Vaccia

Action 5: deliverable 1
Data investigation

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Abstract

Vulnerability assessment of ecosystem services for climate change impacts and adaptation (VACCIA) project started in January 2009. Tvärminne Zoological Station's role is to develop a GIS platform for the identification of changes in the management criteria of coastal ecosystems. The project is being funded by the LIFE financial instrument of the European Community.

The system's geographic information will be collected within the Western Gulf of Finland (WelFin) Long Term Ecological Research (LTER) site and will consist of data sets providing information of both biological and physical chemical characteristics of the area. These characteristics are known to be sensitive to climate induced pressures. There is a notable amount of temporally extensive environmental data available at Tvärminne Zoological Station, which will be supplemented with data gathered from the stations cooperative partners, e.g. Hanko bird-watching station (HALIAS) and Länsi-Uudenmaan vesi ja ympäristö ry (LUVY).

The data provided by HALIAS consists of bird observations made at the peak of the Hanko peninsula as well as the islets, islands and island groups that are being monitored. LUVY's data includes their marine monitoring sites and both physical chemical and biological parameters associated to them. The data sets at Tvärminne Zoological Station are likewise a collection of long term monitoring data from specific marine sites, where environmental data has been collected.

As the amount of data vendors is subject to changes, this investigation does not cover the data from all of the potential partners in cooperation within a close radius to Tvärminne Zoological Station. Thus, this document only focuses on the vendors that are highly involved in the stations day-to-day activities: some key members of HALIAS do active research at Tvärminne and LUVY has a small office and a permanent researcher at the station as well.

Tiivistelmä

VACCIA-projekti (Luonnon tarjoamien palveluiden haavoittuvuusarviointi ja sopeutuminen muuttuvaan ilmastoon) alkoi tammikuussa 2009. Tvärminnen eläintieteellisen aseman tehtävänä on kehittää projektin viidennen toiminta-alueeseen alla GIS-alusta rannikkoalueiden ekosysteemien hallintakriteerien muutosten tunnistamiseksi. Projektia rahoittaa Euroopan yhteisön LIFE-rahoitusinstrumentti.

Järjestelmän paikkatieto kerätään Läntisen suomenlahden LTER-paikalta (WelFin) ja se koostuu sekä alueen biologia että fysikaalis-kemiallisia ominaisuuksia kuvaavasta aineistoista. Nämä ominaisuudet reagoivat herkästi ilmaston aiheuttamiin muutoksiin. Tvärminnen eläintieteellisellä asemalla on hallussaan huomattava määrä laajalle ajanjaksolle levittäytynyttä dataa, jota täydennetään yhteistyökumppaneilta saaduilta aineistoilla. Näitä yhteistyökumppaneita ovat esim. Hangon lintuasema (HALIAS) ja Länsi-Uudenmaan vesi ja ympäristö ry (LUVY).

Hangon lintuaseman data kuvaa lintuhavaintoja Hankoniemen kärjessä ja seurannan alla olevilla luodoilla, saarilla sekä saariryhmillä. LUVY:n aineisto liittyy järjestön merellä sijaitseviin tarkkailupisteisiin ja niihin liittyviin fysikaalis-kemiallisiin sekä biologisiin parametreihin. Tvärminnen data on niin ikään pitkäaikaista ympäristödataa merellä olevilta pisteiltä.

Tiedon toimittajien määrän muuttumisen vuoksi tämä aineistokartoitus ei kata kaikkien Tvärminnen eläintieteellisen aseman läheisyydessä olevien potentiaalisten yhteistyökumppaneiden aineistoja. HALIAS ja LUVY ovat näkyvillä aseman jokapäiväisissä toiminnoissa, joten ne ovat erityisen tarkkailun alaisina tässä dokumentissa. Hangon lintuaseman toimijat tekevät aktiivisesti tutkimusta Tvärminnessä ja Länsi-Uudenmaan vesi ja ympäristö ry:llä on pieni toimipiste aseman tiloissa.

