I. INTRODUCTION

1.1 Background

Between December 1991 and May 1993 torrential rains occurred in the middle and lower basins of the Paraná River, and between March and May of the latter year the same thing happened in the middle and lower basins of the Paraguay River, causing extreme flooding in Argentina, Brazil, and Paraguay. The floods seriously damaged the socioeconomic infrastructure of the region affected and forced the evacuation of more than 100,000 people in the Argentine provinces of Buenos Aires, Chaco, Corrientes, Entre Ríos, Formosa, Misiones, and Santa Fe. In Paraguay more than 70,000 people were evacuated from the cities of Asunción, Concepción, Alberdi, and Pilar. In Brazil torrential rains and floods in these basins forced the removal of thousands of people, besides causing serious economic damage. In all three countries the capital losses and the losses of production and service capacity were considerable, especially in such important sectors as agriculture, energy, and transport. In 1993 the flooding of the Mississippi River basin in the United States, apart from its impact on the health and well-being of the population affected, caused losses exceeding US$12 billion.

In view of this background, the Department of Regional Development and Environment (now the Unit of Sustainable Development and Environment) of the Organization of American States (OAS), with the support of the Brazilian Ministry of the Environment, Water Resources and Legal Amazonia and of Itaipu Binacional, decided to hold the Seminar-Workshop on Reduction of Vulnerability of the Agricultural, Energy, and Transport Sectors to Floods in River Basins, which took place from November 29 to December 1, 1995, in Foz do Iguaçu, Paraná State, Brazil.

1.2 Objectives of the Seminar-Workshop

The main objective of the Seminar-Workshop was to evaluate the results of the work done by various countries in the hemisphere to mitigate the effects of flooding in river basins and its interrelations with basin-management programs, and to examine and agree upon activities susceptible to hemispheric cooperation. Some of the more specific objectives were the following:

- To examine the applicability and usefulness of various mechanisms for reducing the impact of floods and define an action plan that would incorporate them:
  - into environmental impact studies;
  - into the formulation of new investment projects; and
  - into post-disaster reconstruction activities.

- To identify possible activities for hemispheric cooperation and exchanges of information and experiences.

1.3 Progress of the Seminar-Workshop

The opening ceremony was presided over by Paulo Alfonso Romano, Secretary of Water Resources of Brazil. Brazílio de Araujo Neto, Director of Brazilian Coordination of Itaipu Binacional, welcomed the participants and stressed the importance of the Seminar-Workshop and the support of the General Secretariat of the OAS and of the Brazilian Ministry of Environment, Water Resources, and Legal Amazonia in bringing it about. He ended by speaking of the activities of Itaipu in the regional context of the Plata basin, especially in relation to the environment.

Next, Newton Cordeiro, Chief of the South American Area of the DRDE, expressed the pleasure of the OAS General Secretariat in being able to support the Seminar-Workshop, which gathered together specialists of great experience in dealing with one of the topics of high priority to the OAS. He said that, in general, demographic pressures and other demands on natural resources in Latin America increase its vulnerability to the effects of floods and other natural resources, and furthermore that the supply of food, energy, and shelter for the socioeconomic infrastructure and the satisfaction of other basic needs requires protection against natural hazards if it is to be maintained in a sustainable manner. He went on to say that floods, landslides, earthquakes, and volcanic eruptions are natural events that are quickly forgotten even though they are among the environmental management topics facing the hemisphere, and that natural disasters are no more "natural" than the degradation of ecosystems through pollution and overuse; both are to a great extent a result of the way in which the countries' populations interact with their physical environments. He recalled the objectives of the Seminar-Workshop and thanked the Brazilian Secretariat of Water Resources and Itaipu Binacional for their valuable collaboration.

