e. 1, 2, 3, 4, etc.)
3. Both authors of *The Future of Drylands – Revisited* are affiliated to the Office of Arid Land Studies at the University of Arizona (USA)

Nigerian President pledges US\$5 billion towards **National Science Foundation**

President Olusegun Obasanjo of Nigeria has announced a US\$5 billion endowment fund for the establishment of a National Science Foundation of Nigeria (NSF-N). The announcement was made in Abuja on 23 May during a briefing of the President by UNESCO's International Advisory Board for the Reform of the Science, Technology and Innovation System of Nigeria (IAB).

The move reflects the President's commitment to using the 'windfall' generated by current high oil prices to diversify Nigeria's economy by investing in S&T. President Obasanjo is determined for Nigeria to become one of the top 20 economic leaders in the world by the year 2020.

In line with this vision, UNESCO's IAB put forward three recommendations in May which were favourably received by the President. In addition to the endowment fund, six Nigerian universities are to benefit from incentive measures which should enable them to rank among the 200 top universities in the world by 2020. Technology-based 'good business' zones are also to be created in each State. It is intended that the US\$5 billion endowment fund be supplemented by donors.

The proposed NSF-N would be an independent funding body for competitive research and projects and programmes in innovation. Its main functions would be the provision of grants to research bodies, universities, enterprises and individuals on a competitive basis; the equipping and capitalization of research groups and; the establishment of research universities.

The Presidential briefing on 23 May was attended by the Minister of Science and Technology, the President of the Nigerian Academy of Sciences, representatives of professional groups and leaders of other stakeholder groups. Included in the UNESCO delegation led by Hans D'Orville were Hubert Charles and Anthony Maduekwe, respectively Director and National Programme Officer of UNESCO's Abuja Office, and Folarin Osotimehin, UNESCO's Senior Science Policy Advisor, who is serving as Secretary to the IAB.

The IAB is presided by Dr Jo Ritzen, President of the University of Maastricht, former Science Minister in the Government of the Netherlands and former Vice-President of the World Bank. Dr Ritzen made a presentation to the President on 23 May on the theme of *Nigeria embraces S&T for growth: scenario 2020*. Citing World Bank figures, he forecast that the reform of Nigeria's science system would translate into economic growth of 8–10% per annum, up from 4% today, and that the number of those living on less than US\$1 per day would drop over the same period from

71% of the population to 20%. Nigeria's population is expected to grow from 130 million today to 175 million by 2020.

The draft bill on the creation of the NSF-N is being prepared by the Minister of Science and Technology, Prof. T. Isoun, and the Chief Economic Advisor to the President, Dr Osita Ogbu, in cooperation with UNESCO. Dr Ogbu is also Chief Executive of the National Planning Commission and a member of the IAB. The draft bill and operational details of the NSF-N will be examined by the Cabinet and submitted, after approval, for the consideration of Parliament.



President Obasanjo

As part of the reform process, UNESCO is already working with the S&T committees of Parliament. On 21 June, the Director-General launched the Parliamentarian Forum on Science and Technology in Abuja.

Progress towards revitalizing the Nigerian S&T sector was assessed at a Presidential Retreat on Science and Technology on 10 August. The Retreat was attended by over 600 participants, including Cabinet Ministers and diplomats. The

President used the Retreat to urge UNESCO to fast-track both the science reform programme and the elaboration of an Action Plan on Science, Technology and Innovation.

Shortly before the Retreat, UNESCO submitted a report to the Nigerian government detailing the framework for the future high-level science governance council, which will be chaired by the President of Nigeria.

For details: www.unesco.org/science/psd/

UNESCO and the BBC bring **science to the screen**

UNESCO and the BBC Worldwide, the commercial arm of the British Broadcasting Corporation, have agreed to work together to facilitate access to high-quality television programmes on science in developing countries, as part of UNESCO's new Science Communication Initiative. A Memorandum of Understanding to this effect was signed between the BBC and UNESCO at the latter's headquarters in Paris (France) on 22 September.

As a first step, UNESCO has acquired the rights for one year, at minimal cost, to 46 titles in the award-winning BBC Horizon series for 41 African and 9 Asian countries⁴.

Each of the 50-minute programmes will be distributed by UNESCO to public service broadcasting channels in all 50 countries via the Organization's field network. State broadcasting stations will be entitled to screen each film up to six times on national television. Subjects range from Einstein's Theory of Relativity to the science of natural disasters like landslides and tsunamis, and gene therapy.

For details: i.panevska@uneso.org or a.candau@unesco.org

A regional **biotechnology centre** for India

UNESCO and the Government of India signed an agreement in New Delhi on 14 July for the establishment of a Regional Centre for Biotechnology Training and Education combining teaching and research. It will be housed at the National Institute of Immunology in New Delhi pending construction of permanent facilities in the capital and should be operational by January.

‘The centre will focus essentially on areas like nano-biotechnology, biotechnology, environmental biotechnology and so on’, Maciej Nalecz, Director of UNESCO’s Division of Basic and Engineering Sciences, told the *Times of India* after the signing. ‘It will offer postgraduate and post-doctoral programmes in biotechnology and related areas, including intellectual property rights, technology transfer, bio-entrepreneurship and management, bioethics and biosafety.’

M K Bhan, Secretary of the Indian Department of Biotechnology, explained at the signing that the centre was an endeavour to develop research capacity and a reflection of the government’s desire to link education to research. The centre will be forging partnerships with other biotech institutions at home and across Asia to tackle common problems in agriculture, health and the environment through research and development. It will also be developing cooperation with institutions beyond Asia to improve research capacity.

As the centre will be operating under the aegis of UNESCO, its governing body will include representatives from both the UNESCO secretariat and Member States. ‘We will secure top scientists from different countries for the advisory body’, commented Nalecz, ‘and, through them, will seek their respective governments’ participation to develop the centre further.’

The Indian government will be funding the centre initially but hopes to see other countries in the region supplement this effort once the centre is up and running.

For details : m.nalecz@unesco.org; l.hoareau@unesco.org; www.unesco.org/bes

A smiling Kapil Sibal, Indian Minister for Science and Technology and Ocean Development, looks on as Maciej Nalecz passes the agreement for the biotechnology centre to M K Bhan for signing in Delhi on 14 July



Experts appeal for greater support for **sea-level rise research**

Scientists meeting at UNESCO in Paris from 6 to 9 June have confirmed that, since the dawn of high-accuracy satellite altimetry in the early 1990s, global mean sea-level has been observed to be rising at a rate of $3.2 (\pm 0.4)$ mm/year, compared to $1.7 (\pm 0.3)$ mm/year over the 20th century as measured by tide gauges alone.

It is not yet clear whether this increase reflects a genuine acceleration or decadal variability. In order to dispel the uncertainty and thereby improve projections for the benefit of coastal planning, the 163 experts, who hail from such diverse disciplines as geology, geodesy, meteorology, oceanography, marine science, glaciology and hydrology, have appealed for greater support for research into sea-level rise.



Flooding in the Irish Sea in 2002, ‘the worst in living memory’

Photo courtesy of Isle of Man Newspapers

To get a better picture of the temporal and spatial variability of sea level from one decade to another, the experts recommend extending the Jason series of satellite altimeters for a second decade. These observations will also help to detect a possible acceleration in global sea-level rise.

They recommend completing the UNESCO-IOC-coordinated Global Sea-Level Observing System (GLOSS) network of 300 tide gauges, two-thirds of which is operational. These tide gauges can also be used to assess changes in the frequency and intensity of extreme events like the flooding produced by Hurricane Katrina in New Orleans (USA) last year.

Current estimates of thermal expansion (due to a warming of the oceans) account for about half of change observed in global mean sea-level rise over the first decade of the satellite altimeter record but only about a quarter of change during the previous half century. Does this reflect under-sampling of ocean temperature or greater climate change over the past decade? The experts recommend bringing the number of free-drifting Argo profiling floats (which measure temperature and salinity from the surface to 2000 m) from 2500 to the planned 3000. Extending the Argo observation array to the ice-covered polar regions

is considered a high priority, as is a deep-ocean observing system (below 2000 m).