Table of contents

1. Introduction

Tvärminne Zoological Station's GIS platform is being developed for the identification of changes in the management criteria of coastal ecosystems. The development work is part of the project VACCIA, which stands for the Vulnerability assessment of ecosystem services for climate change impacts and adaptation (Tvärminne Zoological Station 2009a). The project is being funded by the LIFE financial instrument of the European Community.

This document includes a general description of the data that is to be included in the GIS platform as well as its providers. The data set investigation briefly identifies the spatial and temporal extent of the data, as well as the central research parameters related to them. Data received from the following vendors were investigated: Hanko bird-watching station (HALIAS), Länsi-Uudenmaan vesi ja ympäristö ry (a regional association of water protection located in Western Uusimaa, also known as LUVY) and Tvärminne Zoological Station.

2. Hanko bird-watching station, HALIAS

2.1 General information

Hanko bird-watching station is located at the far end of the Hanko peninsula (Uddskatan) in southern Finland. The station is maintained by Tringa r.y., the ornithological society of Helsinki. The station was found in 1979 and is still actively providing bird-watching data (Hangon lintuasema 2008). According to Lehikoinen (2009) the only big gap in data production took place in spring 1990, when bird-watchers were not allowed to enter the harbour area.

The bird-watching station's exact coordinates are:
N 6640334, E 3269884 (KKJ3)

2.2 Observation parameters and site information

The following observation parameters apply to the data:

- Species
- Date
- Local birds
- Migratory birds, total (total/day)
- Migratory birds, constant (observations made under a 4 hour constant watch, number included also in "Migratory birds, total")
- Footnotes (e.g. sex ratio)
- Observation (true/false)

(Lehikoinen 2009)

In addition, there is a separate ringing data available at the Finnish Ringing Centre, located at the Finnish Museum of Natural History in Helsinki. The data includes records from 1979-1999. There are plans of making a database out of the ringing data for the station's use (Lehikoinen 2009). The ringing data includes the following records:

- Species
- Date
- Time (1hr accuracy)
- Age
- Gender
- Catching method

(Lehikoinen 2009)

HALIAS has also been an active part in studying bird nesting at several islets, islands and island groups at the birdlife conservation area of Tulliniemi. The studies are conducted every third year in collaboration with Metsähallitus. Coordinates (in KKJ3) for the observed sites are following listed in table 1.

Table 1. Coordinates provided by Lehikoinen (2009).

Nesting site	N	E
Boberggrundet	6640392	3268260
Granskär + Granskärsharun + islets	6638396	3269163
Gustavsvärn	6638975	3272547
Högskär	6639146	3270720
Kistskär	6639559	3268943
Kolagrundet	6641917	3268545
Kvarnskär	6641001	3269049
Låglandet + islets	6638762	3271768
Långholmen	6638920	3271118
Lilla Klippingen	6642472	3268855
Måsskär + islets	6638436	3271008
Norr Klippingen	6642472	3268855
Örskär	6637715	3271620
Rågskär	6637872	3272308

Ryssön + lislets	6638254	3271933
Sälsten	6640931	3268565
Söder Klippingen	6642195	3268866
Svanglarna + Fläskaren + NW islet	6638669	3270470
Tistrorna	6637739	3270307
Tjuvskär	6640540	3269220
Tullholmen,Hauensuoli, Lilla Ankargrundet + islets	6639635	3270549
Tvihjälpan	6640973	3267898
Uddgrundet	6640529	3269732
Utterklinten	6641012	3267471
Yttre and Inre Kalskär	6640792	3269861

More specific data regarding each of the studied islets, islands and island groups are also available. (Lehikoinen 2009)

3. Länsi-Uudenmaan vesi ja ympäristö ry, LUVY

3.1 Description of activity

LUVY is a regional association of water protection and water service provider. A rough translation of the associations name would be Western Uusimaa's water and environment. Their offices are in Lohja, Raasepori (in the former city of Tammisaari) and they also have a permanent researcher stationed at Tvärminne Zoological station (Tvärminne Zoological Station 2009b). LUVY's aim is to promote water protection, environmental protection and healthy living environments in western Uusimaa (Länsi-Uudenmaan vesi ja ympäristö ry 2009a, 2009b).

