WP4.4 Pilot Case Studies indicators database for MCA

Structure of the Chisone decisional tree

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Summary

SHORT DESCRIPTION
This document intends to describe the structure of the SESAMO trees projects and the MCA application to the Pilot Case Study of Chisone river.

Document Control

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Table of contents

Summary

The report summarizes the general methodological approach, the criteria and the indicators used to test the multi criteria analysis (MCA) on the Chisone pilot case study. The report highlights the progress of the MCA model development. The main aspects analyzed are:

- Focus on MCA application;
- Criteria, sub-criteria, & Indicators evaluation and
- Layout of the decision trees.

This report is devoted to the explanation and justification of the leaves belonging to each branch of the Chisone decisional tree model. We identified potential indicators which might be useful to evaluate the management alternatives chosen.

Structure of the Chisone decisional tree

The Chisone stream belongs to the Pellice river basin and is the main tributary of the Pellice river. It originates from the foot of Mount Barifreddo, at 3028 mt a.s.l. and, after a 180° degree turn, in Perosa Argentina it receives the stream Germanasca, its main tributary. The Chisone sub-basin covers an area of 288 km2 and is not densely populated. Its average altitude of 845 m. a.s.l. and the area has a remarkable tourist vocation which is linked to the nearby skiing resorts in Sestrière and the surrounding protected areas (Natural Park of Orsiera Rocciavré, Val Troncea Natural Park). In the valley part there are the established industrial estates belonging to the Pinerolo district, which are specialised in the metal and mechanical sector.
There are medium sized hydropower plants on the whole mountain portion of the Chisone river and almost all the river channel are affected by authorized water withdrawals. The presence of the Pourrieres reservoir, located in the municipality of Usseaux, is relevant from the point of view of the downflow regime in the mountain part of the river as it closes the water flow of the river by accumulating water for HP uses. The connected power station is located in Fenestrelle and is managed by Energie SpA. The whole system was chosen as a case study for the application of the Multi Criteria Analysis within the framework of the Chisone river.

The hydropower plant

The Fenestrelle plant started its activities in 1952 and uses the water coming from the hydrografic basin of the Pellice river. It is constituted by a dam on the Chisone river which forms a small reservoir, allowing daily partial regulation of production according to the water level; by 5 weirs, placed on the lateral streams, which allow the water to go into channels leading to the reservoir, a 4 km long pressure tunnel leading to a piezometric well, from which a 800mt long penstock originates. Two 8,4 MVA alternator groups have been installed in the plant and they are connected to two turbines.

The power station includes, beside the plant, a system of withdrawals on the Chisone river and on some lateral tributaries:

- Pourrières dam and reservoir (Chisone river, with a regulation capacity of about 300,000 m3);
- Gorge (Chisone river, flood recovery downstream the dam);
- On the hydrographic left side: Assietta stream, della Rossa brook, Usseaux stream;
- On the hydrographic right side: Laux brook, Crestovo brook.

The technical data of the plant are: maximum flow : 7250 l/s, average flow authorised: 2090 l/s, MIF at Gorge: 297 l/s, head 301 m, generators installed power: 16800 kVA, maximum power which can be produced 13000 kW.

Alternatives description

We worked on the Chisone Case Study to develop a forecasting system enabling to define the response, in terms of environmental state as described through a set of indicators, to different hydropower uses of water resources. Specifically, we compared the conditions sampled in four river reaches of the Chisone River, interested by the presence of a hydropower plant (Pourrières reservoir and Fenestrelle power station) with a series of scenarios covering a range of hydropower uses and pressures. The Alternatives considered are 4:

1. Scenario 0: no intake structures. This is a hypotetical scenario, which does not include the Pourrières reservoir and, therefore, it refers to conditions of potential naturality, both from the hydrological and morphological point of view. The values used for the different indicators are partially extracted from assessments done within the framework of real reference conditions (reference sites located upstream and/or in the near Dora Riparia Valley), and partially extracted from deductions based on experts' judgement.

2. Scenario 1: Reservoir – MIF– Current Hydropeaking. This condition corresponds to the current management practices of the Pourrières reservoir and its relevant plant for hydropower (HP) production located in Fenestrelle:
    - The MIF released is modulated on a monthly base directly from the dam.
    - HP production is concentrated in the moment of maximum demand (and, therefore, when the energy produced has the maximim cost), with generation of daily or multiday hydropeaking in the river downstream the water restitution.

3. Scenario 2: Reservoir – no MIF – Hydropeaking. This condition corresponds to the 2007-8 management practices of the Pourrières reservoir and its relevant plant for HP production located in Fenestrelle:
    - No MIF release from the dam.
    - HP production is concentrated in the moment of maximum demand (and, therefore, when the energy produced has the maximim cost) with generation of daily or multiday hydropeaking in the river reach downstream the water restitution.

4. Scenario 3: Reservoir – no MIF – no Hydropeaking. This condition corresponds to the 2000-1 management practices of the Pourrières reservoir and its relevant plant for HP production located in Fenestrelle:
    - No MIF release from the dam.
    - HP production is distributed within the working days of the week with absence of hydropeaking or, more in details, weekly variations between working days and week ends.

The definition of the indicator values within the different scenarios was done through:

- Data collected in the tested reaches, at different times (during the SHARE project and in previous years);
- Surveys done in areas with hydropower pressures belonging to the same environmental category;
- Information provided by the manager of the HP plant (including both the reservoir and the plant itself) about how the plant operates, how much water is used and how much energy is produced in the different periods considered.
- Expert opinions of the stakeholders involved.

The actual MCA tree includes only the indicators that can be affected by the difference among the considered scenarios. Other parameters, that could be considered as unavoidable constraints, are not included in the tree, but have to be considered in the MCA analysis as constants, that have to be respected to evaluate a single design option.
These parameters are:

- Ecological status of the water body
- Other uses of water (drinking water abstraction, irrigation, industrial uses) downstream the reservoir and the power plant.

MCA tree

- Pourrieres
  - Energy
    - Global
      - Production
        - %_production_over_national_production_[%] (F)
      - Towards_20_2020_goals
        - %_contribution_to_national_goal_[%] (F)
    - Local
      - Production
        - %_production_over_regional_production_[%] (F)
      - Towards_20_2020_goals
        - %_contribution_to_regional_goal_[%] (F)
  - HP_Economy
    - Costs
      - Annual_amortization_[N] (F)
      - Annual_maintenance_[N] (F)
    - Proceeds
      - Annual_proceeds_[N] (F)
  - Environment
    - Residual_flow_reach
      - River_ecosystem
        - Hydrology
          - Flow_variation
            - Ratio_of_real_monthly_Q_to_natural_monthly_Q
              - QReal_QNat_Section_A1_[%] (A) (F)
              - QReal_QNat_Section_A2_[%] (A) (F)
            - Ratio_of_real_annual_Q_to_natural_annual_Q
              - RealOnNat_AnnualQ_Section_A1_[%] (F)
              - RealOnNat_AnnualQ_Section_A2_[%] (F)
          - Hydrological_integrity
            - Question_5_IFF_[N] (F)
        - Morphology
          - Riverbed_substratum
            - Granulometry
              - Section_A1
                - Rocks_[class] (F)
                - Pebbles_[class] (F)
                - Silt_[class] (F)
              - Section_A2
                - Rocks_[class] (F)
                - Pebbles_[class] (F)
                - Silt_[class] (F)
          - Banks
            - Erosion
              - Erosion_Section_A1_[N] (F)
              - Erosion_Section_A2_[N] (F)
          - Morphological_integrity
            - IQM_index
              - IQM_Section_A1_[N] (F)
              - IQM_Section_A2_[N] (F)
            - IFF_subindex_Morphological_functionality
              - Subind_Morph_Section_A1_[N] (F)
              - Subind_Morph_Section_A2_[N] (F)
        - Aquatic environment

- Aquatic_environment
  - Section_A1
    - Mesohabitat
      - Fish_fauna_suitability_IFFQ10_[N] (F)
      - Mesohabitat_evaluation_IFFQ11_[N] (F)
    - Macrophytes
      - Macrophyte_functional_groups_[N] (F)
    - Macrobenthos
      - IASPT_[N] (F)
  - Section_A2
    - Mesohabitat
      - Fish_fauna_suitability_IFFQ10_[N] (F)
      - Mesohabitat_evaluation_IFFQ11_[N] (F)
    - Macrophytes
      - Macrophyte_functional_groups_[N] (F)
    - Macrobenthos
      - IASPT_[N] (F)
- Riparian_environment
  - Section_A1
    - Presence_of_characteristic_riparian_habitat_[N] (F)
    - Riparian_communities
      - Typology:_IFFQ2_perifluvial_vegetation_[N] (F)
      - Extension:_IFFQ3_4_[N] (F)
      - IFF_subindex_perifluvial_vegetation_functionality_[N] (F)
  - Section_A2
    - Presence_of_characteristic_riparian_habitat_[N] (F)
    - Riparian_communities
      - Typology:_IFFQ2_perifluvial_vegetation_[N] (F)
      - Extension:_IFFQ3_4_[N] (F)
      - IFF_subindex_perifluvial_vegetation_functionality_[N] (F)
- River_corridor_functionality_index_IFF
  - IFF_Section_A1_[N] (F)
  - IFF_Section_A2_[N] (F)

- Reach_downstream_of_water_release
  - River_ecosystem
    - Hydrology
      - Hydropeaking
        - Instant_max_flow_variation_[N] (F)
        - Instant_average_flow_variation_[N] (F)
        - Variation_frequency
          - Average_distance_between_two_events_Hv>3_[hours] (F)
          - Average_distance_between_two_events_Hv>15_[hours] (F)
      - Hydrological_integrity
        - Question_5_IFF__[N] (F)
    - Morphology
      - Riverbed_substratum
        - Granulometry
          - Section_B1
            - Rocks_[class] (F)
            - Pebbles_[class] (F)
            - Silt_[class] (F)
          - Section_B2
            - Rocks_[class] (F)
            - Pebbles_[class] (F)
            - Silt_[class] (F)

Chisone River reach case study tree's constructed

Indicators description – Chisone River PCS

The following section contains the metadata of every indicator used in the Chisone River reach example directly related to MCA model Sesamo software.
The structure of the decision tree for pilot case of Chisone River, considers 4 main branches:

1. **Energy;**
2. **HP Economy;**
3. **Environment;**
4. **Fruition**

• The first branch called **ENERGY** includes global and local criteria on the hydropower production. It is divided into 2 sub-criteria:

- ***GLOBAL***: this sub-criteria is evaluated through energy indicators such as:
- **Production**;
- **Towards 20 2020 goals**
- ***LOCAL***: sub-criteria evaluated through energy indicators such as
- **Production**;
- **Towards 20 2020 goals**

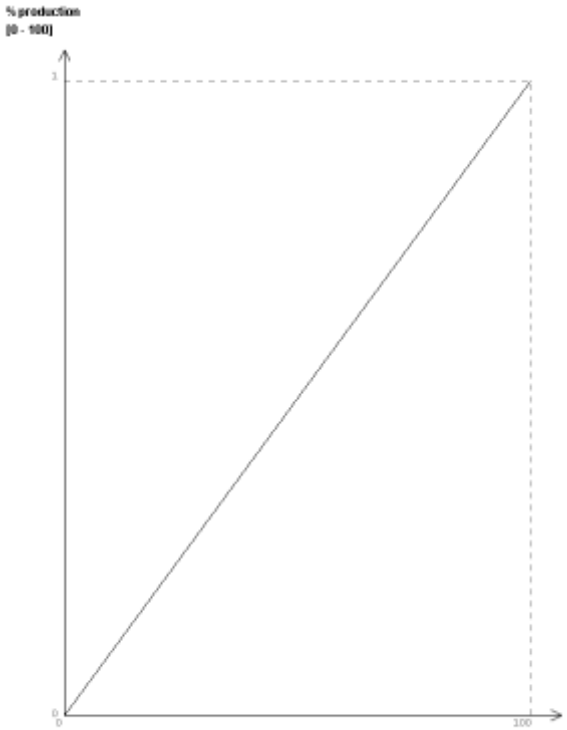
Chisone tree | ENERGY | Global | Production

FIELD	DESCRIPTION
INDICATOR NAME	% production over national production
ACRONYM	
DPSIR	D (Driving Forces)
DESCRIPTION	% of the plant annual production in the year considered over the national production It furnishes an evaluation of the contribute of annual plant energy production (*GWh/year*) over the national production.
AIM	Establishing the contribute of the plant production at the national level
KEY MESSAGE	
MEASURE UNIT	*%*
REFERENCES	–
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	% calculation
INDICATOR LIMITS	----

<table>
<tr><td>EVALUATION</td><td>The main parameters considered for the calculation are:

<table>
<tr><th></th><th>Alt 0</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>Production</td><td>18335</td><td>20905</td><td>30284</td><td>18335</td></tr>
<tr><td>Fenestrelle Production</td><td>0</td><td>13</td><td>6</td><td>6</td></tr>
</table>

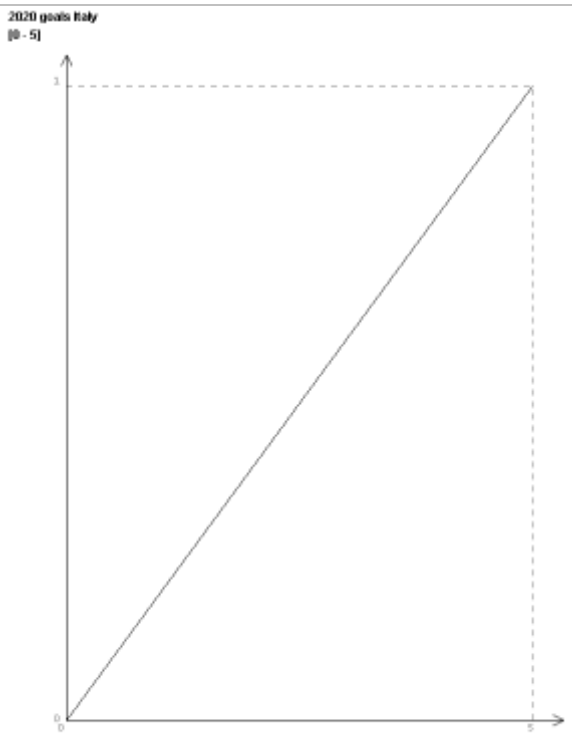
The values for the different alternatives of Chisone correspond to:

<table>
<tr><td>Alt 0</td><td>Alt 1</td><td>Alt 2</td><td>Alt 3</td></tr>
<tr><td>0</td><td>0.043</td><td>0.029</td><td>0.033</td></tr>
</table>
</td></tr>
<tr><td>AVAILABLE UF</td><td>YES</td></tr>
<tr><td>UF</td><td>The Utility Function adopted is LINEAR growing (0 – 100 %)
 
</td></tr>
<tr><td>SHARE RELATED IND.</td><td>-</td></tr>
<tr><td>COUNTRY CODE</td><td>IT</td></tr>
<tr><td>WFD HER</td><td>INNER ALPS SOUTH</td></tr>
<tr><td>FIELD</td><td>DATASOURCES</td></tr>
<tr><td>DATA SOURCE</td><td>HP producer</td></tr>
<tr><td>TIME COVER</td><td>year</td></tr>
<tr><td>UPDATE FREQUENCY</td><td>annual</td></tr>
<tr><td>NUT III CODE</td><td>ITD32</td></tr>
<tr><td>NORMATIVE REFERENCE</td><td>-</td></tr>
</table>

NORMATIVE RELEVANCE	-
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENERGY | Global | Towards 20 2020 goals

FIELD	DESCRIPTION
INDICATOR NAME	% contribution to national goal
ACRONYM	
DPSIR	D (Driving Forces)
DESCRIPTION	% of the plant annual production in the year considered over the national goal of 20 2020 Directive It furnishes an evaluation of the contribute of annual plant energy production (GWh/year) over the national goal.
AIM	Establishing the contribute of the plant production at the achieving of national goals
KEY MESSAGE	
MEASURE UNIT	%
REFERENCES	
FIELD	METHODS AND MONITORING STANDARDS
INDICATOR ELABORATION	% calculation
INDICATOR LIMITS	This indicator depends on the contribution of the single HPP to the total energy production
EVALUATION	In absence of real production data the calculation have been done considering the maximum potential production. The values for the different alternatives of Chisone correspond to: Alt 0: 0 — Alt 1: 1.74 — Alt 2: 0.8025 — Alt 3: 0.8025
AVAILABLE UF	YES
UF	The Utility Function adopted is LINEAR growing (0 – 5 %)

	
SHARE RELATED IND.	-
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	HP producer
TIME COVER	year
UPDATE FREQUENCY	annual
NUT III CODE	ITD32
NORMATIVE REFERENCE	-
NORMATIVE RELEVANCE	-
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENERGY | Local | Production

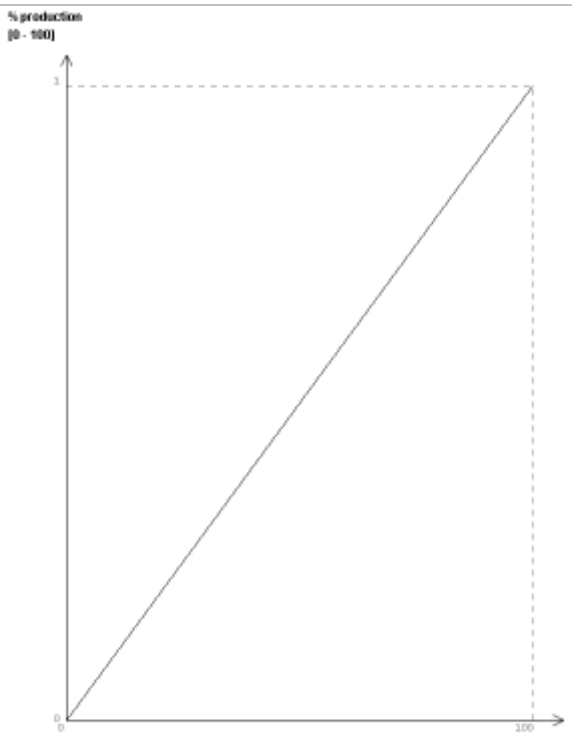
FIELD	DESCRIPTION
INDICATOR NAME	% production over regional (Piemonte) production
ACRONYM	

<table>
<tr><td>DPSIR</td><td>D (Driving Forces)</td></tr>
<tr><td>DESCRIPTION</td><td>% of the plant annual production in the year considered over the regional production in Piemonte
It furnishes an evaluation of the contribute of annual plant energy production (GWh/year) over the regional production.</td></tr>
<tr><td>AIM</td><td>Establishing the contribute of the plant production at the regional level</td></tr>
<tr><td>KEY MESSAGE</td><td></td></tr>
<tr><td>MEASURE UNIT</td><td>%</td></tr>
<tr><td>REFERENCES</td><td></td></tr>
<tr><td>FIELD</td><td>METHODS AND MONITORING STANDARDS</td></tr>
<tr><td>INDICATOR ELABORATION</td><td>% calculation</td></tr>
<tr><td>INDICATOR LIMITS</td><td>----</td></tr>
<tr><td>EVALUATION</td><td>The main parameters considered for the calculation are:

<table>
<tr><td></td><td>Alt 0</td><td>Alt 1</td><td>Alt 2</td><td>Alt 3</td></tr>
<tr><td>Production</td><td>1988</td><td>2880</td><td>1744</td><td>1988</td></tr>
<tr><td>Fenestrelle Production</td><td>0</td><td>13</td><td>6</td><td>6</td></tr>
</table>

The values for the different alternatives of Chisone correspond to:

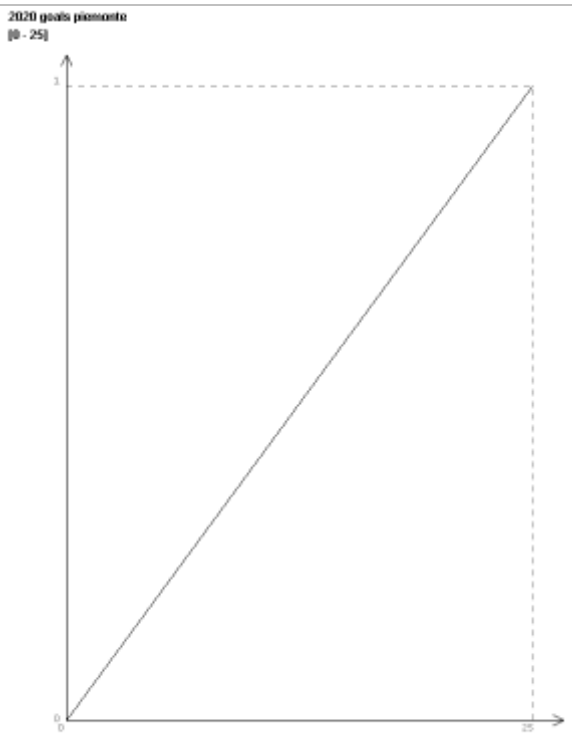
<table>
<tr><td>Alt 0</td><td>Alt 1</td><td>Alt 2</td><td>Alt 3</td></tr>
<tr><td>0</td><td>0.451</td><td>0.344</td><td>0.302</td></tr>
</table>
</td></tr>
<tr><td>AVAILABLE UF</td><td>YES</td></tr>
<tr><td>UF</td><td>The Utility Function adopted is LINEAR growing (0 – 100 %)</td></tr>
</table>

	
SHARE RELATED IND.	-
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	HP producer
TIME COVER	year
UPDATE FREQUENCY	annual
NUT III CODE	ITD32
NORMATIVE REFERENCE	-
NORMATIVE RELEVANCE	-
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENERGY | Global | Towards 20 2020 goals

FIELD	DESCRIPTION
INDICATOR NAME	% contribution to regional (Piemonte) goal
ACRONYM	

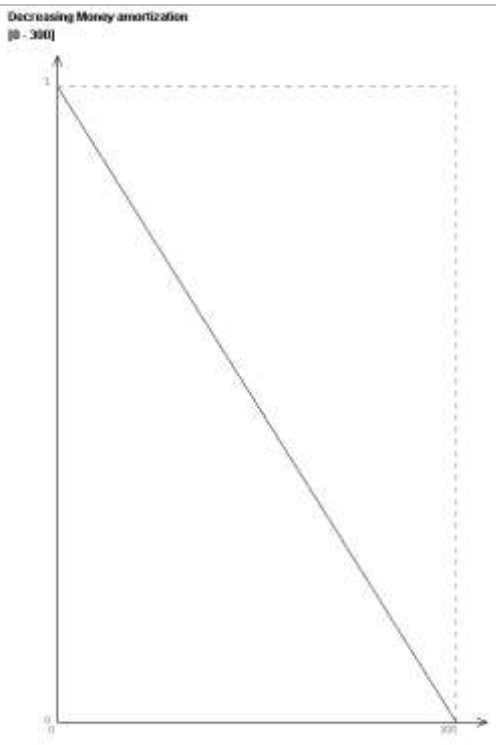
DPSIR	D (Driving Forces)
DESCRIPTION	% of the plant annual production in the year considered over the regional goal of 20 2020 Directive It furnishes an evaluation of the contribute of annual plant energy production (GWh/year) over the regional goal.
AIM	Establishing the contribute of the plant production at the achieving of regional goals
KEY MESSAGE	
MEASURE UNIT	%
REFERENCES	
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	% calculation In absence of real production data the calculation have been done considering the maximum potential production.
INDICATOR LIMITS	This indicator depends on the contribution of the single HPP to the total energy production
EVALUATION	The values for the different alternatives of Chisone correspond to: Alt 0: 0 — Alt 1: 19.21 — Alt 2: 8.865 — Alt 3: 8.865
AVAILABLE UF	YES
UF	The Utility Function adopted is LINEAR growing (0 – 25 %)

	
SHARE RELATED IND.	-
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	HP producer
TIME COVER	year
UPDATE FREQUENCY	annual
NUT III CODE	ITD32
NORMATIVE REFERENCE	-
NORMATIVE RELEVANCE	-
SHARE PILOT CASE STUDY	Chisone

- The second criterium called **HP ECONOMY** is here explained by two branches:
  - ***COSTS***: this sub-criteria is evaluated through indicators such as:
  - **Annual amortization**;
  - **Annual maintenance**
  - ***PROCEEDS***: sub-criteria evaluated through anindicator:
  - **Annual proceed**

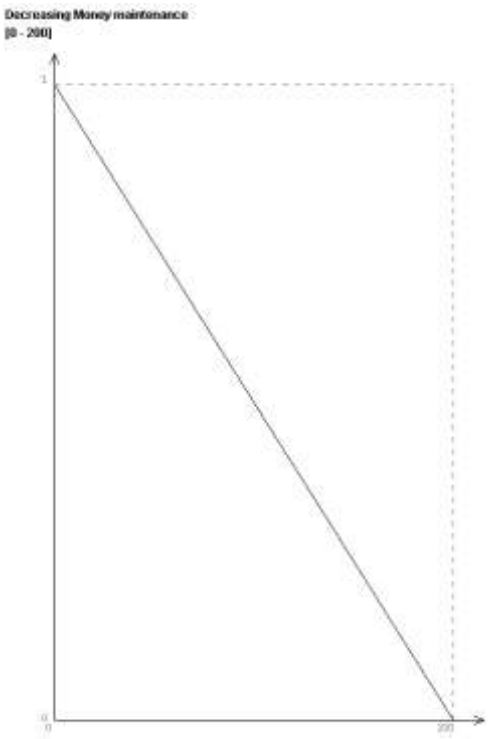
Chisone tree | HP ECONOMY | Costs | Annual amortization

FIELD	DESCRIPTION
INDICATOR NAME	Annual amortization
ACRONYM	
DPSIR	
DESCRIPTION	This indicator furnishes an evaluation of fthe costs incurred by the plant owner as amortization of costs of purchase and/or construction.
AIM	To evaluate the investment costs of the owner.
KEY MESSAGE	
MEASURE UNIT	*€ (N)*
REFERENCES	–
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Waiting for having more detail about the producer's depreciation costs, we used value indicators taken from preliminary provisional information.
INDICATOR LIMITS	
EVALUATION	The values for the different alternatives of Chisone correspond to: Alt 0 Alt 1 Alt 2 Alt 3 0 200 100 100
AVAILABLE UF	YES
UF	The Utility Function adopted is LINEAR decreasing fron 300 to 0

	
SHARE RELATED IND.	-----
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	HP producer
TIME COVER	Cosidered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	----
NORMATIVE RELEVANCE	----
SHARE PILOT CASE STUDY	Chisone

Chisone tree | HP ECONOMY | Costs | Annual maintenance

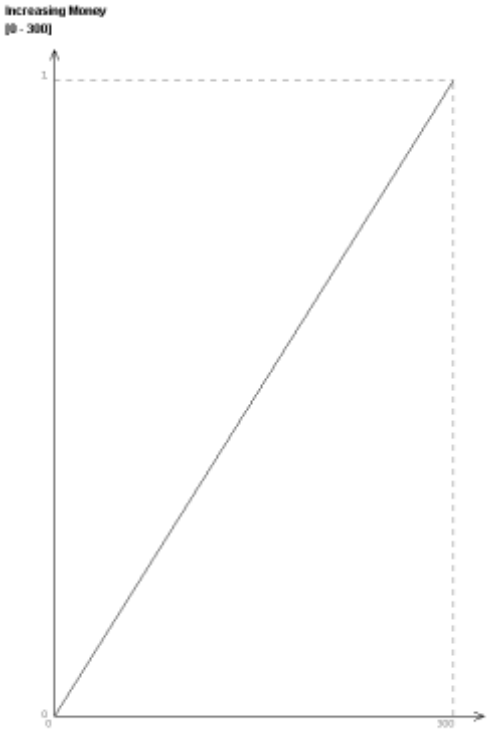
FIELD	DESCRIPTION
INDICATOR NAME	Annual maintenance
ACRONYM	
DPSIR	

DESCRIPTION	This indicator furnishes an evaluation of fthe costs incurred by the plant owner as maintenance of the plants.
AIM	To evaluate the maintenance costs of the owner.
KEY MESSAGE	
MEASURE UNIT	*€ (N)*
REFERENCES	–
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Waiting for having more detail about the producer's maintenance costs, we used value indicators taken from preliminary provisional information.
INDICATOR LIMITS	
EVALUATION	The values for the different alternatives of Chisone correspond to: Alt 0: 0 — Alt 1: 80 — Alt 2: 120 — Alt 3: 100
AVAILABLE UF	YES
UF	The Utility Function adopted is LINEAR decreasing fron 200 to 0 

SHARE RELATED IND.	-----
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	HP producer
TIME COVER	Cosidered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	----
NORMATIVE RELEVANCE	----
SHARE PILOT CASE STUDY	Chisone

Chisone tree | HP ECONOMY | Proceeds | Annual proceed

FIELD	**DESCRIPTION**
INDICATOR NAME	Annual proceed
ACRONYM	
DPSIR	
DESCRIPTION	This indicator furnishes an evaluation of fthe proceeds achieved by the plant owner from the plant.
AIM	To evaluate the proceeds of the owner.
KEY MESSAGE	
MEASURE UNIT	*€ (N)*
REFERENCES	–
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Waiting for having more detail about the producer's proceeds, we used value indicators taken from preliminary provisional information.
INDICATOR LIMITS	

EVALUATION	The values for the different alternatives of Chisone correspond to: Alt 0 Alt 1 Alt 2 Alt 3 0 300 150 100
AVAILABLE UF	YES
UF	The Utility Function adopted is LINEAR increasing fron 0 to 300 
SHARE RELATED IND.	-----
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	HP producer
TIME COVER	Cosidered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	----
NORMATIVE RELEVANCE	----
SHARE PILOT CASE STUDY	Chisone

• The third branch is **ENVIRONMENT**, which is divided into 3 sub-criteria (the first two correspond to the two different stretches considered).

