Interreg Baltic Sea Region

EUROPEAN REGIONAL DEVELOPMENT FUND

EUROPEAN UNION

WAMBAF

Blue Targeting – manual

How to do Blue Targeting for planning of best management practice (BMP) for forestry along small streams

Title:	Blue Targeting – Manual. How to do Blue Targeting for best management practice (BMP) for forestry along small streams
Reference:	Henrikson, L. 2018. Blue Targeting – Manual. How to do Blue Targeting for best management practice (BMP) for forestry along small streams. Swedish Forest Agency, EU Interreg project Water Management in Baltic Forests, WAMBAF. 15 pp.
Text & photos:	Lennart Henrikson, *lennart.henrikson@naturochmanniska.se* Natur och Människa AB (Nature and Man Ltd), Friared Prästgården, SE-51198 Hyssna, Sweden
Drawing (page 3):	Hans Sjögren
Publisher:	Swedish Forest Agency, www.skogsstyrelsen.se EU Interreg project Water Management in Baltic Forests, WAMBAF
Contact:	Linnéa Jägrud, linnea.jagrud@skogsstyrelsen.se
Publishing date:	May 18, 2021

How to do Blue Targeting for best management practice (BMP) for forestry along small streams

*The Blue targeting tool was developed by WWF Sweden in 2011 within the project "Living Forest Waters" (*www.wwf.se/levandeskogsvatten*) where Lennart Henrikson was the project leader. A Swedish manual was published in 2011*[1]*.*

This English manual was produced within the EU Interreg project WAter Management in Baltic Forests, WAMBAF. The project is running between 2016-2019. Nine partners in five countries are involved. The aim of the project is to develop tools and guidelines (Best Management Practices) for forestry activities resulting in a reduced inflow of nutrients and hazardous substances to the regional waters of the Baltic Sea. WAMBAF focuses on three main topics, each one with a potential of high impact on the water: beaver population management, drainage system management and the management of riparian forests. This manual is included in the topic regarding management of riparian forests.

1. Introduction

Blue Targeting (BT) is a tool for best management practice (BMP) for forestry along small streams. The tool was originally developed by WWF Sweden (Lennart Henrikson, Erik Degerman, Stefan Bleckert) in corporation with the forestry sector in the years 2007-2011. It was constructed for small streams (width approx. <10 m) in boreal and Scandinavian conditions. However, by changing the indata, the tool can be adapted to streams in other biomes.

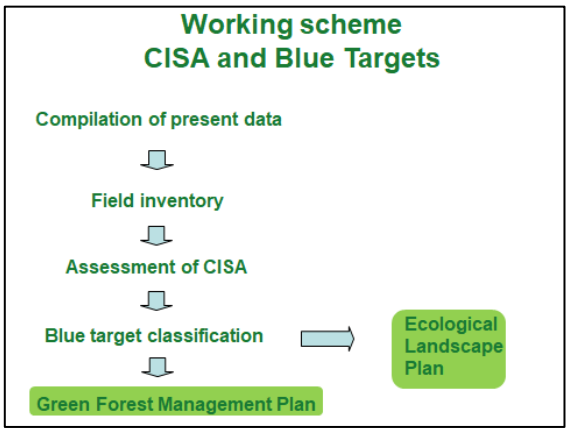
The main objective of the tool is to do:

- the right measure
- at the right place
- to the right extent.

BT tool is scientifically based and simplified to be used by non-professionals in practice. When simplifying science, some of the accuracy is lost. To tackle this, the tool has been tested in different ways, by experts and non-professionals. The tests show consensus regarding the final assessment or Blue targets when performed by non-experts. Since 2017 BT is in operational use by the Swedish Forest Owners Association when developing forest management plans. Swedish companies with large forest areas in ownership have implemented BT at a landscape level in pilot studies.

2. Working scheme

There are several steps in Blue targeting. The first step is to gather present data, for example electrofishing data and existing data concerning the chemical status of the water. There might be a lack of data for many streams. If that is the case, the process can start at the second step. The second step is the inventory of stream sections using a simple check list (appendix). Data are collected for Conservation value (C), Impact (I), Sensitivity (S) and Added values (A). The next step is an assessment of CISA. This is the base for choosing the Blue Target. The result can be used in forest management plans at different geographical scales.



[1] Bleckert, S., Degerman, E. & Henrikson, L. 2011. NPK+ och Blå målklassning – enkla verktyg för skoglig vattenplanering. WWF Sweden. The publication is available at www.wwf.se.

