Report on the First Meeting of the National Focal Points of the IANAS Water Programme

March 12th and 13th of 2005
Colombian Academy of Exact, Physical and Natural Sciences
Bogotá, Colombia

Participants

Alberto Groot Saenz (Empresa de Acueducto y Alcantarillado Bogotá); Daniela Mercedes Arellano Acosta (National Focal Point - Cuba); Dorys Yaneth Rodriguez (COLCIENCIAS); Fernando Urquidi-Barrau (National Focal Point - Bolivia); Gabriel Roldán-Pérez (National Focal Point - Colombia); Hebert Gonzalo Rivera (Focal Point IHP UNESCO - Colombia); Henry A. Romero Pinzón (IDEAM - M.A.); Henry Vaux (National Focal Point – USA); Ignacio Benavent Trullenque (National Focal Point – Peru); Inés Bernal de Ramírez (Academia Colombiana de Ciencias Exactas, Físicas y Naturales); João Bosco Senra (Rede Inter-Americana de Recursos Hídricos); José A. Lozano (Academia Colombiana de Ciencias Exactas, Físicas y Naturales); José Galizia Tundisi (National Focal Point – Brazil); Julio Calderón Artieda (Regional Coordinator for UNEP); Katherine Vammen (Cara Network); Keith W. Hipel (National Focal Point – Canada); Kevin B. McCray (National Ground Water Association); Luis Marin Stillman (National Focal Point – Mexico); Marcos Cortesão Barnsley Scheuenstuhl (Brazilian Academy of Sciences); Maria Del Rosario Guerra (COLCIENCIAS); Moisés Wasserman (Academia Colombiana de Ciencias Exactas, Físicas y Naturales); Oscar A. Escolero Fuentes (UNAM); Yarko Niño (National Focal Point – Chile); Yves Quéré (IAP).

1. Opening Session

The session was inaugurated by Moisés Wasserman, president of the Colombian Academy of Exact, Physical and Natural Sciences at 9:00 a.m. Wasserman welcomed the participants to the meeting and to Bogotá, expressing his honor and satisfaction to host in Colombia the first meeting of the IANAS water programme. He registered the relevance of the water programme and the importance of the presence of representatives from a good number of Academies and governmental authorities. Concluding his remarks, he wished to all a good stay in the country and a most successful meeting. The following speaker was Carmen Helena Arévalo Correa, the Colombian Vice-Minister of Environment. She saluted the present Academies of Sciences and participants, conveying to the floor the government's views on the importance of the meeting. COLCIENCIAS' director Maria Del Rosario Guerra presented a general view of S&T in Colombia, highlighting the importance of international cooperation and the contribution that the IANAS programme could bring to the involved countries. She was followed by IAP co-chair Yves Quéré, who thanked the invitation made to IAP to participate in the meeting. Quéré asserted his contentedness with the launching of the IANAS programme that, in a manner, also represented the launching of the IAP water programme. The session ended with the pronouncement of the two co-chairs: José Tundisi and Luis Marín. Both expressed their satisfaction with the meeting, remembering the initial steps of IANAS and the

water programme and emphasizing the responsibility and role that the programme can play in the bettering of the living conditions of the population of the Americas. A special thanks was made by both to the Colombian Academy of Exact, Physical and Natural Sciences, that so kindly had offered to host the inaugural meeting of the water programme.

2. THE INTER-AMERICAN EXPERIENCE

The idea of this session was to assemble representatives from major regional water programmes and initiatives to share with the national focal points of the IANAS Academies their views and experiences on water research and networking in the hemisphere. The first presentation was made by Katherine Vammen, who is the team leader for CARA (Central American Water Resource Management Network) at the National Autonomous University of Nicaragua. She presented a general overview on the network, which has as main objectives: the enhancement of the capacity of Central American countries to educate and train human resources in the area of hydrogeology and water resource management; the establishment and strengthening of Master's degree programs at the University of Costa Rica, the University of San Carlos in Guatemala, and the National University of Nicaragua; and the linking of institutions in a network of public/private sector professionals and non-governmental agencies. Just the week before the IANAS meeting, CARA held a much successful congress in Managua. Katherine concluded her exposition by declaring her conviction on the importance of the arousing of a regional water programme led by the Academies of Sciences, asseverating that collaboration with IANAS would be most welcome to CARA.

Oscar Escolero from the Universidad Nacional Autónoma de Mexico made the second presentation focusing on the Mexican experience in capacity building in underground water research and management. Demonstrating the overexploitation of the aquiferous over the last decades, he pointed the need for the sustainable use of the underground reserves. To face this challenge, Mexico has invested at the graduate level and the increase of MSc and PhD courses has been significant. Besides supporting the development and strengthening of programmes, regional centers have also been established to network water researchers throughout the country. To cope with the water problem, the Mexican Academy of Sciences created in 2002 the Water Network, which aims at the growth and well being of the citizens and the environment of the world, through the sustainable and integral use of surface and ground water management through science. The AMC Water Network has successfully published the book “Water in Mexico: A point of view from Academy” (with a strong concern on peer review), developed workshops and negotiated scholarships for graduate students from Mexico and abroad. In the area of science education, the Water Network has also accomplished the publishing of “Children’s Letters to Scientists”, besides organizing several conferences. In conclusion, addressing the importance of institutional development, Escolero featured on partnership experiences with the private sector and the development of a consortium of universities to support capacity building of hydrogeologists for the research centers of Mexico.