The Earth is in perpetual motion. To what extent does this contribute to sea-level rise and variability? The Global Geodetic Observing System studies the Earth, its gravitational field and such phenomena as the motion of the poles, the Earth's crust and the tides. To keep the system robust, the experts recommend installing GPS at all appropriate GLOSS tide gauge stations.

The flow from outlet glaciers of polar ice sheets is accelerating both in southern Greenland and in critical Antarctic locations. Both inland snow accumulation and marginal ice melting have increased over the Greenland ice sheet but the evidence is less clear-cut over the Antarctic ice sheet. The experts recommend further ice sheet mass balance studies and making maximum use of several ongoing and planned satellite missions to study the ice sheet, surface elevation and gravity.

Little is known about the effect on sea level of human-induced changes in water storage on land. The experts recommend extrapolating the latest estimates of large-reservoir storage from the International Commission on Large Dams to include progressively smaller reservoirs. They also advocate compiling data for representative sites on changes in subsurface water storage resulting from the draining of wetlands, groundwater use, aquifer mining, irrigation recharge and surface storage leakage, all of which prevent freshwater from reaching the oceans via rivers.

The June workshop on Understanding Sea-Level Rise and Variability was hosted by the UNESCO-IOC. It was organized under the World Climate Research Programme, jointly sponsored by the UNESCO-IOC, ICSU and WMO.

Read the report:

<http://copes.ipsl.jussieu.fr/Workshops/SeaLevel/>

National tsunami preparations an absolute priority

Countries in the Indian Ocean must give priority to helping coastal communities protect themselves in case of a tsunami warning, delegates were told on 31 July at the third meeting of the Intergovernmental Coordination Group (ICG) for the Indian Ocean Tsunami Warning and Mitigation System, in Bali (Indonesia).

The meeting took place just two weeks after a local tsunami in eastern Java killed more than 600 people and left tens of thousands homeless. The tsunami was generated on 17 July by an offshore underwater earthquake of 7.7 magnitude.

This was the first test of the warning system in the Indian Ocean, which has only been operational since 24 June. Within 12 minutes of the earthquake, the Pacific Tsunami Warning Center in Hawaii had issued a bulletin estimating a tsunami impact time for Indonesia 24 minutes hence.



Photo courtesy of Monise Laif

Flooding caused by a high tide in Funafuti on 28 February. In the first two months of this year, Tuvalu experienced some of the highest tides ever recorded there. The average altitude of the Tuvalu group of atolls (26 km²) in the South Pacific is 1.5 m and the highest point is just 5 m above sea level

The message was acknowledged by the Government of Indonesia but not relayed to the coast in time.

‘This tragic event highlights the urgency of improving national and local tsunami warning and response capacities’, said Patricio Bernal, Executive Secretary of the UNESCO-IOC which organized the three-day meeting. Achieving this has now become the top priority for the ICG.

If ‘Thailand is now confident it can get tsunami information rapidly to people on the beach and several others, including Madagascar and the Maldives, are getting close to this’, according to Bernal, many of the 28 countries in the region still do not have the capacity to transmit information on earthquakes and tsunamis quickly to coastal communities. Like Indonesia, ‘other nations with coastlines close to fault lines remain vulnerable, including Pakistan, Oman and Iran’.

In Bali, Indonesia’s Minister of Science and Technology, Kusmayanto Kadiman, urged countries of the region to use all possible means to [build national response systems to tsunamis], including loudspeakers in mosques and community bells where they existed. ‘High technology alone cannot provide all the answers’ he said, ‘especially in isolated coastal areas’.

Over the past 18 months, efforts have focused on establishing the scientific infrastructure for the system. Today, 24 out of a possible 28 operating national Tsunami Information Centres are capable of receiving and distributing Tsunami Advisories around the clock. The system also has 25 new real-time seismic stations and 23 new real-time sea-level stations; three DART buoys deployed by Malaysia (1) and Germany (2) are being tested and deep-sea pressure sensors and ground deformation sensors should be available by 2008.

For details: <http://ioc3.unesco.org/indotsunami/>

4. **In Africa:** Algeria, Angola, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia. **In Asia:** Bangladesh, Bhutan, Cambodia, India, Laos, Maldives, Nepal, Pakistan, Sri Lanka

Badaoui Rouhban

Making schools safe in a disaster

A global campaign was launched at UNESCO on 15 June to show that disaster risk reduction begins at school. The two-year campaign was launched by the Inter-Agency Secretariat of the UN International Strategy for Disaster Reduction (ISDR), in tandem with UNESCO and the French National Committee for the UN Decade of Education for Sustainable Development. The campaign's objectives are two-fold: to make risk reduction part of the school curriculum and to improve school safety by encouraging the application of building norms to make sure schools can withstand any type of natural hazard.

An earthquake engineer, Badaoui Rouhban is Chief of the Section for Disaster Reduction at UNESCO. He outlines the campaign strategy.

What is UNESCO's role in the campaign?

The campaign is an initiative of the Coalition on Education formed at the United Nations' World Conference on Disaster Reduction in Kobe (Japan) in January 2005. Education for Disaster Reduction is one of five priority areas outlined in the ten-year Hyogo Framework for Action adopted in Kobe. Although UNESCO is recognized as the focal point for this particular topic, that doesn't mean we shall be doing the job alone. It will be a collective 'movement' involving many stakeholders.

It does explain however why UNESCO hosted the campaign launch last June and convened the brainstorming sessions among various UN agencies and NGOs interested in the topic. Just as UNESCO is coordinating the World Water Assessment Programme involving 24 UN agencies, it is also serving as reference agency for a cluster of at least 15 UN agencies and other international bodies.

How do you plan to introduce disaster risk reduction into school curricula?

The purpose is to plant the notion of resilience to hazards in the minds of teachers and school pupils, either by introducing natural hazards into the curriculum or giving them greater emphasis. You can teach children about the science of volcanoes, earthquakes, floods and so on by incorporating this into existing subjects like geography and geology.

A second aspect concerns disaster preparedness. This should be based on the type of natural hazard which threatens the region in

which the school is located. Depending on the level of probable risk, you will adapt the extent to which you integrate preparedness into the curriculum. If you are in Amsterdam (Netherlands), you don't need worry too much about the notion of earthquake risk, as Amsterdam is not prone to high-magnitude earthquakes. In Paris (France) or Addis Ababa (Ethiopia), you would give more emphasis to floods and anthropogenic hazards. Remember what happened to the French city of Toulouse five years ago. The explosion at a chemical factory manufacturing AZT fertilizer dug a crater 50 m deep, killing 29 people and seriously injuring 650. The factory was located just 3 km from central Toulouse, a city of 500 000 habitants.

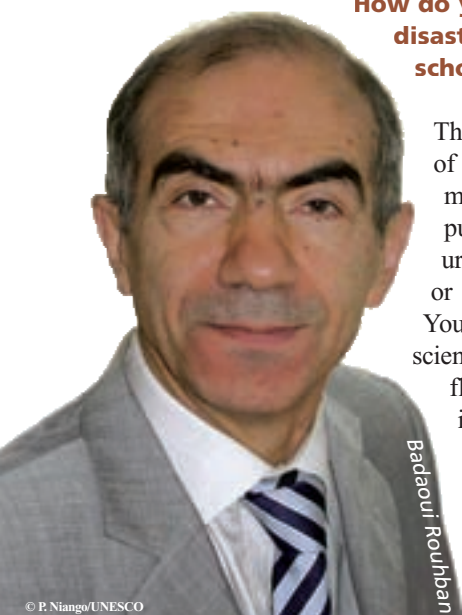
Does the campaign also cover anthropogenic hazards?

The campaign falls within the ISDR. Although essentially concerned with disasters of natural origin, the Strategy does recognize the close interaction between managing the risk of disasters of both natural and human origin. After all, building a culture of prevention in schools strengthens safety against all categories of hazards, be they natural or man-made.

How can schools in danger zones prepare for the worst?