- ***RESIDUAL FLOW REACH***
- ***REACH DOWNSTREAM OF WATER RELEASE***
- ***GLOBAL ENVIRONMENT***

The indicators used for the first two sub-criteria belong to different categories:

- ⇒ Hydrology
  - Flow variation
    - Ratio of real monthly Q to natural monthly Q
    - Ratio of real annual Q to natural annual Q
  - Hydropeaking
    - Hydropeaking index
      - Instant max flow variation
      - Instant average flow variation
    - Variation frequency
      - Average distance between two events Hv>3
      - Average distance between two events Hv>15
  - Hydrological integrity
    - Question 5 IFF
- ⇒ Morphology
  - Riverbed substratum - Granulometry
    - Rocks
    - Pebbles
    - Silt
  - Banks
    - Erosion
  - Morphological integrity
    - IQM Index
    - IFF subindex morphological functionality
- ⇒ Aquatic environment
  - Mesohabitat
    - Fish fauna suitability IFFQ10
    - Mesohabitat evaluation IFFQ11
  - Macrophytes
    - Macrophyte functional groups
  - Macrobenthos
    - IASPT
- ⇒ Riparian environment
    - Presence of characteristic riparian habitat
  - Riparian communities
    - Typology: IFFQ2 perifluvial vegetation
    - Extension: IFFQ3 4
    - IFF subindex perifluvial vegetation functionality
- ⇒ River corridor functionality
    - IFF

The indicator used for the third sub-criterium is:

- CO2 offset

Chisone tree | ENVIRONMENT | Hydrology | Flow variation | Ratio of real monthly Q to natural monthly Q

FIELD	DESCRIPTION

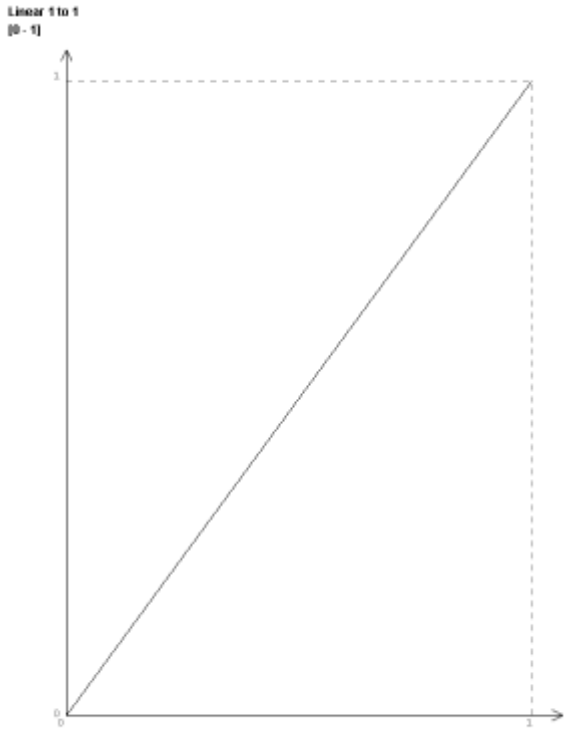
INDICATOR NAME	Ratio of real monthly Q to natural monthly Q
ACRONYM	
DPSIR	I – Impact indicator
DESCRIPTION	The monthly average flow in a certain section is given by rainfalls and the surface of the relevant basin. The assessment of the real flows/natural flows ratio gives the water abstraction impact on the hydrological regime in the specific section, and is defined as residual hydric balance.
AIM	Assessing hydrological alterations determined by current water abstraction with regard to annual natural average flows.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ B.D. Richter, J.V. Baumgartner, J. Powell, D.P. Braun – 1996 - A Method for Assessing Hydrologic Alteration within Ecosystems. – Conservation Biology 10(4):1163-1174 ⇒ ISPRA 2010, Implementazione della Direttiva 2000/60/CE. Analisi e valutazione degli aspetti idromorfologici - Bozza 11.03.2010, Istituto Superiore per la Protezione e la Ricerca Ambientale, Roma
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	In the absence of data directly collected on instrumented sections, the value of the average monthly natural flow is estimated by mathematical modeling (calculated on the basis of the area of the basin underlying the section identified and the system of pluvio-nivali inflows). Similarly, the value of the actual monthly average flow is estimated by mathematical modeling (developed on the basis of the residual basin surface, net from the basin underlying the dam, and the regime of pluvio-nivali inflows). For each section is added, we calculated the ratio between the real monthly average flow (determined by adding the runoff from the residual basin and the MIF released) and the monthly average natural flow for each month of the year. This defines a maximum water balance for the identified section.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

	Alt 0	Alt 1	Alt 2	Alt 3
Section A1				
January	1	0.367	0.078	0.084
February	1	0.403	0.092	0.089
March	1	0.352	0.081	0.083
April	1	0.244	0.25	0.334
May	1	0.385	0.316	0.511
June	1	0.424	0.231	0.425
July	1	0.209	0.161	0.131
August	1	0.198	0.078	0.15
September	1	0.247	0.429	0.478
October	1	0.299	0.231	0.587
November	1	0.285	0.067	0.16
December	1	0.358	0.08	0.08
Section A2				
January	1	0.387	0.112	0.119

	February	1	0.42	0.129	0.126
	March	1	0.367	0.115	0.118
	April	1	0.267	0.277	0.363
	May	1	0.404	0.337	0.526
	June	1	0.442	0.254	0.439
	July	1	0.233	0.185	0.154
	August	1	0.222	0.108	0.175
	September	1	0.27	0.446	0.49
	October	1	0.32	0.253	0.6
	November	1	0.306	0.096	0.191
	December	1	0.377	0.114	0.114

Data relating to each months have been aggregated according to the function "minimum"

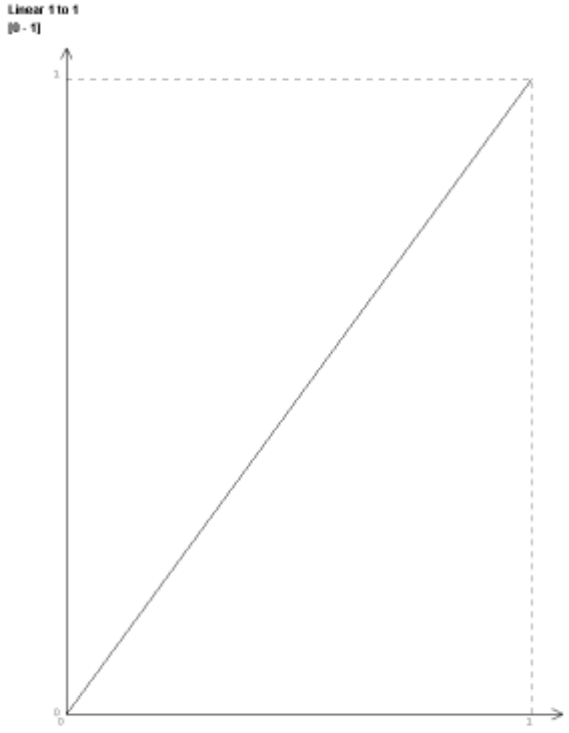
	Alt 0	Alt 1	Alt 2	Alt 3
Section A1	1	0.198	0.067	0.08
Section A2	1	0.222	0.096	0.114

AVAILABLE UF	YES
UF	The utility function (UF) for the values normalization is LINEAR 1 to 1 increasing 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	Hydrodata s.r.l. on behalf of Regione Piemonte
TIME COVER	Considered years

UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Hydrology | Hydropeaking | Ratio of real annual Q to natural annual Q

FIELD	DESCRIPTION
INDICATOR NAME	Ratio of real annual Q to natural annual Q
ACRONYM	
DPSIR	I – Impact indicator
DESCRIPTION	The annual average flow in a certain section is given by rainfalls and the surface of the relevant basin. The assessment of the real flows/natural flows ratio gives the water abstraction impact on the hydrological regime in the specific section, and is defined as residual hydric balance.
AIM	Assessing hydrological alterations determined by current water abstraction with regard to annual natural average flows.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ B.D. Richter, J.V. Baumgartner, J. Powell, D.P. Braun – 1996 - A Method for Assessing Hydrologic Alteration within Ecosystems. – Conservation Biology 10(4):1163-1174 ⇒ ISPRA 2010, Implementazione della Direttiva 2000/60/CE. Analisi e valutazione degli aspetti idromorfologici - Bozza 11.03.2010, Istituto Superiore per la Protezione e la Ricerca Ambientale, Roma
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	In the absence of data directly collected on instrumented sections, the value of the average annual natural flow is estimated by mathematical modeling (calculated on the basis of the area of the basin underlying the section identified and the system of pluvio-nivali inflows). Similarly, the value of the actual annual average flow is estimated by mathematical modeling (developed on the basis of the residual basin surface, net from the basin underlying the dam, and the regime of pluvio-nivali inflows). For each section is added, we calculated the ratio between the real annual average flow (determined by adding the runoff from the residual basin and the MIF released) and the annual average natural flow for each month of the year. It is therefore identified a maximum water balance for the identified section.
INDICATOR LIMITS	

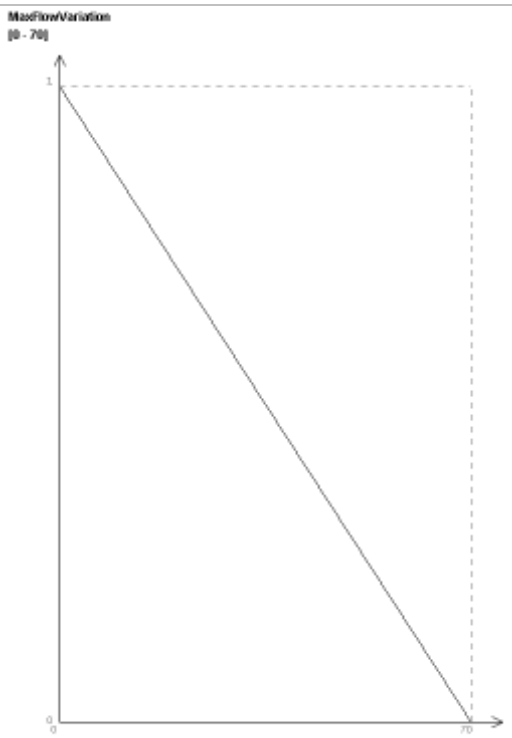
EVALUATION	Data used for the Chisone tree are the following: Alt 0 Alt 1 Alt 2 Alt 3 Section A1 1 0.355 0.248 0.397 Section A2 1 0.376 0.271 0.416
AVAILABLE UF	YES
UF	The utility function (UF) for the values normalization is LINEAR 0 to 1 increasing 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	Hydrodata s.r.l. on behalf of Regione Piemonte
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Hydrology | Flow variation | Hydropeaking | Hydropeaking index

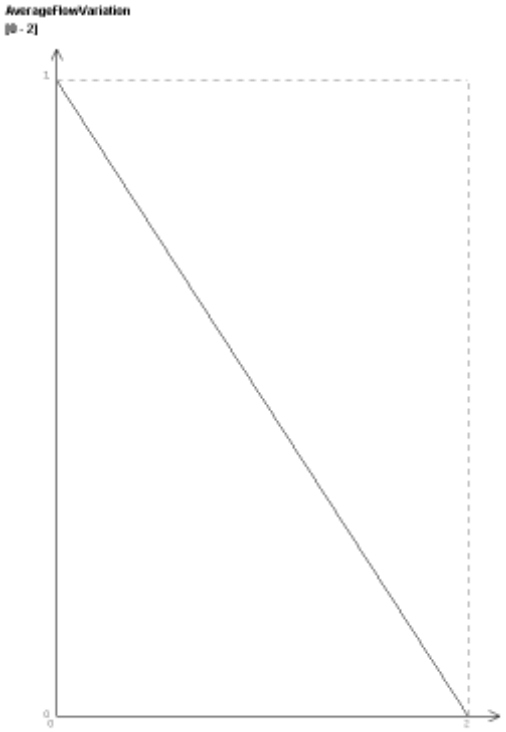
FIELD	DESCRIPTION
INDICATOR NAME	Hydropeaking index
ACRONYM	
DPSIR	I – Impact indicator
DESCRIPTION	One of the main anthropogenetic causes of the ecological decline of many alpine waterbodies is hydropeaking. Flow variations may be much bigger than the minimal flow and show variable minimum and maximum points, in relations to the hydropower production needs during the day. Often level variations are directly connected to the trend of economic values of the electric share market. Every sudden flow change provokes important effects on the macrobenthos community and the phenomenon of catastrophic drift.
AIM	Assessing instant hydrological alterations determined by the intermittent functioning of the hydropower plant
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ A. Siviglia – 2010 - Alterazioni eco-idrauliche dei corsi d'acqua alpini: l'hydropeaking. – Relazione al Workshop "Idromorfologia e Direttiva Quadro Acque" Roma, 22-23 aprile 2010
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The hydropeaking index is calculated considering the values of the hourly flow variations in relation to the so-called base flow, which is the flow naturally produced by the basin where the power station discharge pulsation is produced: Hv = Qv / Qv Qm where Qv is the hourly variation of the discharged flow and Qm is the hourly "base" flow . The index is therefore an adimensional parameter. In order to calculate the maximum instantaneous variation, we considered both positive and negative variations. It was also used as an indicator the average annual variation.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