LUVY has several monitoring sites located inside its area of operation. The temporal scale of LUVY's monitoring data reaches back to 1976. Since 1987 the monitoring of the area has followed a program established by LUVY (Länsi-Uudenmaan vesi ja ympäristö ry 1997: 1). The sites are placed on both north and south side of the Hanko peninsula, the marine area of the former city of Tammisaari (nowadays part of the city of Raasepori) and the rivers of Fiskars (Fiskarsinjoki) and Mustio (Mustionjoki).

3.2 Marine monitoring sites of Hanko and Bengtsår

The monitoring sites of the marine area of Hanko and Bengtsår are listed in table 2. Basically, all of the data can be accessed via the management system for environmental data (Hertta). The system is located on the website of Finland's environmental administration. Some of the sites were missing from Hertta's database and some had slightly different names.

Table 2. The site coordinates are represented in KKJ3.

Site	N	E
Anklarensbukten 160	6641411	3277866
Bengtsår lounas 13	6648760	3281465
Bredsundsfjärden 34	6648413	3278955
Hanko länsi 32	6642404	3271000
Hankoniemi etelä 117	6640206	3278603
Hankoniemi etelä 118	6639439	3277406
Hankoniemi etelä 121	6640481	3277173
Hanko etelä 123	6640797	3275284
Hanko 128	6640940	3272567
Hankoniemi etelä 143	6639648	3276104
Hankoniemi etelä 156	6639109	3278714
Hankoniemi etelä 157	6640802	3277839
Hankoniemi etelä 158	6640668	3276140
Hankoniemi Forcit 25	6646795	3279292
Hankoniemi Forcit 26	6646057	3278788
Hankoniemi Forcit 27	6646351	3278040
Hankoniemi länsi 33	6644419	3269399
Hankoniemi pohjoinen 37	6645744	3276410
Hanko pohjoinen 29	6644300	3275123
Hanko 125	6638846	3274134
V2B	6648124	3284881
Östra Sandfjärden 8	6648339	3284120
Bengtsår itä 9	6650239	3284196
Syningsviken 5	6650480	3286390
Östra Sandfjärden 4	6649688	3285313
Basafjärden 10	6652033	3283727

The physical and chemical samples are collected from the monitoring sites from various depths, several times per year. The following analyses are carried out.

- Secchi depth
- Temperature
- Oxygen
- Turbidity
- Conductivity
- pH
- Tot.-N
- NO_2-N
- NO_3-N
- NH_4-N
- Tot.-P
- Faecal coli bacteria

(Länsi-Uudenmaan vesi ja ympäristö ry 1997: 7)

In addition, chlorophyll a levels are being observed on almost all of the monitoring sites six times during the growing season. If need be, the observations are also organoleptically evaluated. (Länsi-Uudenmaan vesi ja ympäristö ry 1997: 7)

Bottom fauna research is carried out at 18 locations (see table 3). These locations are spread around the Hanko peninsula. The following list sums up some of their information. (Länsi-Uudenmaan vesi ja ympäristö ry 1997: 8)

Table 3. Bottom fauna research locations according to Länsi-Uudenmaan vesi ja ympäristö ry (1997: 9).

Area	Location	
Hanko southern		
	H I	Andalskär
	H IB	Granskär
	H II	Lergrund
	H III	Gunnarskär
Hanko northern		
	H IV	Slakteribukten
	H V	Tvihjälpan
	H VI	Bockaholm
	H VII	Silversand
Oy Forcit Ab		
	Forcit I	
	Forcit II	
	Forcit III	
	Forcit IV	
	Forcit V	
Oy Visko Ab		
	Visko I	
	Visko II	
	Visko III	
	Visko IV	
	Visko V	

Samples are being collected from several depths and the following parameters are involved in the studies:

- Species
- Diversity
- Quantity
- Biomass
- Size (for Pontoporeia affinis and Macoma baltica)

(Länsi-Uudenmaan vesi ja ympäristö ry 1997: 8)

Marine macro vegetation samples are collected from 0-2 meters depth at 42 locations (Länsi-Uudenmaan vesi ja ympäristö ry 1997: 9). These are also spread around the Hanko peninsula. Information on these sites provided by LUVY is summed in table 4.