The CISA inventory is made at stream sections of similar conditions. A new section is started when the stream or the riparian zone significantly changes. Some examples of when new sections are done can be when the water changes from rapid to swiftly flowing or the trees in the riparian zone are cutted. This means that the sections will have different lengths. It is proposed to keep the sections no shorter than 100 metres.
The Blue Targeting protocol is filled in after that the stretch has been walked through.

3. The check list

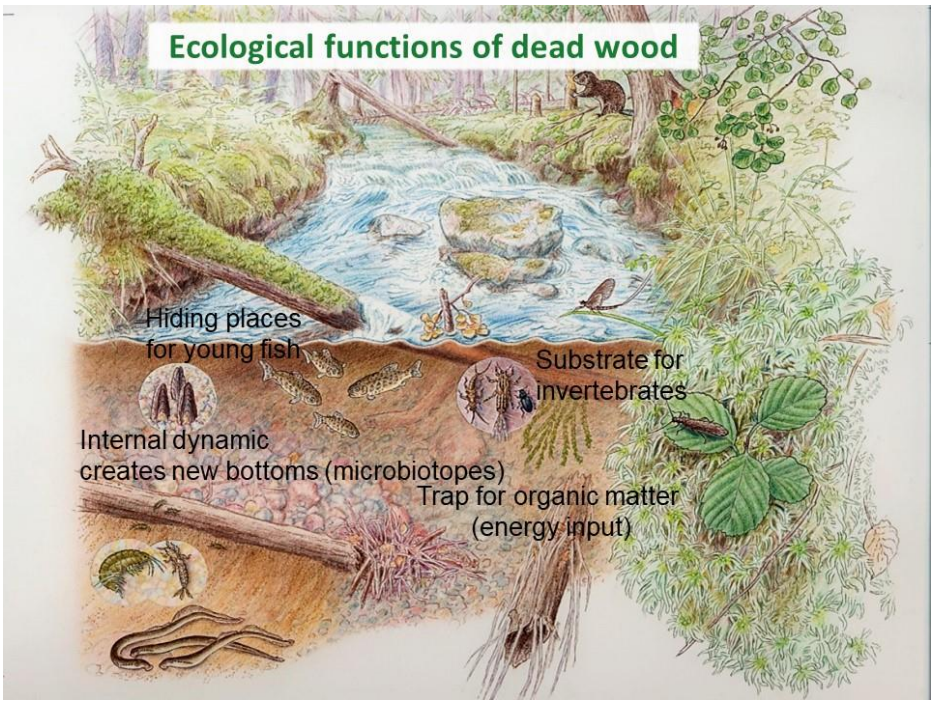
BACKGROUND INFORMATION
Date – day of data collection
Name of person making the survey – the person responsible for data collection.
Name of stream – the official name (can be found at maps or official data bases). Many streams, especially small ones, have no official name.
Stretch survey – the length of the stream section surveyed. This should be changed when the water or the surroundings significantly changes.
Coordinates, upper and lower – according to international (e.g. latitude/longitude) or national standards.
Average with – estimated mean width of the water course.
Stream order – according to the Strahler system (or national standard).
Dominating bottom substrate – eg. gravel/small stones or boulders.
The last three ones give a rough picture of the stream section for people that have not visited the stream section.

C – CONSERVATION VALUE
The data on conservation value illustrates the potential for physical conditions to harbour a natural composition of flora and fauna. In all ecosystems, higher habitat heterogeneity gives conditions for more species – a great physical variation means a high conservation value. Fast flowing water has higher conservation value than slow flowing water as the latter ones is more common in the landscape and hence less threatened and that the biology in slow flowing water reminds of that in lakes.

