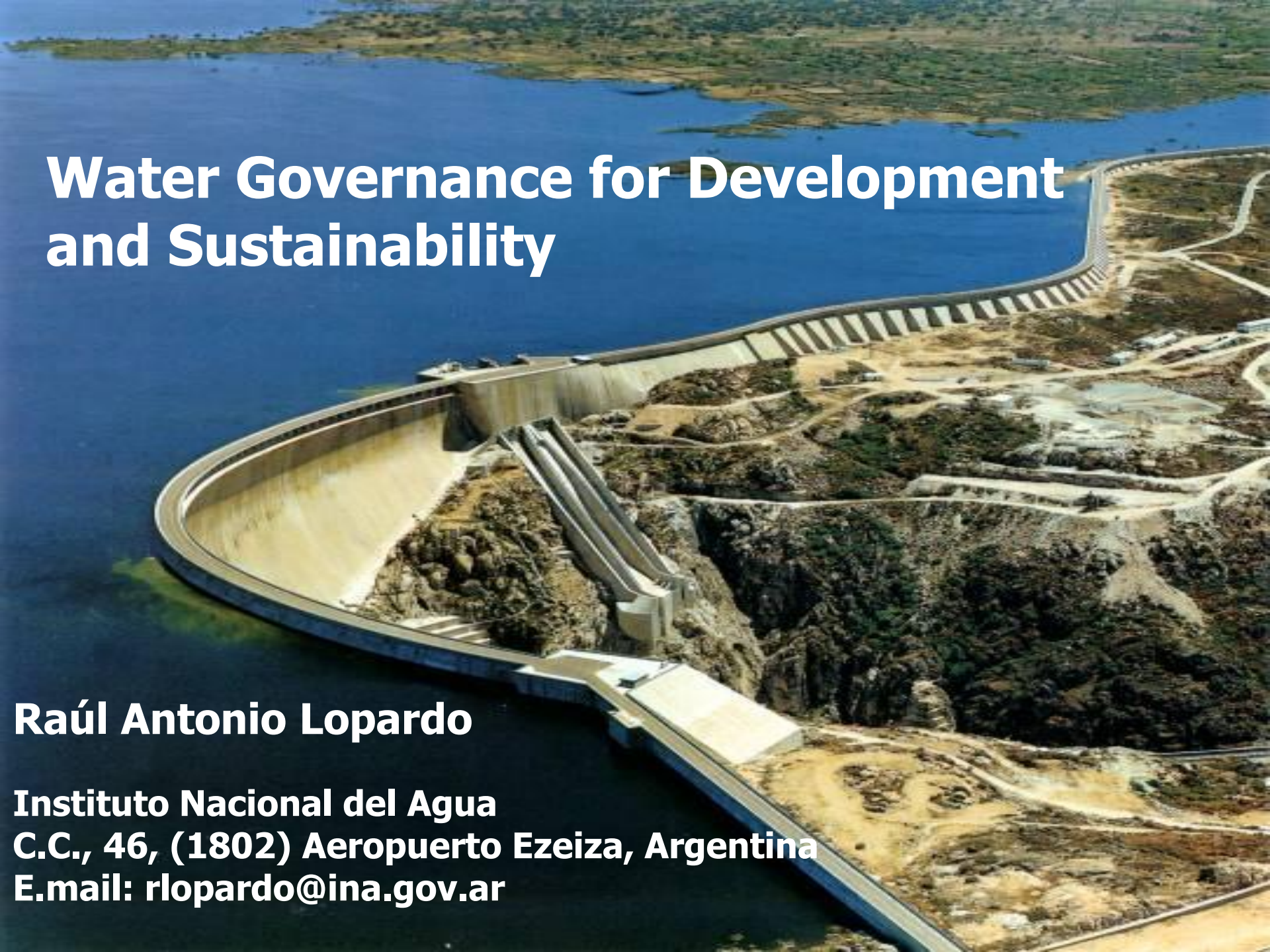

Water Governance for Development and Sustainability

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WATER GOVERNANCE

- "The water crisis is mainly a crisis of governance. Working towards effective water governance requires an enabling environment and appropriate institutional structures that allow stakeholders to work together for effective water management. Financial practices must be realigned to support the sustainable use of water resources" (Global Water Partnership, 2000)

- “Good governance, capacity building and financing are of the utmost importance to succeed in our efforts. In this context, we shall promote integrated water resources management” (Solanes & Juravlev (2006).