In communities that are especially at risk, like the town of El Asnam in Algeria, which has a recurrent earthquake almost every 25 years, the situation warrants secondary teachers devoting more time to direct disciplines like hazard assessment and mitigation, as well as community preparation for a disaster.

In some cases, you might need to create a special discipline, or a presentation could be given every two weeks. Class lectures could cover, for example, the causes of earthquakes, floods, landslides and so on, and the degree of exposure to each hazard in the community. Subsequent lectures would explain how to diminish such exposure through better preparation.





Eleven year-old Tilly Smith was one of a dozen children who gave first-hand accounts of disasters they had lived through at the campaign launch at UNESCO in June. Thanks to what she had learned about tsunamis in a geography lesson before going on holiday to Thailand with her parents in December 2004, Tilly recognized the danger signs when the tide suddenly receded and, by urging her parents and other bathers to leave the beach, saved a hundred lives

What difference will their lessons on disaster preparedness make to children in El Asnam when the ground next starts trembling?

The aim is to give children some psychological preparation for an earthquake, so that they are not confronted with the notion for the first time when there is a seismic shock. This does not mean they will behave normally but at least they will know what to expect when an earthquake strikes, as do children in Japan. This will lessen the trauma. It will also enable the children and their teachers to react effectively in the emergency phase.

How will this save their lives?

An earthquake usually lasts 5–50 seconds. During the shock, children will have learnt how to react. They will know not to rush out of the room, for example, and to take shelter under a table in the classroom. Children will know the structure of their school buildings and how to reach the designated assembly area. They will know where to find a first-aid kit and how to follow evacuation routes. In case of fire, they will know where to find a fire extinguisher and the location of the nearest fire department.

Children will also have learnt to recognize the warning signs of an approaching disaster, as did Tilly during the tsunami of December 2004 (see photo). Of course, in the case of an earthquake, there are no warning signs.

Just a few weeks ago, on 4 August, a tsunami warning drill was organized for the first time in Batam, in the Riau Islands province of Indonesia, to prepare residents for a real disaster. The exercise involved residents of Panau hamlet in

A secondary school in Pakistan's North West Frontier Province (NWFP) destroyed by the earthquake of 8 October 2005. The earthquake killed 18 000 children, most of them in their classrooms. Almost 1000 teachers in North West Frontier Province and Pakistan-administered Azad Jammu and Kashmir suffered the same fate. In the worst-hit areas of the NWFP, 46% of all schools and colleges were destroyed or severely damaged. In some parts of Azad Jammu and Kashmir, the figure was as high as 96%. Still today, when meeting with educational authorities and administrators, we are invited for tea in a tent or out on the lawn – administrators too suffered the loss of family members and colleagues, homes and offices. The government has vowed to build back better than before and has a massive challenge ahead.' Account given last March by Eli Rognerud, responsible for education in emergencies and reconstruction in UNESCO's Islamabad office

Nongsa district and had to be repeated several times before participants understood where to go in the event of a tsunami. Hundreds of pupils and residents took part in the drill, which was so realistic that it left some people believing an actual tsunami was headed for the island.

This kind of exercise is vital. Obviously, the drill was triggered by the tragic earthquake-generated tsunamis which devastated Aceh in December 2004 and the southern coast of Java last July, both of which dramatically demonstrated the lack of disaster preparedness.

Do you plan to use lessons learned from recent disasters to get your message across?

We always draw lessons from disasters. In the Pakistani earthquake last October, 73 000 people died, many of them children at school (see photo). Children have been luckier in Algeria in recent years simply because earthquakes have tended to occur at night when they were not at school. There was also the mudslide in the Philippines last February, in which about 1500 people lost their lives, including 250 children and their teachers from a single primary school.

We are planning to select five countries from each of Asia and Africa for a series of pilot projects. We shall be teaming up with the Ministry of Education in each country to run training workshops for ministry staff to build awareness of the problem and provide them with a roadmap for ensuring that new schools are constructed in a safe way or that existing schools are made safe.

We shall then run regional workshops for school teachers on the need to educate children. We plan to invite 10 teachers from each country to these workshops. These teachers will then go on to train other teachers in their respective countries.

In the coming months, we shall be touring a number of donor countries with our 'pilgrim stick' to drum up funding for these pilot projects and other activities.

Will the Coalition be rebuilding schools?

No. It is not our intention to handle infrastructure because it is not our role to act locally. Besides, we have no means



of doing so. As you know, there used to be a unit dealing with school architecture at UNESCO but it was abolished about six years ago. The physical (re)construction of schools is not part of UNESCO's current strategy.

Last March, the Pakistani newspaper *The Nation* reported that UN construction of permanent structures would begin in April. Given the harsh winter in this mountainous region of Pakistan, surely reconstruction should have begun sooner? Wouldn't schools rebuilt to seismic norms have made much more effective shelters from the bitter cold than tents?

You are raising important but complex issues. Reconstructed schools could definitely have been used as shelters. Reconstructing a school is a priority because the resumption of school life breeds a sentiment of recovery in a community in much the same way the re-opening of a hospital does. A functioning hospital builds a community's morale.

This said, there is a difference between reconstructing a school and reconstructing one that will be earthquake-proof. There is not a big difference in cost, however, between a school that is completely earthquake-proof and one that is not. We are talking about a supplementary cost of 10–15%, depending on the magnitude of earthquake the structure can resist. As ISDR Director Salvano Briceno recalled at the launch last June, in many hazard-prone developing countries, it is a matter of a few hundred dollars to make a school safer.

It becomes a question of economics. The technology for making a school earthquake-proof exists and we know it is not costly.

It was reported after one tragic earthquake in Turkey that school dormitories had collapsed killing their occupants because the building contractor had mixed too much sand with the cement to cut costs. Does the Coalition include any body which can verify the compliance of school architecture with government policy?

Here again, you are raising an important point. However, the role of UN agencies is not to take the place of governments when it comes to enforcing building codes. In the Coalition, there is no control board of this nature.

Nevertheless, when we advise on building norms, we keep underlining the necessity of enforcing building codes through national legislation.

Can you list some of the building norms for an earthquake-proof building? What materials should ideally be used in construction?

Countries are encouraged to adopt national earthquake-resistant building codes, in particular for major public

buildings like hospitals and schools. Ideally, a building should be designed in such a way that all the elements are both flexible and stable. It should be conceived as a unit. The basic plan, shape or configuration of the building should be simple. The best choice is a building which is symmetrical in shape and elevation. It is best to avoid 'L' or 'T' shapes, for instance. Cantilevered (or overhanging) balconies, cornices and parapets should also be avoided whenever possible.

Building materials should be ductile. In other words, they should be capable of absorbing energy and tremors without suddenly rupturing. Steel, for example, can bend without breaking. By contrast, brittle materials such as brick or non-reinforced concrete need proper reinforcement.

How will universities contribute to the campaign?

We are assuming that teachers will also be able to obtain information on earthquakes, volcanic eruptions, floods and so on from university departments in their home country. In order to know whether a school is located in a seismic area for example, you need to know the seismicity of the area. This information can only be provided by a country's geophysicists and seismologists in institutions of higher learning.

Will you be addressing parliamentary committees?

That is something we have not considered. It is true that the notion of stakeholder groups in the ISDR includes parliaments. The regional parliamentary fora on science and technology being set up by UNESCO in West and South Asia, Latin America and the Arab States could serve as a vehicle for involving parliaments.

How will you measure progress?

We would like to establish a number of benchmarks. One could be that, by the year 2010, we achieve something like 50 safe schools. We are thinking about the timeliness of fixing goals like this. Some would claim that it is not for the international community to fix targets, that our role is restricted to insufflating ideas.

Surely precedents exist, such as the Millennium Development Goals or Human Development Index?

Yes, you need to have measurables. In 2010, we shall need to be able to tell governments what the Coalition has achieved in its first five years. This will be the challenge for us.