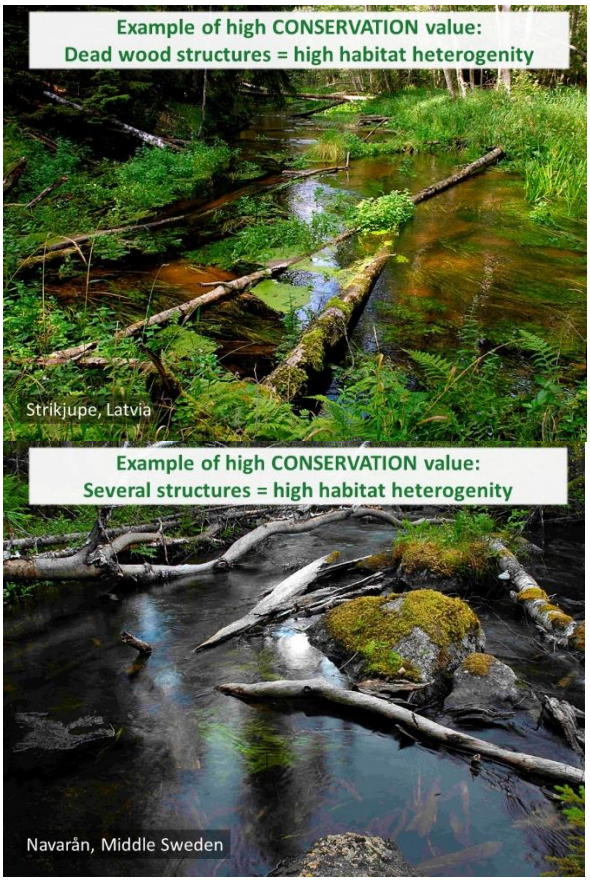
The conservation value is assessed for the stream section and the riparian zone. The reason is that the riparian zone has an extremely high importance for the stream itself. Likewise, the riparian forest is depending on the stream. The stream and the riparian zone should be considered as being one ecological unit.

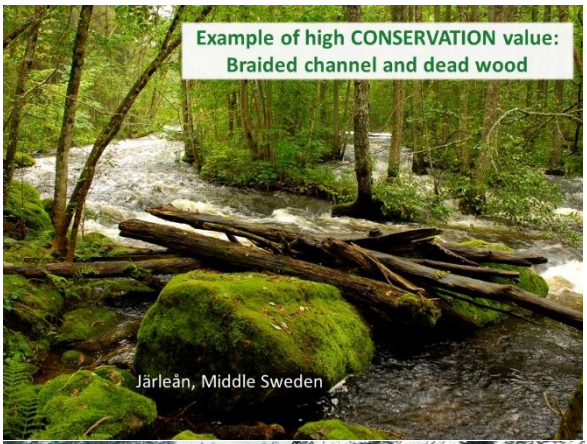
The conservation value is assessed by the structure of the stream, special biotopes or species, and the structure of the riparian zone.

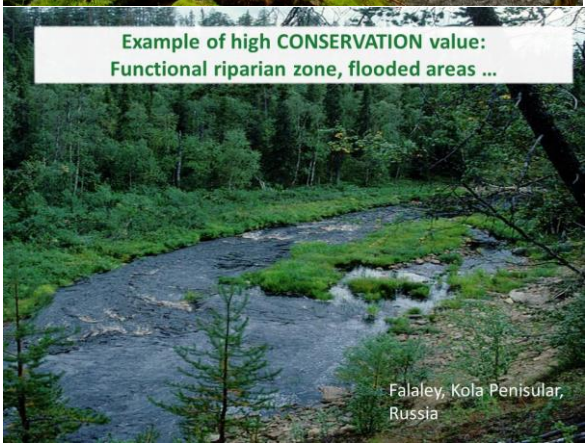
N1. CONSERVATION VALUES– Stream
Strong habitat variation – the stream morphology and the bottom substrate give good conditions for high species number.
Dead wood – has several ecological functions, like hiding places for fish and substrate for invertebrates. It also creates an "internal physical dynamic" as the bottom substrate close to dead wood is constantly changing, which may create "new" microhabitats. There are several scientific studies showing that coarse woody debris in the water contributes to the production of fish. Swedish studies show that more than seven pieces of coarse woody debris per 100 m stream are needed for a viable Brown trout population. Pieces of dead wood above the water surface are included in this survey if it they are covered or partly covered with water at high flow.
Rapids or swiftly-flowing water (broken water surface) – host characteristic species for running waters.
Stretch with lots of boulders – means a great physical variation with e.g. hiding places for several species.



There are several scientific studies showing the importance of dead wood for biodiversity in streams in different biogeographical regions. The occurrence of coarse woody debris increases the habitat heterogeinity forming hiding places for young fish and substrate for invertebrates. It also traps organic matter which may be used by invertebrates. Coarse woody debris changes the water currents leading to sorting of sand, gravel and stones and creation of "new" different substrate favouring different species. Illustration: Hans Sjögren.