Table 4. Research sites for marine vegetation. (Länsi-Uudenmaan vesi ja ympäristö ry 1997: 10)

Area	Lines
Hanko southern	1 – 18
Hanko northern	23 – 32
Forcit	33 – 36
Visko	37 – 46

Samplings are carried out during the growing season in late July or early August. Special attention is paid to species indicating eutrophication. The following parameters are studied:

- Species
- Species abundance
- Visual estimate of epiphytic algae abundance on bladder wrack (Fucus vesiculosus)

(Länsi-Uudenmaan vesi ja ympäristö ry 1997: 9–10)

Water quality measurements (physical and chemical monitoring, chlorophyll a levels) are carried out every year. The results are discussed 3-4 times per year in shorter reports and in a wider report, where the results from the whole year are discussed. The more detailed biological studies (flora and fauna) are done every 4th year. A wider report discussing the areas development is written in conjunction with the studies. (Länsi-Uudenmaan vesi ja ympäristö ry 1997: 10)

3.3 Marine monitoring sites of Fiskarsinjoki, Mustionjoki and the marine area of Tammisaari

The monitoring sites for Fiskarsinjoki, Mustionjoki and the marine area of Tammisaari exact locations listed in table 5. The coordinates are represented in Finnish KKJ3.

Table 5. The monitoring site coordinates were transformed from KKJ2 to KKJ3.

Site	N	E
Mustionjoki 0,5	6669478	3309136
Mustionjoki 1,9	6669737	3310490
Mustionjoki 21,6	6675595	3321722
Mustionjoki 24,7	6675080	3324301
Mustionjoki 4,9	6668695	3313136
Mustionjoki 8,3	6667431	3315342
Fiskarsinjoki 0,7	6670559	3308704
Pohjanp.lahti Huluvik 12	6660826	3302484
Pohjanp.lahti Huluvik 13	6660809	3302873
Pohjanp.lahti etelä 11	6658381	3302082
Pohjanp.lahti kesk. 5	6664731	3305595
Pohjanp.lahti Storö 1	6668060	3307269
Pohjanp.lahti Åminne 2	6669333	3308348
Båssafjärden 93	6655214	3301478

Båssafjärden 96	6653756	3301602
Dragsviksfjärden 87	6657132	3305330
Järnö Predium 151	6649851	3293182
Källviken 100	6653265	3298074
Lappohja 153	6649029	3291442
Skogbyfjärden 101	6651007	3295078
Stadsfjärden Vitsten 210	6656163	3299318
Tvärminne Storfjärd 152	6646683	3289053
Hevy 16, Pohjanlahti 92	6661656	3303633
Tvärminne Storfjärd 111	6643748	3290392

The following analyses apply to the monitoring sites:

- Temperature
- Secchi depth
- Oxygen
- pH
- Conductivity
- Turbidity
- Tot.-N
- Tot.-P
- Chlorophyll a (possibly added to the list in the late 1980's)

The following are also measured at some sites:

- NH_4-N
- Faecal coli bacteria
- Oil

The parameters for the river monitoring sites include:

- COD_{Mn}
- BHK_7
- Fe
- Solid matter

4. Tvärminne Zoological Station

4.1 Overall information

Tvärminne Zoological Station (TZS) belongs to the Faculty of Biosciences, University of Helsinki. It serves as a centre for a large variety of high quality biological research, carries out environmental monitoring, and offers facilities for field courses, symposia and seminars.

4.2 Monitoring sites

Tvärminne Zoological Station has several monitoring sites, some of which have been used for decades (see Table 6). The list sums up the most central long term monitoring sites in the vicinity of the station. The exact whereabouts of some of the listed data are yet to be discovered. This is pretty much a matter of just asking the right person for directions, as some of the data is quite old and the station's personnel has undergone changes as well.