The following presentation was on the Inter-American Water Resources Network (IWRN), having been delivered by João Bosco Senra, co-chair of the network. Bosco is also the National Secretary for Water Resources, of the Brazilian Ministry of Environment. Bosco explained the functioning of the IWRN as a network of networks, which has as its major objectives: the establishment and strengthening of alliances between countries, organizations and individuals in the area of water resource management; the promotion of education and free interchange of information and technical experiences; and the improvement of communication, cooperation and financial commitment on matters related to sustainable and integrated management of water resources in the Americas. Bosco also lectured on the “DeltaAmerica”, which is a program aimed at the promotion of linkages between the different actions in the area of integrated management of transboundary waters in Latin America and the Caribbean region. The proposal of this

program is to provide information to the major national stakeholders in the area of water management, helping them to analyze and appraise the diverse experiences. The databank developed by "DeltaAmerica" is presently being developed by the different countries, being the Academies invited to interact and participate on this process.

The fourth presentation on this session was delivered by Hebert Gonzalo Rivera, who is the Focal Point for the UNESCO International Hydrological Programme (IHP) at Colombia. He initially presented a general overview of the United Nations, the insertion of UNESCO on this system, the IHP, and more specifically the action of IHP in Latin America and the Caribbean. Basically, IHP is a UNESCO intergovernmental scientific co-operative programme in water resources, acting as a vehicle through which the member States can upgrade their knowledge of the water cycle and thereby increase their capacity to better manage and develop their water resources. The programme aims at the improvement of the scientific and technological basis for the development of methods for the rational management of water resources, including the protection of the environment. As UNESCO's principal mechanism to contribute to the priority issue of water resources and related ecosystems, the IHP strives to minimize the risks to water resources systems, taking fully into account social challenges and interactions and developing appropriate approaches for sound water management. Gonzalo Rivera saluted IANAS' initiative to establish the programme, stating that the regional Montevideo office, headed by María Concepción Donoso, was most open and interested in cooperating with the IANAS programme.

Kevin McCray, Executive Director of the National Ground Water Association presented the subsequent lecture. Founded in 1948 and being constituted by scientists and engineers, academics, regulatory professionals, contractor professionals, manufacturers, suppliers and others with an interest in ground water, NGWA holds as its mission: the enhancement of the skills of all ground water professionals; the development and exchange of ground water knowledge; the promotion of the ground water professions; and the promotion of understanding of ground water. McCray spoke about NGWA's cooperative affiliations with nine other ground water associations around the world, as well as the International Hydrologic Programme of UNESCO. He elaborated on the actions developed by some of these. The 92,000 citation bibliographic database of ground water literature developed by NWGA was also presented as an important asset. This database also includes a USAID WASH database of developing world water and sanitation information and instantly downloadable PDFs of NGWA's journal of *Ground Water*, as well as *Ground Water Monitoring and Remediation*, and selected NGWA conference proceedings. The association also publishes other journals that circulate throughout the world; develops annual conferences; short courses, and trade fairs; presents awards to high school students at international science and engineer fairs; and organizes scientific and technical foreign missions. NGWA also considers very positive the launching of the IANAS programme and is willing to cooperate with the initiative.

Gabriel Roldán, who acts as the national Colombian node, presented the EUTROSUL Network. Recently established, this network that is funded by the Brazilian National Research Council (CNPq) has as its scope: the development of studies aiming at the identification of the major causes of eutrophication; the appraisal of nitrogen and phosphorous discharges contaminating dams, rivers and lakes; the analysis of how aquatic ecosystems react to eutrophication, nutrient concentration, flourishing of cyanobacterias and its effects over aquatic biodiversity; the study of the evolution of eutrophication; the analysis of the accumulation of inorganic nutrients and contamination of sediments of lakes and dams; the use of bioindicators; the study of the economic costs of eutrophication on water treatment and public health; the investigation of the interactions between climatic and hydrologic processes and the eutrophication of lakes and dams; and the study of the impact of algae toxins on aquatic organisms. Roldán explained the network's strategy, based on the enhancement of the exchange of the scientific experiences of researchers and laboratories within the different countries; the development of local capacities for the management of eutrophication; and the increasing of social awareness of the problem. He also called the attention on the

need to identify the different structures used by the countries to deal with this problem, as well as the different contexts in which the phenomena occurs. As stated, the challenge is to enhance capacity, interchange experiences and promote technologies to cope with the problem, making these available to the public and private sectors, via seminars, workshops; publications and technical meetings.