- Finally, Governments have the primary role in promoting improved access to safe drinking water, basic sanitation, sustainable and secure tenure, and adequate shelter, through improved governance at all levels and appropriate enabling environments and regulatory frameworks, adopting a pro-poor approach and with the active involvement of all stakeholders (Solanes & Juravlev (2006).

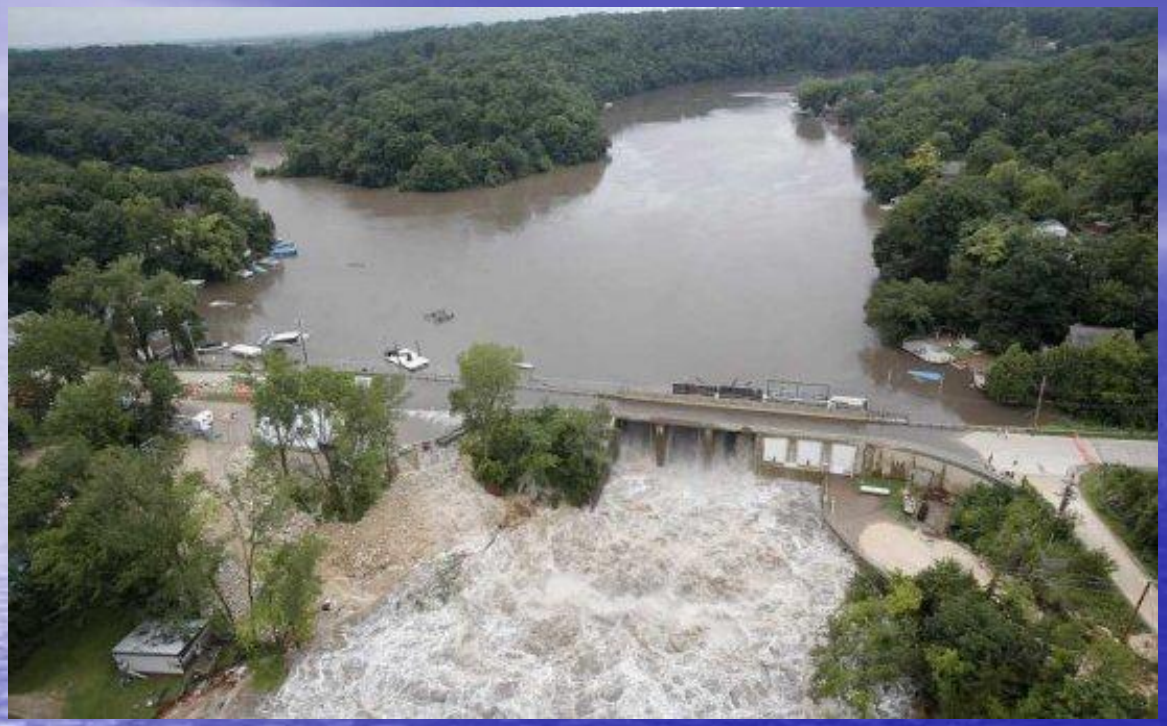
BRIDGE BREAKING

Arroyito Dam bridge

More than 50% of the bridges breaking cases in US were damaged because its poor hydraulic design.

Then, *"the addition of bridge failings produced by earthquakes, typhoons, hurricanes, bad structural design, inconvenient foundations, accidents and terrorism, cannot reach the number of bridges failed because a bad conception as hydraulic structure" (Murillo, ASCE, 1987).*

DAM BREAKING



Delhi Dam (Iowa, USA)

Between 1935 and 1985 there were 173 large dams failed, as 3.5 by year. 46 % of them because bad hydraulic design of spillways

Large dams breaking can produce severe social and economical damages, numerous fatal accidents and dramatic modification of the natural environment.

SAFETY AND IMPACTS

Pescado River (Salta, Argentina)

There are dams that are in no danger, but have design mistakes that prevent fulfill the functions for which the designers envisioned.

The failure to include the environment as a decisive element in the design of hydraulic structures has led to many of them to become negative elements of society that has funded.

RENEWABLE ENERGY SOURCES

The production of electricity by conventional thermal power plants with fossil fuels has serious disadvantages, since it is an indirect and inefficient method, with an intrinsic efficiency limit imposed by the Carnot cycle.

