

DINNER/DISCUSSION SUMMARY

Peak Water – can the developing world find the water needed for food production and a growing population?

Held at The Royal Society on 14th July, 2010

The Foundation is grateful for the support for this meeting from
Arup, the Biotechnology and Biological Sciences Research Council, Lloyd's of London and Lloyd's Register

Chair: **The Earl of Selborne KBE FRS**
Chairman, The Foundation for Science and Technology

Speakers: **John D Liu**
Film Director - director of "Hope in a changing climate", China
Michael Norton MBE
Managing Director, Water and Power, Halcrow Group
Jennifer Schooling
Research Business Manager, Arup
Professor Chris Whitty FRCP
Chief Scientific Adviser, Department for International Development

MR LIU said the project for the rehabilitation of the Loess Plateau in China, which he had been studying, gave hope that environmental degradation, caused by generations of agricultural use, could be reversed and land restored to fertility. The plateau, the birthplace of the Han tribe, had historically been fertile and wealthy, but through successive waves of agricultural practice - cutting down trees, overuse of the soil, overgrazing - had lost its vegetation and become arid and eroded. The effects of this degradation were not only local - they had led to excessive silting of the Yellow River, and dust storms affecting the Beijing. In 1995 the Chinese government with help from the World Bank decided to regenerate the region. They undertook extensive GIS mapping and worked to persuade the local population that it was worth giving up some short term economic benefit for ecological benefit (e.g. losing some land from cropping to create environmental features and tree planting). There was resistance, but the eventual benefit in employment and increased fertility had won them over. Mistakes had been made, but now results could be seen. Vegetation had recovered, with biomass, biodiversity and organic material and water retention in the soil increased. The natural equilibrium of the region had been restored with other global benefits, such as carbon capture from trees. The crucial message was that without action to ensure biomass, biodiversity and organic material, ecological degradation was inevitable, mankind would suffer, and life eventually become unsustainable. This message must now be spread in Africa and other parts of the world suffering from ecological degradation. Local action must then be taken, with help from the rest of the world. Degradation was never only a local issue; it had wide and unforeseeable global consequences - such as affecting river flows, rain patterns, increased poverty, migration and inter-group and inter-nation disputes.

MR NORTON said that in spite of 4/5ths of the globe being covered with water, water scarcity was already with us - scarcity both in actual physical terms, in there not being enough drinking water available, and in economic terms in there not being enough to allow adequate agricultural or industrial use. Moreover, scarcity was increasing at a geometrical, not arithmetical rate. Population growth, and increased water demand from agriculture and industry would lead to a scramble and struggle for resources. A sign of hope was that people were now becoming aware of the problem. There had recently been valuable reports, from the UN, from the World Economic Forum, and from McKinsey and the IFC. These reports had recommended the urgent need for water professionals "to think outside the box", i.e. to work hard to inform and persuade politicians and the public about the problems; for

industries, governments and communities to work together; to create incentives to catalyse acceptance of innovative techniques; and to remove institutional and nationalistic barriers. No matter by how much supply was increased and demand restricted, many countries would have a gap between resources and use - for different reasons and on different scales. There was no one solution which fitted all. Only a small fraction of the huge planetary water cycled through rain and the seas resulted in available fresh water supplies, most of it going to sustaining flora and agriculture - (only 0.1 per cent for human consumption). We must understand the concept of virtual water and the water footprint - e.g. UK consumption per head was 4.5 cubic meters, but 2/3rds of that was imported in products - virtual water. Water, energy, and food production were intimately linked and all are forecast to increase sharply by 2030 - food by 45 per cent, water by 4 per cent, energy by 50 per cent - "a perfect storm". Global water security means sufficient affordable drinking water, sustainable supplies for agriculture, integrated water management of resources, strong regulatory systems and incentives for private investment. Water professionals have a key role to play in all these areas.

