



URBAN FLOODS IN SOUTH AMERICA

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Pantanal during wet season



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- **Urban development**
- **Floods types**
- **Issues on urban drainage floods**
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Pantanal during dry season

Urban development

- High rate of urbanization increase in developing countries, mainly in Latin America where most of the countries are above 75% of Urban population.
- Population increase in the city limits and decreasing downtown due to costs and lack of planning;

City	Population in 1996 Million	Growth rate in the city center between 91 and 96 %	Growth rate at city boundaries between 91 and 96 %
S. Paulo	16,667	2	16,3
R. de Janeiro	10,532	1,3	7,1
B. Horizonte	3,829	3,5	20,9
P. Alegre	3,292	2,0	9,4
Recife	3,258	3,7	7,4
Salvador	2,776	6,6	18,1
Fortaleza	2,639	11,1	14,7
Curitiba	2,349	12,3	28,2
Belém	1,629	-8,1	157,9

Urban development and floods

Most of causes of floods are related to the expansion on urban development:

- Occupation of risk areas: In 15 of January of 2004 46 died due to floods and land slide due intense rain.
- Increasing the impervious areas and canalization

Types of floods

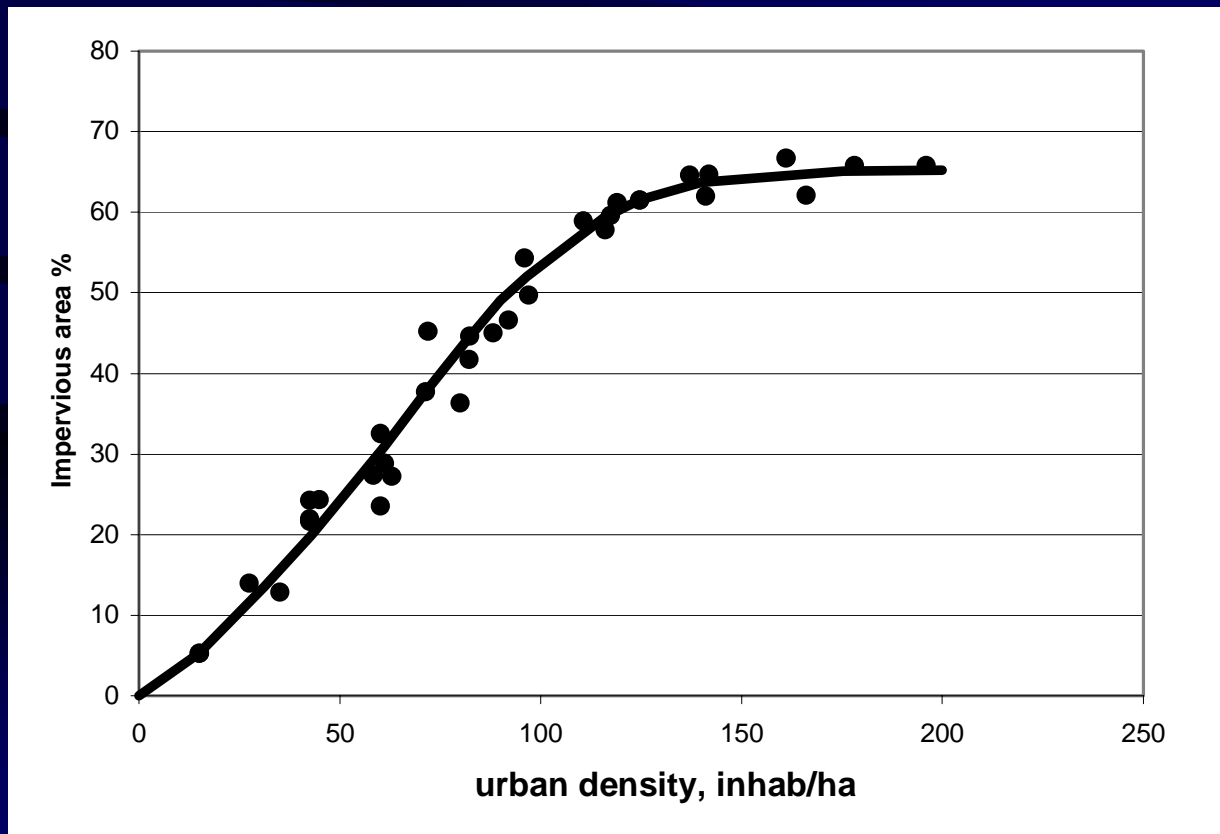
- *Flood plain* are the natural floods in which the impacts are mainly due to the lack of the control of occupation of risk areas;
- *urban drainage floods* are mainly due to the increase of the peak and overland flow after the increase of the impermeable areas and flow velocity on the sewers.