Argentina is not an exception, as it consumes annually 60 million tons of fossil fuels, mainly for electricity production in power plants and vehicular transportation.

Comprehensive systems were developped to use primary sources of clean, renewable energy to replace fossil fuels, such as solar, wind, hydro, geothermal, tidal power, wave power. They would be more "friendly" to the environment

WATER AND ENVIRONMENT

Environment is the set of interrelationships between the natural environment, consisting of plant and animal kingdoms (excluding human) and the social environment, consisting in the socio-political issues *(human world)*

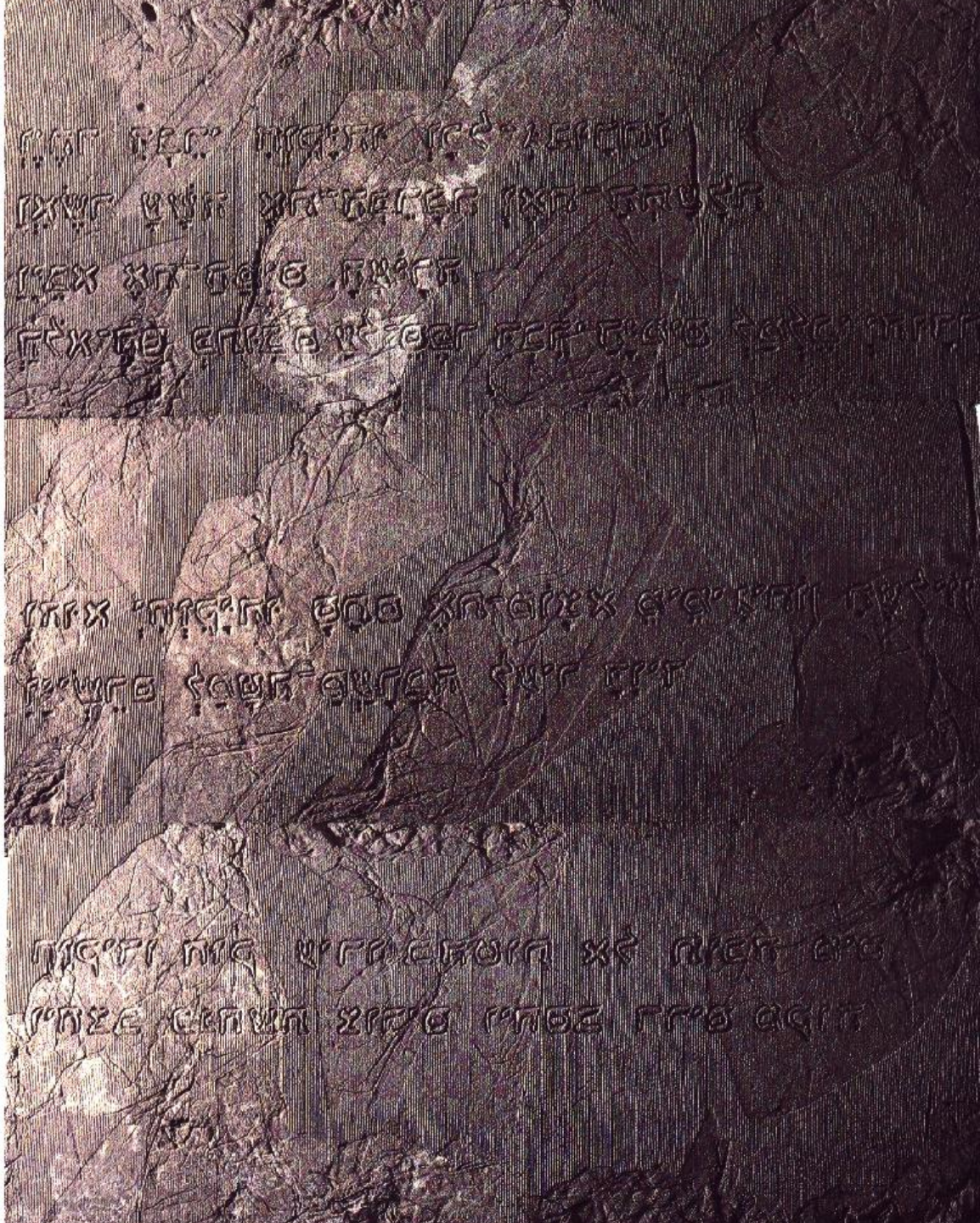
There is a strong interconnection between water and environment, on the one hand, and water and development, on the other, both with totally opposite characteristics.