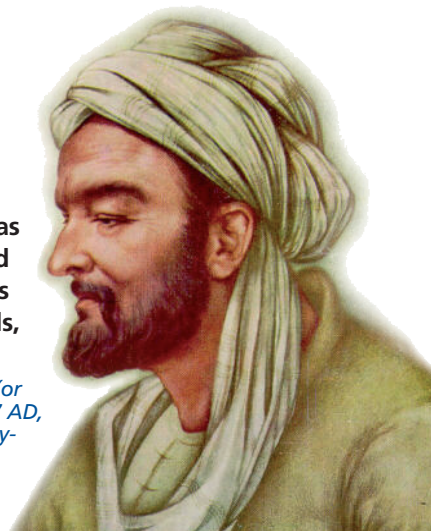
Interview by Susan Schneegans

For details: b.rouhban@unesco.org

The very real success of the **Avicenna Virtual Campus**

In just three-and-a-half years, an e-learning knowledge network in the Mediterranean has become a model for quality online teacher training and education for students. Named after a 10th-century Persian scientist and philosopher, the Avicenna Virtual Campus uses information and communication technologies to help educate students and share skills, resources and research results among universities.

The programme involves partner universities in Algeria, Cyprus, Egypt, France, Italy, Jordan, Lebanon, Malta, Morocco, Palestine, Spain, Syria, Tunisia, Turkey and the United Kingdom. Other countries beyond the Mediterranean are now clamouring to join the project, among them the Democratic Republic of Congo, Ethiopia, Hungary, Iran, Iraq, Mozambique, Tanzania and Ukraine.



Portrait of Ibn Sina (or Avicenna), 980–1037 AD, the most famous physician, astronomer, mathematician and philosopher of his time

Avicenna was launched by UNESCO in November 2002 with funding from the European Commission through its Euro-Mediterranean Information Society (EUMEDIS) programme. In providing the final installment of a 3.7 million euro funding package last June to wind down the project, the European Commission declared the Avicenna Virtual Campus a ‘sustainable model’ that had fulfilled its goal of creating a self-perpetuating campus based on cooperation between institutions. Now that the project is over, Avicenna Centre directors will be carrying on the work.

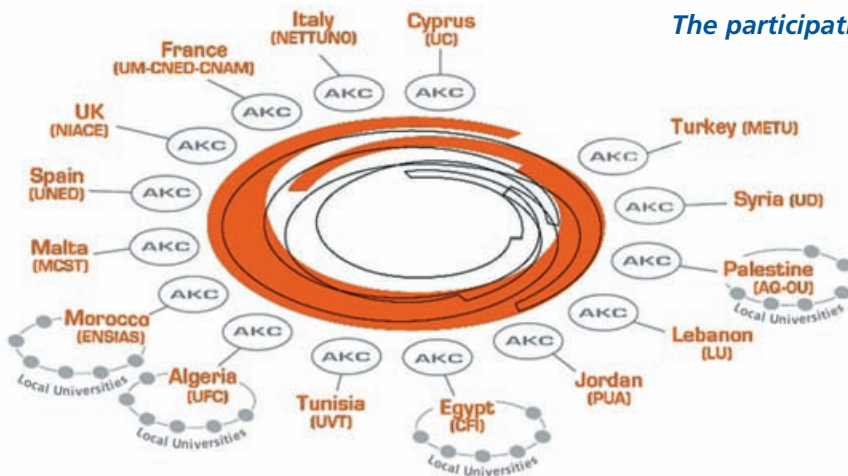
The Avicenna model differs from other virtual campuses in that each university is autonomous in creating its own online course material. In addition, each is entitled to share the knowledge bank of an open virtual library constituted by the partners in the network. Within this virtual knowledge network, professors produce courses in scientific and engineering fields online using their university’s curriculum. Participating universities may share, adapt and translate teaching modules via the open virtual library. Although it is a ‘campus’, Avicenna does not actually award degrees itself. That remains the prerogative of the universities concerned.

In addition to producing courses, Avicenna has helped to establish local infrastructure and transfer best practices and professional know-how within the participating universities. ‘We launched the programme with teacher training, to enable teachers to put their courses online,’ explains UNESCO’s Avicenna project coordinator, Mohamed Miloudi, one of the principal authors of the project and formerly Professor in Computer Science at Versailles University in France.

In the past three years, Avicenna has trained 300 teachers in online course production. A further 300 tutors have been trained how to use the courses. More than 200 online modules have been produced.

One of the keys to the project’s success lies in its five-pillar framework: organization, education, technology, legal issues and quality control. ‘Avicenna works because we evaluate the courses and define the rules using stringent criteria,’ says Miloudi. ‘We have also solved the problem of intellectual property rights by creating a contract that all partners could agree upon. All the producers of course material give Avicenna the right to use them in the network’.

The participating centres in the Avicenna Virtual Campus



KEY

- AKC: Avicenna Knowledge Centre
- AQ-OU: Al-Quds Open University
- CNED: Centre national d’enseignement à distance
- CNAM: Conservatoire National des Arts et Métiers
- CU: Cairo University
- ENSIAS: École Supérieure d’Informatique et d’Analyse des Systèmes
- LU: Lebanese University
- MCST: Malta Council for Science and Technology
- METU: Middle East Technical University
- NETTUNO: Network per l’Università Ovunque
- NIACE: National Institute of Adult Continuing Education
- PUA: Philadelphia University in Amman
- UC: University of Cyprus
- UD: University of Damascus
- UFC: Université de la Formation Continue
- UM: Université de la Méditerranée, Marseille
- UNED: Universidad Nacional de Educación a Distancia
- UVT: Université Virtuelle de Tunis



By the end of the 2005–2006 academic year in September, some 70 000 students were using the learning modules, a figure that is expected to double by the end of the next academic year.

Sharing knowledge with the neighbours

The *Universidad Nacional de Educacion a Distancia* (UNED) in Spain was one of Avicenna's founding partners. Says Alicia Del Olmo, Director of the Avicenna Knowledge Centre at UNED, 'With Avicenna, we have seen a big expansion in distance learning and e-learning. The most important benefit for us has been sharing knowledge and opportunities with Mediterranean countries that were new to us, as our natural region for cooperation has always been Latin America.'

'Our most important contribution to Avicenna', says Del Olmo, 'is World Package Number Six, which includes development of the Avicenna Virtual Library. This is a very important e-learning tool; it includes a catalogue of courses from the 15 partners and the Metadata Repository. This innovative tool is a kind of storage of learning objects (metadata) that different partners can share. Objects may be a video or a document containing the Avicenna pedagogical model'.

Another important contribution from UNED has been organizing a meeting of the Avicenna Knowledge Centre directors and pedagogical and technical experts in 2004 in Madrid. Fifty people from 17 institutions attended.

While Del Olmo found the number of partners both a challenge and an advantage for the "richness of the programme," she discovered that sub-networks are particularly successful. 'UNED had very good relations and created a technical sub-network with Lebanon, Turkey and Palestine,' she says, adding that their experts had come to Spain and contributed to developing the virtual library.

Del Olmo says UNED will continue collaborating with UNESCO on different initiatives. 'We are thinking about the possibility of submitting proposals to the European

Commission,' she says. 'We want to benefit from Avicenna by creating smaller partnerships on different issues like 'virtual mobility', recognition of credits and quality standards. 'Virtual mobility', she explains, 'means giving students of open and distance learning universities the chance to study other universities' courses online without leaving their country', which would then be recognized by their university.

One offshoot of the Avicenna Virtual Campus is a project to develop an e-learning network in biotechnologies for health care in the Euro-Mediterranean region (BINTEL). Launched last January, the programme is a joint initiative of the World Academy of Biomedical Technologies and the Avicenna team. Eleven Avicenna partner countries are collaborating on the BINTEL Virtual Campus. They will be integrated into the Academy's European platform.



Teacher training in online course production in Tunisia in January 2006

Blended learning and meta-courses in Jordan and Egypt

Mohamed Bettaz is Dean of the Faculty of Information Technology at Philadelphia University in Jordan. He specializes in computer networks. 'Before Avicenna, we just had distance learning deanships', he says. 'The programme helped so much in developing online material and actual courses. Teacher training and student learning are equally important', he says. 'Teachers must be aware of this new kind of teaching to pass on that knowledge to students'.