Urban drainage

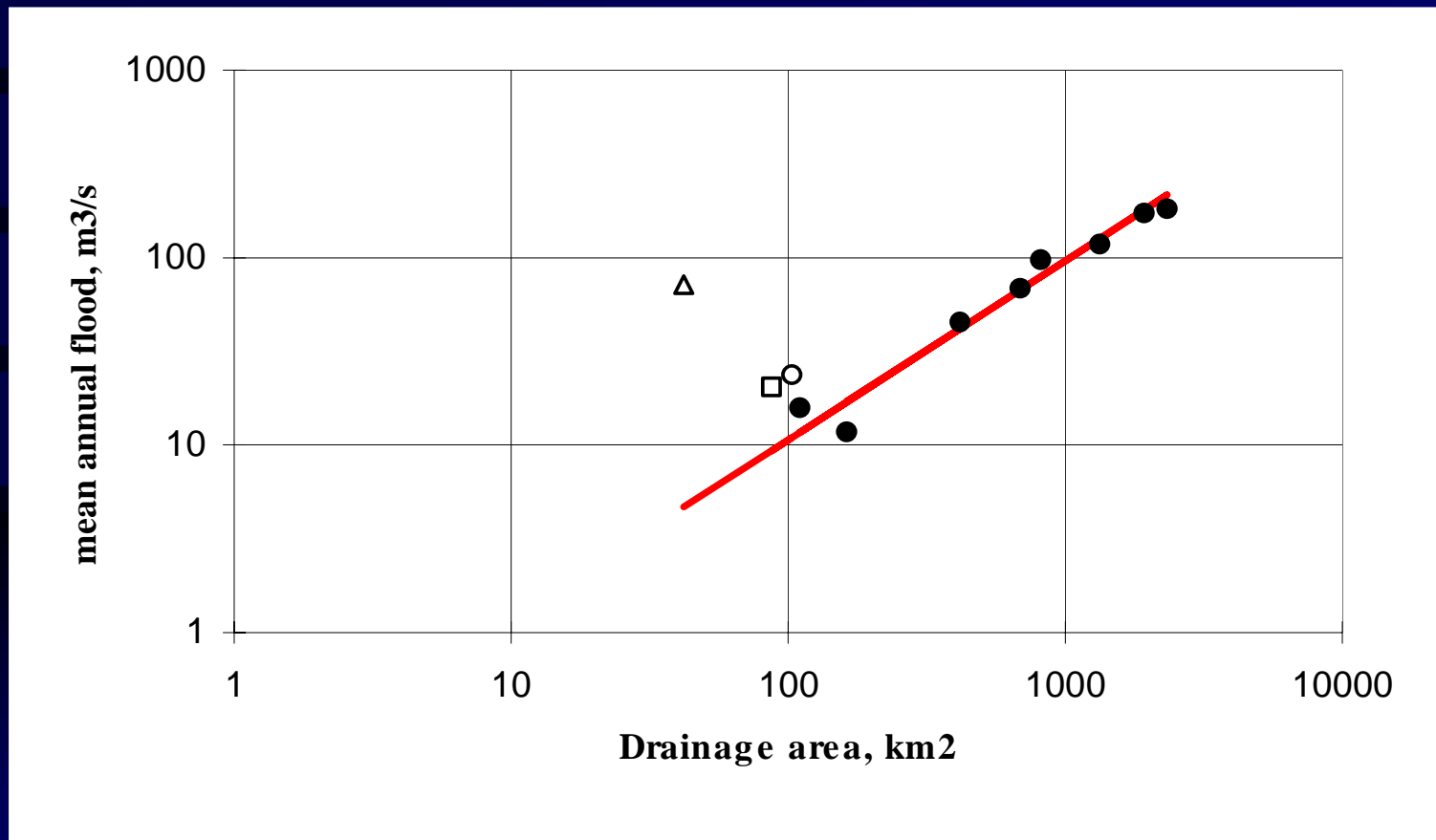
- Flood frequency increase
- Total Solids
- Water quality degradation