From remote antiquity, culture and development of the people was inextricably tied to works that allowed the use of water for the benefit of society.

"... The rest of the story of Hezekiah, all his power and built the dam and aqueduct brought water to the city is it not written in the book of the chronicles of the kings of Judah?"

Old Testament (Hebrew text, Two Kings, 20:20)

Mention of the great works for Jerusalem during the reign of King Hezekiah (725-697 BC).



WATER AND DAMS

Until recently, it was considered that the services of hydropower, irrigation, water supply and flood control, were sufficient to justify the significant investments being made to the construction of dams.

Often cited other benefits such as the impact of economic prosperity in a region ,due to the new multiple cropping, rural electrification, the effect of tourism in the reservoirs and the expansion of physical and social infrastructure such as roads and schools.

These obvious benefits are considered, and when they are compared with the costs of construction and operation, economic and financial terms, seemed to justify that dams were the most competitive alternative.

DAMS AND ENVIRONMENT

The cost-benefit became a concern due to increasing public display of results. The opposition began to grow, citing the impacts of dams on people, watersheds and ecosystems, as well as its economic performance, making the debate a global issue.

Opponents point to the adverse impacts of dams, as the debt burden, cost overruns, displacement and impoverishment of people, destruction of important ecosystems and fisheries resources, deforestation and the inequitable distribution of costs and benefits.

DAMS AND ENVIRONMENT

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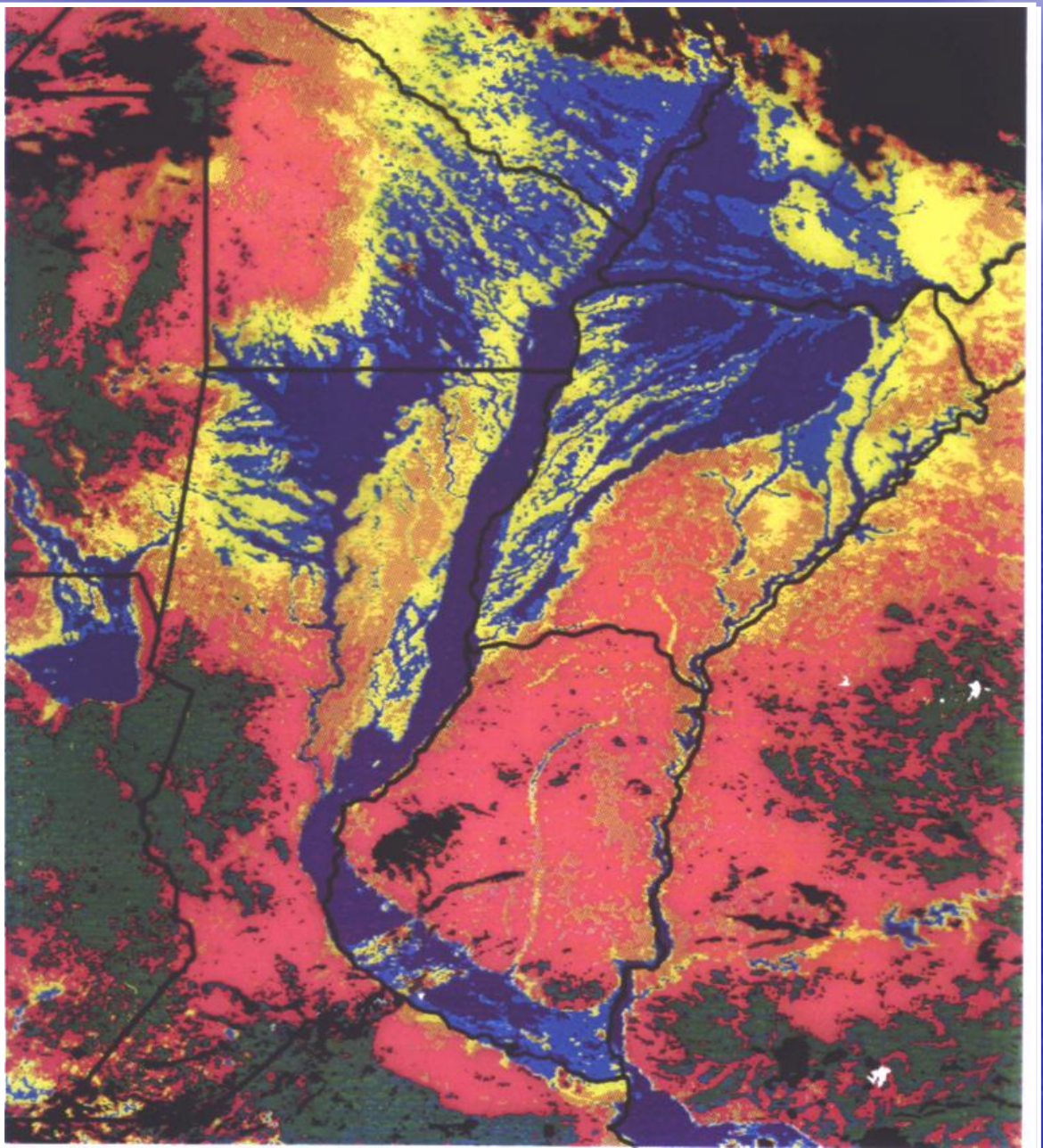
This indiscriminate fight against hydroelectricity comes to striking generalizations, which because of their absolute incoherence, make impossible a rational debate.