Bettaz admits there were challenges in dealing with so many partners. 'At the beginning', he says, 'we had problems because we had to create a network involving different cultures and countries. We had to make a mutual effort to understand each other but this is normal.' Staff and students also questioned the programme's usefulness. 'But when people saw the new modules produced, the new pedagogical methods and how they could be used, things improved,' Bettaz adds.

The university developed eight courses which are available online in the Learning Management System. Four are

in information technology, two in science and two in engineering. These are part of Philadelphia University's regular curriculum. Portions of each course are available during the 2006–2007 academic year as blended learning, which combines traditional and e-learning.

In addition, Philadelphia University has developed an online training course in English, French and Arabic for Avicenna course developers. 'This is a meta-course allowing e-learning course developers in general and Avicenna e-learning course developers in particular to learn online the pedagogy and technicalities needed to develop an online course and put it on the Learning Management System,' explains Bettaz.

For the future, Philadelphia University is striving to develop more courses. 'Once all the curriculum courses have been put online, we shall ask the Minister of Higher Education for permission to create an online degree,' he says. 'Many Gulf countries are calling us and asking for that. Our second objective is to open up the network to make a domestic version of Avicenna for Jordanian universities.'

Gamal Darwish is a founding partner of Avicenna. A consultant at the Ministry of Communications and Information Technology in Egypt and Professor of Information Technology at Cairo University, he is helping to spearhead new projects in Egypt and the region. All universities can use these courses for Bachelor's and Master's degrees, whether in Egypt or beyond. While education can be blended or solely distance learning, blended tends to be the main method used', he says.

'Avicenna has been very beneficial because we use the courses in the education programme. The students love this and benefit greatly from it, even in their final exams,' says



Professor Dima giving an online course in computer science at Al Quds University

Darwish. 'Other universities in Egypt are asking to use these courses, too.'

The Cairo centre is now working on a new model based on Avicenna called Education for All for instructors and primary and secondary pupils. 'We intend to use the Avicenna model to help train teachers, which will improve the quality of education,' says Darwish, adding that they are only waiting for financial support to get the programme off the ground.

A 24-hour, seven-day service

Students, too, are happy with the programme. At Al-Quds Open University in Palestine, exchange student Jennifer Moghanam enthuses, 'By using Avicenna courses, I obtained fast and documented feedback. I learned independently and controlled my schedule, learning at my own pace.'



Girls walking to school in an Egyptian village on the Nile. Rural women can use the Avicenna Virtual Campus to study from home

Fellow student, Jad Freij, a senior at Al-Quds, adds, 'With the help of Avicenna, I can access my courses seven days a week, 24 hours a day, in my leisure time.'

Giving village women virtual mobility

Avicenna can remove one of the barriers to higher education for Arab women. 'In big countries like Algeria, Morocco and Egypt, women have problems leaving their village to attend university in the city,' says Miloudi. 'With Avicenna, they can enroll in university without leaving home. They just need the Internet connections. To paraphrase an old adage, *'if they can't come to the university, the university can come to them'*.'

Helping the blind

The Avicenna model can be used to help the blind. Miloudi was the project officer for a virtual learning centre for the visually impaired in India, which was launched by UNESCO in November 2001. Miloudi trained staff, technicians and educators at the National Council of Education Research and Training in New Delhi how to use the innovative technology for students, which is comprised of a Braille terminal and electronic voice.



A blind student using a Braille terminal and (tactile) screen reader at the Alexandria Library in Egypt. The prototype for this technology, which enables blind students to surf the Internet and type on a computer, was designed by Mohamed Miloudi

By introducing a low-cost Braille technology that can be manufactured in India, Miloudi provided otherwise unaffordable technology. 'We try to replicate this for blind students in the Avicenna centres,' he says, adding that UNESCO has implemented other projects for the visually impaired in Qatar, Morocco and Egypt. 'Now we have 1000 blind students using the centre at the Alexandria Library', he says. A feasibility study is currently being prepared for a similar project with the Avicenna Centre in Tunisia.

Open universities for Egypt and Iraq

With the help of UNESCO, a number of new developments are being planned or implemented. Among these is the Open

University of Science and Technology in Egypt, which aims to establish infrastructure and transfer best practices and professional expertise within selected universities.

Explains Darwish, 'We plan to start the Open University based on the e-learning concept we have learned from the Avicenna project.' While discussions are still under way as to how this can be implemented and funding is still to be arranged, organizers hope to launch the project in October 2006. The Open University would include 17 Distance Learning Centres within a national network developed in two phases. Miloudi calculates that, 'In Egypt, 1 million teachers will be trained, as well as 16 million primary and secondary pupils.'

Another new project is the Open University in Iraq, which aims to create 23 distance education centres between now and 2010. 'We have been asked by UNESCO to transfer our experience to Iraq', says Bettaz. 'People sent by UNESCO from the Open University in Iraq have visited Jordan to get a project under way to assist these centres. Our teachers are trained. We are ready.' Bettaz explains that, if all goes well, teacher training will start in September, course development in January and teaching in mid-2007.

Using Avicenna to train teachers in Africa

At the African Union's Summit in Khartoum (Sudan) last January, UNESCO agreed to use the Avicenna model to train teachers in Sub-Saharan countries within the New Partnership for Africa's Development (NEPAD). The first project will target the Democratic Republic of Congo, with funding from the African Development Bank. In parallel, the model is being used to teach 200 000 teachers in Algeria, where it is also planned to open 40 Avicenna centres.

At present, the African Virtual University is the only network on the continent. Funded by the World Bank, the African Virtual University provides private e-learning centres. The spread of this fee-paying model is hampered however by the fact that most students cannot afford the fees.

Were it possible to set up an Avicenna e-learning centre at each African university, students and teaching staff across the continent would be able to share free online courses and other teaching resources – no modest challenge for UNESCO, the African Development Bank and the European Commission in their efforts to help Africa.

Marnie Mitchell⁵

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m.el-tayeb@unesco.org; m.miloudi@unesco.org*

For examples of online courses: <http://pleiad.unesco.org/> (Login and password = ibnsina)

5. Journalist

Students choose life in Kenya

Kenyan universities have made great strides in recent decades but AIDS is now spreading so swiftly that it is in danger of turning back the clock. Nowhere has been harder hit than the universities, where the epidemic has reached alarming proportions, particularly among women students. At 15.5%, the rate of infection among women in the 15–24-year age group is more than double the national average (6.7%)⁶ and the rate of infection among young men of the same age (6.0%). The virus has taken hundreds of students – and often their educators – to an early grave. The loss of these bright young minds is a personal tragedy but also a tragedy for Kenya's development agenda.

If Kenyan universities succeed in curbing the spread of HIV/AIDS on campus, it will be a collective success, with a wide range of partners all sharing some of the credit. These will include UNESCO, which has been actively encouraging universities in Kenya and beyond to develop an institutional policy and to mainstream HIV/AIDS in their academic programmes. It will also be a victory for I Choose Life–Africa, an NGO founded in 2001, for the Kenyan Commission for Higher Education and of course for the staff and students at the universities themselves.

In November 1999, the then President of the Republic of Kenya, Daniel Moi, declared HIV/AIDS a national disaster. The Ministry of Education, Science and Technology was instructed to introduce HIV/AIDS education into all institutions of learning across the country and all ministries and institutions were expected to establish an AIDS Control Unit.

Most Kenyan universities also opted to introduce AIDS Control Units on campus to enable them to liaise with the sub-sector AIDS Control Unit at the Commission for Higher Education. Many universities have been using their annual *ACU Bulletins* to disseminate available information on HIV/AIDS to students and staff.

By 2003, a number of institutions had introduced an HIV/AIDS policy to foster prevention and provide care and support for people living with AIDS, among them Kenyatta University. Other public and private universities followed suit, especially once the government's HIV/AIDS Policy for the Education Sector was in place. Thanks to these policies and a number of concrete programmes, the level of awareness at these universities is now very high.

A good number of universities had introduced orientation courses for first-year students by October 2005. Others, like Kenyatta University, have programmes



which include talks on the epidemic and information on how students can protect themselves from the virus. Kenyatta University also offers students a compulsory core unit on HIV/AIDS and drug abuse.