Urban density and impermeable areas

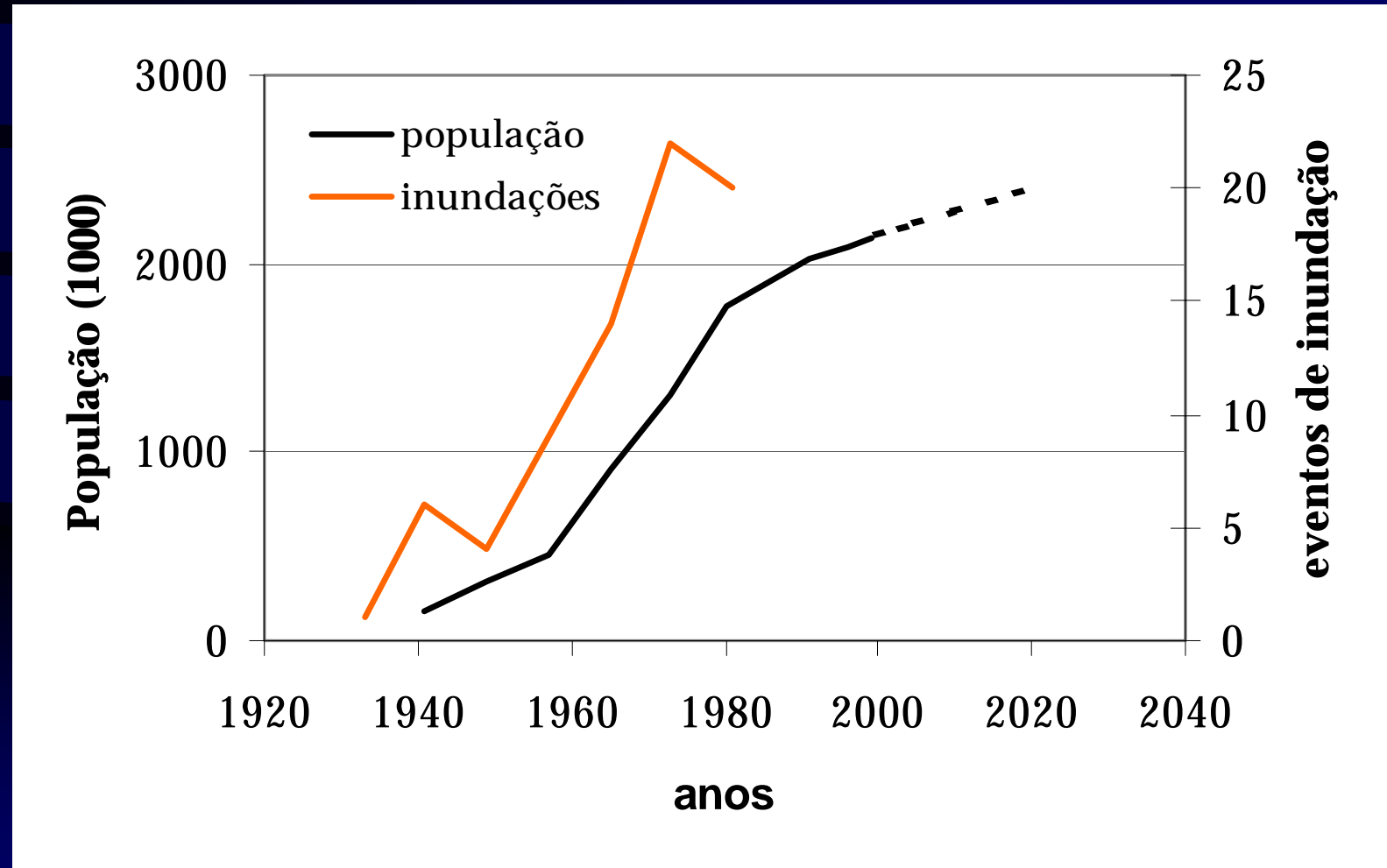
(Data from São Paulo, Porto Alegre and Curitiba)



Mean Annual Flood flow in Metropolitan Area of Curitiba



Belo Horizonte



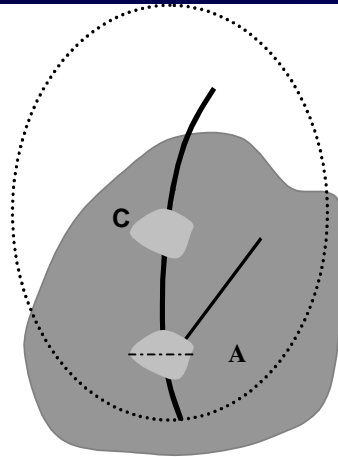




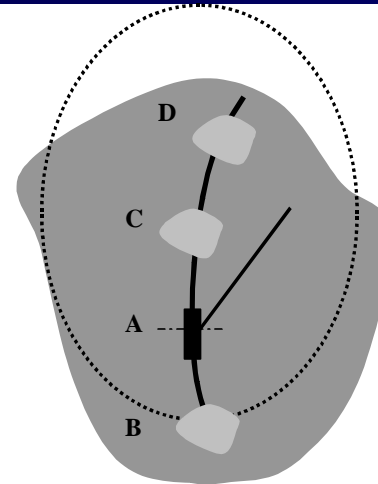
GARBAGE IN THE ENTRANCE OF
DETENTION POND