Dams reservoirs in Argentina reach only a digit percent of deforestation that the caused of the advance of soybeans in recent years.

Regarding the loss of aquatic biodiversity and fishery resources, nothing is said of this effect numerically in relation to the depredations of mass fishing of species such as hake and squid and elimination of non-commercial species entering the arts of fishing.

IMAGEN NOAA-AVHRR-MAYO 1998 (Thermal band)

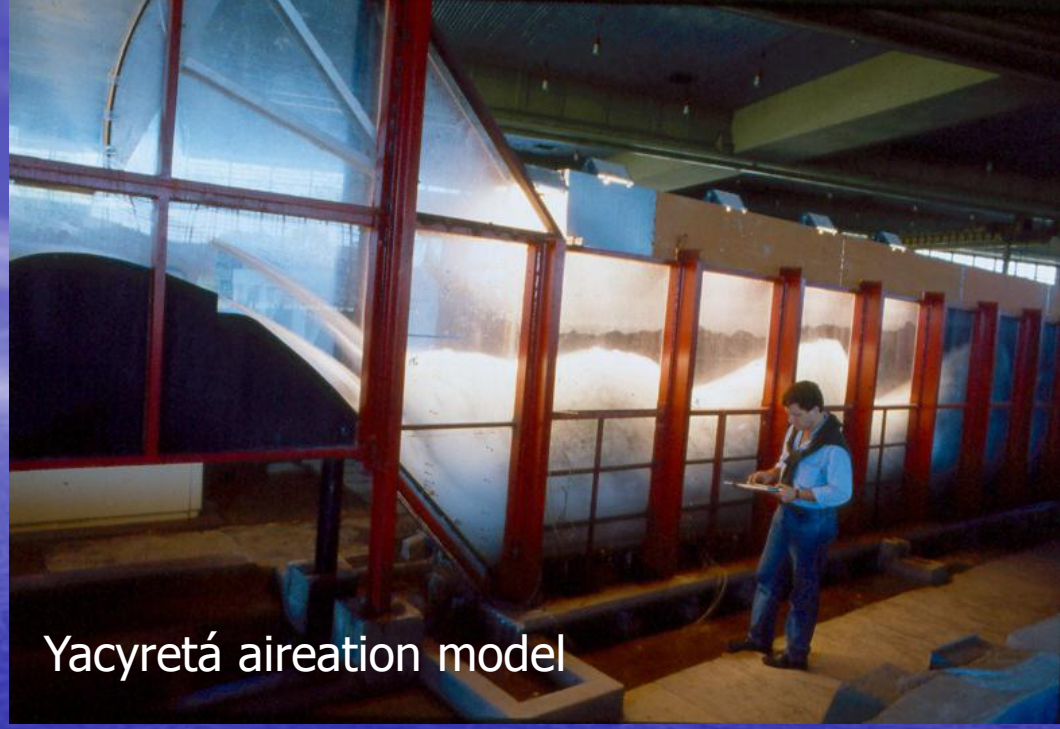
Source: INA-INTA-CONAE




MISIONES ARGENTINA
Río Pepirí Guazú
BRASIL, deforestado
YABOTI
GN
MOCONA
Parque N. Brasil
RIO URUGUAY

Paraná River in Yacyretá (Argentina-Paraguay)

Salto Grande cavitation



Yacyretá aireation model

Yacyretá aireation control

Yacyretá aireation prototipe

REFLEXIONS ON EDUCATION

- To *“learn how to know”* is essential to combine a sufficiently broad general knowledge with the opportunity to deepen their knowledge in a small number of subjects, which is also "learning to learn"

  We must *“learn to do”* in order to acquire not only an occupational skill but a competition that will enable the individual to deal with many technical situations

  “Learn to coexist” implies the development of understanding towards the other and the perception of the forms of interdependence, enabling the student to work as a team, undertaking joint projects and learning to manage conflicts.