N2. CONSERVATION – Special biotopes and species

Natural water falls or braided channel. Water falls are unique habitats and may favour several species. For example, the "rapid fog" create a permanent humid environment around the stream favouring organisms like mosses. Braided channel means that the stream splits into three (at least) streams unifying downstream. These increases the physical variation.

Clear water without brown color. Waters with clear water, without brown color or high turbidity (due to sedimentation transport), is generally not common. Hence, these should be considered as a special biotope.

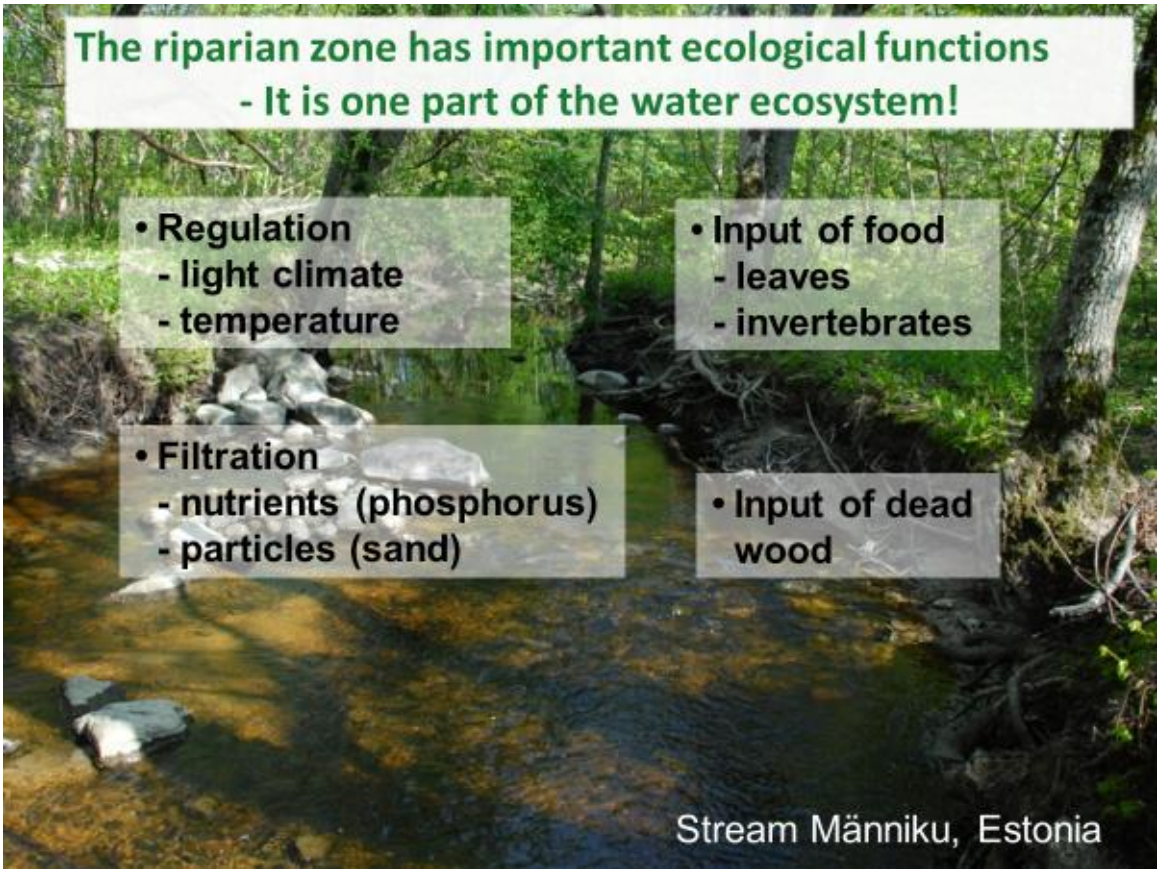
Lake inlet or outlet or tributary inlet – are habitats that generally hosts high densities of different species. One reason is that lakes produce great amount of food favouring filtrating invertebrates.

The Freshwater Pearl Mussel Margaritifera margaritifera *is a red listed species, often found I forest streams.*

Valuable species – like red listed species or interesting species related to the regional biogeography.

N3. CONSERVATION – Riparian zone

The riparian zone along a small stream is very important for providing the aquatic ecosystem with the ecological functions it needs: shading and thus keeping the temperature at low degrees, filtering soil water from particles and nutrients, supporting the stream with organic matter (like leaves), i.e. food supply, and supporting the stream with dead coarse woody debris.