3. COOPERATION AND FUNDING OPPORTUNITIES

This session was organized with the objective of putting together the national focal points of the IANAS water programme and officers from key multilateral organizations/agencies in the Americas to discuss opportunities of cooperation and funding to the IANAS initiative. Although the speakers on this session had confirmed participation, due to last minute problems a few did not show up for discussion. Anyway, the United Nations Environment Programme (UNEP) sent its representative and the Environment Manager of the Acueducto de Bogotá also delivered a presentation on the Colombian experience on water management in the fourth largest city of the Americas.

The session was opened by Julio Calderón, regional coordinator for UNEP in the Americas. Calderón initially described the general mission of the programme, then addressing the actions developed in the area of water resources. The UNEP water policy and strategy focuses on three key areas: assessment, management and coordination of actions. All three components of the water policy and strategy stress the cross-sectoral nature of water issues. One of the goals of the water policy and strategy is to identify and promote the tools that will address the critical water issues facing humanity. UNEP has significantly contributed in the field of water through several activities and projects. UNEP accords high priority in its activities to the protection, conservation and more efficient use of freshwater resources, both for human survival and for the maintenance and protection of ecosystems of value to humans. Priority areas for UNEP include the provision of technical, legal and institutional advice to governments, upon request, in establishing and enhancing their national legal and institutional frameworks. These priorities have guided and will continue to guide the development and implementation of the UNEP water policy and strategy. The primary goals of the UNEP water strategy are: achieving greater global understanding of freshwater, coastal and marine environments by conducting environmental assessments in priority areas; raising awareness of the importance and consequences of unsustainable water use; supporting the efforts of governments in the preparation and implementation of integrated management of freshwater systems and their related coastal and marine environments; providing support for the preparation of integrated management plans and programmes for aquatic environmental hot spots, based on the assessment results; and promoting the application by stakeholders of precautionary, preventive and anticipatory approaches. In pursuit of these goals, the UNEP water strategy is concentrating on the following focal areas: freshwater scarcity and water conflicts between human activities and aquatic ecosystems; land-based sources of pollution and alteration of habitats, and their impacts on aquatic ecosystems; aquatic biological diversity, its functions and the benefits to be derived from a properly operating aquatic ecosystem, and the relationship of that ecosystem with fisheries and aquaculture; resource use and management planning in harmony with economic and social development; knowledge and technology transfer in integrated water management. Calderón concluded his remarks bringing a message from the regional office of UNEP, expressing the openness and interest of the office in collaborating and working together with IANAS.

The last lecture of the day was delivered by Alberto Groot, Environment Manager of the Acueducto de Bogotá. He initially presented a historical perspective of water management in Bogotá, then describing the organization and functioning of the company. Groot explained that Bogotá is located on a region with large water supplies. The Acueducto de Bogota is the largest public services company in the area of water in Colombia. The company invests heavily in supplying water and sewage system to the less favored social sectors of the capital city, assuring well being to a population with more than eight million people

living in Bogotá and in eleven surrounding municipalities. The legalized districts of Bogotá are totally covered by water services, which locate the company among the best in the continent in terms of coverage. The sanitary sewage system covers 94% of the population, while the pluvial sewage system has a 86% coverage. Due to the high implications of water supply and sewage systems, the company has developed a big effort to provide these services - with no type of social distinction - successfully overcoming all technical difficulties. The Acueducto de Bogotá has built a hidden underground city, with more than 15 thousand kilometers of ducts distributing clean water and collecting sewage and pluvial waters. There is a permanent maintenance of channels, rivers and gorges, as well as of 200 thousand wells of sewage system and drains to avoid floods in the urban area. The company has received the National Prize of Engineering in the program of Hydraulic Sectoring, what demonstrates the technical quality of its operation. Another aspect that is a motive for pride is the high quality of the water that is furnished to 100% of the legalized districts of the city.

4. IANAS WATER PROGRAMME: GUIDELINE PROPOSALS (THE VIEW OF THE ACADEMIES)

This session was intended to collect the views and expectations of the members Academies on the programme to be developed by IANAS. Each Academy was invited to make a short presentation focusing on aspects that they considered important to highlight. These could be related to the state of the art of water research and management in their respective countries or to particular problems that should demand the attention of the IANAS programme. The session was opened by Fernando Urquídi, Bolivian focal point, who initially presented a general overview of the actions developed by the National Academy of Sciences of Bolivia in the area of water resources. The Bolivian Academy has already constituted a water committee, which has compiled information and data for the publication of the book "Water in Bolivia: the View of the National Academy of Sciences". The Academy participates in the National Water Council, which is a body of the Ministry of Sustainable Development of Bolivia. It also has been active in advising the Ministry of Foreign Affairs in issues related to the Mauri-Maure River, a transboundary river cutting both Peru and Bolivia, and in problems associated to transboundary groundwater aquifers. Urquídi pointed the lack of international laws regulating the international aquifers as a problem that demands a greater attention of governments and policy makers. He then discussed the major water resources management problems in the Bolivian frontiers, focussing on both surface and ground waters. In closing, Urquídi demonstrated how climate change throughout time influenced in the composition of water resources in the Southern hemisphere.

