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INTERNATIONAL WATERS EXPERIENCE NOTES

River Environmental Flow Assessment with holistic approach: testing a methodology for Azerbaijan and Georgia



Abstract: In 2018 two pilot basins in Azerbaijan and one in Georgia were selected as pilot sub-basin to test an Environmental Flow Assessment methodology. An experts' group including experts of different disciplines (hydrology, river morphology, ecology, water quality) was set up to monitor the rivers and assess the environmental flow following an "holistic approach". The river monitoring activity and the experimental ecological flow assessment of the Aragvi river was supervised by an international expert in river ecology. The monitoring activity allows the characterization of 4 water bodies on each pilot basin in Azerbaijan (the Shamkirchay and Alijanchay) and of 6 water bodies in the Aragvi pilot basin in Georgia. Based on the results of the monitoring activity, following the holist methodology through an expert based approach, for each water body the three main components (survival flow, low flows, high flows) of the EF regime have been estimated

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River Environmental Flow Assessment with holistic approach: testing a methodology for Azerbaijan and Georgia

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UNDP GEF/IW: Kura II: Advancing IWRM across the Kura river basin through implementation of the transboundary agreed actions and national plans

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PROJECT DESCRIPTION

The Kura II Project was developed to address the priority needs in the ministerially endorsed Strategic Action Plan (SAP) through implementation of the SAP and national Integrated Water Resources Management Plans to strengthen and harmonize coordinated conjunctive transboundary ground and surface water management. It comprised five components: Support for institutional governance protocols; professional development and capacity building for water managers across sectors; stress reduction measures in critical areas; stakeholder education and empowerment; and, enhanced science for governance.

A key output of the Project is to develop guidelines for establishing environmental flows in the Kura basin, and conduct a series of rapid ecological assessments, including bio-monitoring, of the river ecology throughout the basin, based on best international practices.

THE EXPERIENCE

Issue

There are several major laws and numerous sublegal acts regulating the protection and management of water resources in Georgia and Azerbaijan. However, current water-related legislation is inconsistent and does not provide clear regulation of some important topics.

In Azerbaijan, Article 90 of the Water Code of the Republic of Azerbaijan mentions the environmental water discharge which refers to the water to be released downstream reservoirs in order to maintain relevant environmental requirements. However, there is no regulation specifying the the minimum or maximum water discharge to be released and what are the relevant environmental requirements. Additionally, it only refers to the water bodies interested by the presence of water reservoirs . Therefore, it is worth mentioning that, in this legislative document, the terminology “environmental water discharge” does not cover the concept environmental flow.

Currently, Georgian legislation does not define the meaning and the method of calculation of environmental flow. The Ministry of Environmental Protection and Agriculture of Georgia (MEPA) is in charge of developing legislation, conducting ecological expertise for environmental permitting, setting norms for water abstraction and wastewater discharge, collecting and processing statistical forms submitted annually by users of water resources (irrigation companies, hydroelectric and thermoelectric enterprises and industries).

Addressing the Issue

Environmental or ecological flows are the water that is left in a river ecosystem, or released into it, for the specific purpose of managing the condition of that ecosystem. The very final aim of Environmental Flow Assessment (EFA) is to improve the ecological conditions of a river (increase its “ecological status”,

according to the terminology of EU Water Framework Directive – WFD), by reducing the bad ecological effects of flow regime alteration.

In 2018 two pilot basins in Azerbaijan (the Shamkirchay and Alijanchay) and one in Georgia (the Aragvi river basin) were selected as pilot sub-basin to test an EFA methodology. An experts' group including experts of different disciplines (hydrology, river morphology, ecology, water quality) was set up to monitor the rivers and assess the environmental flow following an "holistic approach". The river monitoring activity and the experimental ecological flow assessment of the Aragvi river was supervised by an international expert in river ecology.

With the term "holist approach" it was intended to apply an EFA not merely based on hydrological or hydraulic criteria but take into account the "needs" of the river biological community and those of the river morphology. An EFA methodology following an holistic approach have to consider three important points about environmental flows:

1. They are ecologically (or geomorphologically [habitat]) defined. They cannot be determined on the basis of hydrology alone.
1. They are not limited in scope to single species protection, but rather consider the entire river community as a whole.
2. They are not just minimum flows. They are *patterns* of flow events, or components, defined by their magnitude, frequency, duration, timing, and rate of change. The seasonal streamflow *patterns* shape natural habitats, provide cues for migration and spawning, distribute seeds and foster their growth, and enable rivers to function properly.

A very wide scientific literature on "environmental flow assessment" was produced in the last 40 years; since the years 1990s most of them follow an holistic approach. Based on the existing worldwide experience in this field, in 2017 a group of international experts involved in a USAID technical assistance in Georgia developed an EFA holistic methodology for the rivers and streams of Georgia¹. Such methodology proposes a very flexible approach that could be adopted in many geographical situations: that's why such EFA methodology has been used as a reference for the experimental EFA on the Aragvi river basin.

RESULTS AND LEARNING

Summary of work and outputs

To assess the Environmental Flow of the pilot sub-basins of the Kura river, in the framework of the Kura II project, an extensive hydrological, chemical-physical, ecological and social monitoring campaign was envisaged, to assess the environmental conditions of different river stretches, identify the effects of flow alteration and investigate the socioeconomic conditions in the areas.