Riparian zone for >75% - primarily shading of the stream along at least 75% of the length of the section.
Natural composition of tree species – related to the actual site and regional biogeography.
Old riparian zone – primarily producing dead wood but also high terrestrial conservation value.
Flooded zone or permanent area of diffuse groundwater outflow or spring – areas with high species richness and areas of great important for the quality of inflowing water.

I – IMPACT

Many human activities affect water courses physically, chemically, or biologically. The impact is assessed for the stream itself, the riparian zone and the water quality. In the check list the "no"-word is used to create a better function of the tool. The impact section shows where measures in field are needed to improve the naturalness and decrease the human impact.

I1. IMPACT – Stream

Not cleaned or not straightened. This includes removal of boulders, stones, and gravel but also straightening and clearing of the stream morphology, which impairs the ecological conditions.
No serious sedimentation. Sedimentation/siltation is the most severe problem in many forest streams. Fine particles (< 1 mm) from the surroundings fill the interstitials in the sediment. This have greatly negative impact of the survival of invertebrates and fish eggs buried in the gravel. It can be very hard to visually see this serious siltation. Accumulated fine particles on the bottom surface may indicate the problem.
No water regulation or extraction of water. Natural water dynamic is essential in streams. In many streams there are dams where the water flow is regulated. In some streams water extraction may cause too low flow during parts of the year. This is unfavourable for many water organisms, as it may stress them. Water regulations upstream the section surveyed may be noted under "General description and comments".
No artificial migration barriers. Migration barriers for fish and invertebrates do exclude species from suitable habitats upstream. Dams and road culverts are common obstacles. Definitive barriers made by beaver may be noted if it is completely impossible for fish to pass. Brown trout and salmonid species are generally good at passing migrations barriers. Barriers upstream or downstream the section surveyed may be noted under "General description and comments".

I2. IMPACT – Riparian zone

Functional riparian zone – is of extremely high importance for the stream biology. An ecological functional zone generally has a mix of tree species, tree height and tree age. The effects on the water is shading, filtering, litter input, and dead wood input.
No inflow from ditches. Ditches most often transport organic and/or inorganic particles leading to risk of siltation.
No soil damages. Soil damages like tracks from heavy vehicles and site preparation (scarification) may lead to soil particles entering the stream and cause siltation. It can also cause leakage of methylated mercury.
No roads. Scientific studies have shown that roads close to streams and road crossings affects the streams negatively. By roads, it is here referred mainly to gravel roads and paved roads. One reason for the negative impact on streams is that road ditches might transport nutrient and sediment into the stream. Another reason might be the lack of trees, as seen in the picture below, meaning no ecological functional zone.

I3. IMPACT – Water quality

Water quality is of great importance for stream biota. Since chemistry is hard to observe, it is very difficult to assess the quality of water by visually observation only. Therefore, the CISA-protocol is mainly focusing on structures and elements. However, there are some visible indicators on water quality.

No turbid water. Some waters are naturally turbid due to fine grained soils in the catchment. In some cases, there is an abnormal turbidity, which may cause siltation. Such turbidity is normally caused by human activities, like outflow from ditches, or driving or digging in or close to the stream. The picture of a dam at page 7 and a culvert page 10 shows very brown water. This is natural (=no impact) as the catchments have a lot of peat areas and hence the water become humic (brown)

No anthropogenic litter. Litter may affect the water as well as the riparian zone.

No eutrophication. Large amounts of vegetation, e.g. reed or green algae, can be an indication of eutrophication.

No point sources. Discharge of polluted water from human activities may affect the water quality.

S – SENSITIVITY

Sensitivity means the risk of sedimentation/siltation outflow to running waters, which is the most severe problem in forest streams. Forest operations may damage the upper soli layer leading to erosion and hence flow of inorganic matter to the stream. Slopes and wet areas has the highest risk for this. Sensitivity is the most important variable in this method.

Soil types tending to erode. Several types of soil easily erode, for example sand, silt, and peat.

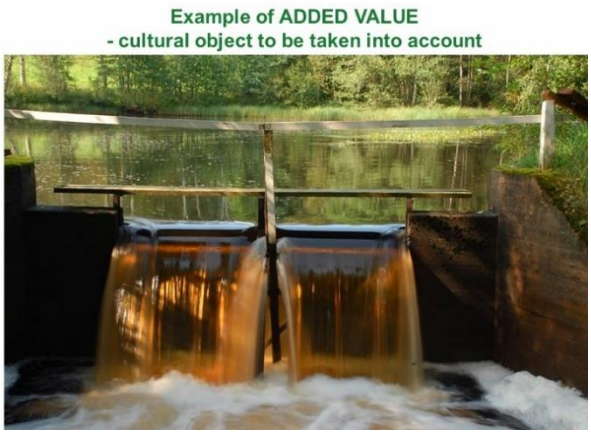
Slope towards the stream. Higher slopes lead to increased risk for soil erosion.