BAD PUBLIC INVESTMENT BASED ON CANALIZATION

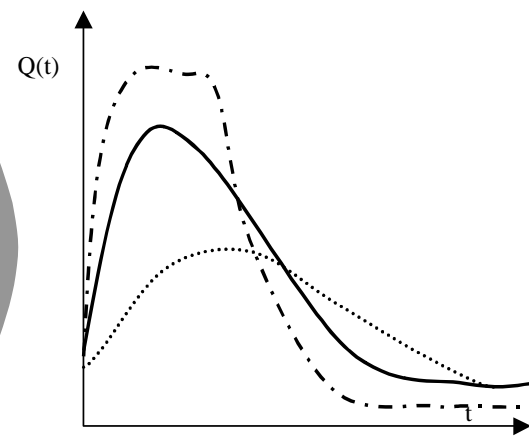
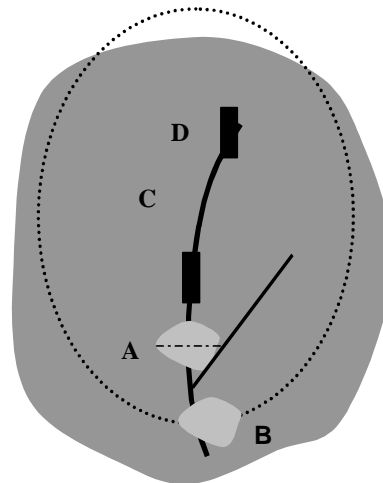
stage 1



stage 2



stage 3



Hidrograma em A

Flood plains

- Occupation of flood plains, mainly by low income population;
- without urban planning for the flood plains, population moves to it after some years of low floods. When comes a high level flood the damage cost are sky high and created na economical problem.
- In Latin America during its main economic grow the flood were smaller increase after that on 80's
- There is no prevention, insurance or structural investments