In concluding the opening ceremony, Mr. Romano congratulated the OAS General Secretariat for organizing the Seminar-Workshop and recounted the development of water resources in Brazil, in particular the creation of the ministry dealing specifically with this matter and the law establishing the legal and institutional framework for water. He also mentioned the economic importance of water use, the problems connected with its management, and the creation of the National System of Water Resources Management. He stressed the importance of democracy to the full development of water resources, multiple use of these resources, and the program of the Committees on Hydrographic Basins, in which the states of the Brazilian federation participate actively. He showed how important dialogue and discussion are in resolving problems and conflicts, including those concerning floods, and how the Brazilian Government is giving increasing attention to the presence and participation of citizens in decision-making. An example of this is the creation of the Citizens' Movement for Water. Finally, he thanked the participants from Argentina, Bolivia, Canada, Colombia, Ecuador, Paraguay, Peru, the United States, and Venezuela and those from the Global Environment Facility, the United Nations Environment Program, and the OAS for their presence in Foz do Iguaçu.

The agenda appearing in Appendix 1 was then approved by the participants, who are listed in Appendix 2. The two topics of the Seminar-Workshop were thereupon considered by means of presentations, panelists' comments, and general discussion.

Topic 1: RECENT EXPERIENCES IN FLOOD IMPACT ON THE AGRICULTURAL, ENERGY, AND TRANSPORT SECTORS IN RIVER BASINS

Presentation: "The Largest Floods in the Plata River Basin"

Víctor Pochat - National Director of Water Resources, Buenos Aires, Argentina.

Panelists:

Gilberto Canali - Superintendent of Environment, Itaipu Binacional, Foz do Iguaçu, Paraná, Brazil.

Christopher Ungate - Water Resources Management Group, Tennessee Valley Authority, Knoxville, Tennessee, United States.

Luz Helena Abello - Colombian Technical Unit/OAS Technical Cooperation Projects, Bogotá, Colombia.

Presentation: "The 1987 Disaster in the Limón River Basin"

Julio Lescarbora - Hydrometeorological Adviser, Ministry of Environment and Renewable Natural Resources, Venezuela.

Panelists:

Julio César Fossati - Adviser on problems of the Bermejo y Pilcomayo rivers, Buenos Aires, Argentina.

Paulo Augusto Sanguinetti - Department of Civil Defense Planning, Brasilia, Brazil.

Juan Poveda - Ecuadorian Technical Unit/OAS Technical Cooperation Projects, Quito, Ecuador.

Presentation: "The 1996 Mississippi River Basin Flood"

Gerald E. Galloway - Dean of Faculty, Industrial College of the Armed Forces, Washington, D.C., United States.

Panelists:

Antonio Eduardo Lanna - Professor, Institute of Hydraulic Research (IPH), University of Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

Jeffrey Thornton - Senior Program Officer, Freshwater Unit, United Nations Environment Programme (UNEP), Nairobi, Kenya.

Alejandro Felicia - Chief, Program of Research and Development in Hydrology and Environment, Regional Littoral Center, National Institute of Water Science and Techniques (INCYTH), Santa Fé, Argentina.

Topic 2: RECENT EXPERIENCES IN FLOOD MITIGATION PROGRAMS BEFORE AND AFTER THE EVENT

Presentation: "Flood Mitigation Programs in the Magdalena River Basin"

Hernán Guzmán - Institute of Hydrology, Meteorology, and Environmental Studies (IDEAN), Bogotá, Colombia.

Panelists:

Al Grosboll - Senior Adviser, Office of the Governor of the State of Illinois, Springfield, Illinois, United States.

Luiz Eduardo Ganoia - Superintendent of Administration of the Paraná Waterway, Ministry of Transportation, São Paulo, Brazil.

Ciro Loureiro Rocha - Manager of Water Resources Policies, Secretariat of Urban Development and Water Resources of Santa Catarina, Florianópolis, Brazil.

Presentation: "Flood Control of the Alto Paraná River Basin by the Brazilian Electrical Sector"

Alcides Lyra Lopes - Chief, Division of Hydrology, Department of Planning and Analysis of Energy Operations, Electrobrás, Rio de Janeiro, Brazil.

Panelists:

Luc Mougeot - Senior Administrator, Center for International Development Research, Ottawa, Canadá.