Wet-moist riparian zone. Damages to wet-moist areas may lead to soil erosion.
Spring or outflow of water in the riparian zone. These are the sites where the ground water turns into surface water. These areas are especially vulnerable and damages, by e.g. heavy vehicles, may cause impaired water quality.

A – ADDED VALUE

Besides conservation, impact, and sensitivity there may be other interesting aspects, which can influence the degree of consideration in forestry.

Cultural values and/or ancient remains – must not be damaged by forestry operations. N.B. There may arise a conflict between keeping a dam of cultural interest and the elimination of the dam to regain connectivity.



Nature protection or recreational area. Sometimes a buffer zone is appropriate to adjacent nature reserves. Arrangements done to enhance possibilities for e.g. trekking and sport fishing may require special attention by forestry. Another example is places for outdoor education.
Actions for restoration. Physical restorations done, or planned, like fish ways, may require special attention by forestry.
Occurrence of interesting species. Some species may be of special interest from e.g. biogeographical or cultural aspects. These species may require special attention by forestry.

GENERAL DESCRIPTION AND COMMENTS
Describe the section survey in a way so that other people get an inner picture of the stream section. Example of comments are fish barriers downstream.

FINAL ASSESSMENT
Fill the boxes with the scores and the total sum. Write the assessment in words using the guiding principle just below the boxes in the check list. Note the Blue Target class.

ACTIONS ACCORDING TO TARGET CLASS
Write a short description of the proposed actions to improve C, I, S, and A.