NEREU DE ALMEIDA - POMERO, BANCO DE DADOS/AGÊNCIA IBIS - 12/10/00



Normal
Flow

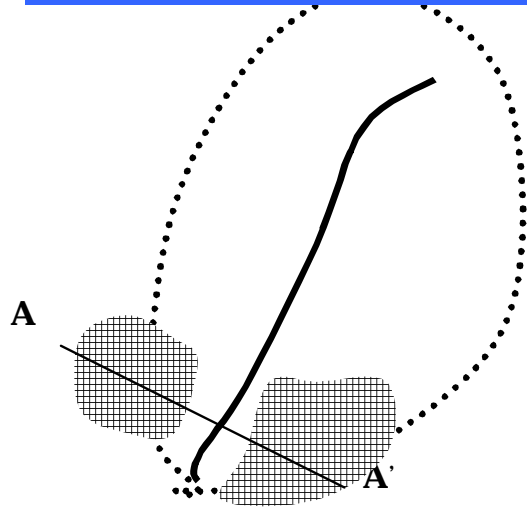


União da
Vitória
and Porto
União

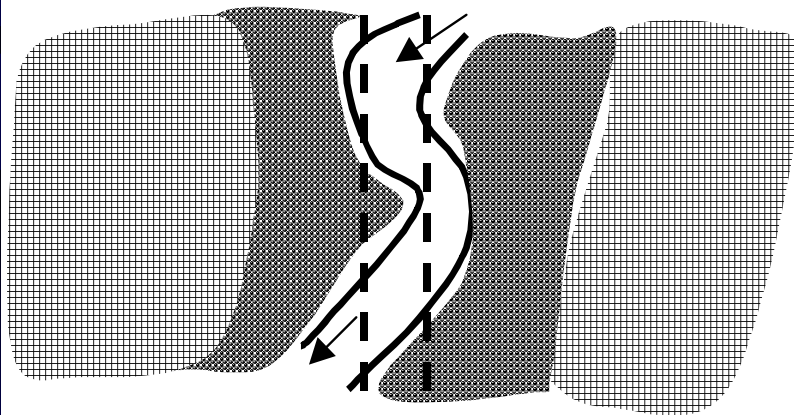
1983 Flood



Early scenario

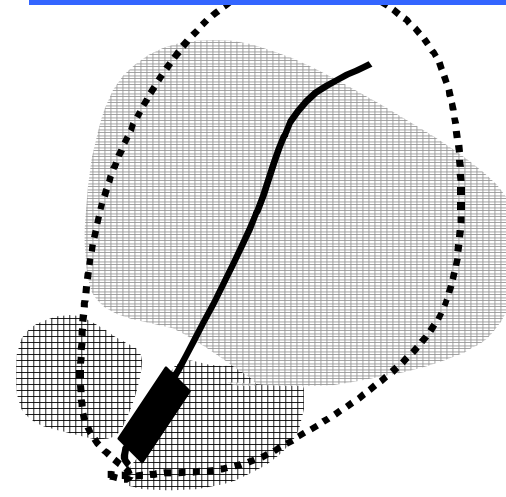


(a) Basin view before urban development

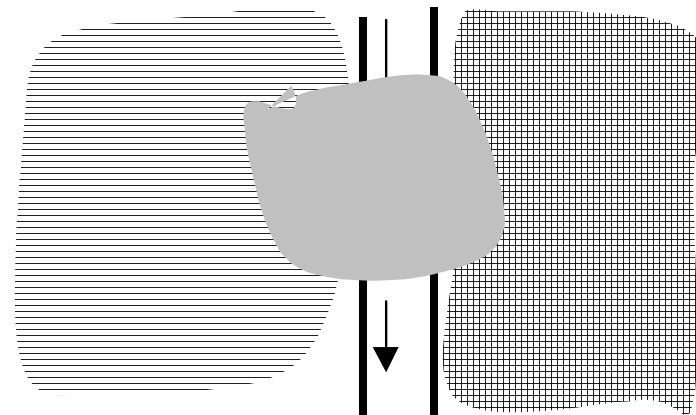


(c) local view of flood areas and nearby urbanization in the first stage

Future scenario



(b) second stage: new urbanization upstream



(d) second stage: occupation of flood areas and flood due to upstream developments

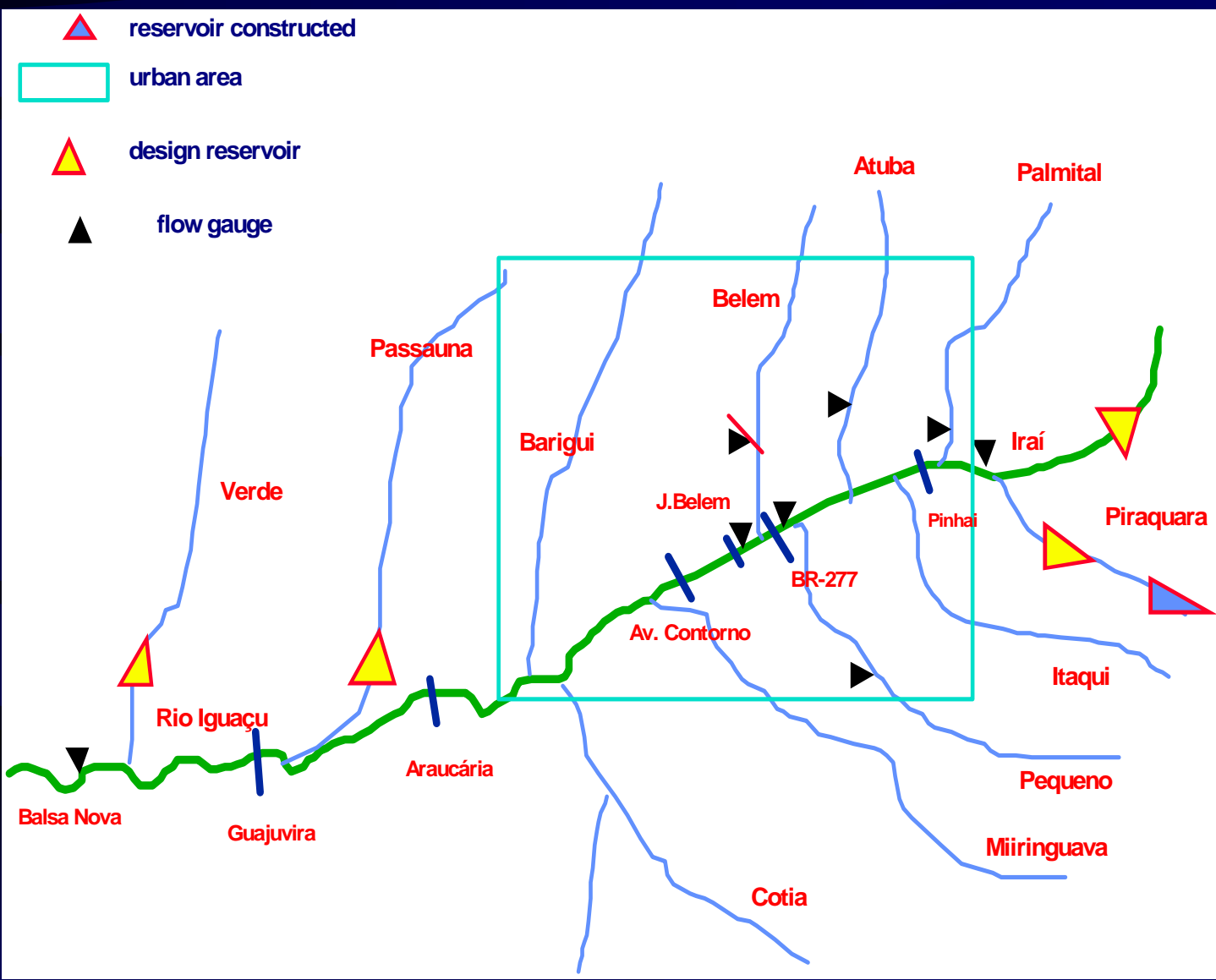
Figure 7.2 Stages of basin occupation and impacts