In some of these universities, keen awareness of the pandemic has led students to create Anti-AIDS associations to raise awareness further among the student population. The University of Nairobi, for example, has a very strong student association known as Medical Students Against AIDS, which does not limit its activities to the campus alone; it has been invited by UNESCO to conduct peer education activities in secondary schools in some of the Kenyan provinces. Kenyatta University has also formed a Students Aids Control Organization to discourage risky sexual behaviour.

Although all Kenyan universities have thrown themselves into HIV/AIDS prevention, the degree of involvement varies, as does the impact of these programmes.

Positive peer pressure

The introduction of the I Choose Life programme in the six public institutions of higher learning across Kenya (grouping 80% of students) has also made an impact. The programme adopts



Students listening to a lecture on HIV/AIDS during a training session organized by Kenyatta University's I Choose Life programme

Helping universities fight HIV/AIDS

The global initiative on Education and HIV/AIDS (EDUCAIDS) is led by UNESCO in collaboration with other United Nations agencies within UNAIDS; it strives to prevent the spread of HIV/AIDS by educating *en masse* those who are most vulnerable to AIDS, the young, via the school and university systems, and informal education. Young people between the ages of 15 and 24 accounted for half of the 3.2 million new infections in sub-Saharan Africa in 2005.

UNESCO's office in Nairobi is the Regional Bureau for Science in Africa. In 2001, the office began working with Ministries of Education and relevant stakeholders to ascertain what the education sectors were doing to prevent the spread of HIV and mitigate the impact of HIV/AIDS. Alice Ochanda, the office's focal point for HIV/AIDS, youth and gender, began working with Kenya's Commission for Higher Education to encourage universities to develop an institutional policy or guidelines for HIV/AIDS prevention and impact mitigation, and to mainstream HIV/AIDS in their academic programmes. As the result of a first workshop in 2004, 12 out of 18 Kenyan universities have now developed institutional policies on HIV/AIDS and the Commission for Higher Education has even developed its own policy. Kenyatta University has since also introduced a post-graduate course on nutrition and HIV/AIDS.

Alice Ochanda has gone a step further by working with the Association of African Women in Science and Engineering (AWSE) to

encourage Faculties of Science and Engineering in African universities to develop curricula on the biology and social impact of AIDS, within a project funded by UNAIDS. The purpose is to make Faculties of Science and Engineering aware of the important role they have to play not only in reducing the prevalence of HIV and AIDS on campus but also in serving an AIDS-affected society in desperate need of their help.

AWSE is a logical partner for this enterprise on a continent where women are increasingly present on campus and in research but also more vulnerable to AIDS than their male counterparts. In 1988, there were 2 million women and as many men living with HIV/AIDS in Africa. By 2004, seropositive women (14 million) easily outnumbered seropositive men (10 million).

Last April, UNESCO's Nairobi office and AWSE ran a joint workshop to take stock of progress. The workshop brought together Faculty Deans of Science and Engineering and coordinators of HIV/AIDS programmes from 23 universities in Botswana, Eritrea, Ghana, Kenya and Rwanda. The aim was to make scientists and engineers aware of the need for common undergraduate courses on HIV/AIDS within their Faculties and to train them in developing teaching modules on HIV/AIDS. Those which had already developed curricula, including Kenya's six public universities, were encouraged to share their experiences with fellow universities.

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a novel approach to HIV/AIDS education based on positive peer pressure. I Choose Life – Africa (ICL) first put this approach to the test at the University of Nairobi four years ago before expanding into the universities of Kenyatta, Moi, Maseno, Egerton and Jomo Kenyatta University of Agriculture and Technology.

A report published last April by ICL on the *Impact of Peer Education on HIV Prevention among Kenyatta University Students* reflects the importance ICL attaches to monitoring the impact of its programme. The first thing I Choose Life–Africa did upon arriving at Kenyatta in 2004, for example, was to conduct a baseline survey of students. The survey revealed that as many as 92% of students were knowledgeable about HIV/AIDS. The problem at Kenyatta lay thus not in a lack of knowledge but in the difficulties students encountered in putting their knowledge into practice.

In light of this, ICL decided to enlist the help of students to bring about behaviour change among first-year students in particular. The first 'peers' were recruited in 2004, with a

strong focus on gender parity. The same approach has been employed in the other five public universities with encouraging results.

How (and why) it works

This is how the ICL programme works. Students are recruited on the basis of their past commitment to fighting HIV/AIDS on campus. Each receives 32 hours of peer educator training on sexuality and HIV/AIDS, followed by a four-week life skills course. In the middle of their training, the peer educators pair up with other students to initiate 'behaviour change communication groups'. These groups are formed around a shared interest which 'can be anything from Salsa dancing to financial planning'. ICL provides educative materials and information, as well as mentorship and logistical support for peer educators.

The programme sets out to deepen knowledge of HIV/AIDS, delay the first sexual experience, reduce the number of sexual partners, increase condom use among sexually active students, combat the stigmatization of people living

with HIV/AIDS and strengthen policy development and implementation, with student participation. Students are also encouraged to undergo voluntary testing and counselling.

Our people, our problem

The programme enhances personal and institutional commitment, which is crucial in the fight against HIV/AIDS. In the public universities, mobile voluntary testing and counselling clinics are set up every semester at convenient places for students. These are well-advertised and provide free testing for a period of two to four weeks. The vehicles are supplied by bodies like the National AIDS and Sexually Transmitted Diseases Control Programme at Kenyatta National Hospital.

In addition, some University Students Associations have set up an annual HIV testing day on campuses. At Kenyatta University, the theme of the first testing day in 2004 was Our People, Our Problem. The event has taken place annually ever since. It is usually crowned by a beauty pageant to elect a Miss and Mr Status who will go on to act as ambassadors for

Giving women "bedroom power"

'Despite the urgent need to protect themselves from sexually transmitted diseases, women have few options', noted the Task Force on Science, Technology and Innovation in a report⁷ published last year by the United Nations' Millennium Project. 'The condom requires male consent... The female condom's indiscreetness makes it a less than ideal option'.

Now, it looks as if bedroom power may be coming to women, thanks to innovation. 'Genomics and other biotechnologies are enabling the development of a number of new forms of female-controlled protection against sexually transmitted diseases like HIV/AIDS', observes the report. 'These biotechnologies include vaginal microbicides... These gel or cream formulations of chemical compounds block the transmission of the infection across the vaginal wall'. Six first-generation vaginal microbicides were undergoing safety and efficacy trials in 2005.

The biggest trial yet concerns the Pro 2000 gel. Some 10 000 African women, all seronegative, are expected to participate in the trial, which is being organized by the British Medical Research Council (MRC) with 62 million euros from the public purse. The MRC began recruiting volunteers in South Africa and Uganda in October 2005 and has since extended its campaign to Tanzania and Zambia. Half the volunteers will receive a placebo but all will be advised on the importance of using a condom during intercourse to ensure their protection. The gel has sailed through laboratory testing and studies on animals, proving to be effective not only against the HIV/AIDS virus but also against sexually transmissible diseases like the herpes virus or chlamydia and gonorrhoea, both caused by a bacteria. The clinical trial is due to run until 2010.

the AIDS programme on campus. The ICL noted in its 2006 report that the annual event 'had greatly increased the uptake of voluntary testing and counselling at the university'.

Risky behaviour

Why are students particularly vulnerable to HIV/AIDS? This is due to several factors. The practice of multiple partnering, laxity in condom use and a confined environment have all accelerated the spread of HIV/AIDS on campus among a young and sexually active population. Peer pressure and the influence of the media seem to be other factors, as these can lead to alcoholism, drug abuse and early sexual experience. Alcohol consumption certainly reduces the likelihood of condom use. This trend seems to be a major factor among university students.

Is the message about risky behaviour getting through to students? Thanks to a second student survey in early 2006, ICL has been able to measure behaviour change at Kenyatta over the past two years. The 2004 ICL survey showed that 36% of students practised abstinence. Of the remainder, only 40% used condoms consistently. The 2006 ICL survey found no decrease in the number of sexual partners and no increase in rates of abstinence. A growing number of students did however report using a condom consistently (see overleaf). Moreover, 'favourable attitudes toward condom use were moderately associated with more frequent use'.