Marco Córdova - Environmental Advisory Commission of Ecuador, Quito, Ecuador.

Patricio Fernández - Director, CIMA Consultants, Santiago, Chile.

Presentation: "Regional Development Plan for Irrigation and Flood Control of the Guayas River Basin"

Félix Cabrera - Manager, Executive Unit of the Guayas Basin, Quito, Ecuador.

Panelists:

Abel Barroso López - National Director, National Commission on the Pilcomayo and Bermejo Rivers, Tarija, Bolivia.

Roberto Moreira Coimbra - Chief, Division of Control of Water Resources, National Department of Water and Electric Power, Brasilia, Brazil.

Roger Amisial - Coordinator, Inter-American Program OEA-CIDIAT, Mérida, Venezuela.

In addition, "General Environmental Considerations in Flood Mitigation Programs" and "A Case Study: The Pilcomayo River Basin" (between Argentina, Bolivia, and Paraguay) were the topics of special presentations by, respectively, Alfred Duda, Senior Environmental Specialist (Water Resources) of the Global Environment Facility, Washington, DC, and Luis Meyer, National Director of the Pilcomayo River Commission, Asunción, Paraguay.

Three working groups were then formed to prepare the conclusions and recommendations for the Final Report of the Seminar-Workshop. They covered the following topics:

- Policy guidelines for reducing vulnerability to floods in river basins.

- Use of information on flood impacts in the preparation of investment projects and in the management and sustainable development of river basins.
- Hemispheric cooperation and exchanges of information and experiences.

After the meetings of the working groups the present Final Report, which contains the principal results of the Seminar-Workshop, was drafted. The Report was analyzed, discussed, and approved by the participants.

In the closing ceremony the results of the Seminar-Workshop were highlighted and the participants were thanked for their valuable presentations, clarifying discussions, and conclusions and recommendations. Thanks were also given to the OAS General Secretariat, for its initiative to hold the meeting, and to the Government of Brazil, through the Ministry of Environment, Water Resources, and Legal Amazonia, and to Itaipu Binacional for its excellent organization.

The participants, for their part, spoke of the importance of the Seminar-Workshop and the timeliness of bringing together specialists from government agencies, nongovernmental organizations, private enterprises, and international organizations to exchange knowledge and experiences on the subject of the reduction of vulnerability in the agricultural, energy, and transport sectors to floods in river basins.

II. Conclusions and Recommendations

1. Guidelines for Policies to Reduce the Vulnerability of River Basins to Floods

Some of the largest river basins in the world are found in the Western Hemisphere. These basins have extensive networks and diverse climatic and biological characteristics. The socioeconomic activities carried out in these basins rely on an infrastructure that includes transportation and communications networks, river-borne navigation, reservoir systems, and energy production and distribution facilities.

The losses from natural disasters in Latin American and Caribbean countries in the last 18 years (1976-1994) have totaled about US$43 billion, an amount equal to all the technical and financial aid received by those countries during the same time period.

Given that there is a strong relation between decreasing the vulnerability of river basins to flood damage, landslides, and other natural hazards and applying the principles of environmental and river-basin management in the context of sustainable development and that the river basin is an ideal and effective geographic unit to use in environmental planning and management of a region, the participants in the Seminar-Workshop recommend the following actions:

- Establish multisectoral river-basin committees with representatives of the agencies involved in the supply, demand, and management of renewable natural resources and water resources to carry out integrated management.

- As part of interdisciplinary programming, include both structural and nonstructural measures in the development of actions to prevent natural disasters.

- Promote and support the development and expansion of environmental information networks to exchange data, methodologies, and procedures among the countries of the region and especially among countries that share river basins.

- Develop national and regional programs to provide information to and increase the awareness of the various groups involved — government authorities, professionals, social leaders, and the society at large — in order to make the decision-making process better and more efficient.

- In planning and carrying out activities in river basins, pay greater attention to the operation, maintenance, and monitoring of the works constructed by means of evaluations of these activities and the reporting of the results.

