Monitoring of rewetted areas (action D5) within project ReBorN in the county of Norrbotten

(LIFE15 NAT/SE/000892)

Picture 1. Råneälven 2020 planning for action.

Picture 2. Råneälven 2020 executing plan,

Dan Ojanlatva

County Administrative Board of Norrbotten 2022

County Administrative Board of Norrbotten

Table of contents

Summary

To monitor one of the expected results, that the rewetted area will increase in a restored river reach, we have used drones to take pictures before and after restoration. Polygons were created in DroneDeploy and by measurements in LM Orto pictures. They then were sorted in categories of:

- New wet area (in the riparian zone)
- Re-opened side channels

In the monitored sites we have a result of 50,1 ha of rewetted area along a total river length of 101,6 km. Increased rewetted area is 0,5 ha/km.

Drone surveys are depending on natural circumstances as wind, rain, shading and water levels to get accurate results. This makes it time consuming and combined with no-go flight zones (military or civil air zones) and new overall regulations for flights out of sight makes it impossible sometimes.

Measurement without high resolution drone pictures can give a lower degree of accuracy. Restoration measures in large river systems provide extensive response in increased ha/km because the width of the riparian zone is often proportional to river width.

In some of the sites in Åbyälven, restored in 2021, there are no new footage available. The estimations in those sites have been done in a manual work process, coordinators and foremen have discussed each site individually using available work material. These estimates are as accurate as high-resolution pictures, but it is much more time-consuming process than using drone footage.

Background

Due to the former channelizing for timber flotation use, the rivers were narrowed, and the wet areas were decreased. In many areas the rivers old shorelines are visible on land behind the wall of boulders, stones and gravel.

The different techniques that were used during removing material from the rivers gives a wide ratio of how effected the riparian zone have been. Manual or partly manual removal often resulted in smaller effects on the riparian zone, late channelization made by bulldozers gave large effects on the riparian zone.

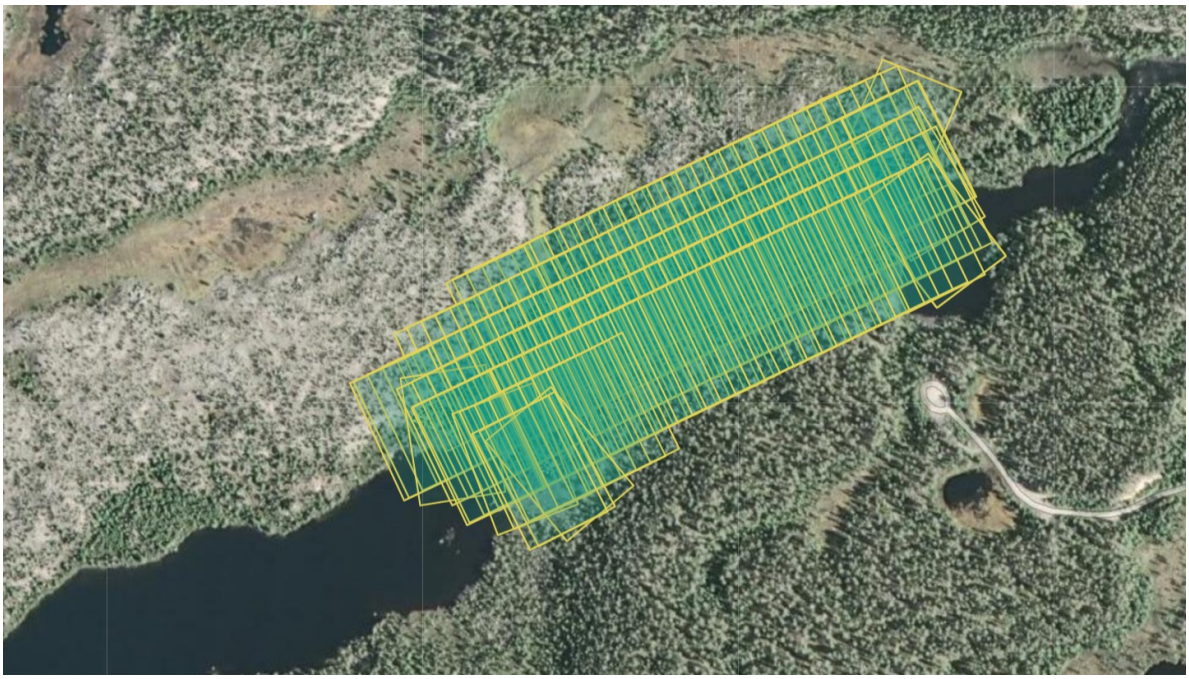
By restoration it is possible to rewet the old floodplain and reopen side channels. Rivers in northern part of Sweden has been channelized and material removed during a period of approximately 100 years. In the beginning it was done manually and with simple tools, horses and dynamite and in the later period large machines were used as bulldozers and logging machines. The size of the new wet areas after a restoration is depending on surrounding terrain and the slope of the river, a steep slope with steep banks will give a smaller area with possibilities for water retention.