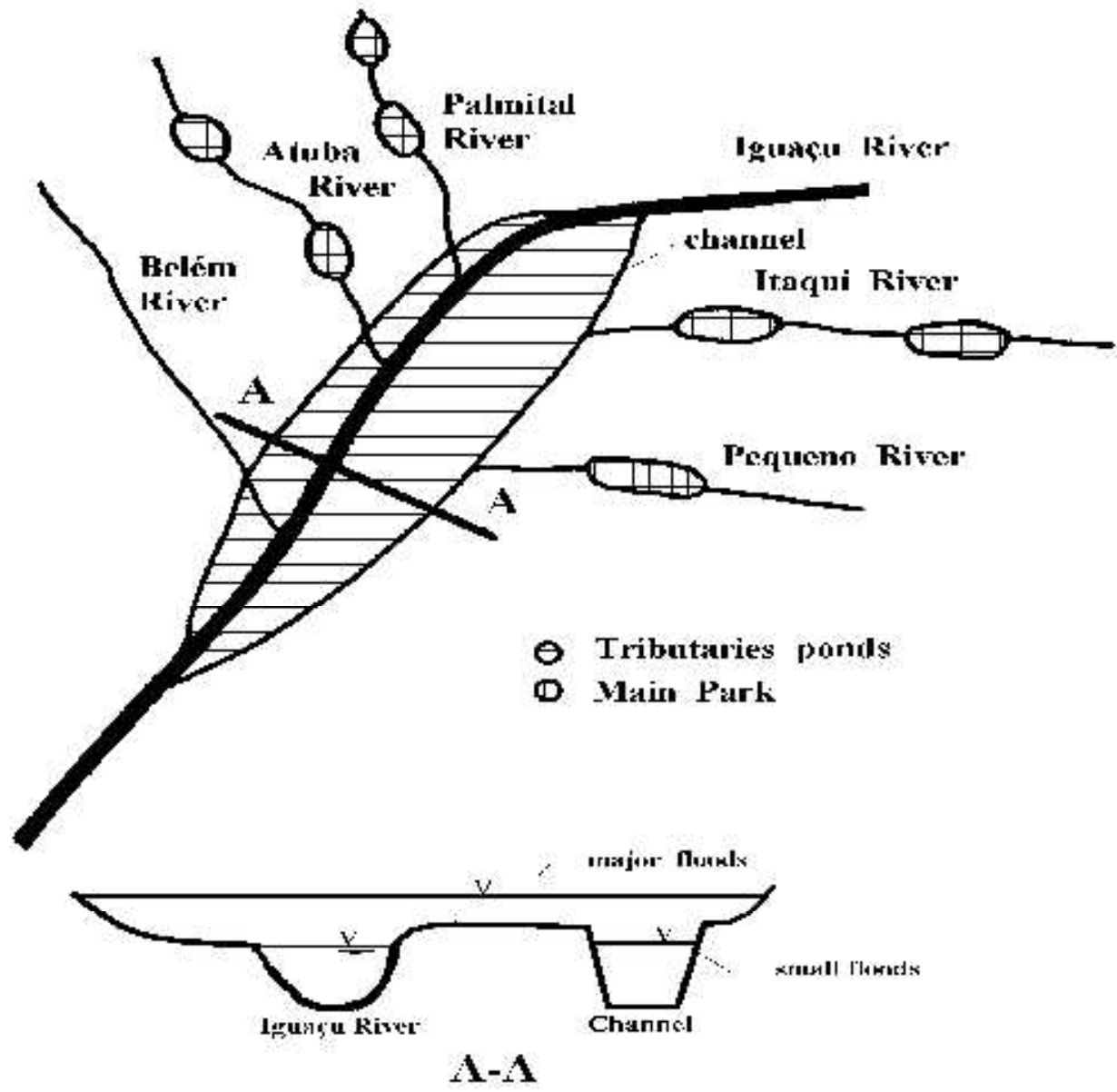
Case Studies

- Metropolitan Area of Curitiba
- Workshop for decision makers

Curitiba

- Flood Control was a Project inside of PROSAM, program funded by the World Bank;
- Flood Control planned stages were:
 - ↓ Emergencial actions
 - ↓ Iguaçu Flood Plain control
 - ↓ Urban Drainage Metropolitan Area





VIEW OF THE AREA



VIEW OF THE AREA



PARQUE



SAMTAC/GWP FLOOD MANAGEMENT ACTIVITY

Activities developed in 2002-2003 supported by APMF

- **Urban Floods in South America - book - with the modern flood management contents, six country chapters and summary of the above workshop.**
- **workshop for decision makers on floods in five countries: Argentina, Brazil, Chile, Colombia and Peru**