MS SCHOOLING stressed considering resilience in the light of climate change and demography. Although "peak water" was a concept derived from "peak oil" there was a major difference. Oil is not a renewable resource; water is. So, with water, it is the gap between supply and usage which is crucial. By 2015 2bn people will be suffering absolute scarcity - insufficient drinking water - and 2/3rds of the world's population will be in areas of water stress - insufficient supplies for productive agriculture and industry. Climate change will exacerbate the problems. But, water is moving up the political agenda - she noted Mr. Norton's reference to recent reports from the World Economic Forum and others and the particular interest that the energy industry, who understood the linkage between energy and water were now including water supply in their thinking. But, as Mr. Liu had said, there is no one solution fits all. Each area must be looked at in terms of its own problems. She gave the example of Ho Chi Min City, which lies at the confluence of two rivers. The city suffered seasonally from flooding and scarcity. A well designed water storage system served both to curb floods and to provide reserves for droughts. But in other areas, the crucial policies might be better irrigation methods; conserving ground water; or ensuring that potable water had a high value, so that more of the resource was exploited, demand curtailed and contamination guarded against. Water had no fixed value - value depended on use. So fitting the quality of water to its use was essential; investment in water could then be

made economically, and sources for both human use and environmental use developed. But public participation and understanding, and smart economics were needed.

PROFESSOR WHITTY said that water is the point where many major international development and aid problems intersect, agricultural production, poverty, inequality, security, and industrial development. Intervention in water resources can have major and unpredictable effects both in time and space - i.e. effects may not become apparent for many years, or affect areas far from the intervention and then be suddenly disastrous. One should be cautious about grand schemes, beloved of governments, as their results may be disastrous and irreversible. Water was vital for health. If food supplies were restricted because of water shortage then malnutrition led to an increase in malaria. Communicable diseases spread through both inadequate supplies and, sometimes, major projects such as the Aswan dam, which benefited many but, through spread of disease damaged others. He distinguished between diseases caused by lack of clean drinking water - cholera, those caused by insufficient water to wash food and hands - typhoid and diarrhoea - and those caused through water developments such as Aswan and the Three Gorges Dam - guinea worm and schistosomiasis. The spread and effect of diseases was not universal, but specific to particular areas, e.g. the different effects in East and West Africa of rice farming. Effects were also different in rural and urban areas. In urban areas - and the urban population was increasing - the problems were slums and inadequate sewers, with inadequate water to wash and contamination of drinking water. There were engineering solutions to these problems - if you could pay for them. But with poverty, many could not pay. So there would be complex trade offs between those who could pay, those who would have to subsidize and those who might benefit. The conflicts were not only between states, but also between groups within states, and - as with energy, - between generations. Water stress could well get worse for the poor, and inequality grow, even while society as a whole gets richer. Ultimately, countries have to face the philosophical dilemma - do we seek the greatest happiness for the greatest number, or do we seek to prevent the greatest harm to the greatest number.

Many of the speakers in the following discussion spoke warmly of Mr. Liu's presentation of the Loess Plateau project and strongly endorsed his analysis of the causes of ecological degradation, the need to rebuild biodiversity, biomass, and organic material as the means of reversing the degradation, and his passionate belief that degradation in any one area had global implications. But, questions were raised about the long term viability of the Loess rehabilitation. How susceptible was it to variations in rainfall? How long term were the employment prospects of the inhabitants? Had the population really bought into the project, and was there migration from the area to cities, as in other parts of China? It appeared, however, that, because the soil was now retaining moisture, the area was capable of withstanding drought, and it was able to respond to differing rain patterns in the north and south. It appeared, too, that the population, particularly the younger generation, were enthusiastic about the project and understood its benefits. Inevitably, the older generation took time to change their practices, and understand that it was these practices that had led to the degradation of the area in the first place.