The second Academy to present its views was the Royal Society of Canada. Keith Hipel, acting as focal point for Canada at the meeting, initially presented a brief geographic description of the country. As for its water resources, Canada has abundant supplies: the five Great Lakes bordering the Canadian province of Ontario and nine American states constitute the largest source of freshwater in the world. Besides, Canada possesses more than 30,000 lakes. According to Hipel, most Canadians feel that water is an integral component of Canadian culture. He then talked about the problems associated to the country's water supplies. In the past the Great Lakes have been polluted from the heavy industrial and agricultural enterprises located in the Great Lakes basin, but fortunately nowadays much of the pollution has been removed. The Prairie provinces, consisting of Alberta, Saskatchewan and Manitoba, are heavily dependent upon water supplies from the North and South Saskatchewan Rivers and other rivers which are fed by glaciers in the Rocky Mountains. Because of climatic change, the glaciers are retreating and in the future may not be able to furnish sufficient water. Moreover, before reaching Lake Winnipeg, as the rivers flow from west to east, there are large water withdrawals along the way. In fact, there is the potential that Lake Winnipeg could become an ecological disaster just like the Aral Sea in Asia. Because the North of Canada receives little rainfall, it can be regarded as a desert, even though the long winter months are extremely cold. Many of Canada's rivers flow north to the Arctic Ocean and Hudson's Bay where few people live. In

fact, the majority of Canada's population lives within 100 km of the American border. Hipel then discussed the uses of water. Dams and associated reservoirs have been constructed on many of Canada's major rivers for multipurpose uses but especially for the generation of hydroelectric energy. Large reservoirs constructed as part of the James Bay project in Northern Quebec have flooded huge areas for the sole purpose of electricity generation and this is of great concern to environmentalists. Nevertheless, Canadian engineers have done an admirable job in harnessing Canada's freshwater to benefit its citizens. The ten provinces in Canada possess a considerable amount of political power and their provincial agencies dealing with water overlap in jurisdictional responsibilities with Federal agencies. Due to Canada's developed capacity in water management, Hipel said that the country could much contribute to capacity building in the hemisphere. The harnessing of Canada's water resources has led to the development of extensive management expertise in Canada's educational institutions. For instance, most major Canadian universities have many courses and research activities related to water in departments such as Civil Engineering, Geography, Biology Earth Sciences, and Systems Engineering. Hence, there is great potential for cooperation between Canada's universities and technical colleges with similar institutions elsewhere in the Americas. Students from American countries would be welcome to pursue degrees in water resources in Canada, and Canadian teachers and researchers could carry out joint teaching and research projects with colleagues and students from the Americas. Canadian consulting engineering companies are also highly competent in their knowledge about water and would be in a position to contribute to the development of water projects in American countries. In closing, Hipel focused on the management of transboundary water resources. As an example, he talked about the Boundary Waters Treaty between Canada and the United States, created in 1909. The implementation body for this treaty is the International Joint Commission (IJC). When a problem over water quantity or quality arises, the two countries can call upon the IJC to study the problem and come up with a recommended solution for their consideration. According to its mandate, the IJC must make an unbiased recommendation which benefits both sides as much as possible. When carrying out a study, the IJC utilizes key experts from both countries including scientists, engineers, economists, and social scientists, in order to arrive at a beneficial and fair recommendation. Recently, the IJC recommended that water not be exported in bulk quantities from the Great Lakes unless it can be proven that ecological systems are not harmed. However, if water were exported just once in bulk quantities, under Chapter 11 of the North American Free Trade Agreement (NAFTA), private water-exporting companies could argue that they should be able to export water from the Great Lakes and elsewhere. Hipel understands that researchers connected to IANAS may wish to examine conflicts arising over trade versus the environment and develop sound policies and international treaties to promote sustainable development in the Americas. The Boundary Waters Treaty of 1909 could act as a model for creating bilateral and multilateral agreements over water among countries in the Americas.

