



CASE STUDY

Greece: Flood Resilience under Climate Change - Implementing a Water-Human Conflict Resolution Dialectical Model

Summary

On Crete Island, Greece, floods have become frequent and catastrophic under climate change. In the case study of Giofyros River, the city of Heraklion, to complement the Integrated Flood Management (IFM) model, a social component has been added. The new model is based on conflict resolution between human activities and hydrological/hydraulic laws. This model uses the observation that historically, water-human interactions have been and remain contradictory, i.e. at the same time conflictual and cooperative. To increase flood security, firstly the conflicts are assessed and analyzed; secondly, by unifying the opposite water-human interactions, a dialectic flood resilient solution is obtained.

Background

A historical review indicates that the way humans manage water-related issues reflects their relationship with nature. This has continuously oscillated between two opposites: conflict and cooperation. In ancient times, nature and water were respected as divinities. At the same time, water was hostile because it originated catastrophic floods. Humans have conceived their interaction with nature as a balance of power between natural forces and their capacity to regulate them. After the second industrial revolution (1870-1970), they felt able to dominate nature. The construction of the pharaonic Hoover Dam in 1935 is a milestone for the engineering profession to serve human interests by modifying and regulating nature. The water-human relationship is also reflected in the water resources management model that has been in constant temporal evolution. In the late 20th century, the IFM model was promoted as the state-of-the-art tool integrating water resources, land use, and risk management. In this case study, we claim that the IFM model is anthropocentric and technocratic, and because it neglects the social dimension it is unable to achieve high flood resilience.

To illustrate the eristic-dialectical model, the case study focuses on the Giofyros River, Crete Island, Greece. Giofyros is one of the biggest streams of this Mediterranean island that outfall the Aegean Sea through the western suburbs of the city of Heraklion. On 13th January 1994, a devastating flood occurred in the Giofyros basin, after a series of the following events.

- **Rainfall.** The total rainfall recorded on the day of the flood was about 185 mm, equal

to about half of the mean annual precipitation in the region of Heraklion. A maximum rainfall intensity of 37 mm/h has been recorded, and in 6 hours, which is about the retention time for the Giofyros basin, total rainfall of 143 mm has been recorded.

- **Soil.** The soil was almost completely saturated because rainfall of a light intensity had persisted several days before the critical storm.
- **Deforestation** and the removal of several hectares of vineyards during the months preceding the storm have increased the intensity of the flood.

Many houses near the coast were flooded and damage was evaluated at several hundreds of thousands of Euros. The most important effect of the flood was the damage caused to the city's wastewater treatment plant. Many of the plant's reservoirs, made of concrete, were rendered unserviceable or completely destroyed by the force of the incoming water.

In our case study, a new eristic-dialectical approach is suggested to complement IFM by adding a social component to increase flood resilience. The new model proceeds in two steps: (a) firstly, possible conflicts between stakeholders' activities and natural laws are assessed (Eristic Analysis), and (b) secondly, by unifying the opposite objectives through a dialectical approach a flood resilient solution is achieved (Dialectical Resolution).

Actions taken

This case study has been originated from a catastrophic flood that happened in January 1994 in Heraklion, the capital city of Crete Island. The city authorities were deeply concerned by the severity of the flood that damaged many private houses and public property in the coastal area of the city.

Outcomes

The social component in the new Eristic-Dialectical Integrated Flood Management (EDIFM) model is an addition to the IFM model that has common elements with the IWRM approach. It proceeds with the following steps

(1) River Basin Authorities (RBAs)

IFM plans are developed by the RBAs at the river basin scale. RBAs are responsible for collecting data, assessing the existing natural and ecological status of water bodies, and setting up the River Basin Management Plans (RBMPs). In the EDIFM model, RBAs have additional duties for including the stakeholders in the flood management process. A strong consultation with stakeholders is added and the conflictual interaction between water users and water resources is considered.