Rewetted areas are often very important because they are suitable as habitats for juvenile fish and invertebrates. By letting the river flow naturally, we also connect the riparian forests with the river and many valuable ecosystems benefits from this.

Method

Mapping of the areas is done with an UAV[1] and with a specific application (we used DroneDeploy) which allows us to pre-set the area where we want to take pictures.

The area and the resolution of the mission is planned in the application[2] and the UAV performs the mission autonomously (picture 3).



Picture 3. Picture projection plan for Björklidsforsen (project area Åbyälven) executed with ”DroneDeploy”.

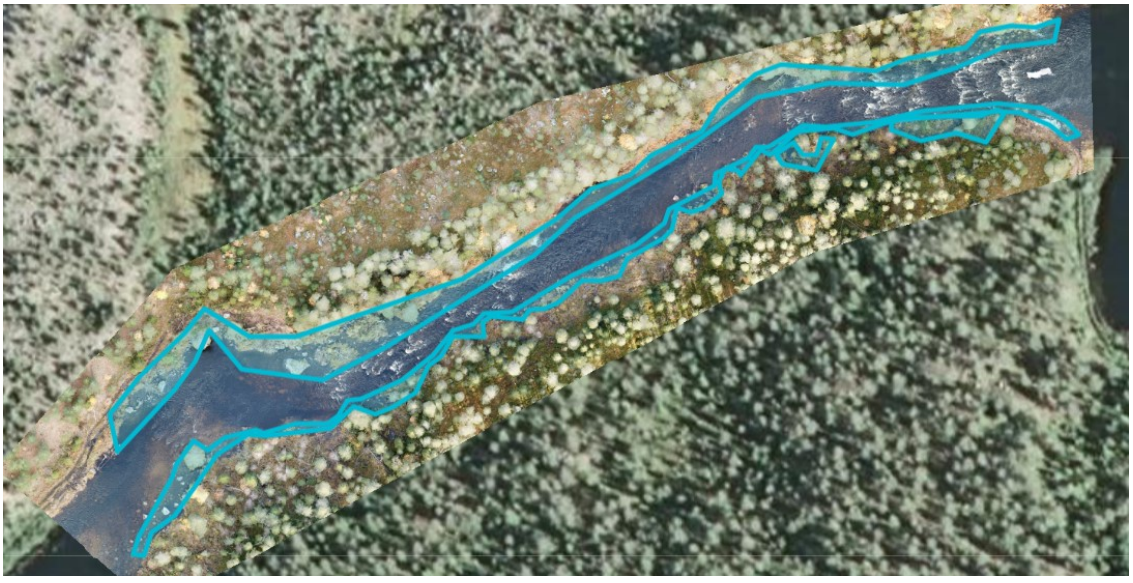
Flight mission results in high-resolution pictures (3.8 cm/pix) made by stacking aerial pictures with 80% overlap horizontally and vertically (picture 4).

[1] UAV-Unmanned Aerial Vehicle also called drone

[2] Drone Deploy www.dronedeploy.com

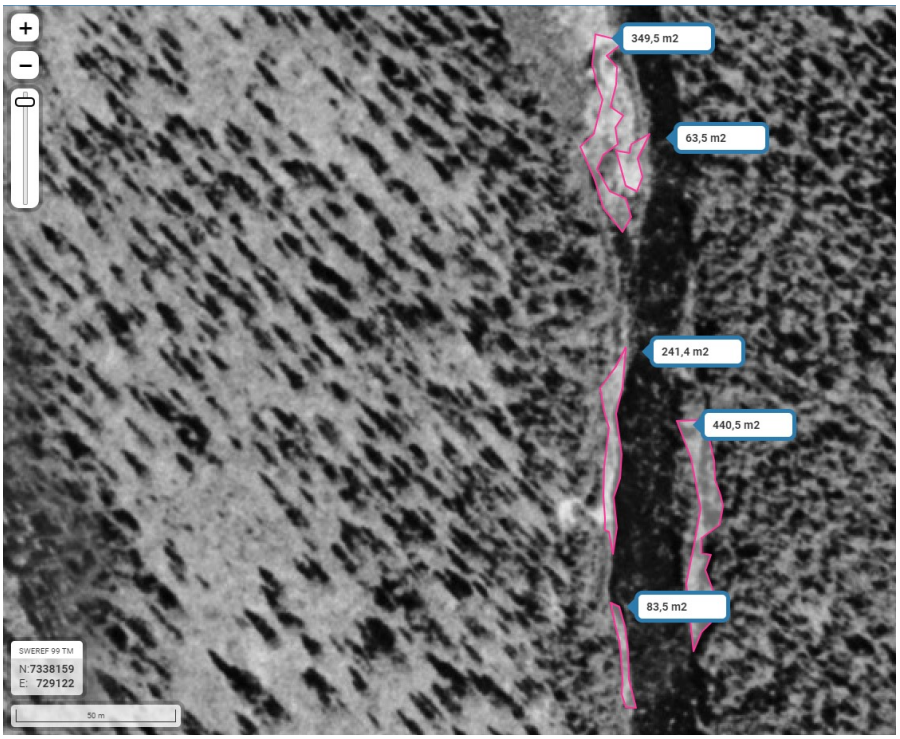
Picture 4. High-resolution picture.