Yarko Niño, national focal point for Chile, focused his presentation on environmental engineering and the use of water resources in Chile. He initially illustrated his talk with several examples on how has development imperiled the environment and water resources in Chile. Several are the causes of environmental stress, being cited as examples: problems caused by the mining industry in the northern region of the country; anthropogenic impacts on coastal wetlands; impact generated by hydropower plants on river ecology; discharge of pollutants in surface waters; eutrophication caused by the pressure of tourism; and impacts of aquiculture in southern Chile aquatic systems. To cope with these problems, science and engineering are called for action. As an engineer he stressed the need to conciliate development and environmental protection, which demands tools to estimate the impacts of human activities on the environment and to support decision making regarding the management of natural resources. Focusing on the impacts caused on water resources, he identified as major problems: flow rate reduction and change of natural flow regimes and time scales; changes in stream geomorphology and bed sediment size characteristics; the reduction of groundwater levels; nutrient, organic matter and contaminant load increase and oxygen level decrease in streams and groundwater; trophic level increase in

lakes, reservoirs and coastal zones; and changes in biodiversity and balance alteration of aquatic ecosystems due to habitat destruction, changes in flow rate regimes and changes in water quality and presence of contaminants. As a proposal, Niño claimed the need to foster multidisciplinary research and the integration among the existing centers aiming at the development of scientifically sound models to assess the impact of human activities on the aquatic environment and at the development of tools to support decision making based on these models.

The next presentation was delivered by Daniela Mercedes Arellano Acosta, focal point of the programme in Cuba. She initially talked about the problems related to water management that are commonly faced by the least developed countries. Among these, Mercedes Arellano highlighted: the lack of networks for the monitoring of the variables of the hydrological cycle, or networks that do not take into account the spatial (and temporal) variability of the hydrological processes; the development of temporal series of variables (such as volumetric, evaporation, precipitation) with insufficient length; inadequate treatment of the hydrological data; calculation methodologies that do not consider all of the properties that are intrinsic to the geologic environment through which underground water flows; different approaches in the calculations on infiltration on the aquiferous; and limited investment in capacity building. The reported availability of hydrologic resources are not reliable and comparable. This situation is worse in transboundary basins. She then demonstrated the effort developed by Cuba to recover land coverage and the action developed by the government in the building-up of dams as a solution to regulate surface runoff to face extreme hydrologic phenomena such as draughts and floods. Considering the country's hydrologic potential, Mercedes Arellano demonstrated how Cuba manages in a sustainable manner its water resources. As concluding remarks, she talked about the role that the Academies can play in promoting research and knowledge generation, supporting the training of researchers and managers, and promoting international cooperation for the interchange of knowledge and experts.

Gabriel Roldán, the Colombian national focal point to the programme, discussed on his presentation the use of aquatic macroinvertebrates as bioindicators for water quality. This is a simple method for the evaluation of water quality that can be used complementarily to other commonly used physicochemical and bacteriological procedures. Basically this method consists of the analysis of the macroinvertebrates found in freshwater. When analyzing water, if macroinvertebrates like may flies, cadisflies or stone flies are found, this means that the water is of good quality. If leeches and molluscs are found, you can conclude that the water quality is not so good. But if you find mud worms - that live in organic material - in the examined water, you can be sure that this water presents a high degree of pollution. Numerous groups of organisms have been used in the elaboration of indices of detection of the biological quality of water. The reasons why macroinvertebrates were elected are several: size (since they can be easily observed); relative facility of identification; heterogeneity; and long vital cycles in comparison with those of other freshwater organisms like algae and bacteria. In short, all these characteristics make macroinvertebrates a very reliable group to evaluate the biological quality of water. Roldán explained also the Biological Monitoring Working Party (BMWP) method, which was developed in England in the 1970's and adapted for Colombia by Roldán (2003). The method is based on a 10-1 scale that reflects the tolerance of the different groups of macroinvertebrates to pollution. Families with scores of 10 means the best water quality; as this number goes down, the water quality is decreasing until a very critical condition. This is a very simple and inexpensive method that can be of big use to Latin-American countries as a whole. An important aspect is that every region must have keys for their own organisms since they vary specially with latitude.

Following the presentation of the Colombian Academy, Ignacio Benavent, national focal point from Peru, delivered his talk, focusing on the use of ground water in Peru. Initially he showed the distribution of water in the country, which withholds 4.6% of the world's surface water supplies. Notwithstanding, these supplies lie inland, far from the coastal region where most of the population live. The coastal region is