A number of speakers, while not doubting Mr. Liu's analysis, questioned how applicable the Loess solution was for the rest of the world - particularly Africa. Did it not depend, for example, on the totalitarian nature of the Chinese government, the particular structure and culture of the Loess population and economy? Would it apply to a continent of many different tribes and cultures, with, in some areas, rich export trades in agricultural products? However, it could be argued that the Chinese government was not as effectively tyrannical as outsiders might believe. The Loess Plateau population had little contact with central government as suggested, and it would have been very difficult for Beijing to

impose its rule dogmatically on the local communities. The government had taken time to persuade the communities that it was in their interest to change the landscape. A crucial factor was the historical study of the area, the mapping of all possible watercourses and sources and the demonstration that what had existed before could be recreated. So, in Africa, historical study could reveal where vegetation and agriculture had existed (e.g. in the Sahara) and point the way to rehabilitation. Indeed a project in the south Sahara to plant trees; and reclaim the desert was in progress. But progress would inevitably be slow, through cultural differences (a women's job is to plant trees, a man's job is to cut them down), fears of neo colonialism, and tribal divides. Again, in some areas - e.g. Ethiopia - it was necessary to dissuade local people from believing that their situation was hopeless because of lack of rain, when they did have enough rain but did not know how to capture and use it ecologically.

Questions were raised about the possibility of water trading, and the use of water tariffs. Water trading could work, in limited areas, but was unlikely to be effective on an international scale. It had to be managed on a catchment wide basis, and could have perverse effects on the economies of both traders, particularly in increasing inequalities. A more promising way of developing a better system of water usage was through the use of tariffs, which could be structured so as to make it more costly for large users to use water, and, through subsidy, diminish the costs for those in poverty. But such schemes had to run the gamut of political opposition from the rich agriculturists, who would oppose them. In fact, the likelihood of conflict over water would be more likely to rise between groups, than from between nations. While there was no likelihood that a system of international regulation of water resources would emerge, there had been some successful schemes of catchment agreement between states where they shared a river basin - such as the Nile. But these agreements must be flexible, to cope with population movements, and climate the change issue. Indeed, the Nile arrangements were already under threat.

Was it sensible to use water to grow Bio fuels? Using water for any purpose changed its value; if no one put a higher value on potable water than water for growing bio fuels, then it was sensible to use it for growing bio fuels. But that meant more people would do without potable water so it was a question of regulation and pricing to make sure that a proper value was given to potable water. What if water management plans in one region caused degradation elsewhere e.g. the Russian canal that took water away from the Aral Sea? As for degradation - Mr. Liu's view that any degradation had an international effect and should be opposed was widely agreed.

In many cases better use of water depended on effective, transparent regulation and the separation of land rights from water rights. This, in turn, depended on land rights being certain. In many cases regulation was non existent or ignored, land rights were either held commonly or privately. But where misuse led to inadequate supplies, countries should recognize wider costs, such as in health and diseases, and seek to view changes holistically. The ultimate holistic approach was that which Mr. Liu had so forcibly put - human life depends on working ecosystems; such systems require biomass, organic material and biodiversity. If an area suffers such degradation that these systems are threatened or disappear, the consequences will not be limited to that area. The world will suffer. So it is crucial that all of us work to implant an understanding of that danger and how it can be mediated, in all professionals and politicians. It will then be for them to educate the public and ensure a wide degree of public participation in ecological schemes. The public must be driven to accept that long term sustainability means sacrificing short term benefit.

Sir Geoffrey Chipperfield KCB

Useful references and web links are on the next page.

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Useful URLs

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www.arup.com

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www.atkinsglobal.com

Biotechnology and Biological Sciences Research Council

www.bbsrc.ac.uk

Department of Communities and Local Government

www.communities.gov.uk

Department for Environment, Food and Rural Affairs

www.defra.gov.uk

Department for International Development

www.dfid.gov.uk

The Foundation for Science and Technology

www.foundation.org.uk

John D Liu – "Hope in changing climate" film project

www.blog.earthshope.org/about-us/founder-john-liu

John D Liu – BBC World News interview on YouTube

www.youtube.com/watch?v=5SmQV1n99co

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The Royal Academy of Engineering Water Report

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