  Finally, it should be emphasized *“learning to be”,* in order to flourish better personality, develop their critical thinking and being able to act with ever greater autonomy, judgment and personal responsibility.

NEW EDUCATIONAL CHALLENGES

A careful analysis of the events of the last forty or fifty years indicates the need for conceptual changes in the training of hydraulic engineers in this new century.

This conclusion is based on the occurrence of significant changes in the socioeconomic landscape of the world and include fundamentals, among others less obvious:

- the information revolution
- the environmental revolution

ENGINEERING EDUCATION AND INFORMATION REVOLUTION

How can engineers be consistent with the information revolution?

One might think that perhaps it would be possible "computerized teaching".

The information technologies offer a new infrastructure that has to change the ways of learning. However,

"to suppose that any content of the digital age has excellence by the mere fact of being represented in the new language is to fall into a new form of fundamentalism" (H. Reggini).

COMPUTER FUNDAMENTALISM

The main risk is to convey to students a false true, of using commercial mathematical models, with which it is possible to estimate any value with any accuracy.

Tables with many decimal places and beautiful color graphics in two and three dimensions are now essential in the production of any technical report, often ignoring basic conceptual issues, such as assumptions and physical laws that underlie these models and the real experimental support for its adjustment coefficients.

EXPERIMENTAL PRACTICE IN THE FORMATION OF THE ENGINEER

In engineering education is essential to develop the spirit of experimentation, the need to search for real data, the analysis of information obtained through probably the most modern instruments coming from the electronics and information revolutions.

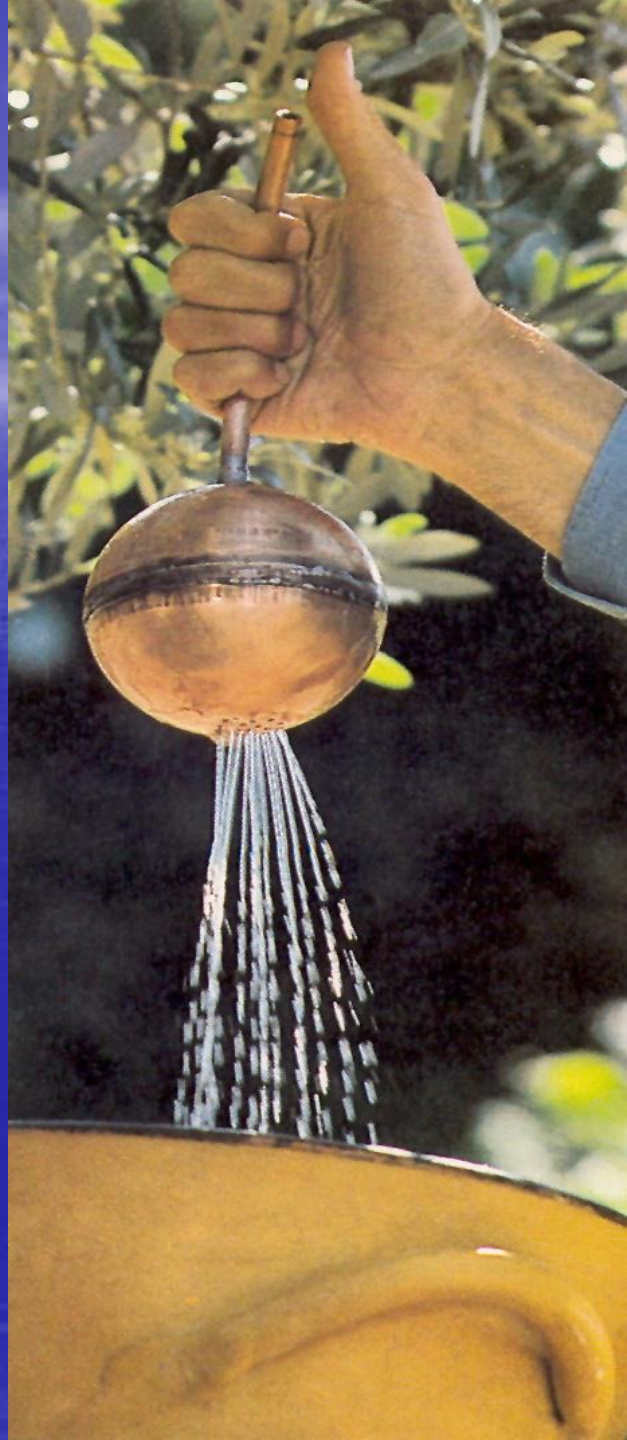
The importance of experimentation in engineering education is linked to basic training through the "scientific method" and applied training in the development of some “engineering criteria" to contrast their projects to reality.

