Improved environmental flows for river restoration – a case study from the Lesser Caucasus, Azerbaijan

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² UNDP/GEF “Reduction of transboundary degradation in the Kura Aras river basin”

European River Restoration Conference, 5th Edition
Celebrating successes and addressing challenges

11-13 September 2013, Vienna, Austria
Pilot river basins
Pressure: water abstraction

Water intake facility of Zurnabad HPP
Gancachay river

Irrigation network, Gancachay river basin
Pressure: industry & mining

Diffuse & point sources of pollution

Industrial waste

Tailing dam
Goshkarchay River

Iron ore mining
Qoshkarchay River
Flood protection

*Physical and morphological changes of water bodies*

Flood protection constructions on river bank

Reservoirs with volume > 2 million m³
Impacts from human activities

- Change in natural flow regime of rivers.
- Deterioration of water quality and ecological state.
- Drying up of river flow, from excessive withdrawal for irrigation, and storage in reservoirs.

Monthly water discharges at Berd (upstream, blue) and Oysuzlu (downstream, red), Tovuzchay River.
E-flow approach

*Former Soviet Union*

- Medium-sized rivers – maintain annual flat flow rate equal to 75% probability of lowest average monthly flow

*New proposal*

1. Specific for each month, no annual flat rate.
2. Based on natural flow, before anthropogenic impact.
3. Observed monthly $Q_{min}$ as 1$^\text{st}$ approximation for E-flow value.
4. Correction $\Delta Q_1$: statistical analysis of long-term changes in monthly discharge. *Account for Climate Change*
5. Correction $\Delta Q_2$: statistical analysis of intra-monthly variation coefficient. *Account for natural variability*

**Final formula:** \[ Q_{ef} = Q_{min} - \Delta Q_1 + \Delta Q_2 \]
Proposed new E-flow approach

In Practice

1. Calculate long-term average monthly flow for anthropogenic impact period ($Q_{\text{observed}}$).

2. Compare monthly $Q_{\text{observed}}$ with monthly $Q_{\text{ef}}$.

3. If monthly $Q_{\text{observed}} \geq Q_{\text{ef}}$, then E-flow is provided, otherwise not.

4. Water available for extraction: ($Q_{\text{abstract}}$) based on $Q_{\text{observed}}$, corrected for $Q_{\text{ef}}$:

$$Q_{\text{abstract}} = Q_{\text{observed}} - Q_{\text{ef}}$$
New E-flow – practical application

Gancachay upstream

Water discharge (m$^3$/sec)

Month

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<th>Month</th>
<th>Q observed</th>
<th>Q ef</th>
<th>Q 75%</th>
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New E-flow – practical application

Shamkirchay middle section

Water discharge (m$^3$/sec)

Month

Q observed
Q ef
Q 75%

Month
Recommendations

- **E-flow hydrographs** for pilot tributaries were calculated from statistical analysis of long-term discharge time series.

- Proposal prepared to adopt **new government regulations**, to guide water abstraction licensing for economic use.

- E-flow only (first) part of solution. Recognized need for:
  - *Addressing land use* in floodplains and beyond.
  - *Active restoration of aquatic ecosystems.*
  - Improved *science & monitoring.*
Thank you for your attention