Activity in development

- **Integrated Flood Control of an Transboundary basin of Quarai (Uruguay and Brazil)**

- Urbanization
- Urban Waters
- Floods and urban drainage
- Floods and urban drainage in South America countries: Argentina, Bolívia, Brazil, Paraguay, Peru and Uruguay
- workshop for decision makers

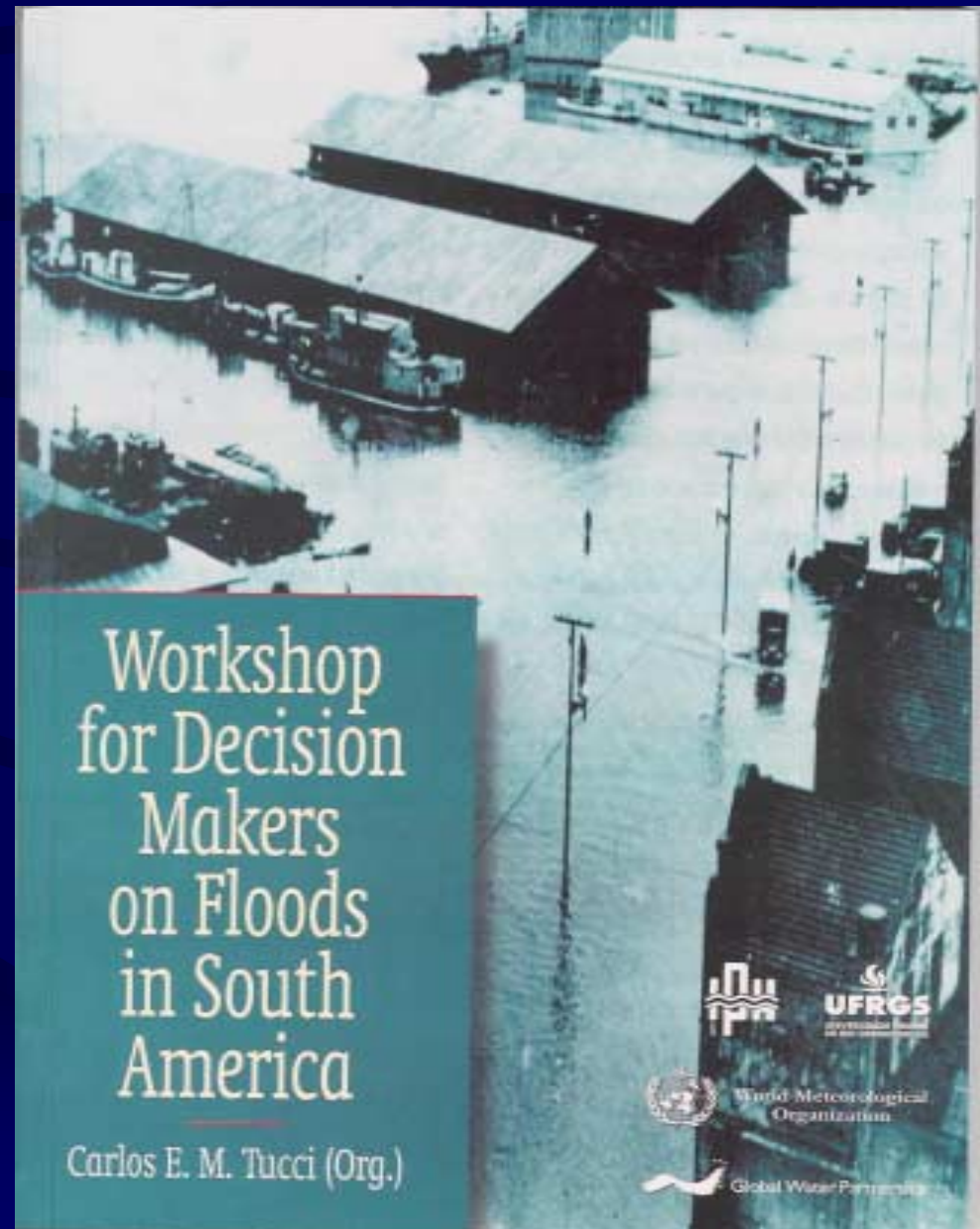


Output was published as a book

It can be download from →

www.iph.ufrgs.br

Programa de Inundações
da América do Sul



Workshop for decision makers on floods

- The main objective is to improve knowledge of local decision-makers on and propose solutions for flood management problems in South America.
- Local decision-makers are understood here as: city mayors and other first level municipal administration; State and Basin high level administrators; and NGO's (Non Governmental Organization) representatives.