arid, receiving most of its water from 53 river basins of seasonal regime. Of these, only 8 assure water all and every year around: in millions m^3/year, Puyango-Tumbes (3.03); Catamayo-Chira (3.70); Santa (4.99); Pativilca (1.55); Cañete (1.84); Ocoña (2.68); Majes-Camaná (2.84); and Tambo (1.25). The agriculture is developed in the irrigated areas of these rivers, nevertheless the necessary water supply would have to be transferred from the western rivers with permanent fluvial regime towards other dry basins, building dams, intakes and great channel networks, or transported from the eastern river basins through the Andes. But the development of these projects are extremely expensive (specially due to the Andes), being these responsible for a significant part of the present external debt of Peru. For example, the Chira-Piura irrigation investment surpasses US$1 billion. Benavent explained that historically these projects, designed mainly for irrigation, have been conceived by the government with a noticeable social consideration, but many times they leave aside economic and technical aspects. Most of the farming is directed to the production of cultures of immediate yield (cash crop), with excessive rates of irrigation and old fashioned technologies. There is little investment in agro-industrial cultures of export, of high economic performance, although this is increasing. The use of great amounts of water, together with deficient systems of drainage, has produced the salinization of vast coastal areas, producing irreversible situations due to the high costs of recovery. As a solution, Benavent proposes the articulated use of both surface and ground water. The problem is that although groundwater is widely used in Peru, the legal framework regulating its use - and even the awareness of its importance - is quite limited. Information in groundwater is little, having the first national hydrogeologic map been drawn only in 2004. There are elevated scientific hindrances due to the small number of hydrogeologists and PhDs, besides the fact that there is no teaching of hydrogeology in the Peruvian universities as a specific career. One reason for the small groundwater scientific activities is their cost: the groundwater researching requests a suitable network of sample points that allows to collect enough information such as hydrochemical, isotopic, water depth, in addition to hydrological and geological aspects, in order to reach the acquifer knowledge. Benavent presents as a positive aspect the fact that Peru develops intense mining activities that, in a way, relates itself with very interesting information useful to the aquifer researching. As major challenges, Peru demands: the establishment of graduate courses and research activities in the area of hydrogeology; enhancement of the awareness on groundwater; the development of studies on the aquifers applying not only the classic hydrologic techniques but the isotopic techniques as well, and private and public comprehension on the need to finance these actions.

The last national focal point to deliver its presentation before the proposition of the outline of the programme by the co-chairs was Henry Vaux, representing the US National Academy of Sciences (NAS). Vaux initially made a brief history of the NAS, which had its origins in the 1860s during the administration of President Abraham Lincoln. The purposes of the Academy were two: to advance science and technology; and to advise the national government on policies governing the establishment and operation of scientific institutions and to provide scientific advice on a broad range of public policies. Ultimately, the National Academy of Sciences grew into a complex which included the National Academy of Sciences (1863), the National Academy of Engineering (1964), the Institute of Medicine (1970) and the National Research Council (1916). Vaux then talked about the National Research Council (NRC), which is the operating arm of the National Academies and was created by President Woodrow Wilson in response to the threats of World War I. The NRC develops much of the scientific advice offered by the Academies through the use of expert committees. The processes governing how the Committees are appointed; their operations; and the publication of results are carried out under the supervision of one or more of the 100 Boards that are housed within the NRC. The Board whose responsibilities are most directly of interest to the members of the IANAS Water Programme is the Water Science and Technology Board (WSTB). Over the years, Committees appointed and overseen by the WSTB have produced reports in fields such as: 1) Water Services; 2) Hazardous Waste Clean-up and Water Quality; 3) Aquatic Ecosystems and Watershed Management; and 4) Hydrology. Other Boards and offices of the NRC whose focus is on international matters have also been involved in the development of a series of workshops on

improving the scientific bases for decision making in countries whose economies and scientific capabilities are growing. Examples include a Workshop on Ground Water Management organized collaboratively with the Mexican Academy in 2004; a Workshop on the Management of Hazardous and Toxic Wastes organized collaboratively with the Chinese Academy in 2004; and a Workshop on Agricultural Water Management to be held in Tunisia in Spring. 2005. As his concluding remarks, Vaux said that the U.S. National Academies wishes to be supportive of the IANAS Water Programme in ways that are both appropriate and helpful. The kinds of activities that might be considered include: workshops on science-based decision making—these could be bilateral or multilateral; and joint studies of common problems. Examples of the latter are a joint study of water supplies for Mexico City, completed in the mid-90s and a recently conducted workshop between the National Academies (USA) and the Mexican Academy of Sciences. The subject of the workshop was "Science-Based Decision Making for Sustainable Groundwater management". It was held in February, 2004, in Merida, Yucatan, Mexico. The report is currently in review, and it will be published both in English and in Spanish.