	Alt 0	Alt 1	Alt 2	Alt 3
Instant max flow variation	0	40.73	62.65	50.35
Instant average flow variation	0	0.86	1.25	1.53

AVAILABLE UF	YES
UF	The utility function (UF) used for Instant max flow variation is LINEAR decreasing from 70 to 0



The utility function (UF) used for Instant average flow variation is LINEAR decreasing from 2 to 0



SHARE RELATED IND.	
COUNTRY CODE	IT

WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	Hydrodata s.r.l. on behalf of Regione Piemonte
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Hydrology | Flow variation | Hydropeaking | Variation frequency

FIELD	**DESCRIPTION**
INDICATOR NAME	Variation frequency
ACRONYM	
DPSIR	I – Impact indicator
DESCRIPTION	Frequency of the sudden change in hourly flow discharge in the riverbed, due to the power station. We used two different indicator thresholds to describe the phenomenon: - Hv> 3 - to identify all the phenomena of "ordinary" hydropeaking, - hv> 15 - to identify the phenomena of "extraordinary" hydropeaking.
AIM	Assessing the frequency of instant hydrological alterations determined by the intermittent functioning of the hydropower plant
KEY MESSAGE	
MEASURE UNIT	hours
REFERENCES	⇒ A. Siviglia – 2010 - Alterazioni eco-idrauliche dei corsi d'acqua alpini: l'hydropeaking. – Relazione al Workshop "Idromorfologia e Direttiva Quadro Acque" Roma, 22-23 aprile 2010
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The analysis was carried out by calculating, for each period considered, how often and with what intensity the hydropeaking phenomenon occurs and trying to identify the most critical periods, in terms of both frequency and seasonal nature of the phenomenon.
INDICATOR LIMITS	

EVALUATION

Data used for the Chisone tree are the following:

	Alt 0	Alt 1	Alt 2	Alt 3
Average distance between two events Hv>3	500	9.5	12.9	9.5
Average distance between two events Hv>15	1,000	26	33.6	150

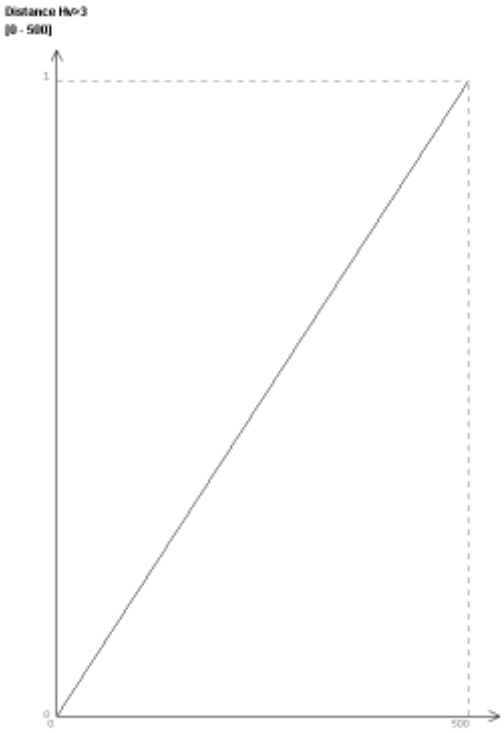
The values for Alternative 0 have been assumed arbitrarily (they had to be infinite)

AVAILABLE UF

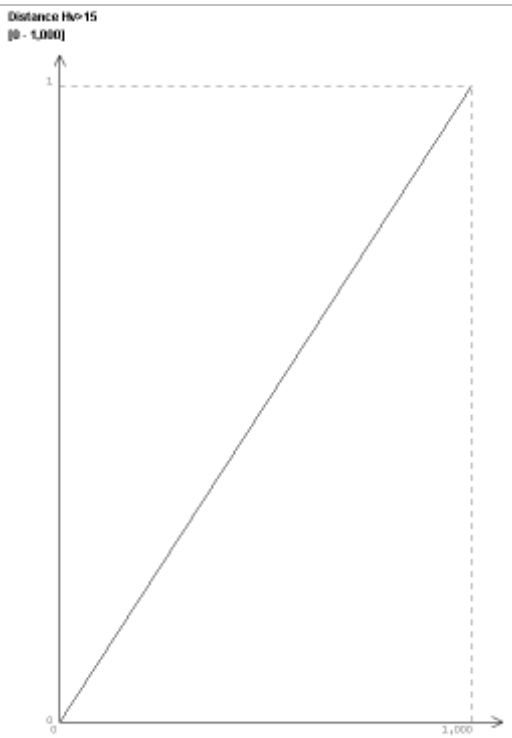
YES

UF

The utility function (UF) used for Average distance between two events Hv>3 is LINEAR increasing from 0 to 500



The utility function (UF) used for Average distance between two events Hv>15 is LINEAR increasing from 0 to 1000

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	Hydrodata s.r.l. on behalf of Regione Piemonte
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

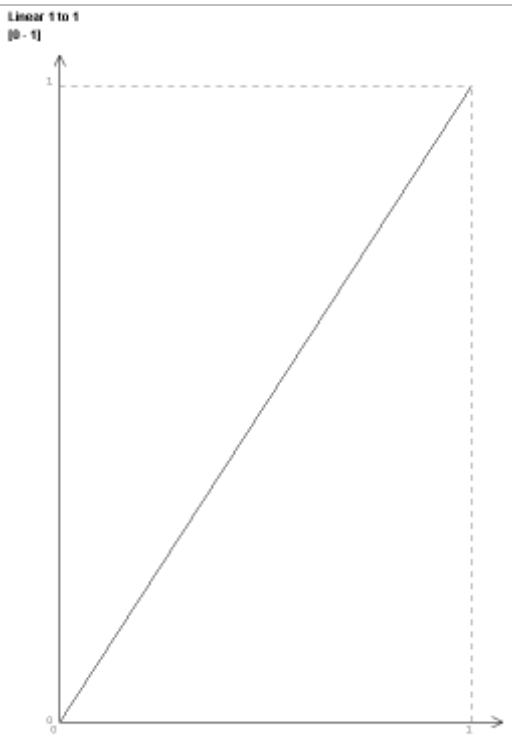
Chisone tree | ENVIRONMENT | Hydrology | Flow variation | Hydrological integrity | Question 5 IFF

FIELD	DESCRIPTION
INDICATOR NAME	Hydrological integrity
ACRONYM	*IFF Q5*

DPSIR	I – Impact indicator
DESCRIPTION	The index requires the answer to the question: HYDROLOGICAL CONDITIONS, defining if it is a) perennial regime with undisturbed flows and wet riverbed width > 1/3 moderate flow riverbed; b) long-term induced flow fluctuations with wet riverbed width < 1/3 moderate flow riverbed; c) frequent flow disturbances or seasonal natural non-prolonged dryness or constant induced flows or variations of the hydraulic bar alone; d) strong, very frequent or sudden flow disturbances or prolonged dry conditions having anthropic origin.
AIM	Assessing the effects on the functionality of the flow trend determined by hydrological trend in the river stretch considered. The frequency and intensity trends of the flow variations influence the colonization efficiency of the animal and vegetal communities. The most functional situations are those where flow variations are limited and naturally modulated, or not induced by morphological/hydrological alterations.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Based on available information, we assigned to the question one of the 4 answers proposed by the method (see manual IFF 2007 for more details). We assigned a value to the answer according to the following method: Answer A -> 1; Answer B -> 0.66; Answer C -> 0.33; Answer D -> 0. We then calculated the weighted average for the homogeneous sections on both sides (separately measured) in the stretch considered.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

	Alt 0	Alt 1	Alt 2	Alt 3
Reach downstream of water release	1	0	0	0.33
Residual flow reach	1	0.33	0.33	0.33

AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

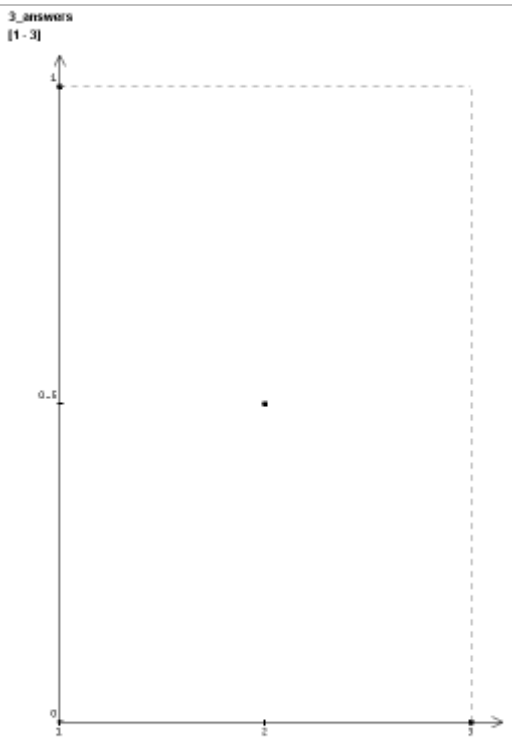
Chisone tree | ENVIRONMENT | Hydrology | Morphology | Hydrological integrity | Riverbed substratum – Granulometry | Rocks – Pebbles – Silt

FIELD	DESCRIPTION
INDICATOR NAME	Granulometry alteration
ACRONYM	

DPSIR	I – Impact indicator
DESCRIPTION	The alteration of hydrological conditions, with regards especially to the frequent and sudden level variations (hydropeaking) may cause phenomena of selective transport of sediments, which can significantly alter granulometry. For the case study, have been considered Rocks, Pebbles and Silt.
AIM	Assessing the granulometric alteration of the sediment compared to the referece conditions.
KEY MESSAGE	
MEASURE UNIT	class
REFERENCES	
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	For each granulometric class considered, the presence percentages are calculated in the considered stretch. For each granulometric class, we calculated the ratio between the actual coverage and that expected coverage in the river typology considered. We assigned a value index using the following procedure: 1: Deviation less than 33%; 2 deviation from the expected value between 33% and 66%, 3: Deviation from the expected value above 66%.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

			Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	Rocks	1	1	1	1
Residual flow reach	Section A1	Pebbles	1	1	1	1
Residual flow reach	Section A1	Silt	1	1	1	1
Residual flow reach	Section A2	Rocks	1	2	1	1
Residual flow reach	Section A2	Pebbles	1	3	1	1
Residual flow reach	Section A2	Silt	1	3	3	3
Reach downstream of water release	Section B1	Rocks	1	1	1	1
Reach downstream of water release	Section B1	Pebbles	1	2	2	2
Reach downstream of water release	Section B1	Silt	1	1	1	1
Reach downstream of water release	Section B2	Rocks	1	3	3	3
Reach downstream of water release	Section B2	Pebbles	1	1	1	1
Reach downstream of water release	Section B2	Silt	1	2	2	1

AVAILABLE UF	YES
UF	The utility function (UF) used is STEP decreasing from 1 to 3

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

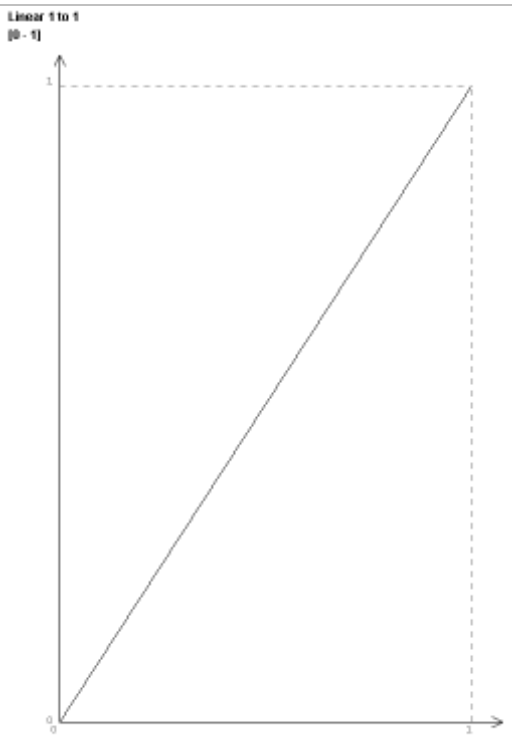
Chisone tree | ENVIRONMENT | Morphology | Banks | Erosion

FIELD	DESCRIPTION
INDICATOR NAME	Bank erosion
ACRONYM	

DPSIR	I – Impact indicator
DESCRIPTION	The alteration of hydrological conditions, with regards especially to the frequent and sudden level variations (hydropeaking) may cause phenomena of localised erosion, with undermining of river banks.
AIM	Assessing the presence of erosion phenomena due to undermining of river banks.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	We assessed whether the erosion is: A) Not clear and not relevant or only present in the bends, B) located on the straight stretches with and / or low vertical incision, C) frequent, with excavation of the river banks and basis and / or obvious vertical incision; D) very clear with eroded and collapsed banks or presence of artificial works. We therefore assigned a value to the index using the following steps: Answer A: 1; Answer B: 0.66; Answer C: 0.33; Answer D: 0. We calculated the weighted average of the homogeneous sections on both sides (measured separately) in the stretch considered.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

		Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	1	0.66	0.66	0.33
Residual flow reach	Section A2	1	0.39	0.58	0.33
Reach downstream of water release	Section B1	0.61	0.61	0.52	0.03
Reach downstream of water release	Section B2	0.84	0.37	0.8	0.06

AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1

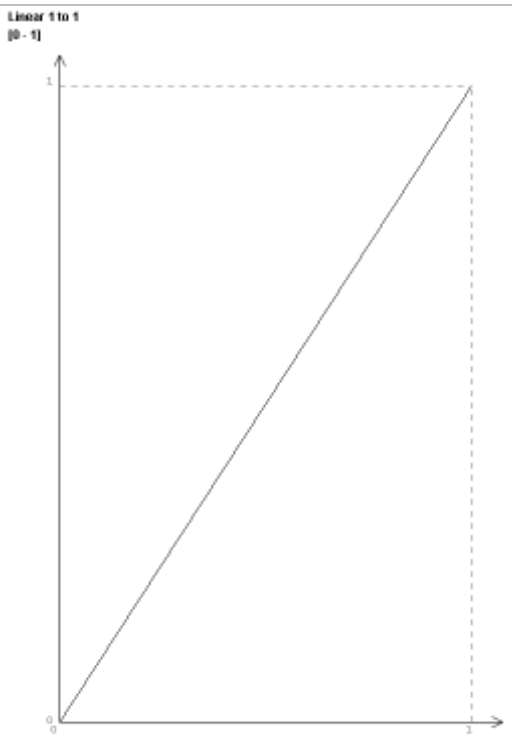
	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Morphology | Morphological integrity | IQM Index

FIELD	DESCRIPTION
INDICATOR NAME	Morphological Quality Index
ACRONYM	*IQM*

DPSIR	S – State indicator
DESCRIPTION	IQM evaluates the morphological state by considering geomorphologic functionality, artificialization and morphological variations. It provides a measure of the deviation of the existent hydromorphological situation with respect to a reference situation
AIM	Assessing the deviation of the current morphological features from an established reference state.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Rinaldi M., Surian N., Comiti F., Bussettini M. 2011 - Manuale tecnico – operativo per la valutazione ed il monitoraggio dello stato morfologico dei corsi d'acqua – Versione 1 - Istituto Superiore per la Protezione e la Ricerca Ambientale, Roma, 232 pp.
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The method includes the collection of both historical and cartographic information, and the survey of features in the field, on the basis of a defined protocol defined in the operative manual. The evaluation of the morphological quality is carried out separately on three aspects: Geomorphological functionality (evaluating forms and features of the processes); Artificiality (based on the presence of works and interventions); Morphological variations (assessing the changes occurred in recent decades, with particular reference to the 50s with regard to planimetric variations). The total IQM value is obtained in relation to the maximum value that can be obtained for the stretch considered.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1

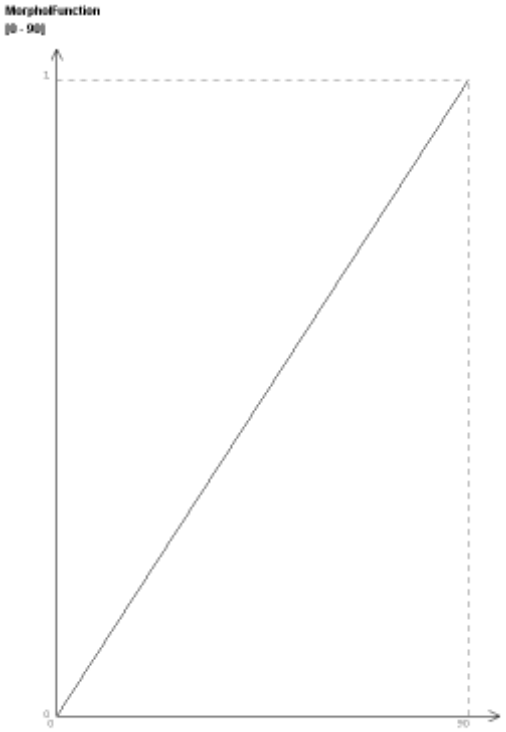
		Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	1	0.91	0.91	0.91
Residual flow reach	Section A2	0.82	0.73	0.73	0.73
Reach downstream of water release	Section B1	0.71	0.62	0.62	0.62
Reach downstream of water release	Section B2	0.9	0.77	0.77	0.81

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Morphology | Morphological integrity | IFF subindex morphological functionality

FIELD	DESCRIPTION
INDICATOR NAME	Morphological Functionality Subindex IFF
ACRONYM	

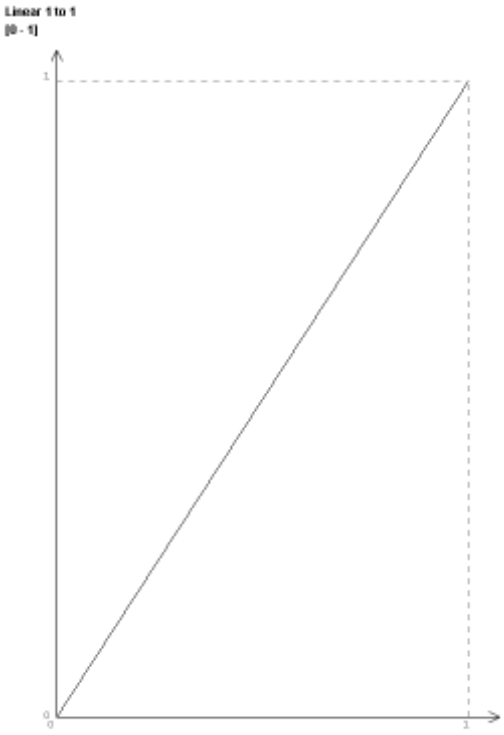
DPSIR	S – State indicator
DESCRIPTION	The morphological functionality of the riverbed is evaluated by adding the scores of questions 6 (flooding efficiency), 7 (riverbed substrate and retention structures for the trophic inputs), 9 (cross section) and 11 (hydromorphology) of the IFF Method. Question 6: a) non-canalised stretch, ordinary maximum flow riverbed more than three times the minimum flow riverbed; b) ordinary maximum flow riverbed between 2 and 3 times the minimum flow riverbed (or, if canalised, more than three times); c) ordinary maximum flow riverbed between 1 and 2 times broader the minimum flow riverbed (or, if canalised, 2-3 times broader), d) V valleys stretches with strong steepness of the slopes and canalised stretches with ordinary maximum flow riverbed <2 times the minimum flow riverbed; Question 7: a) riverbed with boulders and / or firmly embedded old logs (or presence of bands of reeds or hydrophytes); b) presence of boulders and / or branches with deposit of organic matter (or reeds or hydrophytes sparse and not very extensive); c) retention structures which are free and mobile with floods (or absence of hydrophytes and reed), d) riverbed with sandy sediments or smooth artificial outlines due to uniform flow; Question 9: a) intact riverbed with high morphological diversity, b) presence of modest artificial works and discrete morphological diversity, c) presence of artificial works or lack of morphological diversity, d) artificial or morphological diversity close to zero; Question 11: a) well distinguished hydromorphological elements in a regular sequence; b) well distinguished hydromorphological elements with in an irregular succession c) indistinct hydromorphological elements or preponderance of just one type; d) indistinguishable hydromorphological elements.
AIM	Assessing the contribution of the morphological component to the overall functionality of the river reach examined.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Rossi G.L., Minciardi M.R., 2009. Proposta di sub indici derivanti dall'IFF 2007 per la caratterizzazione e il monitoraggio degli ambienti fluviali. Atti del Convegno "L'Indice di funzionalità: strumento di gestione e pianificazione". Trento, 19-20 novembre 2009. ⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Based on observations made, we assigned to the questions one of the 4 answers proposed by the method (see IFF 2007 manual for more detail). We assigned to each question the value foreseen by the IFF method; then we added up the values of the different questions. Then we calculated the weighted average of the homogeneous sections on both sides (separately measured) in the stretch considered.
INDICATOR LIMITS	

EVALUATION	Data used for the Chisone tree are the following: Residual flow reach – Section A1: Alt 0 = 61, Alt 1 = 61, Alt 2 = 70, Alt 3 = 66 Residual flow reach – Section A2: Alt 0 = 66, Alt 1 = 61, Alt 2 = 65, Alt 3 = 65 Reach downstream of water release – Section B1: Alt 0 = 55, Alt 1 = 38, Alt 2 = 35, Alt 3 = 69 Reach downstream of water release – Section B2: Alt 0 = 57, Alt 1 = 46, Alt 2 = 54, Alt 3 = 60
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 90 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32

NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Aquatic environment | Mesohabitat | Fish fauna suitability IFFQ10

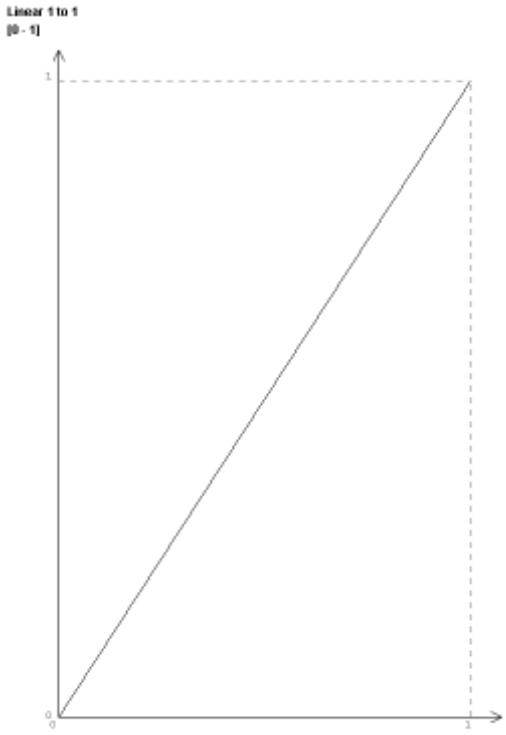
FIELD	DESCRIPTION
INDICATOR NAME	Hydromorphological elements functionality – Fish fauna suitability
ACRONYM	*IFF Q10*
DPSIR	S – State indicator
DESCRIPTION	The index requires the answer to the question: "Fitness for fish", defining if it is a) high b) good or fair; c) barely sufficient; d) absent or poor.
AIM	Evaluating, by examining the suitability of the stretch considered to host thevocational fish fauna, the morphological features at the mesohabitat scale.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The operator shall identify, for homogeneous sections, the presence or absence of: areas of refuge, spawning areas, shaded areas, trophic areas and presence of transversal barriers that prevent the free movement of migrant fish along the longitudinal profile of the rivers. On the basis of the observations made, the operator will assign to the question one of the 4 answers proposed by the method (see IFF 2007 manual for more detail). A value is then assigned to the index using the following procedure: Answer A -> 1; Answer B -> 0.66; Answer C -> 0.33; Answer D -> 0. Then the weighted average number of the homogeneous sections on both sides (separately measured) in the stretch considered is calculated.
INDICATOR LIMITS	

EVALUATION	Data used for the Chisone tree are the following: Residual flow reach – Section A1: Alt 0 = 1; Alt 1 = 1; Alt 2 = 1; Alt 3 = 1 Residual flow reach – Section A2: Alt 0 = 1; Alt 1 = 0.79; Alt 2 = 0.96; Alt 3 = 0.96 Reach downstream of water release – Section B1: Alt 0 = 0.66; Alt 1 = 0.33; Alt 2 = 0.48; Alt 3 = 0.55 Reach downstream of water release – Section B2: Alt 0 = 0.82; Alt 1 = 0.58; Alt 2 = 0.66; Alt 3 = 0.7
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	

SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Aquatic environment | Mesohabitat | Mesohabitat evaluation IFFQ11

FIELD	DESCRIPTION
INDICATOR NAME	Hydromorphological elements functionality – Hydromorfology
ACRONYM	*IFF Q10*
DPSIR	S – State indicator
DESCRIPTION	The index requires an answer to the question Functionality of hydromorphological elements of the IFF 2007 index, choosing from a) hydromorphological elements well separate with a regular succession b) hydromorphological elements well separate with irregular succession c) hydromorphological elements not well separate with preponderance of a single type d) hydromorphological elements not separate
AIM	Assessing the morphological diversification of the riverbed at a macro and meso-scale, produced by the free evolution of hydrodinamical and geomorphological processes (riffles and pools in alpine vale streams).
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The operator will identify, in the stretch considered, the presence of the different hydromorphological elements and the distance at which they follow one another along the longitudinal sequence. Under conditions of high naturalness, the riffles follow one another at a distance of approximately 5-7 times the width of the moderate flow riverbed. On the basis of the observations done, one of the 4 answers proposed by the method is given to the question (see IFF 2007 manual for more details). A value is then assigned to the index by using the following procedure: Answer A -> 1; Answer B -> 0.66; Answer C -> 0.33; Answer D -> 0. The weighted average of homogeneous sections on both sides (separately measured) of the considered stretch is then calculated.
INDICATOR LIMITS	

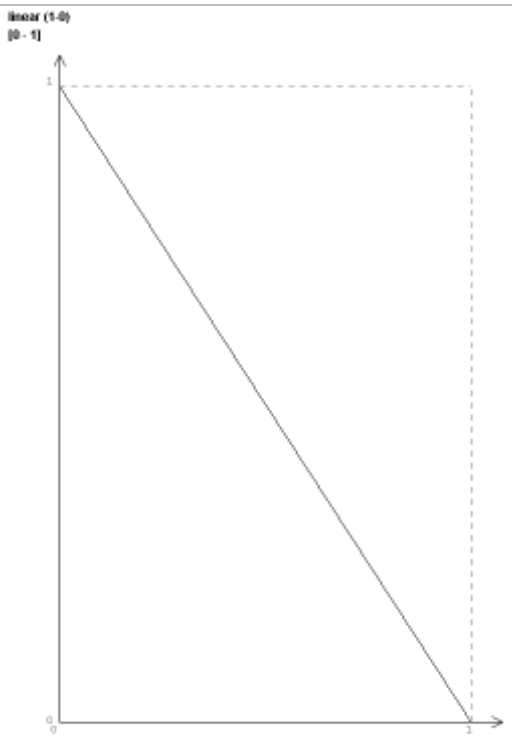
EVALUATION	Data used for the Chisone tree are the following: Residual flow reach – Section A1: Alt 0 = 1; Alt 1 = 0.66; Alt 2 = 1; Alt 3 = 1 Residual flow reach – Section A2: Alt 0 = 1; Alt 1 = 0.84; Alt 2 = 0.92; Alt 3 = 0.92 Reach downstream of water release – Section B1: Alt 0 = 1; Alt 1 = 0.33; Alt 2 = 0.33; Alt 3 = 0.33 Reach downstream of water release – Section B2: Alt 0 = 1; Alt 1 = 0.33; Alt 2 = 0.74; Alt 3 = 0.74
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	

SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Aquatic environment | Macrophytes | Macrophyte functional groups

FIELD	DESCRIPTION
INDICATOR NAME	Macrophyte functional group abundance
ACRONYM	
DPSIR	S – State indicator
DESCRIPTION	The presence of macrophytes tolerating emergence, which constitute the functional group of aquatic vegetation subjected to the effects resulting from the hydroelectric use of water, is evaluated.
AIM	Assessing, by analyzing the presence of macrophytes functional groups, if the hydro-morphological alterations induced by hydraulic works had an impact on the macrophyte communities.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The index expresses the ratio between the number of taxa tolerant to emergence detected in the sampling station and of the total number of detected taxa.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR decreasing from 1 to 0

		Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	0.17	0.33	0.33	0.33
Residual flow reach	Section A2	0.3	0.4	0.4	0.4
Reach downstream of water release	Section B1	0.25	0.5	0.5	0.4
Reach downstream of water release	Section B2	0.17	0.5	0.5	0.4

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

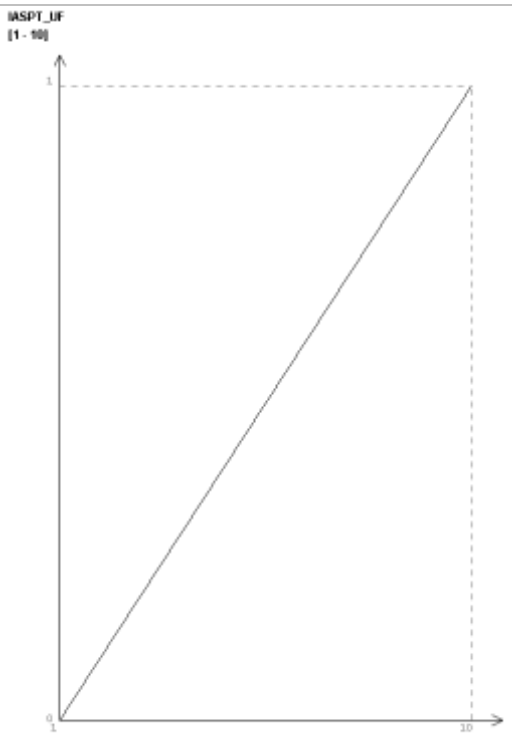
Chisone tree | ENVIRONMENT | Aquatic environment | Macrobenthos | IASPT

FIELD	DESCRIPTION
INDICATOR NAME	Iberian Average Score Per Taxon
ACRONYM	*IASPT*

DPSIR	S – State indicator
DESCRIPTION	The IASPT index derives from the IBMWP index, dividing it by the number of families collected in the sample. The IBMWP index value is obtained adding the sensitivity scores assigned to each macroinvertebrate family collected in the sample, if the index includes that family in the list of scored ones
AIM	Assessing the ecological quality of the watercourses through the composition analysis of the macroinvertebrate community, in terms of sensitivity/tolerance of the collected families.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Alba-Tercedor, J., P. Jáimez-Cuéllar, M. Álvarez, J. Avilés, N. Bonada, J. Casas, A. Mellado, M. Ortega, I. Pardo, N. Prat, M. Rieradevall, S. Robles, C. E. Sáinz-Cantero, A. Sánchez-Ortega, M. L. Suárez, M. Toro, M. R. Vidalabarca, S. Vivas & C. Zamora-Muñoz., 2002. Caracterización del estado ecológico de ríos mediterráneos ibéricos mediante el índice IBMWP (=BMWP'). - Limnetica, 21: 175-185.
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The IASPT index derives from the IBMWP index, dividing it by the number of families collected in the sample
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

		Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	6.22	5.6	5.6	5.6
Residual flow reach	Section A2	6.7	6.25	6.67	6.67
Reach downstream of water release	Section B1	6.22	6.6	6.6	6.6
Reach downstream of water release	Section B2	6.7	6.17	6.17	6.57

AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 1 to 10

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

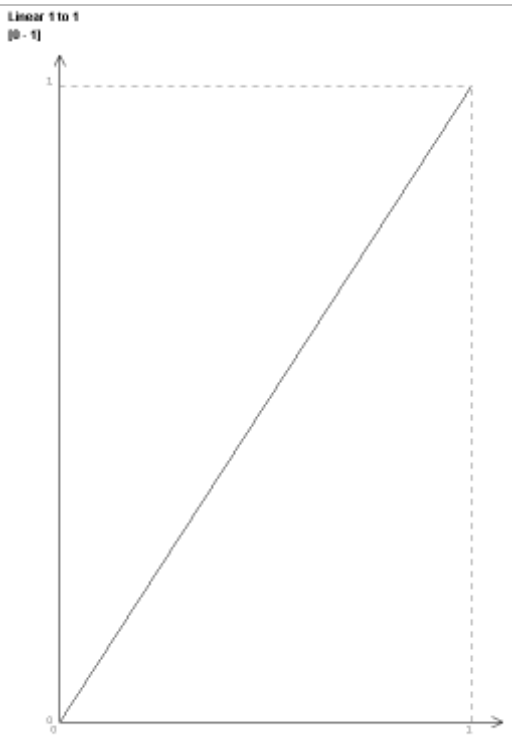
Chisone tree | ENVIRONMENT | Riparian environment | Presence of characteristic riparian habitat

FIELD	DESCRIPTION
INDICATOR NAME	Presence of characteristic riparian habitats
ACRONYM	

DPSIR	S – State indicator
DESCRIPTION	The index detects the presence/absence and the condition of the riparian habitats characteristic of the river type to which the surveied site belongs, basing on an established list
AIM	Assessing whether the alterations due to human impacts have lead to the impairment/loss of the riparian habitats characteristic of the river type to which the surveied site belongs, based on an established list
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Minciardi M.R., Rossi G.L., 2010. Modalità ecosistemiche di valutazione dell'impatto derivante dalla presenza di derivazioni in un corso d'acqua. Rapporto tecnico ENEA RT/2010/32/ENEA;
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Field survey of riparian habitats in the river stretch where the considered sampling station is: the survey is carried out with a form which includes an inventory of the plant assemblages detected. By giving a naturalness value to each typology detected (on a scale of 5 classes of decreasing naturalness), a numerical value is assigned to each homogeneous stretch sampled, by using the following procedure: Class 1 -> 1, Class 2 -> 0.75; Class 3 -> 0.50, Class 4 -> 0.25 ; Class 5 -> 0. The weighted average of homogeneous sections on both sides (separately measured) in the considered stretch is then calculated.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

		Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	1	1	0.75	1
Residual flow reach	Section A2	0.95	0.77	0.72	0.97
Reach downstream of water release	Section B1	0.58	0.36	0.38	0.58
Reach downstream of water release	Section B2	0.67	0.65	0.65	0.67

AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

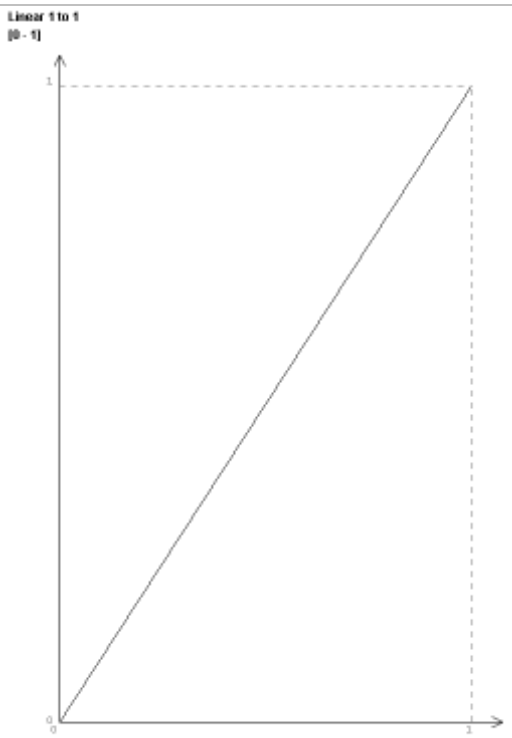
Chisone tree | ENVIRONMENT | Riparian communities | Typology: IFFQ2 perifluvial vegetation

FIELD	DESCRIPTION
INDICATOR NAME	Typology of perifluvial vegetation
ACRONYM	*IFFQ2*

DPSIR	S – State indicator
DESCRIPTION	The question 2 of the IFF index "Vegetation in the perifluvial strip" detects the features, in term of composition and structure, of the vegetation assemblages that are present in the perifluvial strip (primary or secondary), through the choice of one of 4 possible answers describing the situation that could occur: a) presence of complementary functional riparian assemblages; b) presence of one or a simplified series of riparian assemblages; c) absence of riparian assemblages, but presence of funtional vegetation assemblages; d) absence of assemblages with significant functionality. (see IFF 2007 handbook for details)
AIM	Assessing the presence of vegetation assemblages that are effective in the execution of riverine functions: habitat formation; water depurant activity, filter for diffused pollution; mechanical and water stabilization of the river corridor; thermic regulation; trophic intake.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The vegetation typologies present are identified by observations done from the limit of the moderate flow riverbed and advancing distally to the river. In the IFF 2007 manual there is a list of spontaneous assemblages potentially present in the perifluvial strip considered. On the basis of observations made, one of the 4 answers proposed by the method is assigned to the question. A value is then given to the index using the following procedure: Answer A -> 1; Answer B -> 0.66; Answer C -> 0.33; Answer D -> 0. Tthe weighted of the homogeneous sections on both sides (separately measured) in the considered stretch is then calculated.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

		Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	0.66	0.66	0.33	0.66
Residual flow reach	Section A2	0.62	0.55	0.33	0.62
Reach downstream of water release	Section B1	0.62	0.18	0.26	0.26
Reach downstream of water release	Section B2	0.37	0.33	0.37	0.29

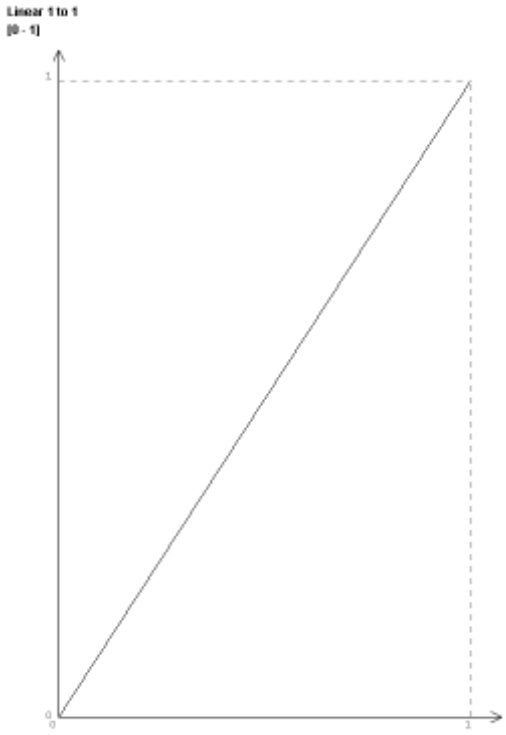
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Riparian communities | Extension: IFFQ3 4

FIELD	DESCRIPTION
INDICATOR NAME	Extension of perifluvial communities
ACRONYM	*IFFQ3 4*

DPSIR	S – State indicator
DESCRIPTION	The total extention of the riparian assemblages, perpendicularly and longitudinally considered, is obtained from the integration of the questions 3 (Width of functional assemblages in perifluvial strip) and 4 (Continuity of the assemblages in the perifluvial strip). The presence and consistence of gaps is detected. Question 3: a) total width of functional assemblages more than 30 m b) total width of functional assemblages included between 30 and 10 m; c) total width of functional assemblages included between 10 and 2 m; d) absence of functional assemblages. Question 4: a) no gap in functional assemblage b) presence of gaps in the functional assemblages c) frequent gaps in functional assemblages or continuous herbaceous or only shrubbs with dominance of exotics and weeds d) bare soil, sparse vegetation populations.
AIM	Assessing whether hydraulic facilities upstream the surveied river reach have caused hydromorphological alteration that varied the extension of riparian assemblages.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Question 3: The width of the functional assemblages must be evaluated as the average extension in the stretch under consideration and must be calculated from the outer edge of the moderate flow riverbed, considering the whole development of helophytes assemblages which may be found around this limit. Question 4: the presence, the frequency and the width of the continuity interruptions in the functional assemblages in the perifluvial strip are surveyed, and if they are very wide it is necessary to consider the portion within the first 30 meters. The interruptions are therefore made by: bare soil, non-hygrophilous grassland assemblages, shrub assemblages dominated by exotic and infestant weeds. Based on the observations made, one of the 4 answers proposed by thr method (see IFF 2007 manual for more detail) is assigned to the question. A value is then assigned to the index using the following procedure: Combination answers (regardless of the order): AA:1; AB:0,85; BB: 0,70; BC: 0,50; CC: 0,30; CD:0,15, DD:0. The weighted average of the homogeneous sections on both sides (separately identified) in the stretch considered is then calculated.
INDICATOR LIMITS	

EVALUATION	Data used for the Chisone tree are the following: Residual flow reach – Section A1: Alt 0 = 1; Alt 1 = 1; Alt 2 = 0.92; Alt 3 = 0.66 Residual flow reach – Section A2: Alt 0 = 0.87; Alt 1 = 0.69; Alt 2 = 0.87; Alt 3 = 0.62 Reach downstream of water release – Section B1: Alt 0 = 0.49; Alt 1 = 0.49; Alt 2 = 0.43; Alt 3 = 0.49 Reach downstream of water release – Section B2: Alt 0 = 0.79; Alt 1 = 0.57; Alt 2 = 0.79; Alt 3 = 0.57
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	

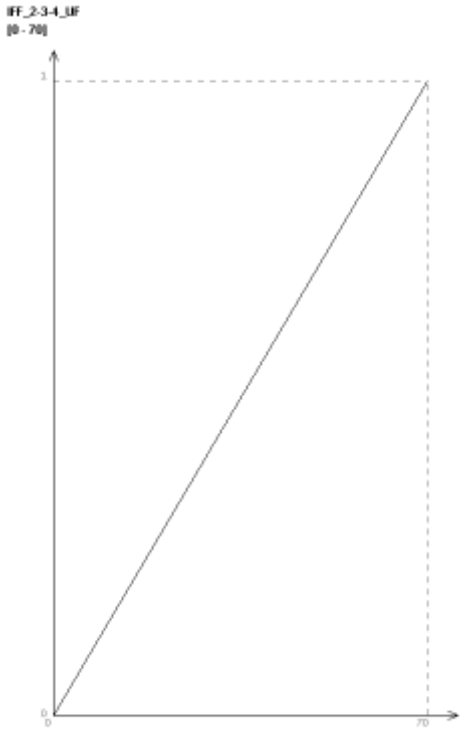
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | Riparian communities | IFF subindex perifluvial vegetation functionality