Case Studies

Country	Case study	Main floods
Argentina	Rosario and cities in Carcarañá River Basin	Flood plain occupation (Rosario) and due to urbanization
Brazil	União da Vitória and Porto União	Flood plain occupation and hydropower conflict
Chile	National Planning	Due to urbanization and flood plain. Overall country discussion
Colombia	Barranquilla	Due to urbanization
Peru	Piura	Flood plain occupation



Countries workshops

Country	Workshop 1	Workshop 2	Institution	Coordinator	e-mail
Argentina	July 11-12	September 5-6	UNC, Universidad de Córdoba and Instituto Nacional del Agua, INA	Juan C. Bertoni	Jcbertoni@arnet.com.ar
Brazil	July 11-12	August 9	IPH – Instituto de Pesquisas Hidráulicas – UFRGS	Carlos E. M. Tucci	Carlos.tucci@ufrgs.br
Chile	July 24-25	-	Universidade de Chile	Luis Ayala Riquelme	Layala@cec.uchile.cl
Colombia	July 9-10	August 26	CEPREVE – Centro de Prevención de Desastres	Omar Agudelo	Cepreve@dnic.unal.edu.co
Peru	August 7-8	September 9	Universidade de Piura	Jorge Reyes	Jreyes@udep.edu.pe

Argentina

- the basin of Carcarañá River, which flow through Santa Fe and Córdoba States
- developed in Rosario (second largest city of Argentina) with 38 participants from 13 cities and in Carlos Paz near to Cordoba with 28 participants from 10 cities
- the participants were decisor makers, cities professionals and university professors

Brazil

- União da Vitória and Porto União cities upstream of a hydropower dam in Iguaçu River
- 60 participants from the council, mayor, population, Power Co, State and Federal institutions;
- more discussion on the following presentation

Chile

- National event
- most of the decision makers at national levels
- document were prepared and deliver to govern
- the event made na important contribution to the flood decision on Chile

Barranquilla, Colombia

- One of the largest city of Colombia
- large participation of the decision makers
- lack of urban drainage
- high slopes, rainfall intensity and urbanization created serious impact on the city economy

Piura, Peru

- One of the oldest city in America
- semi-arid region
- flood plains (the flow can varies from zero to 4,000 m³/s) and urban drainage impacts
- El Nino impacts
- lack of funds for investments

Regional Workshop

- 62 participants from eight countries in South America;
- presentations of case studies, book chapters and develop the regional conclusions and recommendations;
- local: Porto Alegre
- date: September 30 and October 1

Main Conclusions and Recommendations

- *Informations :*
 - (a) *increase the hydrologic data* (quantity and quality)
 - (b) *increase the information about the urban drainage sewer systems in South America cities;*
 - (c) *the workshop strongly recommend:* that all data collect about the urban environment has to be available for the public without cost, since it is collect through public funds. If there will any privatization of the utilities, it is important to introduce this condition in the contract to allow public informations.

Technical aspects

- (a) capacity building*: (i) for planners and decision makers, on flood management;(ii) urban drainage and flood control design;
- (b) Source control measures*: education of architects, engineers and the population about the source control measures. Introduce the legislation related and fiscal incentives
- (c) Water quality control*: use of the control measures which improve the water quality: source control measures, separate system for stormwater and sewer networks, total solids controls and environment education;

(d) Social and economics evaluation: development of the methodologies of economic evaluation of the urban drainage and flood plain which take into account social and economics aspects of developing countries

Governance

- (a) Public management:* urban drainage and flood plains are one of the main sources of public and private losses. The cities should develop an integrated Urban Drainage, Floods, Waste and Total solids Plan as a procedure to reduce and management the impacts in the cities and in the environment
- (b) Legislation:* the communities should develop legislation and regulation for control of the impacts in the cities due to floods. These are measures which does not require great investment and it is important for the the future urban developments;

Governance

(c) Management: the management of the urban drainage utilities and flood control can be public or private, the important results is to have a regulatory procedure approved through public participation;

(d) Public participation: the society should participate on all steps of the decision procedures on the management of the urban drainage. There is a strong recommendation for education of the population in all levels in order to improve the public participation

Proposals

- Create a network of professionals in the region with the objective to document the regional experience;
- Organize workshops on some themes such as: legislation, economic evaluation of the flood projects, courses for cities professionals about all aspects of flood management;
- Develop proposals to introduce the urban drainage and flood management in the undergraduate and graduate program which take into account the local experiences;
- Cooperate with the decision makers of the pilot projects developed in order to find funds to develop the recommendations of the workshops;

Proposals

- Support studies which create institucional program at national levels on the countries in the region to manage the reduction of the floods impacts;
- Develop Transboundary projects and cooperation for floods management through flood forecasting, flood zoning, and other measures. Introduce the pilot studies in the toolbox of GWP;
- Development of data file on urban drainage basins on South America for research and development of tecnologic knowledge for the society;

Conclusions

- Urban development is the source of floods impacts
- Sustainable solutions are based on the institutional aspects of flood managements
- education of local professional and decision makers