The objectives of the monitoring campaigns were:

1. provide sufficient data on river ecosystems, in order to set baselines of the ecological status of different segments of the Aragvi river basin in Georgia, following the project's short-term methodological proposal in the classification guidelines;
2. provide additional data on the ecosystem functions, food webs, species count and variation, indicator species, keystone species, and anthropogenic impacts in order to support the step-wise implementation of environmental flows calculation methodology in both rivers;
3. make available raw and elaborated data in a standardized format, to support further analyses and updates in the future;
4. apply the step-wise implementation of environmental flows calculation methodologies in the Aragvi river basin in Georgia
5. identify strengths and weaknesses of each in each basin and report on the main knowledge gaps in order to inform future monitoring programmes.

¹ USAID 2017. The assessment of environmental flow for the rivers and streams of Georgia. Usaid governing for growth (g4g) in Georgia. Contract number: aid-114-c-14-00007. Deloitte consulting llp

The monitoring campaign started towards the end of 2018 and was planned to be concluded in April 2020 with 8 field campaigns to monitor hydrological, ecological physico-chemical, social, and biological conditions of the two sub-basins.

However, due to the approval of a Kura II Project extension till 28 Feb 2021, the monitoring campaign has been extended till the end of 2020, to allow for more precise and accurate estimation of the environmental flow regime for the sub-basin.

The monitoring activity allows the characterization of 4 water bodies on each pilot basin in Azerbaijan (the Shamkirchay and Alijanchay) and of 6 water bodies in the Aragvi pilot basin in Georgia. Based on the results of the monitoring activity, following the holist methodology mentioned above through an expert based approach, for each water body the three main components of the EF regime have been estimated:

1. **Survival flow** – The critical, extreme low flow recommended during a designated drought period;
2. **Low flows** – Low flows related to specific periods of ecological importance for indicator assemblages, species and life stages, ecological processes, and flows for important social and cultural features. The periods defined are generally one to six months each, and together result in a continuous low flow regime during the year;
3. **High flows** – High flow pulses and flood events of defined magnitudes extending over a specified number of days and intended for specific purposes, such as maintaining channel morphology or cuing ecological responses (e.g., fish spawning or migration). Additional criteria to describe a flow event may be used, including frequency or rate of the receding limb of the hydrograph.

The following table is an example of the EF requirements schedule that has been developed for each water body.

| Period | Effective dates | Discharge (m ³ s ⁻¹) | |
|--|------------------|---|--------------------------------------|
| Annual | Jan - Dec | 3,20 | |
| Criterion | Effective dates | Discharge (m ³ s ⁻¹) | |
| Habitat maintenance for benthic fauna and plant community | Jun 15 – Aug 15 | 9.20 | |
| Spawning season of brown trout (<i>Salmo trutta fario</i>) | Nov 1 – Dec 31 | 4.50 | |
| Motivation | Timing | Duration | Magnitude |
| Floodplain flooding, River channel maintenance | (Apr 1 – Aug 31) | 5 days | > 60 m ³ s ⁻¹ |
| | | 1 day | > 100 m ³ s ⁻¹ |
| | | 1 day | > 100 m ³ s ⁻¹ |

REPLICATION

The Experts' groups in Azerbaijan and Georgia developed a "roadmap" to replicate the EFA throughout the countries. To extend this new and modern method of assessing ecological flow to other rivers in Azerbaijan and Georgia, the existing decision making process should:

- recognise the need of an EFA as a precondition to develop a river water abstraction project o issue a water abstraction license;
- develop a technical guidance for EFA procedure inspired to the methodology developed by USAID (USAID 2017) and using the present report ad a case study.

SIGNIFICANCE

The hydrological regime is a "master variable" of aquatic ecosystems strongly correlated with many physical-chemical characteristics such as water temperature, channel geomorphology, and habitat diversity, which are critical to preserving the ecological integrity of aquatic ecosystems. For the purpose of protecting the environment is necessary to consider the water needs of aquatic ecosystems, thus contributing to preserve, protect and improve environmental quality and the rational use of water resources.

The EU Water Framework Directive does not specify the flow regime required to achieve the Good Status but requires that the flow regime should provide conditions "consistent with the achievement of the values specified for the Biological Quality Elements". Good status is unlikely to be reached in a water body with significantly altered flows, as this will result in changes to the river ecosystem through modification of physical habitat and alterations in erosion and sediment supply rates. Consequently, restoring a suitable flow regime may well be a necessary measure in an aquatic ecosystem that fails good status.

That's why to guarantee an Environmental Flow in each water body, allowing it to reach the good status is one of the typical measures envisaged by River Basin Management Plan throughout European Union. The present experience demonstrate that is possible to assess the EF with an expert based holistic approach in Azerbaijan and Georgia.

REFERENCES

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USAID 2017. The assessment of environmental flow for the rivers and streams of Georgia. Usaid governing for growth (g4g) in Georgia. Contract number: aid-114-c-14-00007. Deloitte consulting llp

KEYWORDS

- ◆ Environmental flow
- ◆ River restoration
- ◆ Sustainable water use

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