FIELD	DESCRIPTION
INDICATOR NAME	Perifluvial vegetation functionality subindex IFF
ACRONYM	
DPSIR	S – State indicator
DESCRIPTION	It is carried out the assessment of the functionality of the vegetation through the sum of the answers 2/2bis, 3 and 4 of the IFF index 2007. Question 2 "Vegetation in the perifluvial strip": a) presence of complementary functional riparian assemblages; b) presence of one or a simplified series of riparian assemblages; c) absence of riparian assemblages, but presence of funtional vegetation assemblages; d) absence of assemblages with significant functionality. Question 3: "Width of functional assemblages in perifluvial strip": a) total width of functional assemblages more than 30 m b) total width of functional assemblages included between 30 and 10 m; c) total width of functional assemblages included between 10 and 2 m; d) absence of functional assemblages. Question 4: "Continuity of the assemblages in the perifluvial strip" a) no gap in functional assemblage b) presence of gaps in the functional assemblages c) frequent gaps in functional assemblages or continuous herbaceous or only shrubbs with dominance of exotics and weeds d) bare soil, sparse vegetation populations
AIM	Assessing the functionality of the perifluvial vegetation strip.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Rossi G.L. & Minciardi M.R., 2009. Proposta di sub indici derivanti dall'IFF 2007 per la caratterizzazione e il monitoraggio degli ambienti fluviali. Atti del Convegno "L'Indice di funzionalità: strumento di gestione e pianificazione". Trento, 19-20 novembre 2009. ⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Question 2: The vegetation typologies present must be defined bymaking the observation from the limit of the moderate flow riverbed and advancing distally to the river. In the IFF 2007 manual there is a reference list of the potentially present spontaneous assemblages in the perifluvial strip. Question 3: The width of the riparian assemblages must be evaluated as the average extension in the stretch considered and must be calculated from the outer limit of the moderate flow riverbed,

	considering also the whole development of the helophytes assemblages which may be found around this limit. Question 4: the presence, frequency and width of continuity interruption in the functional assemblages of the perifluvial strip must be surveyed, and if this is very wide it is necessary to consider the portion within the first 30 meters. The interruptions are therefore made by: bare soil, non-hygrophilous grassland, shrub formations dominated by exotic and infestant weeds. Based on the observations made, one of the 4 answers proposed by method is assigned to the question. The scores obtained from each answer are added up (the total score can range between 3 and 70). The weighted average of the homogeneous sections on both sides (separately measured) in the considered stretch is then calculated.
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following:

		Alt 0	Alt 1	Alt 2	Alt 3
Residual flow reach	Section A1	36	21	22	36
Residual flow reach	Section A2	35	28	35	26
Reach downstream of water release	Section B1	55	55	37	50
Reach downstream of water release	Section B2	48	40	36	48

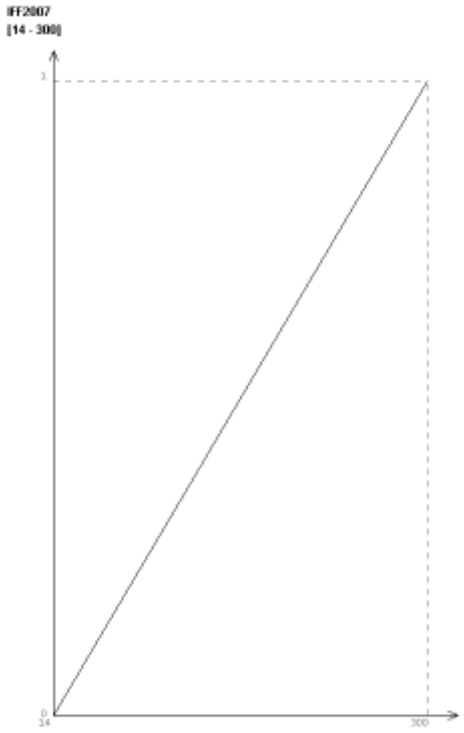
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 70 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**

DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | River corridor functionality | IFF

FIELD	DESCRIPTION
INDICATOR NAME	Fluvial Functionality Index
ACRONYM	*IFF*
DPSIR	S – State indicator
DESCRIPTION	The IFF index 2007 requires the identification of the correct answer to 14 questions regarding the principal features of a watercourse; for each question only one of the 4 proposed answers is allowed. The main objective of the index is to evaluate the overall state of the river and its functionality, understood as the result of synergy and integration of an important series of biotic and abiotic factors present in the aquatic and terrestrial eco-system and linked to it.
AIM	Survey of the overall status of the river environment and in the evaluation of its functionality, considered as a result of the combination effect and integration of a series of biotic and abiotical factors that are present in the aquatic ecosystem and in the connected land ecosystem.
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	⇒ Siligardi M., Avolio F., Baldaccini N.G,, Bernabei S., Bucci M.S., Cappelletti C., Chierici M., Ciutti F., Floris B., Franceschini A., Mancini L., Minciardi M.R., Monauni C., Negri P., Pineschi G., Pozzi S., Rossi G.L., Sansoni G., Spaggiari R., Tamburro C., Zanetti M. , 2007. I.F.F. Indice di Funzionalità Fluviale 2007. Manuali APAT. Ministero dell'Ambiente e della Tutela del Territorio. APAT. APPA Trento: 325 pp
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The period of vegetative activity is the most suitable for the survey. Walking upstream along the river, river stretches having homogeneous features must be identified. On each of them a form will be applied by observing the features of each of the 14 questions. Some features which cannot be observed from the river bank or the riverbed may be considered by using maps and aerial photos. For some questions there is an answer for each river bank. Numerical weights grouped into 4 classes (minimum weight=1 weight=40), expressing the functional differences between the single answers, are assigned to the answers. The IFF score, obtained by adding up the partial scores related to each question, can range between a minimum value of 14 and a maximum of 300. The weighted average of the

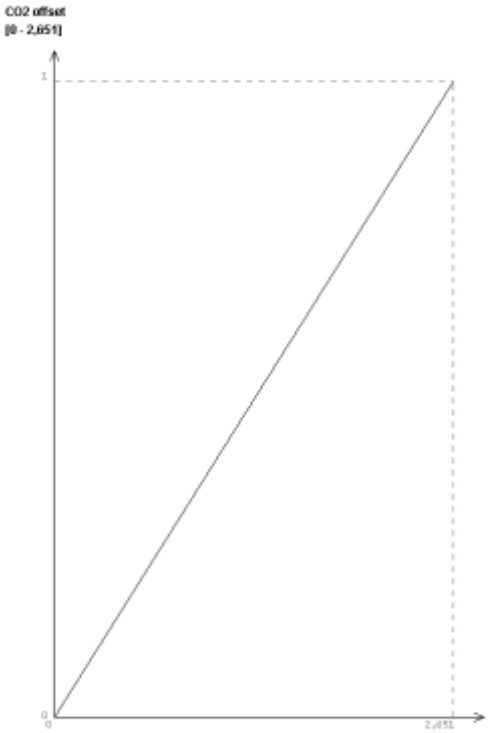
<table>
<tr><td></td><td>homogeneous sections on both sides (separately measured) in considered stretch is then calculated.</td></tr>
<tr><td>INDICATOR LIMITS</td><td></td></tr>
<tr><td>EVALUATION</td><td>Data used for the Chisone tree are the following:

<table>
<tr><th></th><th></th><th>Alt 0</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th></tr>
<tr><td>Residual flow reach</td><td>Section A1</td><td>238</td><td>223</td><td>196</td><td>205</td></tr>
<tr><td>Residual flow reach</td><td>Section A2</td><td>217</td><td>199</td><td>187</td><td>198</td></tr>
<tr><td>Reach downstream of water release</td><td>Section B1</td><td>172</td><td>138</td><td>140</td><td>169</td></tr>
<tr><td>Reach downstream of water release</td><td>Section B2</td><td>182</td><td>157</td><td>182</td><td>157</td></tr>
</table></td></tr>
<tr><td>AVAILABLE UF</td><td>YES</td></tr>
<tr><td>UF</td><td>The utility function (UF) used is LINEAR increasing from 14 to 300
 
</td></tr>
<tr><td>SHARE RELATED IND.</td><td></td></tr>
<tr><td>COUNTRY CODE</td><td>IT</td></tr>
<tr><td>WFD HER</td><td>INNER ALPS SOUTH</td></tr>
<tr><td>FIELD</td><td>DATASOURCES</td></tr>
<tr><td>DATA SOURCE</td><td>ENEA</td></tr>
<tr><td>TIME COVER</td><td>Considered years</td></tr>
<tr><td>UPDATE FREQUENCY</td><td></td></tr>
</table>

NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | ENVIRONMENT | GLOBAL ENVIRONMENT | CO2 offset

FIELD	DESCRIPTION
INDICATOR NAME	CO2 offset
ACRONYM	
DPSIR	P – Pressures indicator
DESCRIPTION	The index express the contribution of this HPP to CO2 emissions reduction; CO2 reduction is assessed respect to energy production from fossil fuel.
AIM	To evaluate the contribution of CO2 emission reduction.
KEY MESSAGE	
MEASURE UNIT	tons
REFERENCES	
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	Waiting to have the detailed data about the real amount of electricity produced in the periods corresponding to the various alternatives consideredwe considered the maximum potential production associated with the plant characteristics. From this production (expressed in MWh) the indicator was calculated using the conversion factor of 83.8 g CO2/MJ (Directive 2009/28/EC).
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following: Alt 0 Alt 1 Alt 2 Alt 3 0 2,651 1,223 1,223
AVAILABLE UF	YES

UF	The utility function (UF) used is LINEAR increasing from 0 to 2,651 
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	Considered years
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

- The fourth criterium called **'FRUITION**, is divided in:

  - ***RESIDUAL FLOW REACH***
  - ***REACH DOWNSTREAM OF WATER RELEASE***

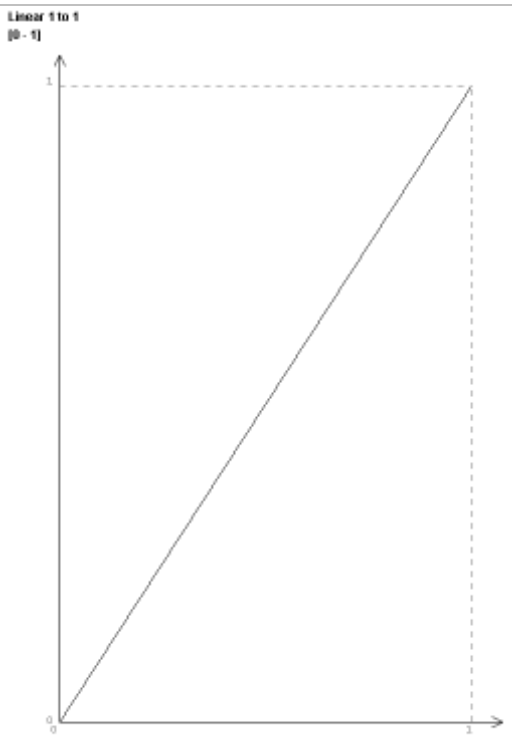
Each of them are evaluated through two indicators:

- **Fishing**

- **Tourism**

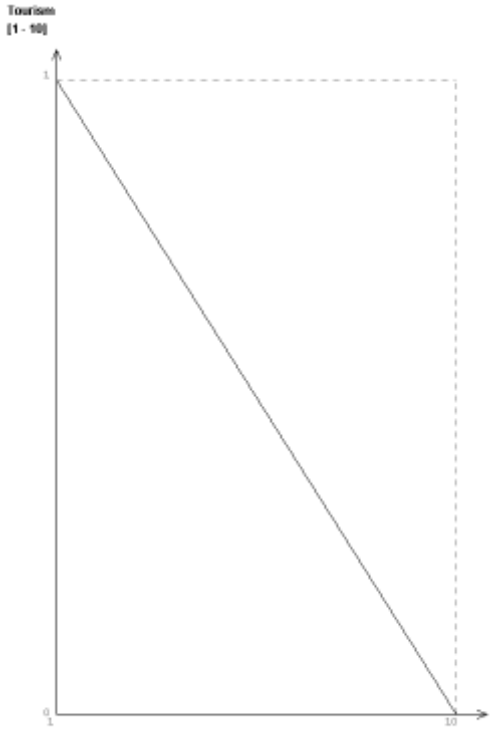
Chisone tree | FRUITION | Fishing

FIELD	DESCRIPTION
INDICATOR NAME	Fishing
ACRONYM	
DPSIR	I – Impacts indicator
DESCRIPTION	Indicator giving an evaluation of pleasure of sport fishing
AIM	Assess the attractiveness of a single river reach from the sport fishing point of view
KEY MESSAGE	
MEASURE UNIT	N
REFERENCES	–
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The value is expressed through a series of interviews with stakeholders in the field of sport fishing. They are asked to express an opinion on a scale divided into 5 classes (1 = maximum attractiveness, 5 = no interest in fishing). Measured values are then transformed according to the following classification: 1 = 1 2 = 0.75 3 = 0.50 4 = 0.25 5 = 0
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following: Alt 0 Alt 1 Alt 2 Alt 3 Residual flow reach 1 0.75 0.5 0.5 Reach downstream of water release 1 0.25 0.25 0.5
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR increasing from 0 to 1

	
SHARE RELATED IND.	
COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Chisone tree | FRUITION | Tourism

FIELD	DESCRIPTION
INDICATOR NAME	Tourism
ACRONYM	

DPSIR	I – Impacts indicator
DESCRIPTION	Indicator giving an evaluation of tourist attraction
AIM	Assess the attractiveness of a single river reach from the touristic point of view
KEY MESSAGE	
MEASURE UNIT	class
REFERENCES	–
FIELD	**METHODS AND MONITORING STANDARDS**
INDICATOR ELABORATION	The value is expressed through a series of interviews with stakeholders in the field of tourism. They are asked to express an opinion on a scale divided into 10 classes (1 = maximum attractiveness, 10 = lack of tourism interest).
INDICATOR LIMITS	
EVALUATION	Data used for the Chisone tree are the following: Residual flow reach: Alt 0 = 1, Alt 1 = 3, Alt 2 = 3, Alt 3 = 3 Reach downstream of water release: Alt 0 = 1, Alt 1 = 4, Alt 2 = 4, Alt 3 = 3
AVAILABLE UF	YES
UF	The utility function (UF) used is LINEAR decreasing from 10 to 1 
SHARE RELATED IND.	