- Evaluate the degree of vulnerability to flooding so that decisions can be made about mitigation actions necessary to reach acceptable levels of risk in the basin.

- Consider, among nonstructural measures, the following:
  - environmental zoning and land-use planning;
  - the improvement of flood alert systems;
  - the education and training of local community leaders so that they can better deal with the dangers of floods and other hazards;
  - the design of alternative types of infrastructure and housing construction that will withstand certain natural hazards;
  - the relocation of populations and activities situated in areas of unacceptably high risk;
  - the use of flood insurance.

2. Use of Information on the Impact of Floods in the Planning of Investment Projects, Watershed Management, and the Sustainable Development of River Basins

At present, information on the vulnerability and capacity of the social and economic infrastructure of river basins and on installations and equipment is not being obtained or updated, much less used. Nor have local populations been considered or guided with respect to the choice of alternative plans of development and the implementation, monitoring and evaluation of specific policies, programs, and projects to reduce vulnerability to floods and the associated hazards.

Participants in the Seminar-Workshop recommend the following actions:

National Actions

- Adopt more comprehensive, multisectoral watershed management programs, including as a key element programs to reduce vulnerability to floods.

- Invest in the collection of data and the creation of comprehensive information systems that are easily accessible to each level of planning (states, municipalities, water basin authorities, etc.).

- Obtain as detailed and pertinent information as possible from new hydrometeorological stations connected to computerized systems, to establish forecasting models.

- Disseminate the information obtained on recent disasters, which could be used to redesign or adjust projects already in operation.

- Conduct, as high priority, integrated and sectoral projects to identify economically and ecologically homogeneous zones for use in planning development projects, and to identify the most affected sectors and possible mitigative activities.

- Make cost-benefit analysis mandatory, with emphasis on hazard mitigation alternatives, particularly the use of nonstructural measures.

- Find more effective ways to increase public participation, particularly by the population sectors most affected, in decision-making measures to reduce flood vulnerability and cost-sharing.

Multinational/Regional Actions

- Use multidisciplinary and multinational teams of experts to develop basic packages of information about natural resources, and economic and social information to use in the evaluation and justification of investment projects.

- Update by 1998 each country's resource inventories and basin studies, including information on natural hazards, vulnerability of the existing infrastructure, and disaster histories, focusing especially on the agriculture, energy, and transportation sectors, with the support of international organizations (OAS, IDRC, international lending institutions) and non-governmental organizations (NGOs).

- Establish pilot programs in specific basins to document the costs and benefits of mitigation policies, programs, and practices, and their distribution in society, to alert officials and obtain their support.

- Design, transfer, and adopt geographic information systems to compile, update, and analyze data on development practices that contribute to vulnerability to floods, on loss of resources, and on the occurrence of extreme events, to be used in designing projects.

- Develop better methodologies and processes for consultation, agreement, coordination, and cooperation among the diverse sectors of society and for gathering the information

necessary for this purpose and using it to communicate development plans and projects in specific areas.

- Implement a planning process for the management of strategic resources that takes into account the diversity of countries that share river basins.

Actions to Be Taken by International Organizations

- Publish the risk criteria used in the preparation of projects to reduce vulnerability to floods as a condition for approving loans.

- Prepare guidelines based on the available manuals (such as that of the OAS) that are illustrated by regional examples, in order to reduce economic losses due to floods.

- Explore methods of transferring the technology for obtaining, storing, and conserving flood data.

- Set a high priority in the World Bank and the Inter-American Development Bank on the inclusion of programs to reduce vulnerability to floods in the criteria applicable to river-basin management. The World Bank should include this issue as part of the water resource administration strategy it requires countries to prepare. Measures for environmental protection and flood damage mitigation should be mandatory, with a specific percentage of the funds required to be dedicated to vulnerability reduction.

- Develop analysis and training capacity models in the preparation of sectoral basin vulnerability profiles, such as those of the OAS, which should be based on current development programs.