The material is subsequently reviewed, and polygons of the rewetted areas and the re-opened side channels area drawn using the application. The high-resolution pictures make it possible to recognize even small differences between the before and after pictures (picture 5).



Picture 5. Polygons, rewetted area and re-opened side channels.

LM orthographic photos are not equally high-resolution. The estimates are made by comparing older orthographic photos with never ones. Orthographic pictures are not taken annually of the northern part of Sweden and the weather conditions can make the quality of the photos differ even if the photos are taken during the same period of the year, i.e. shading from tree canopy can differ a lot.



Picture 6. Orthographic picture before restoration @Lantmäteriet

Picture 7. Orthographic picture after restoration @Lantmäteriet

Results

Results tables of rewetted areas in county of Norrbotten.

Kalixälven	**Area increase m² (% of total area)**
New wet riparian area	71 184 (15)
Re-opened side channels	8 849 (2)
Total new rewetted area	80 033 (17)
Total area after restoration	*560 951*

Table 1. Rewetted areas in project area Kalixälven (Linaälv and Vassaraälv)

Råneälven	**Area increase m² (% of total area)**
New wet riparian area	173 135 (16)
Re-opened side channels	15 220 (1,4)
Total new rewetted area	188 355 (17)
Total area after restoration	1 282 823

Table 2. Rewetted areas in project area Råneälven including Solälven and Rutnajoki

Piteälven	**Area increase m² (% of total area)**
New wet riparian area	61 616 (20)
Reopened side channels	3 854 (1,2)
Total new rewetted area	65 470 (21)
Total area after restoration	376 256

Table 3. Rewetted areas in project area Piteälven (Vitbäcken and Stockforsälven)

Byskeälven	**Area increase m² (% of total area)**
New wet riparian area	10 122 (17)
Re-opened side channels	10 074 (16)
Total new rewetted area	20 196 (33)
Total area after restoration	81 440

Table 4. Rewetted areas in project area Byskeälven (Långträskälven)

Åbyälven	**Area increase m² (% of total area)**
New wet riparian area	120 491 (23)
Re-opened side channels	36 218 (7)
Total new rewetted area	156 709 (30)
Total area after restoration	675 873

Table 5. Rewetted area in project area Åbyälven

Total area before restoration m²	2 466 580
New rewetted area m²	510 763
Gained area %	21
Total area after restoration m²	2 977 343

Table 6. Summary rewetted areas gained in the project ReBorN in county of Norrbotten

Riversystem	**Restored distance km**	**Increase ha/km**
Kalixälven	17.7	0.45
Råneälven	35.6	0.53
Piteälven	23.1	0.28
Byskeälven	4.8	0.42
Åbyälven	24.9	0.63

Table 7. Increase ha/km in the project ReBorN in the county of Norrbotten

Discussion

The use of drones to map areas before and after the work process has been valuable. However, technical and practical issues concerning flight plans, permits to no flight zones and adaption to light and weather conditions are very time consuming. The results are also depended on water levels and the shading from the riparian vegetation. In the northern part of Sweden there is a very short timeframe when the conditions are optimal, the yearly variation is between 1-3 weeks after the spring flood decreases and before there is a dense vegetation cover. Monitoring is more suitable for large systems than smaller because of the vegetation cover.

The results of the restoration process depend on many variables, such as:

- What kind of technique was used in removing the material, is there material left to work with or has dynamite been used?
- How well suited the sites are for rewetting areas, bank slope, surrounding areas, river slope (will the water spread)?
- Local knowledge or long experience, how the rivers behave in different flow regimes.
- How and what type of effort is put in the restoration work and coordination
- Constrains due to landowners and or infrastructure.
- Which excavator operators that are executing the work, experienced or unexperienced?
- Function and equipment of excavators.

Some areas that have been restored shows no extra gained rewetted area. However, the habitat is still very much improved in terms of variation, natural structure and function. Other areas have 3-4 times larger area after the restoration.

Some parts of the side channels were already “wet” but closed or partially closed off from the natural waterflow before restoration. It is important to keep in mind that the real gain of “functional” area therefore is a lot larger than the numbers shown above.

One problem that occurs is that the foremen often only see the river system in a fix water level, and they have problem to adapt the work process so it will fit all water levels. In a project that goes on for several years this can be adjusted during the project time if necessary.

This report has been compiled in the frames of the ReBorN LIFE project (LIFE15 NAT/SE/892), which is co-financed from the EU LIFE Programme.