Women run the greatest risk

Studies carried out in sub-Saharan Africa show that three women are infected with HIV for every two men, on average. The ratio is as high as 3:1 among young women⁸. Most deaths occur between the ages of 20 and 30 years for women and 25 and 30 years for men. This suggests that women are becoming sexually active earlier than men.

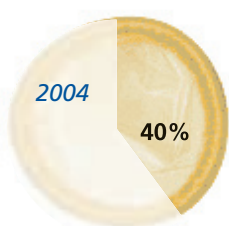
A lack of bedroom power

Gender inequality may contribute to the higher proportion of HIV infection among female students than among their male counterparts. The balance of power in many relationships is tilted in favour of men. Female university students lack the power to refuse sex or to insist on condom use, even when they suspect that their partner may not be monogamous or may himself be infected. This is what Arnfred⁹ refers to as a 'lack of bedroom power'.

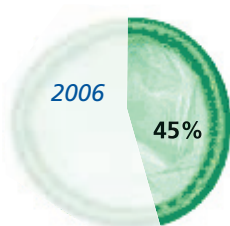
The 'gold rush' mentality

The 2006 ICL report underlines the 'gold rush' phenomenon. 'The newfound autonomy of university life', it states, 'leads many [students] to experiment with a wide range of risky behaviours once they arrive on campus. The freshmen 'gold rush', in which older male students reportedly target newly arrived and inexperienced female students, is just the beginning of pressures university students face throughout their years on campus'.

Student surveys at Kenyatta University, 2004 and 2006



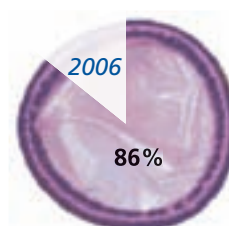
Students who report consistent use of a condom



Condom use



Students who report ever having used a condom



Attitudes towards condom use

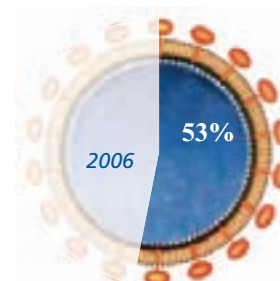
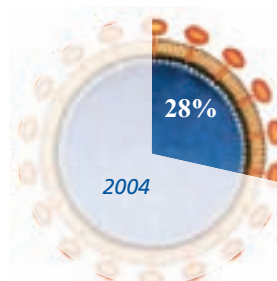
Statement	Students who agreed or strongly agreed with statement	
	Males (%)	Females (%)
I can tell my partner, 'No sex without a condom'.	78	82
Using a condom shows I care about myself and my partner.	80	84
Condoms cannot be trusted to protect you against HIV.	72	76
If I suggest we use a condom, my partner will suspect I have HIV.	22	15

NB Data for 2004 and 2006 have been combined because there was no statistically significant change



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The first HIV Testing Day at Kenyatta University in June 2004. The annual day is an occasion to make students aware of the need to know their serology status



Students who have been tested for HIV

Attitudes towards those living with HIV

Statement	Students who agreed or strongly agreed with statement (%)
If a member of my family became sick, I would be willing to care for him/her in my house.	96
If I knew that a shopkeeper/food seller had AIDS, I would not buy from them.	19
If a member of my family became infected with HIV, I would want it to be a secret.	47
People suffering from AIDS should be allowed to continue with work or school.	94
A teacher who has the AIDS virus but is not sick should be allowed to continue teaching in school.	92

NB There was no statistically significant change in attitude between 2004 and 2006

Source: ICL (2006) The Impact of Peer Education on HIV Prevention among Kenyatta University Students. I Choose Life–Africa. Nairobi

A greater biological vulnerability

Sex in its penetrative sense puts women in a far riskier position than their male counterparts because of the large surface area presented by the vagina for viral entry. The concentration of the HIV/AIDS virus is also higher in semen than in vaginal fluids. The risk of infection per exposure from an infected man to an uninfected woman is generally calculated to be about 1:500, compared to about 1:1000 from an infected woman to an uninfected man.

The use of sex as a commodity

Driven by poverty and the desire for a better life, some female students use sex as a commodity in exchange for services, money and accommodation. On campus, female students move in with boyfriends able to cover their accommodation expenses. Others engage in pre-marital sex both with their boyfriends and with older male partners commonly referred to by female students as 'the working class'.

Female students from poorer families sometimes engage in prostitution to fit in with those from well-to-do families. These women fall prey to the temptations of the good life promised by their prospective clients in the hope of amassing the basic necessities of life for a student. It is no secret that a considerable number of the girls found along some of the famous Nairobi boulevards come from tertiary learning institutions, especially universities.

Risky abortions

Students confronted with unwanted pregnancies are forced to consider abortion to avoid dropping out of university or out of fear of parental retribution. In desperation, some women turn to unqualified practitioners who often use crude methods to terminate the pregnancies, thus putting these young women at risk of contamination with HIV or otherwise endangering their lives.

Signs of behaviour change?

Despite tireless efforts and considerable resources being spent on educating young people about prevention through condom use and sexual abstinence, and about sexually transmitted diseases, it is evident that whatever knowledge is being imparted has not been translated into practice. Young people in Kenya and elsewhere in Africa continue to be more and more vulnerable to HIV infection, mainly through sexual practices. The 15–24 year old age bracket, which is currently categorized as being most affected by the AIDS pandemic, is mainly found at the institutions of higher learning. A concerted effort will be necessary if prevention is to have the desired effect. Apart from being highly active sexually, this group is also prone to rebelling against almost everything advocated by the older generation represented by their parents, lecturers and religious leaders.

'We are seeing some serious behavioural change'

Five years after African leaders declared war on the HIV/AIDS epidemic, there are grounds for hope. In an interview with Reuters News Agency on 4 May at an AIDS Summit in Abuja (Nigeria), UNAIDS chief Peter Piot said that young people in Kenya, Uganda and Zimbabwe were losing their virginity two years later than previously and that the rate of new infections was falling in East African cities. 'What we are seeing is some serious behavioural change', Piot was reported as saying. 'Young people start later with their first sexual intercourse. Also, there's a reduction in the number of partners and condom use has gone up'.

The number of Africans receiving life-saving AIDS drugs had also grown exponentially, Piot said, from a few tens of thousands five years ago to 750 000 today.

Piot concluded that 'Billions of dollars have been invested, some would say poured, into AIDS programmes in Africa and until now there were not that many results. Now these results are coming'.



© Choose Life Africa

Peer educator students from Moi University paying a home visit to families living with HIV/AIDS as part of their practical training. The student in the middle is flipping through a publication on Caring for Loved Ones at Home

All is not lost. The very involvement of students themselves in peer education is a step in the right direction. After all, who better than their peers to convince students that the key to reducing their vulnerability to HIV/AIDS lies with them.

Alice Ochanda, Reginah Njima¹⁰
and Susan Schneegans

This article draws heavily on the report published by I Choose Life-Africa in Nairobi 2006 on The Impact of Peer Education on HIV Prevention among Kenyatta University Students. This report received financial support from UNESCO, Kenyatta University and the UK Department for International Development (DfID). DfID also funds the ICL programme at Kenyatta University.