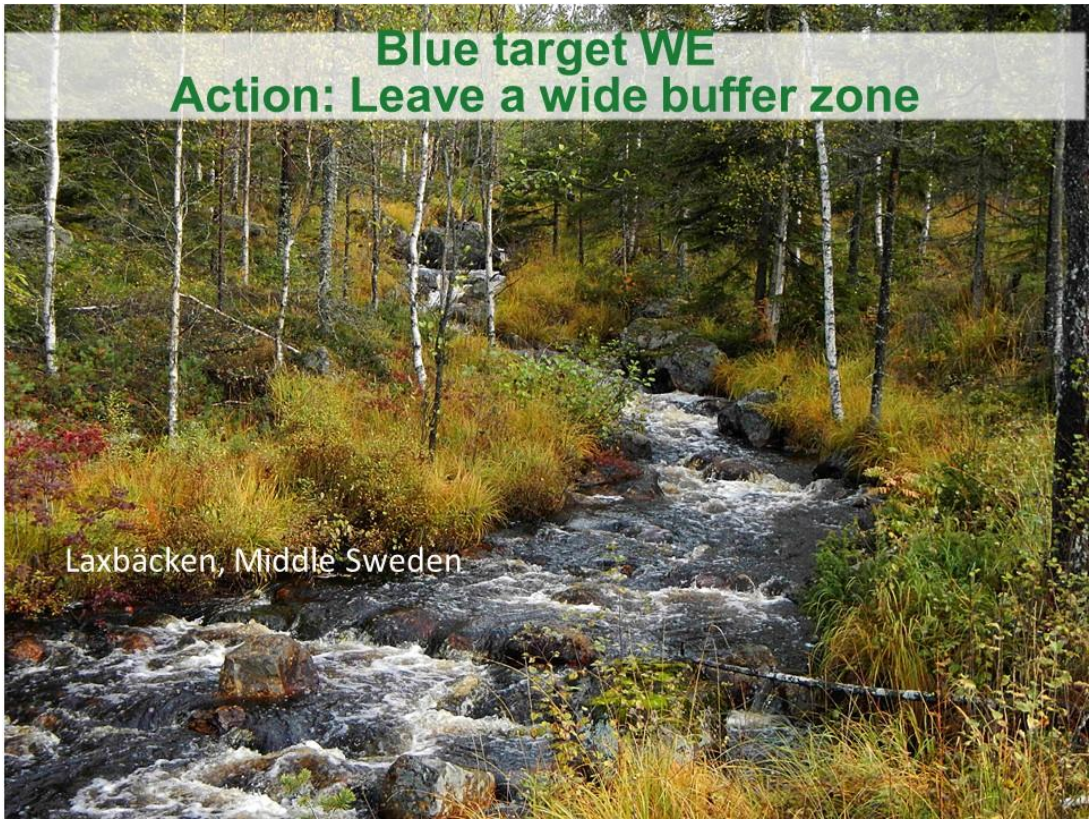
4. Blue targeting

Blue targeting helps forest owners, forest companies and forest operators to optimise environmental considerations to a stream section and to identify actions needed to maintain or improve the stream biodiversity. There are four Blue targets:
WG – Water requiring General consideration
WE – Water requiring Enhanced consideration
WS – Water requiring Special action, in the stream or riparian zone
WU – Water that are to be left Untouched

Low conservation value, low sensitivity.

Low conservation value, low sensitivity.

*High conservation value (habitat for the red-listed Freshwater Pearl Mussel (*Margaritifera margaritifera*), high sensitivity (high slope at the right side of the stream).*



*High conservation value (habitat and reproduction area for Brown trout (*Salmo *trutta) high sensitivity (high slope at both sides of the stream).*

Most of the sediment input from a connecting man-made ditch to the main stream is captured in a sediment trap. The main stream section has the Blue target WS - Water requiring Special action.

Fish and benthos migration barrier.
Blue target WS - Water requiring Special action.

*Planted spruce (*Picea abies*) was removed to get an ecological functional riparian zone.*

Stream section with very high conservation value in the water as well as in the riparian zone.

For each target there are a set of consideration regarding width of riparian (buffer) zone, driving vehicles close to the stream, crossing of the stream and amount of coarse dead woody debris. See table below.

	WG – Water General	**WE – Water Enhanced**	**WU – Water Untouched**	**WS – Water Special actions**
Level of consideration	Basic/according to certifying system and/or legislation.	Enhanced.	Very high.	High regarding actions.
Riparian zone (the meters is referring to Swedish conditions)	5-15 m depending on slope.	15-30 m	>30 m	Not specified. Example: gradually replace homogenic plantations with heterogenic forest.
Driving	Not within 10 m from water edge.	Not within 10 m from water edge.	No.	Not specified.
Crossing	At non-sensitive site, i.e. hard bottom.	Minimize. Only on bridges.	No.	Not specified.
Dead wood	Leave/create.	Leave/create >7 pieces/100 m.	Leave untouched.	Not specified.
Comment				Specify the action needed.

The result from the CISA survey is the base for setting the Blue Targets. While there is a general trend between high scores in the CISA protocol and a higher level of protection, there are no absolute correlation between the outcome of CISA and the Blue Target. Blue target should be decided from case to case. All combinations between CISA and Blue targets are possible. However, the most important variables are Conservation and Impact. The table below may be helpful.

Appropriate actions for WS can be decided out of what has been found and filled in under "Impact" and "Conservation". Whatever has been mentioned as a problem, can have its solution. Examples of actions: elimination of migration barriers or closing of ditches entering the stream. The Blue Target WS must be combined with some of the other three Blue Targets, for example to specify the width of the riparian zone etc.

Stream	**Riparian zone**	**Water quality**
Restore the natural state of streambed (in case of cleaning) or meanders (in case of straightening).	Increase functionality of the riparian zone by replacing homogeneous tree stands (plantations) with heterogeneous ones, by promoting broadleaved trees and by promoting multi-layered, multi-age stands.	Remove anthropogenic litter from the stream and riparian zone in case there is any. Prevent littering in the future.
If possible, prevent excessive water removal and regulation of water level in case there are any.	Use water protection structures, such as sedimentation ponds, overland flow areas and peak flow control dams, to ensure good water quality, in case there are ditches entering the stream.	Enhance oxygen supply in the stream in case of excessive eutrophication (indicated by large amounts of green algae, reed).

Remove artificial migration barriers in case there are any.	Prevent soil damages, promote ground vegetation.	Prevent input of point-source pollution into the stream in case there is any.

The flowchart helping to identify the need for Special actions is presented below.

Table 1. Find the Blue Target. If you end up within the purple box, consult table 2 to find out if Special actions are recommended.

Sensitivity \ Conservation value	Low	Moderate	High
Low	WG	WG-WE	WE
Moderate	WG	WE	WE-WU
High	WE	WE	WU

Your Blue Target is: **WG+S** or **WE+S** or **WU+S**, depending on your result from Table 1.