(2) Joint Action Plan (JAP)

In the EDIFM model, the pressure-response process that is the main component of the IWRM model is complemented by a stakeholder consultation aiming to set up a JAP. The aim of the JAP is to establish a participatory program for collecting hydrological and socio-economic data, analyzing existing conflicts of interest, implementing dialectical solutions for conflict resolution, and registering the progress made. In the JAP, to identify the flood risks not only the natural hazards but also anthropogenic pressures on water resources are taken into consideration by analyzing the conflicts between social activities and the

hydrological/natural laws. The new water-human integrated approach defines a dialectical relationship to nature by taking into account nature's rights and reinforcing environmental equity.

(3) Conflict Eristical Analysis (CEA)

In the CEA process, conflicts are classified into a) conflicts between humans and nature (anthropo-natural), and b) social, economic or political conflicts between stakeholders (anthropo-socio-economic). In the EDIFM model, anthropo-natural conflicts are recognized when man violates natural laws.

(4) Dialectical Conflict Resolution (DCA)

As the most crucial part, it is based on a dialectical reflection and a profound knowledge of natural laws to suggest a conflict resolution based on the unity of opposite issues.

Lessons Learned

Activating stakeholders in the IFM model

Increase flood resilience by adding a social component to the IFM model. This has been achieved by the Eristic-Dialectical IFM model that proceeds in two steps (1) assessing conflicts between stakeholders and hydrological/hydraulic laws and (2) resolving these conflicts by unifying opposite issues and obtaining environmental equity.

Flood detention reservoirs

Flood resilience at the watershed level increases by retaining only the peak of flood instead of storing the total flood volume. Flood detention reservoirs are adequately designed among the river's sub-catchments to avoid the accumulation of tributary flows that may cause an overflow downstream. Water volumes stored in detention reservoirs can be used for irrigation

Solid transportation by Coriolis forces

Coriolis forces were used to facilitate solid transportation from the river's mouth into the sea. This can be achieved by preserving the natural dextral flow deviation with an inclining jetty. The inertial forces prevent possible obstruction of the river's mouth and reduce maintenance costs. This is illustrated in the case study and was proven reliable.

Keep urban streams uncovered

Urban water streams, such as the Giofyros River, can enhance green areas, reduce temperature increase due to climate change and absorb air pollution. Public authorities use to cover water streams because of lack of water flow in summer and activation of mosquitos' colonies. Flood detention reservoirs can provide sufficient water to sustain in summer ecological flows.

Flood Governance

Hydro-Governance is the integration of water management and policy in the political field. It is exercised at different levels, such as National, Regional and Local. Flood Governance at the local level, consisting of the city elected authorities, the public organism for water management (OANAK), and the University team as scientific advisor, was proven very efficient in practice.

Corresponding Author

[Ganoulis, Jacques](#)

Corresponding Author Contact

iganouli@civil.auth.gr

Organisation

[Aristotle University of Thessaloniki, United Nations Educational, Scientific and Cultural Organization - UNESCO](#)

Year

2022

Country

[Greece](#)

Region

[Europe](#)

Keywords

Conflict Management , Crete Island , Giofyros River Basin , Integrated Flood Management

Thematic Tagging

Urban , Climate , Private Sector

Language English

Supporting Materials

[Ganoulis-2021-The-waterman-eristic-dialectics.pdf](#)

[Ganoulis 2022_Urban Hydrosecurity.pdf](#)

[Ganoulis_2022 Environmental and Social Equity.pdf](#)

[Ganoulis_2003_JRBM_Giofyros flood.pdf](#)

[Ganoulis_2022_Water-Man Dialectic reconciliation.pdf](#)

[Do we really understand water inequities in the USA?](#)

Related IWRM Tools

[Integrated Urban Water Management Plans](#), [Integrated Flood Management Plans](#)

**Source
URL:**

<https://iwrmactionhub.org/case-study/greece-flood-resilience-under-climate-change-implementing-water-human-conflict>