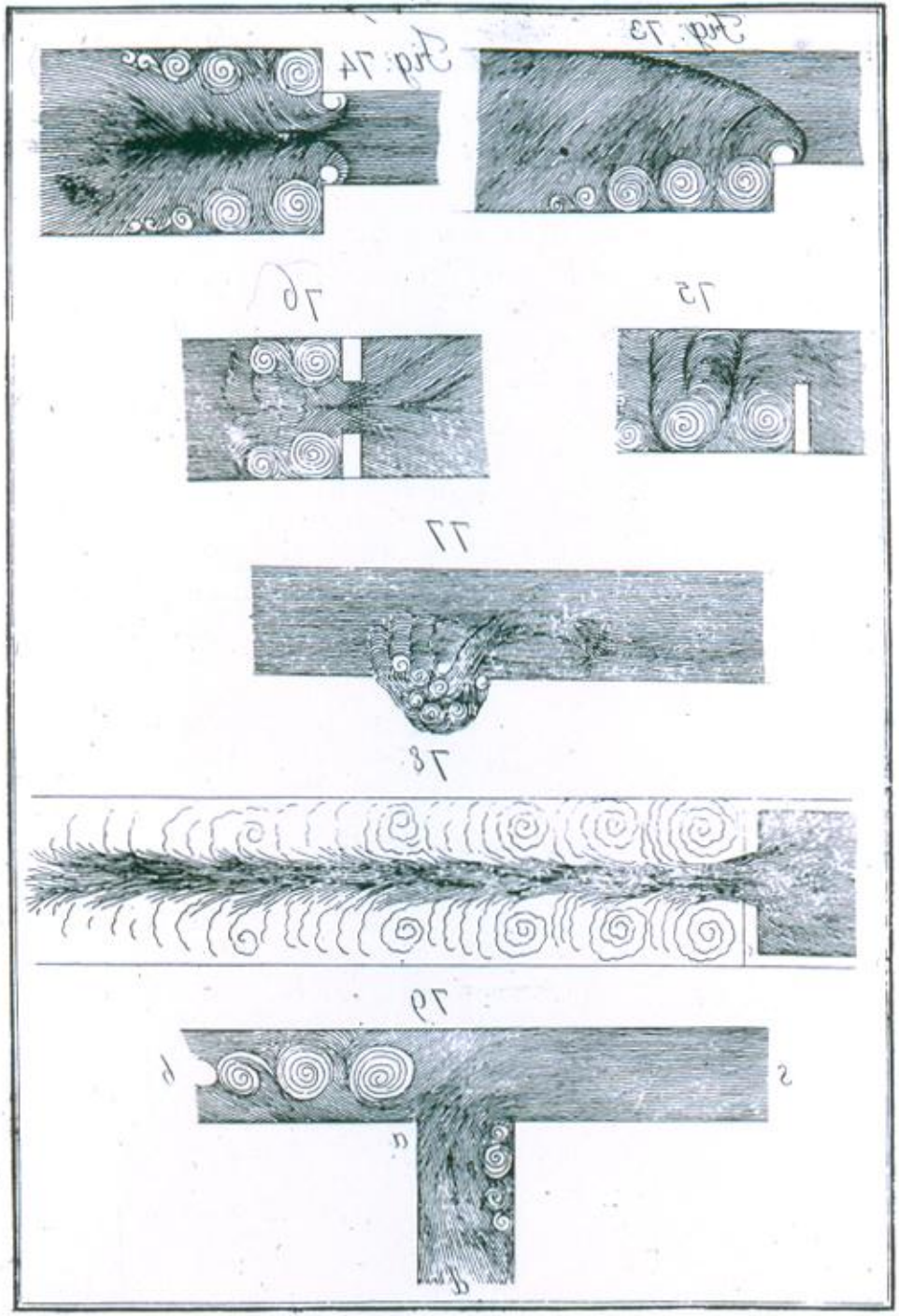
IONIC INFLUENCE ON THE EXPERIMENTAL METHOD (450 years before Christ)