6. Kenyans aged 15–49 years out of a total population of 32 million, statistics supplied by the Kenyan Commission of Education
7. UN Millennium Project (2005) Innovation: Applying Knowledge in Development. The UN Millennium Project is an independent advisory body commissioned by the Secretary-General of the United Nations to propose the best strategies for meeting – the Millennium Development Goals. One of these goals is to promote gender equality and empower women by eliminating gender disparity at all levels of education by 2015. Another goal is to halt and begin to reverse the spread of HIV/AIDS, malaria and other diseases. Directed by Jeffrey Sachs, the Millennium Project groups 10 thematic task forces comprising more than 250 experts from around the world. Engineer Tony Marjoram from UNESCO was a member of the Task Force on Science, Technology and Innovation
8. UNAIDS (2006) Report on the Global AIDS Epidemic. UNAIDS, pp. 8–9
9. Arnfred, S. (2004) Re-thinking Sexualities in Africa. Nordic Africa Institute. Uppsala, Sweden, pp. 25–26.
10. Student of Kenyatta University

Diary

16– 20 October**Managing water supply for growing demand**

Intl symposium organized by Thai Nat. Committee for UNESCO-IHP, Nat. Comm. for UNESCO; Ministry of Natural Resources and Environment, Bangkok (Thailand): g.arduino@unesco.org; www.thirdaphw.org/

19–20 October**Access to energy for all**

Intl seminar under UNESCO patronage. UNESCO Paris: o.benchikh@unesco.org

23–25 October**Environmental education in protected areas**

2nd Congress. Basque government and UNESCO-Etxea office. Urdaibai Biosphere Reserve (Spain): m.chuseneg-godt@unesco.org

23–27 October**MAB Council**

Meeting to approve new Biosphere Reserves and extensions to existing ones, MAB Awards for Young Scientists, etc. UNESCO Paris : www.unesco.org/mab; mab@unesco.org

29–31 October**Groundwater for emergency situations**

Intl workshop. Regional Centre on Urban Water Management (RCUWM), UNESCO-IHP and UNESCO Tehran. (Iran): a.aureli@unesco.org; www.rcuwm.org.ir/

1 November**Sea level**

1st ODINAFRICA workshop on this theme. IODE Project Office. Ostende (Belgium): m.odido@unesco.org

1–3 November**Engineering education for sustainable development**

Workshop at Tsinghua University. Beijing (China): t.marjoram@unesco.org

6–10 November**Remote sensing and operational oceanography**

GOOS/ Large Marine Ecosystems workshop in parallel with meeting of Virtual Global Faculty for Remote Sensing (Bilko). Cape Town (South Africa): j.ahanhanzo@unesco.org; UNESCO-Bilko project: www.noc.soton.ac.uk/bilko/

6–10 November**UNESCO-WTA Training Workshop on Hightech Cluster Governance**

Rep. of Korea: y.nur@unesco.org

6–11 November**Active learning in optics and photonics**

4th UNESCO workshop. Physics teachers and researchers are encouraged to participate. Miranda House, University of Delhi (India): pratibha.jolly@gmail.com; m.alarcon@unesco.org

12–15 November**International Sediment Initiative**

1st conf. of Initiative launched by UNESCO. UNESCO Chair in Water Resources under patronage of Pdt of Sudan. Khartoum: knn.thein@unesco.org; www.isic.ucwr-sd.org

13–17 November**Sustainable management of marginal drylands**

5th intl workshop for UNESCO-MAB's SUMAMAD project. Aleppo (Syria): t.schaaf@unesco.org

26–29 November**Biodiversity governance and prevention of conflicts – UNESCO-MAB. UNESCO Paris:**

m.bouamrane@unesco.org

27 November – 1 December**Water resource variability**

5th FRIEND intl conf. Co-organized by UNESCO-IHP. Havana (Cuba): m.bonell@unesco.org; planos@met.inf.cu

28–30 November**Global change in mountain regions**

Organized by GLOCHAMORE partner Mountain Research Initiative. Almaty (Kazakhstan): t.schaaf@unesco.org

28–30 November**Assessment of snow-glacier and water resources in Asia –**

Regional Environmental Center for Central Asia, Institute of Geography, Kazakhstan, EU, UNESCO Almaty, etc. With UNESCO Beijing, Delhi, Moscow and Tashkent offices. Almaty: a.zotkina@unesco.org; www.unesco.kz

28–30 November**Estuaries and coasts**

2nd Intl Conf. organized by IRTCES, UNESCO, Pearl River Water Resources Committee in China; IAHS; WASER; IAHR. Guangzhou, China: www.irtces.org; knn.thein@unesco.org; chliu@iwhr.com

30 November**Mondialogo Engineering Award**

Deadline for registration. Each team should consist of two student groups from a developing and developed country. Put together a practical engineering project for communities in developing countries that addresses extreme poverty reduction and sustainable development. Submit this project proposal by 31 May 2007. Ten Awards of €20,000 to be won plus €5,000 each for 20 more teams. 2nd edition of this UNESCO/DaimlerChrysler partnership. Registration form: www.mondialogo.org/290.html; for details: t.marjoram@unesco.org

4–9 December**Humid tropical ecosystems**

Intl Conf. on changes, challenges and cutting-edge opportunities for research, conservation and capacity-building. Kandy (Sri Lanka): mab@unesco.org

New Releases

Science, Research and Technology in Nepal

By D. Bajracharya, D. Raj Bhuju and J. Raj Pokhrel. UNESCO Kathmandu Series of Monographs and Working Papers 10. English only, 136 pp.

Examines institutional capability in S&T from the secondary to tertiary learning levels, and in national public S&T bodies, as well as trends in R&D in the public and private sectors. Analyses development plans and science policy from 1980 to 2007. Covers disciplinary developments in agriculture, chemistry, physics, Earth science, engineering, forestry, health sciences, plant sciences and so on. For details: Kathmandu@unesco.org

The Virtual University**Models and messages | Lessons from case studies**

Edited by Susan D'Antoni. Education on the Move series. Produced by UNESCO Institute for Educational Planning (Paris). UNESCO Publishing. ISBN 92-3-104026-9, English only, €14.00, 452 pp.

Explores implications for ICT policy, planning and management of several new or reorganized institutions of higher education; describes trends and the impact of cross-border education. Includes eight case studies from different regions, representing various institutional models.

Stone in Scotland

Ewan Hyslop, Andrew McMillan and Ingvál Maxwell. Contributors: Joan Walsh and Luis Albornoz-Parra. Earth Sciences series, UNESCO Publishing / IAEG, ISBN 92-3-104031-6, English only, €16.00, 72 pp.

Catalogues the stone resources of a country that was once a major producer and exporter of granite, sandstone and flagstone. The rich diversity of Scotland's geology has strongly influenced the diversity of its built heritage.

Biosaline Agriculture and Salinity Tolerance in Plants

Münir Öztürk, Yoav Waisel, M. Ajmal Khan, Güven Görk (eds) Birkhäuser Verlag, Basel, Switzerland, 205p. Supported by UNESCO Office in Doha. Provides new science-based information on physiological aspects of salinity tolerance in plants, as well as bio-geographical information on halophyte

communities. Explains how to use halophytes (salt-tolerant plants); saline irrigation and; drainage management, and describes the effects of salinity on crop productivity. For details, contact (in Doha) : b.boer@unesco.org

Guidelines for a Science and Research Policy in Bosnia & Herzegovina

Produced by UNESCO's Regional Bureau for Science in Europe in Venice, with financial support from the Italian government. UNESCO Science Policy Series. English only, 80 pp.

Underlines the need for adoption of a national Law on Science and Technology in Bosnia & Herzegovina and recommends a series of urgent measures to re-launch competitive science, technology and innovation in the country. Part of UNESCO's Strategy for Strengthening Cooperation with South Eastern European Member States. Download the report: www.unesco.org/science/psd/publications/s-p_series.shtml

Let Our Children Teach Us!

By Ben Wisner for ActionAid (NGO). Produced by ISDR System Platform on Knowledge and Education with support from UNESCO, UN-ISDR, Council of Europe, ActionAid, etc.

Examines good practices for reducing disaster risk through education, knowledge and innovation. A critical (and strategic) look at current activities in order to identify gaps and new opportunities.

For details: www.unisdr.org/; b.rouhban@unesco.org

For the Young

The Gulf Stream

By Bruno Voituriez. IOC Ocean Forum Series. UNESCO Publishing. Exists in English, French and Spanish. ISBN 92-3-203995-4, €18,00, 224 pp.

What is the Gulf Stream? You will find the answer in this book covering the scientific discovery of the Gulf Stream, the phenomena behind it, its role in determining climate and its impact on marine ecosystems in the North Atlantic. Also in this collection: *Climate Change*; *El Niño: Reality and Fiction*; and *The Changing Ocean*.