After the exposition of the views of the national focal points, the co-chairs presented their perspectives on what should be the design of the programme. In a manner, the presentations delivered by Luis Marin and José Tundisi reflected the proposals previously distributed for discussion, but both co-chairs tried to incorporate on these the discussions held during the first day of the meeting. Marin, co-chair of the IANAS water programme and representative of the Mexican Academy of Sciences, initially remembered the issuing, in 2000, of the United Nations Millennium Statement, establishing as an objective the eradication of extreme poverty suffered by one out of six human beings in the planet. This is a reachable goal if, by the year 2015, access to a safe water supply and sufficient food can be guaranteed for all. He illustrated the viability of this goal by showing a study developed by the World Bank that clearly associates the increase of rainfall with the growth of gross domestic product. Marin also demonstrated the ratio between water supply and the sanitation gap in 2000 and the projected evolution of this to 2015, when this gap can be significantly reduced. He then presented the TWAS perspective to the building of scientific capacities. On this sense he highlighted: the need to create and strengthen centers of leadership and excellence (such as the UNESCO centers in Colombia, Chile and Panama); the importance of supporting fellowships, associateships and training programs; the significance of promoting scientific and technological cooperation in the South; the advantages of publicizing and sharing success experiences; the need to develop interdisciplinary panels of experts in the South; the challenge of creating and supporting merit-based Academies of Sciences in the South; and the importance of mobilizing expatriates and institutions in the North. As a general proposal for a plan of action, Marin suggested: the organization of a catalog listing the centers of excellence in the South; the elaboration of a report on water in the Americas; the discussion of issues related to water economics in the Americas; and the development of an outreach program. As international science projects that could be coordinated by different Academies, he identified: eutrophication (Brazil); groundwater (Mexico); mega-urban hydrology (Colombia); water-environment interactions (Chile); water monitoring – quality/quantity (Cuba); surface/ground water interactions (Peru); bioindicators (Colombia); and evaluation and groundwater management in Central America (Nicaragua, Guatemala, Costa Rica). Marin then presented some additional thoughts on capacity building, where he stressed: the importance of networking; the need to publish in English; the possibility of having some large universities encouraged to offer training opportunities; the benefit of having external reviewers for PhD exams; the development of professional internships and of a graduate student mobility program. He also talked about the hydrologic cycle and the need of raising the awareness of groundwater, listing some important meetings that will take place in the coming months. On this topic, one possibility that should be considered is the issuing of a IANAS statement stressing the importance of groundwater. Marin also expressed some issues that the programme should consider: need of a steering committee; definition of what constitutes a local IANAS initiative; importance of establishing short term, mid-term and long-range goals; and identification of permanent observers to be invited to the programme, which could help in funding. As his concluding remarks, he emphasized: the importance of establishing rules of procedures to

assure transparency; the positiveness of adopting formal peer-review to strengthen credibility; need to improve communication among the focal points; possibility of stimulating Academies to establish national water committees to work with the focal points; and the establishment of regional working groups that would work on specific topics of interest.

The last presentation on this session was delivered by the José Tundisi, co-chair of the IANAS water programme and representative of the Brazilian Academy of Sciences. As a background to his proposal, he presented the major challenges for development, based on the Millennium Goals: reduction of poverty; increasing food supply; providing energy services without environmental degradation; development of healthy urban environments, and providing access to water to meet basic human needs. Presently, a large percentage of the human population lives under water scarcity or stress and this number will increase significantly in the next decades if no action is undertaken. To cope with this problem, the Academies should develop a programme that integrates theory, research, management, education and community participation. Tundisi proposes two foci for the programme: eutrophication and contamination. He justifies this option alleging that eutrophication is a key environmental problem worldwide, which is the result of years of waste water discharge from urban and rural areas without any treatment, affecting both surface and ground waters. The consequences of eutrophication are several: it impairs water quality; increases the cost of water treatment; increases problems of human health and water borne diseases; has an economic impact on the lakes, rivers, reservoirs, underground waters; and decreases availability of clean water. He emphasized that the scientific basis to understand eutrophication processes needs to be expanded, specially in tropical and sup-tropical regions. As for contamination, another serious global environmental threat also affecting surface and underground waters, this is a problem that severely impairs the health of human beings and organisms, presenting high treatment costs and affecting water availability. It is important to better scientifically understand the linkages between contamination and human activities, as well as the chronic and acute effects of toxic pollutants such as pesticides, herbicides and heavy metals. Besides the research component, Tundisi proposes a strong emphasis in the training of water resources managers. The major challenges that are presently faced by managers are: water management in urban and rural areas; protection, conservation and recovery of water sheds; increasing public awareness on water treatment; decreasing the costs of water treatment; integrating quantity, quality and water management; reducing risks for human health; designing more adequate, safer and economic water projects; improving systemic view, integrating surface and underground waters in a watershed approach; and improving industrial and agricultural capacity for recycling and water economy. He suggests the adoption of a new management perspective, where water quality and water quantity should have an equal attention. A watershed approach is fundamental to improve management of surface and underground waters. It is vital to emphasize that capacity building must encompass training of managers and decision makers with an integrated, predictive and watershed approach, and with an understanding of the research basis, global, regional and local problems. As part of the framework for improving the development of human resources and the integration of research & management, it is necessary to implement International Training Centers (ITC). Such centers will act as nuclei for training, development of new technologies and field facilities for case studies. These centers will be linked throughout a network that will provide a facility for exchange of programs, scientific data, research information, and training programs. ITC's will have the task to draw attention to the water problems of the Americas in an integrated approach, placing together scientists and managers that will address the pressing problems of water supply and, at the same time, produce advanced scientific knowledge. ITC's will also stimulate publications and enhance activities for public awareness. They will address managers and scientists in specialized training modules, working in cooperation with local and regional Universities. Via cooperation with other international centers worldwide, ITC's will secure a network of high quality institutions, stimulating advanced scientific research. This programme will enhance partnerships between public and private institutions, integrating climatology, hydrology, hidrogeology, limnology and research, development and innovation. Tundisi concluded his talk by saying that presently there are several

programmes dealing with water issues, through a wide range of approaches. A major problem is the lack of integration among these different programmes, which leads to an inefficient duplication of efforts. This is caused by a focus on limited aspects of the problem as well as too much disciplinary research that impairs a systemic approach and makes difficult the transference of technology, delaying innovation. The proposed programme brings an innovative approach, representing a new step forward on water research and management. This is a relevant contribution of the IANAS water programme to international scientific debate and knowledge.