In the days that people knew not the existence of air (the wind was the breath of the gods) Empedocles of Agrigento made the first experiment documented in the history, and proved its existence, using the clepsydra or water thief.

Empedocles discovered something invisible.

He thought that "the air had to be a matter so finely divided that it was impossible to see."





Leonardo Da Vinci (1600)

Treaty of water movement (Madrid Codex)

THE ENVIRONMENTAL REVOLUTION

It is a matter of debate to define the best way to train engineers in the various specialties with an open mind, capable to work for a sustainable development.

Sustainability is a laborious process of agreed changes, an asymptotic path to a target, equipped with new codes of conduct.

This basic objective can not be achieved merely by addition of single issues in a particular chair. These issues must be present for the issuance of all the chairs for comprehensive training of the hydraulic engineer.

After the undergraduate level, later specializing in environmental issues (through courses or postgraduate courses) allowed to participate in transdisciplinary teams impact assessment.

ENGINEER FORMATION FOR SUSTAINABLE DEVELOPMENT

The environmental concept must be present at every stage of any engineering project, as one more condition for a good design. Then, students must necessarily incorporate this vision in all the various subjects they take.

TRAINING OF TEACHERS FOR SUSTAINABLE DEVELOPMENT

The proposed methodology requires the prior customized training for teachers of all subjects of the race, possibly through a team of specialists dedicated to the *"training of trainers",* which is able to transfer to each teacher the best way to raise environmental aspects within the scope of its own chair.

The result of this methodology can be, perhaps, one of the important contibutions for the water governance for development sustainability.

ENGINEERING AND SOCIAL COMMUNICATION

- One of the serious problems facing engineering today is for the appropriate dissemination of achievements in relation to the requirements of the Society.

- The Engineer is systematically observed with caution by the mass media, who consider him dependent on a powerful client (as the Government itself) that threatens the rest of the population. His opinion is constantly put into question by professionals from other disciplines, the journalists themselves and people without any knowledge on subjects.

- Must be recognized the failure in the engineers' ability to disseminate to the media in a timely manner the scope, benefits, problems and possible impacts of their projects. If we don't admit our mistakes we cannot credibly reach the Society.

CONCLUSIONS

- When projecting a hydraulic structure, displacement of populations should be treated with special care, with a sense of organization and political sensitivity. For these populations relaying must inescapably signify an improvement in their standard of living, as those directly affected by the project should be the first beneficiaries. Special attention should be paid to vulnerable ethnic groups.

- It is important to develop ecological and social research in dams and reservoirs that have seen years of service. If you proceed to collect, process, evaluate and publish, in a carefully targeted research box, the great body of knowledge resulting from our long experience in the operation of many dams and reservoirs, could be eliminated errors and shortcomings, could prevent controversy about the impact of dam projects and could be clarified and resolved more easily related problems.

CONCLUSIONS

Then, engineering education should focus not only on scientific excellence and technological capacity to develop their projects but have to find the appropriate methodology for such projects of interest to the Society and accessible to the media through the public hearings.

Train teachers to students interested in experimental science not only be of interest for the future of the few engaged in his profession to research, but for all other activities that will assess the technological and psychological difficulties to which are those subject.

Moreover, the real development and improvement of quality of life is an inescapable contribution to environmental conservation, because as said Indira Gandhi, the worst environmental impact is poverty.

CONCLUSIONS

- ***Despite campaigns as striking as vacant, the water problem is not so much his fault as its poor quality and too often in its poor handling or storage.***

- ***We think that more than thirst, what kills is contaminated water, not forgetting the poor hygiene and lack of education.***

- ***But above all, the real murderer of humanity is poverty, more difficult to fight that disease and drought.***

"Reflexiones desde el agua" ***(Reflexions from the water)***

Carlos Blázquez, Zaragoza 2008

THANK YOU FOR YOUR PATIENCE

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