Water and the Environment
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WATER AND THE ENVIRONMENT CONCLUDING COMMENTS

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The Pontifical Academy of Sciences has created a unique meeting of the world's most distinguished scientists. The Theme of Water and the Environment is multi-faceted – it includes some of the most challenging areas of science, and areas where there is exciting progress to be reported, but also some of the world's most pressing and difficult problems of environmental management.

The meeting has operated on a variety of levels and addressed each of these aspects. At one level, the bringing together of leading experts in adjacent disciplines has provided a unique opportunity for interaction. Individuals will have seen the meeting from different perspectives, but all will have learnt new things and gained new insights and perspectives; for some new collaboration will have begun. This in itself is an important contribution to the development of science.

At another level, the meeting has presented a feast of science. It has focussed on global scales and global issues, and reported important developments in theory and the understanding of earth systems. We have seen the maturing of interactions between hydrology and ecology, represented for example in global models that encompass hydrology, ecosystem response and geochemical cycling.

One of the world's most pressing and politically controversial issues is that of global warming. Here the science presented to the meeting encompassed the assessment of the nature of global warming and the associated global change. On this, the meeting has been unanimous. The clear and unequivocal message is that anthropogenic emissions of greenhouse gases are giving rise to global warming. Climate change is a reality and we have to face the consequences, and adopt appropriate management strategies to mitigate the effects. The major uncertainties concern the

magnitude of future response, 50-100 years hence. Action now will only have benefits on that timescale. And other important policy implications emerged in discussion. For example, it is likely that the single most effective short term contribution to reduction in CO_2 emissions is the reduction of tropical deforestation.

The meeting began with an address by Prof. Ardakanian that highlighted some of the important socio-economic aspects of water, including recognition of the provision of water as a human right. And the closing address by Prof. Falkenmark returned to this theme, stressing the challenge of meeting the Millennium Development Goals for the provision of water and food, and the potential conflict between human socio-economic development and ecological protection. These were management themes highlighted by the meeting, but not addressed in detail. They raise important issues of science, for example the impacts of human activity on changing land use and land management. But these issues of land and water management cannot be resolved without considering the social and economic context. The meeting heard of the deforestation within a generation of 620,000 km^2 of the Brazilian Amazonian rainforest. To resolve these issues raises major social and economic issues. My own current work in the UK focuses on the effects of changes of agriculture on flooding. These changes have occurred in response to agricultural policy and socio-economic forces. Clearly where science informs management, the social sciences are also required to effect solutions.

And finally, to balance the potential conflict between socio-economic development and ecosystem protection, a much closer dialogue is required between hydrology and aquatic ecology. Here important disciplinary differences exist, and the development of an effective common language and the meeting of methodologies has far to go. Interestingly, these challenges are being forced by the European Union through the recent Water Framework Directive. At the European scale, hydrologists are having to recognise the need to communicate with ecologists and to develop effective strategies to balance the conflicts of integrated management.

Much remains to be done to integrate the disciplines of physical, biological and social sciences to meet the challenges of water management and the Millenniums Goals. Perhaps this is one more area where the Pontifical Academy of Sciences can play a leading role.