- In close cooperation with national and regional institutions and with the support of the private sector, continue training courses in the use of information on natural hazards for the preparation of investment projects and environmental assessments.

- Include institutional strengthening and the training of staff at all levels, from the local community to the technical specialist and the decision-maker, in programs of assistance on flood hazard mitigation.

3. Hemispheric Cooperation and the Exchange of Information and Experiences

The participants of the Seminar-Workshop, recalling the presentations and the discussions during the meeting, noted that:

- Cooperation and the exchange of information and experiences among the countries of the hemisphere is an important factor in decreasing the vulnerability of the energy, agriculture, and transportation sectors to floods, especially in international river basins.

One example is the Plata Basin, between Argentina, Bolivia, Brazil, Paraguay, and Uruguay, through the Intergovernmental Coordinating Committee (CIC), within the framework of the Treaty of the Plata Basin.

- International cooperation takes place primarily through multilateral organizations, such as the World Bank, the GEF, the OAS, UNEP, the IDB, and UNESCO. Bilateral cooperation and the exchange of information and experiences is promoted by governments, with the technical or financial support of international organizations in some cases. However, guidance and access to information about current financial and technical cooperation mechanisms are lacking.

- The non-governmental community, represented by professional associations and research institutions, among others, has an important role in compiling and disseminating information about floods in river basins.

- There are few operating binational organizations that coordinate and develop management plans for international river basins that include the reduction and/or mitigation of the vulnerability of the energy, agriculture, and transportation sectors.

- There are no simple mechanisms for obtaining the information produced by the numerous organizations in each country on the various aspects of water resource administration. This is an obstacle to the exchange of valuable experiences.

- In most of the countries, a tradition of storing and disseminating the cumulative experiences of floods that affect communities does not yet exist.

- The use of technologies such as geographic information systems (GIS) to identify and monitor flood-prone areas is inadequate.

- The Inter-American Network of Water Resources represents an important regional effort to join governmental, non-governmental, academic, and international organizations, research groups, industry, and private business for the purpose of transmitting and exchanging information and experiences on water resources.

The Seminar-Workshop participants recommend:

- Providing incentives for the creation of basin and sub-basin committees for international rivers to act as mechanisms for facilitating technical cooperation and the exchange of information and experiences.

- Asking international financial and technical cooperation organizations to disseminate information on their programs, on means of access to their resources, and on their technical capacity to support actions that reduce vulnerability to flooding in river basins.

- Identifying new alternatives for international financing, such as swaps of debt for investment and prevention, soft credits for longer terms of amortization and payment, non-reimbursable resources, and so on.

- Promoting and providing incentives for the active participation of professional organizations and other non-governmental institutions in the dissemination of information on floods in river basins compiled and integrated by public entities.

- Establishing binational commissions with technical, administrative, and financial authority with common objectives directed toward the sustainable development of river basins.

- Creating and strengthening data bases of institutional, legal, project, training, and other basic information on water resources management. The information should be easily accessible and periodically updated with contributions from all its users, taking advantage of new archival and communications technologies.

- Promoting seminar-workshops and training courses for the dissemination and application of new technologies, and personnel training at the managerial, technical, and administrative levels in the planning and application of measures to reduce the impact of river-basin floods.

- Proposing an instrument for hemispheric cooperation aimed at the prevention and mitigation of disasters for discussion at the highest level of hemisphere governments, which could be presented at the Bolivia Summit on Sustainable Development scheduled for 1996.

- Encouraging the participation of the hemisphere countries in the Inter-American Dialogue on Water Management and in the Inter-American Network of Water Resources, of which the OAS serves as technical secretariat. The establishment of focal points in each country will facilitate the dissemination in the national territories of the results obtained by this mechanism.

- Using existing international cooperation programs, such as the Horizontal Cooperation Program of the General Secretariat of the Organization of American States, to promote the exchange of specialists and technical experts between the different countries in order to share and transfer technologies used to reduce the vulnerability of the agriculture, energy, and transportation sectors to floods in river basins.