



First workshop in the case study

On May 7th 2020 the first workshop with the case study group was held within C5a project. The case study group members are representatives from different sectors and interests in the River Klarälven area. The purpose of the workshop was to identify diverse types of weather and weather events that is a challenge or a possibility for the participants different areas of interest. By the results we will determine what kind facts and studies about the water flow in river Klarälven that we are missing today and will ask SMHI to produce. On the next page you will find some of the aspects that was discussed during the workshop.

Participants

Representatives from following stakeholders participated on the first workshop: Värmland County Administrative Board, SMHI, SGI, Swedish Transport Administration, Fortum, Visit Värmland, Karlstad University, Swedish Agency for Marine and Water Management, Profu (from energy science project “Climate effect on the energy system”), Karlstad Municipality and Hagfors Municipality with connection to Klarälven water council.

Within the case study we also have a working group financed by SMHI and The Swedish portal for climate change adaptation. The group consists of representatives from Värmland County Administrative Board, SMHI, SGI and the Swedish Transport Administration. Together they are working with planning and implementing activities in the case study and compiling the results.



Facts about the case study and C5a project

Värmland County Administrative Board in Sweden is participating in C5a, an international climate adaption project taking place between 2019-2021. Within the project Värmland is conducting a case study together with SMHI, Swedish transport administration and SGI about River Klarälven on water flow and regulation in a changing climate. We want to examine how a comprehensive perspective and cooperation between different subject areas can benefit measures in the Klarälven area. One of the objectives in the case study is to share knowledge between stakeholders in the area and contribute to a holistic perspective. This will increase knowledge about the impact of a changing climate on the water flow, regulation and whole area of Klarälven. It will also increase cooperation over both subject and geographical areas and integrate a holistic perspective when planning measures in the Klarälven area.

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High flows - prolonged rainfall and melting snow in the catchment area

Sector	Effect	Consequence
Society and citizens	High flows	<ul style="list-style-type: none"> High flows requires big efforts from rescue services. Overflowed basements i.e. Prolonged flows will lead to flooding of existing buildings and infrastructure.
Nature and ecology	Prolonged high flows during summertime	<ul style="list-style-type: none"> Affects the most unique species in River Klarälven, those that are tied to the dynamic sand environments especially in the meander race.
Water quality	High flows	<ul style="list-style-type: none"> Affects transport of polutions - in example by bringing more substances from poluted areas. Landslips may also bring polutions. If productions with polluting substances are flooded it can affect the water quality. Here it might also be the long term change that will have effects and not just extreme events – like more rainfall in general or drought for a longer period.
Infrastructure	High flows	<ul style="list-style-type: none"> Leads to higher risk for landslips along roads. More long term damage on roads at high flows, difficult to detect. The combination of factors, i.e wet soil+ higher flows (especially during winter time) and a change to mild winters will affects roads.

Downpour - Heavy rainfall in the catchment area

Sector	Effect	Consequence
Infrastructure	Downpour, landslips, landslides	<ul style="list-style-type: none"> Higher occurence of landslips affects infrastructure, i.e Road 62 is the only mainroad leading to Hagfors and thus very important for the municipality. With heavy downpour stormwater will flow down towards the river and cause erosion, leading to higher risk of landslips and landslides. Brings debris that can stop up drainage systems at roads.
Dam safety	Downpour	<ul style="list-style-type: none"> Higher risks concerning dam safety
Water quality	Downpour	<ul style="list-style-type: none"> May flush out polutions that affect water quality.

Other discussions

Discussions also involved other climate effects in the catchment area, tied to snow, high temperatures, drought and fires. Including its impact on nature tourism, grids, ecology, water quality and infrastructure. Both downpour and high flows was of interest, but also other changes in weather like drought, patterns of precipitation and warm years. There is an interest to look at extreme events but also how longer and more structural changes affects different interests. For example, an extended season of growing, increased evaporation, changed pattern for precipitation and shorter periods of ground frost.

It became evident that stakeholders had a need to discuss with each other over sectorial borders and they emphasized the importance of having a whole system perspective in their work with climate adaption.

- We hope that the work we do in this case study will help stakeholders to exchange knowledge and experiences with each other leading to climate adaption measures from a whole system perspective in the Klarälven area.

Low flows - changed patterns of precipitation that leads to less run off water

Sector	Effect	Consequence
Tourism	Lows flows in summer	<ul style="list-style-type: none"> Drought can affect tourism in the river, i.e cancellation of canoeing races.
Nature and ecology	Low flows	<ul style="list-style-type: none"> Negative impact on some species in the river. When confluent goes dry some species like clams can disappear. Species become more vulnerable. Repeatedly reduced spring flows affects the most unique species in River Klarälven, those that are tied to the dynamic sand environments especially in the meander race. Less spring flow leads to less flows pass the hydropower plants which makes in more difficult for salmon and smolt to get downriver. During dry years it also gets more difficult for fish to go upstream.
Hydro power production	Low flows	<ul style="list-style-type: none"> To low flows makes the hydropower production decrease.
Water quality		<ul style="list-style-type: none"> In terms of chemical status, extreme years, both drought and flooding, can affect transport of polutions. In example by bringing substances from poluted areas in other ways than normal. Landslips can also lead to polutions.

Sediment transport - transport of bigger and smaller particles in River Klarälven

Sector	Effect	Consequence
Tourism	Increased flows over a certain level + increased sediment transport	<ul style="list-style-type: none"> Sedimentation close to the area around Karlstad that creates difficulties for boats to travel and visit.
Infrastructure	Increased flows + increased sediment transport	<ul style="list-style-type: none"> Increased erosion affecting roads and infrastructure. Erosion, flows over the middle range. If middlerange flows increase by 25 % it will change the shape of the river, meaning more erosion upstream.

Comming meetings

Workshop 2: 9th of september 2020

We will work together with vision and backcasting to identify common interests, goals and solutions. The C5a projects Cloud2Coast concept will be tested in cooperation with C5a:s research group and the University of Twente in the Netherlands.

Workshop 3: 10th of november 2020

From the data that SMHI have been tasked to produce about the flows in River Klarälven we will discuss how it affects our different interests, regulation, and geographical areas. We share and take part of each other's perspectives.

Contact

Elin Ljunggren
Project manager
Elin.Ljunggren@lansstyrelsen.se

Karin de Beer
Climate adaption coordinator
Karin.de.Beer@lansstyrelsen.se