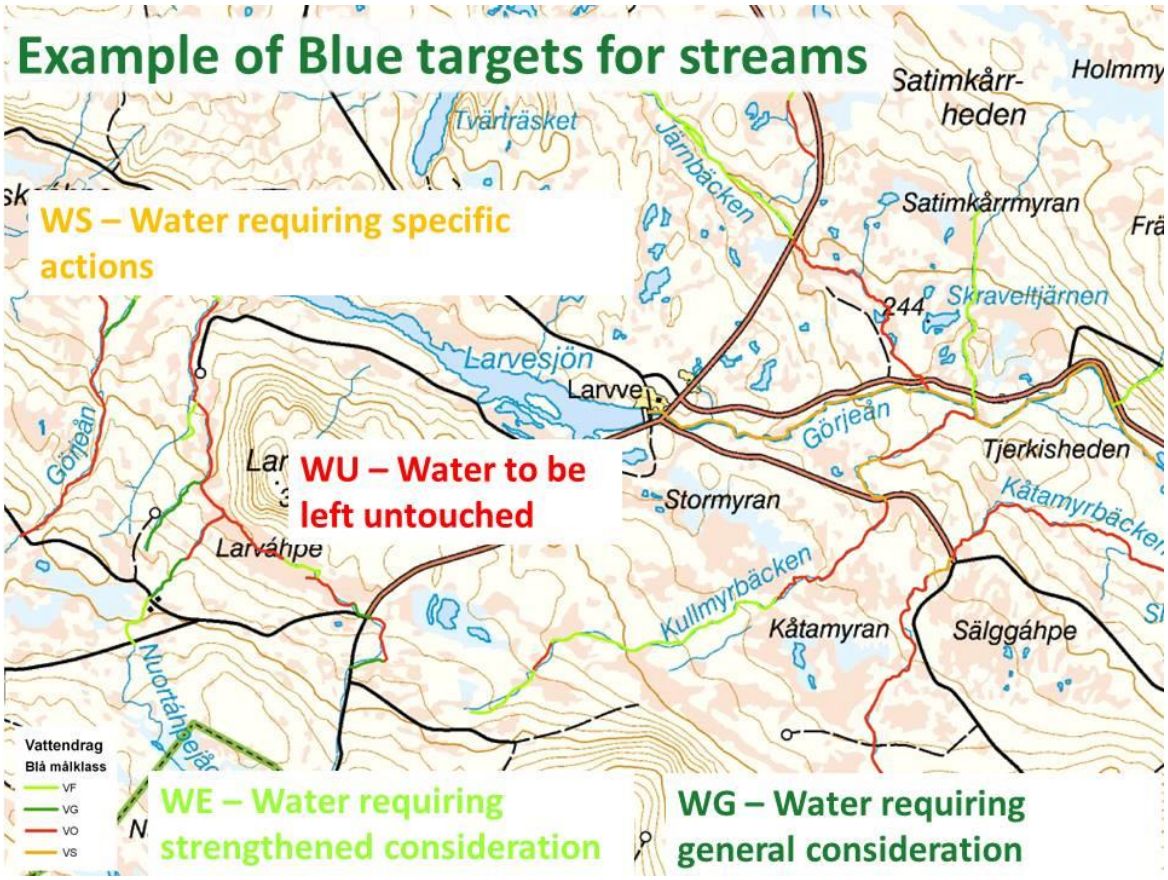
If you end up within the purple box in table 1, then consult Table 2.

If Special actions are recommended, then continue this way.

Impact		
Low	Moderate	High
Low priority for special actions.	Special actions (S) are recommended. Moderate priority.	Special actions (S) are recommended. High priority.

Table 2. The level of impact indicates if Special actions (S) are recommended.

The Blue targets can be presented at e.g. maps.


Example of Blue targets for streams
Satimkårr-
heden
Holmmy
Tvärträsket
Järnbäcken
WS – Water requiring specific actions
Satimkårrmyran
Skraveltjärnen
244
Larvesjön
Larvve
Görjeån
Tjerkisheden
WU – Water to be left untouched
Stormyran
Kåtamyrbäcken
Larváhpe
Kullmyrbäcken
Kåtamyran
Sälggáhpe
Vattendrag
Blå målklass
VF
VG
VO
VS
WE – Water requiring strengthened consideration
WG – Water requiring general consideration