Table 6. A list of the central long term monitoring sites and their research themes at TZS.

Site	Subjects	Initiated	N	E
Brännskär				
	Monitoring of Bladder wrack (Fucus vesiculosus)	1979	6642663	3291359
Granbusken				
	Monitoring of Bladder wrack (Fucus vesiculosus)	1979	6639496	3289774
Krogarviken				
	Collecting temperature data with a ruttner sampler from various depths. Ice coverage data is also collected.	1926	6642991	3289833
Långholmsbranten				
	Monitoring of soft bottom fauna.	1926	6643693	3290224
Längden				
	Hydrography, nitrogen, phosphorous, phytoplankton and chlorophyll-a samples.	1972	6634934	3290190
	CTD (conductivity-temperature-depth)	1990		

Storfjärden				
I	Monitoring of soft bottom fauna.	1926	6643893	3291654
II	Collecting salinity and temperature samples with a Ruttner-sampler.	1926	6644037	3290763
II	Collecting salinity and temperature samples with a CTD-meter (conductivity-temperature-depth).	1989	6644037	3290763
II	Hydrography, nitrogen, phosphorous, silicate and chlorophyll-a samples.	1996	6644037	3290763
II	Studying mesozooplankton populations.	1967	6644037	3290763
Tvärminne pier				
	Temperature monitoring of sea water.	1926	6642888	3289995

5. Observations and challenges

The data investigation showed that some modifications are to be implemented to make certain tabular data more compatible with the stations geographic information system (GIS). This concerns, at this stage, mainly Tvärminne Zoological Station's data, which has not always been documented in a fully GIS compatible format, e.g. in some cases, column headers were split into two rows and some headers started with an invalid character, i.e. a number. These data sets need to be addressed some more carefully to avoid data distortion.

As the amount Tvärminne's of data is quite vast, finding out the exact whereabouts of all the data is not yet complete. This should not pose too much of a barrier for the GIS development work. Tvärminne Zoological Station has parts of the data stored at the station in an electronic format. A general rule of thumb is that the newer a data set is, the more likely it is stored in a digital format. The recovery of the station's old data is a process of its own, as it may require going through research results documented on paper.

Data acquired from HALIAS and LUVY had clearly been constructed in a more GIS compatible style, although when LUVY's data was compared to the data found from Hertta, differences did occur in e.g. monitoring station names. Some monitoring stations were also missing from Hertta. This could be due to the fact that the data report received from LUVY dated back to 1997 where as the data downloaded from Hertta includes entries made in 2009.

Another problem arose when studying the locations of LUVY's bottom fauna and vegetation lines. As seen in tables 3 and 4, the specific coordinates for the lines were not mentioned in the report provided by LUVY, although they were illustrated in one of the maps included in the document. Another problem factor

seems to be that line data has been converted to point data. In terms of data usability, this makes sense, since now the data can be downloaded from Hertta and easily imported into GIS software. A brief discussion with Ralf Holmberg, one of LUVY's scientists, revealed that the exact location of the lines has not been of utmost importance until recently, when suitable technology has been utilised and new regulations were set regarding the collection of coordinates.

LUVY has a large database (V2L) which is currently undergoing some changes to become more spatially compatible. At this stage, it has already been reported that coordinate data can be exported from the database along with monitoring data. HALIAS had informed the station that they have made plans for assessing the ringing data available at the Finnish Museum of Natural History in Helsinki.

6. Epilogue

This data set investigation is the first Action 5 deliverable of the project VACCIA. It addresses some of the central long term data sets to be included in the GIS platform for the identification of changes in the management criteria of coastal ecosystems. More data from new data vendors are likely to be added to the system later.

The essential parts of a GIS are formed up nicely at Tvärminne Zoological Station. All the data sets together with the existing and future cooperation parties provide good means for a successful development work of the GIS. Over the last few years people have become more aware of the possibilities offered by geographic information tools. Not only has GIS gained a foothold on Tvärminne Zoological Station, but it has also made itself visible in the region through other projects, carried out by some of the stations cooperative parties.

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