5. PLAN OF ACTION

The final session of the meeting aimed at the definition of the general outline and plan of action of the IANAS water programme. Based on the discussion held, in the following weeks the co-chairs will work together in the final draft of the programme. This will articulate the views expressed by the Academies and integrate the different proposals, consolidating a strong and vigorous programme.

As of the general outline, it was agreed that the IANAS programme will operate under a systemic view, which integrates surface and underground waters in a watershed approach. Water quality and water quantity will have an equal attention in the design of the programme. This approach is considered fundamental to improve the management of both surface and underground waters. It is vital to emphasize that capacity building must encompass the training of managers and decision makers with an integrated, predictive and watershed approach. Training shall be based on research and on the study of global, regional and local water problems.

A strategic goal for the programme is to ensure that water resources decision makers have adequate and consistent information that will enable them to enhance the optimization of the multiple uses of water resources at national and regional levels. Expected responses are: the integration of research, management and training; education of mid level water resources managers and governmental authorities; and building up of an improved capacity to predict changes at local, regional and global levels. These will enhance the understanding that is necessary to protect water resources and to manage freshwater ecosystems (surface and underground waters) in the Americas.

Presently there are several programmes dealing with water issues, through a wide range of approaches. A major problem is the lack of integration among these different programmes, which leads to an inefficient duplication of effort. This is caused by a focus on limited aspects of the problem as well as too much disciplinary research, which impairs a systemic approach and makes difficult the transference of technology, delaying innovation. The proposed programme brings an innovative approach, representing a new step forward on water research and management. This is a relevant contribution that the IANAS water programme can bring to international scientific debate and knowledge.

The IANAS water programme will initially have three major foci: eutrophication and contamination; groundwater; and urban water cycle. These do not exclude other topics or initiatives and will have as a unifying backbone the capacity building component. Capacity building will be developed via the implementation of International Training Centers (ITC's) that will act as nuclei for training, development of new technologies and field facilities for case studies, offering short courses, seminars and field visits, and stimulating publications and activities for the enhancement of public awareness. ITC's will address managers and scientists in specialized training modules, working in cooperation with local and regional universities. Via cooperation with other international centers worldwide these centers will secure a network of high quality institutions, stimulating capacity building and advanced scientific research.

Other topics were also identified as issues that called for attention and could be dealt through the organization of specific workgroups, seminars or workshops: surface/ground water interactions; innovation & technology transfer; transboundary waters; use of bioindicators for measuring water quality; and coastal water management. Academies are invited to propose to the co-chairs the organization of initiatives, however funding will be of the responsibility of the proposing Academy, together with the other Academies involved in the project.

The programme will also promote publications focussing on water issues in the Americas. As initial proposals the following possibilities are foreseen: "Water in the Americas" and Water Economics for the Americas".

The IANAS water network will also motivate researchers to publish in English, stimulate the use of external reviewers in PhD exams, encourage larger universities to offer training opportunities (PhD and MSc fellowships), and stimulate professional internships and graduate student mobility programs.

As a strategy to strengthen the network and assure continuity in representation, the meeting also recommends the member Academies to establish water committees that would support the national focal points in the programme. Currently, the following academies have water committees: National Academy of Sciences (USA), Mexican Academy of Sciences, Brazilian Academy of Sciences, Bolivian Academy of Sciences, Cuban Academy of Sciences. Both the Royal Society of Canada and the Colombian Academy are considering establishing said committees. An effort will also be developed to stimulate IANAS Academies not yet engaged in the water programme to indicate a focal point. In the case of countries that do not have a Science Academy or still are not IANAS members, participation will be stimulated with these countries participating as observing members in the programme. This was understood as important not only as a mechanism for the strengthening of IANAS, but also as a possibility for the programme to contribute to networking and the development of sciences in the hemisphere. It was noted that the Capacity Building Programme of both IAP and TWAS could possibly support the participation of representatives from these countries in future meetings. According to the focal point from the US, the NAS could also be open to collaborate on this sense.

Finally, the programme shall also seek for funding opportunities in the near future. The Global Environmental Facility (GEF) was mentioned as a possible partner that should be sought. The co-chairs should also discuss other possibilities such as UNESCO, IDB and OAS.

NEXT MEETING

The date of the second meeting of the IANAS Water Programme was not settled, but the co-chairs will discuss with the national focal persons the best opportunity for the next encounter. The following countries offered themselves to host the coming meeting: Cuba, Mexico and Nicaragua.

The meeting was successfully concluded at 5:30 p.m.