COUNTRY CODE	IT
WFD HER	INNER ALPS SOUTH
FIELD	**DATASOURCES**
DATA SOURCE	ENEA
TIME COVER	
UPDATE FREQUENCY	
NUT III CODE	ITD32
NORMATIVE REFERENCE	
NORMATIVE RELEVANCE	
SHARE PILOT CASE STUDY	Chisone

Weights assignment

The weights (W) assigned to the different criteria are shown in the following tables.

Energy	0.25						
		Global	0.5				
				Production	0.5		
						% production over national production	1
				Towards 20 2020 goals	0.5		
						% contribution to national goal	1
		Local	0.5				
				Production	0.5		
						% production over regional production	1
				Towards 20 2020 goals	0.5		
						% contribution to regional goal	1
HP Economy	0.15						
		Costs	0.5				
				Annual amortization	0.5		
				Annual maintenance	0.5		
		Proceeds	0.5				
				Annual proceeds	1		
Environment	0.4						

Residual flow reach	0.381	River ecosystem	1	Hydrology	0.35	Flow variation	0.8	Ratio of real monthly Q to natural monthly Q	0.75	QReal QNat Section A1	0.5						
										QReal QNat Section A2	0.5						
								Ratio of real annual Q to natural annual Q	0.25	RealOnNat AnnualQ Section A1	0.5						
										RealOnNat AnnualQ Section A2	0.5						
						Hydrological integrity	0.2	Question 5 IFF	1								
				Morphology	0.15	Riverbed substratum	0.1	Granulometry	1	Section A1	0.5			Rocks	0.333		
														Pebbles	0.333		
														Silt	0.333		
										Section A2	0.5			Rocks	0.333		
														Pebbles	0.333		
														Silt	0.333		
						Banks	0.1	Erosion	1	Erosion Section A1	0.5						
										Erosion Section A2	0.5						
						Morphological	0.8										

				integrity		IQM index	0.6		
								IQM Section A1	0.5
								IQM Section A2	0.5
						IFF subindex Morphological functionality	0.4		
								Subind Morph Section A1	0.5
								Subind Morph Section A2	0.5
		Aquatic environment	0.2						
				Section A1	0.5				
						Mesohabitat	0.4		
								Fish fauna suitability IFFQ10	0.5
								Mesohabitat evaluation IFFQ11	0.5
						Macrophytes	0.4		
								Macrophyte functional groups	1
						Macrobenthos	0.2		
								IASPT	1
				Section A2	0.5				
						Mesohabitat	0.4		
								Fish fauna suitability IFFQ10	0.5
								Mesohabitat evaluation IFFQ11	0.5
						Macrophytes	0.4		
								Macrophyte functional groups	1
						Macrobenthos	0.2		
								IASPT	1

				Riparian environment	0.15	Section A1	0.5	Presence of characteristic riparian habitat	0.4			
								Riparian communities	0.6	Typology: IFFQ2 perifluvial vegetation	0.3	
										Extension: IFFQ3 4	0.1	
										IFF subindex perifluvial vegetation functionality	0.6	
						Section A2	0.5	Presence of characteristic riparian habitat	0.4			
								Riparian communities	0.6	Typology: IFFQ2 perifluvial vegetation	0.3	
										Extension: IFFQ3 4	0.1	
										IFF subindex perifluvial vegetation functionality	0.6	
				River corridor functionality index IFF	0.15	IFF Section A1	0.5					
						IFF Section A2	0.5					
	Reach downstream of water release	0.571	River ecosystem	1	Hydrology	0.35						

				Hydropeaking	0.8							
						Instant max flow variation	0.333					
						Instant average flow variation	0.333					
						Variation frequency	0.333					
								Average distance between two events Hv>3	0.5			
								Average distance between two events Hv>15	0.5			
				Hydrological integrity	0.2							
						Question 5 IFF	1					
		Morphology	0.15									
				Riverbed substratum	0.1							
						Granulometry	1					
								Section B1	0.5			
										Rocks	0.333	
										Pebbles	0.333	
										Silt	0.333	
								Section B2	0.5			
										Rocks	0.333	
										Pebbles	0.333	
										Silt	0.333	
				Banks	0.1							
						Erosion	1					
								Erosion Section B1	0.5			
								Erosion Section B2	0.5			
				Morphological integrity	0.8							
						IQM index	0.6					

								IQM Section B1	0.5
								IQM Section B2	0.5
						IFF subindex morphological functionality	0.4		
								Subind Morph Section B1	0.5
								Subind Morph Section B2	0.5
		Aquatic environments	0.2						
				Section B1	0.5				
						Mesohabitat	0.4		
								Fish fauna suitability IFFQ10	0.5
								Mesohabitat evaluation IFFQ11	0.5
						Macrophytes	0.4		
								Macrophyte functional groups	1
						Macrobenthos	0.2		
								IASPT	1
				Section B2	0.5				
						Mesohabitat	0.4		
								Fish fauna suitability IFFQ10	0.5
								Mesohabitat evaluation IFFQ11	0.5
						Macrophytes	0.4		
								Macrophyte functional groups	1
						Macrobenthos	0.2		
								IASPT	1
		Riparian	0.15						

				environments		Section B1	0.5				
								Presence of characteristic riparian habitat	0.4		
								Riparian communities	0.6		
										Typology: IFFQ2 perifluvial vegetation	0.3
										Extension: IFFQ3 4	0.1
										IFF subindex perifluvial vegetation functionality	0.6
						Section B2	0.5				
								Presence of characteristic riparian habitat	0.4		
								Riparian communities	0.6		
										Typology: IFFQ2 perifluvial vegetation	0.3
										Extension: IFFQ3 4	0.1
										IFF subindex perifluvial vegetation functionality	0.6
				River corridor functionality index IFF	0.15	IFF Section B1	0.5				
						IFF Section B2	0.5				
		Global environment	0.048	CO2 offset [t]	1						
Fruition	0.2										
		Residual	0.4								

	flow reach		Fishing	0.5
			Tourism	0.5
	Reach downstream of water release	0.6	Fishing	0.5
			Tourism	0.5

The wholle procedure for allocation of weights has been conducted involving the staff working in PP1 Share Case study (Regione Piemonte and ENEA). So the weights have beeen assigned through a participation process. Each level and each branch of Chisone tree has been analysed separately, taking into account the integration of the weights done by Sesamo.

Evaluation of alternatives performance

The results of Alternative Ranking analysis are the following ones:

Alt 0	HZERO_No_dam_scenario	0.591
Alt 1	Dam_MVF_Hydropeaking	0.498
Alt 3	Dam_no_MVF_no_Hydropeaking	0.428
Alt 2	Dam_no_MVF_Hydropeaking	0.397

		Alt 0	Alt 1	Alt 2	Alt 3
	Normalized weights	Objectives	Objectives	Objectives	Objectives
%_production_over_national_production_[%]	0.062	0	0	0	0
%_contribution_to_national_goal_[%]	0.062	0	0.348	0.16	0.16
%_production_over_regional_production_[%]	0.062	0	0.005	0.003	0.003
%_contribution_to_regional_goal_[%]	0.062	0	0.768	0.355	0.355
Annual_amortization_[N]	0.038	1	0.333	0.667	0.667
Annual_maintenance_[N]	0.038	1	0.6	0.4	0.5
Annual_proceeds_[N]	0.075	0	1	0.5	0.333
QReal_QNat_Section_A1_[%]	0.016	1	0.198	0.067	0.08
QReal_QNat_Section_A2_[%]	0.016	1	0.222	0.096	0.114
RealOnNat_AnnualQ_Section_A1_[%]	0.005	1	0.355	0.248	0.397
RealOnNat_AnnualQ_Section_A2_[%]	0.005	1	0.376	0.271	0.416
Question_5_IFF_[N]	0.011	1	0.33	0.33	0.33
Rocks_[class]	0	1	1	1	1
Pebbles_[class]	0	1	1	1	1
Silt_[class]	0	1	1	1	1
Rocks_[class]	0	1	0.5	1	1
Pebbles_[class]	0	1	0	1	1
Silt_[class]	0	1	0	0	0
Erosion_Section_A1_[N]	0.001	1	0.66	0.66	0.33
Erosion_Section_A2_[N]	0.001	1	0.39	0.58	0.33
IQM_Section_A1_[N]	0.005	1	0.91	0.91	0.91
IQM_Section_A2_[N]	0.005	0.82	0.73	0.73	0.73
Subind_Morph_Section_A1_[N]	0.004	0.678	0.678	0.778	0.733
Subind_Morph_Section_A2_[N]	0.004	0.733	0.678	0.722	0.722
Fish_fauna_suitability_IFFQ10_[N]	0.003	1	1	1	1
Mesohabitat_evaluation_IFFQ11_[N]	0.003	1	0.66	1	1
Macrophyte_functional_groups_[N]	0.006	0.7	0.6	0.6	0.6
IASPT_[N]	0.003	0.58	0.511	0.511	0.511
Fish_fauna_suitability_IFFQ10_[N]	0.003	1	0.79	0.96	0.96
Mesohabitat_evaluation_IFFQ11_[N]	0.003	1	0.84	0.92	0.92
Macrophyte_functional_groups_[N]	0.006	0.83	0.67	0.67	0.67
IASPT_[N]	0.003	0.633	0.583	0.63	0.63
Presence_of_characteristic_riparian_habitat_[N]	0.005	1	1	0.75	1
Typology:_IFFQ2_perifluvial_vegetation_[N]	0.002	0.66	0.66	0.33	0.66
Extension:_IFFQ3_4_[N]	0.001	1	1	0.92	0.66
IFF_subindex_perifluvial_vegetation_functionality_[N]	0.004	0.786	0.786	0.529	0.714
Presence_of_characteristic_riparian_habitat_[N]	0.005	0.95	0.77	0.72	0.97
Typology:_IFFQ2_perifluvial_vegetation_[N]	0.002	0.62	0.55	0.33	0.62
Extension:_IFFQ3_4_[N]	0.001	0.87	0.69	0.87	0.62

IFF_subindex_perifluvial_vegetation_functionality_[N]	0.004	0.686	0.571	0.514	0.686
IFF_Section_A1_[N]	0.011	0.783	0.731	0.636	0.668
IFF_Section_A2_[N]	0.011	0.71	0.647	0.605	0.643
Instant_max_flow_variation_[N]	0.021	1	0.418	0.105	0.281
Instant_average_flow_variation_[N]	0.021	1	0.57	0.375	0.235
Average_distance_between_two_events_Hv>3_[hours]	0.011	1	0.019	0.026	0.019
Average_distance_between_two_events_Hv>15_[hours]	0.011	1	0.026	0.034	0.15
Question_5_IFF__[N]	0.016	1	0	0	0.33
Rocks_[class]	0.001	1	1	1	1
Pebbles_[class]	0.001	1	0.5	0.5	0.5
Silt_[class]	0.001	1	1	1	1
Rocks_[class]	0.001	1	0	0	0
Pebbles_[class]	0.001	1	1	1	1
Silt_[class]	0.001	1	0.5	0.5	1
Erosion_Section_B1_[N]	0.002	0.61	0.61	0.52	0.03
Erosion_Section_B2_[N]	0.002	0.84	0.37	0.8	0.06
IQM_Section_B1_[N]	0.008	0.71	0.62	0.62	0.62
IQM_Section_B2_[N]	0.008	0.9	0.77	0.77	0.81
Subind_Morph_Section_B1_[N]	0.005	0.611	0.422	0.389	0.767
Subind_Morph_Section_B2_[N]	0.005	0.633	0.511	0.6	0.667
Fish_fauna_suitability_IFFQ10_[N]	0.005	0.66	0.33	0.48	0.55
Mesohabitat_evaluation_IFFQ11_[N]	0.005	1	0.33	0.33	0.33
Macrophyte_functional_groups_[N]	0.009	1	1	1	1
IASPT_[N]	0.005	0.58	0.622	0.622	0.622
Fish_fauna_suitability_IFFQ10_[N]	0.005	0.82	0.58	0.66	0.7
Mesohabitat_evaluation_IFFQ11_[N]	0.005	1	0.33	0.74	0.74
Macrophyte_functional_groups_[N]	0.009	0.75	0.5	0.5	0.6
IASPT_[N]	0.005	0.633	0.574	0.574	0.619
Presence_of_characteristic_riparian_habitat_[N]	0.007	0.58	0.36	0.38	0.58
Typology:_IFFQ2_perifluvial_vegetation_[N]	0.003	0.62	0.18	0.26	0.26
Extension:_IFFQ3_4_[N]	0.001	0.49	0.49	0.43	0.49
IFF_subindex_perifluvial_vegetation_functionality_[N]	0.006	0.514	0.3	0.314	0.514
Presence_of_characteristic_riparian_habitat_[N]	0.007	0.67	0.65	0.65	0.67
Typology:_IFFQ2_perifluvial_vegetation_[N]	0.003	0.37	0.33	0.37	0.29
Extension:_IFFQ3_4_[N]	0.001	0.79	0.57	0.79	0.57
IFF_subindex_perifluvial_vegetation_functionality_[N]	0.006	0.5	0.4	0.5	0.371
IFF_Section_B1_[N]	0.017	0.552	0.434	0.441	0.542
IFF_Section_B2_[N]	0.017	0.587	0.5	0.587	0.5
CO2_offset_[t]	0.019	0	1	0.461	0.461
Fishing_[class]	0.04	1	0.75	0.5	0.5
Tourism_[class]	0.04	1	0.778	0.778	0.778
Fishing_[class]	0.06	1	0.25	0.25	0.5
Tourism_[class]	0.06	1	0.667	0.667	0.778