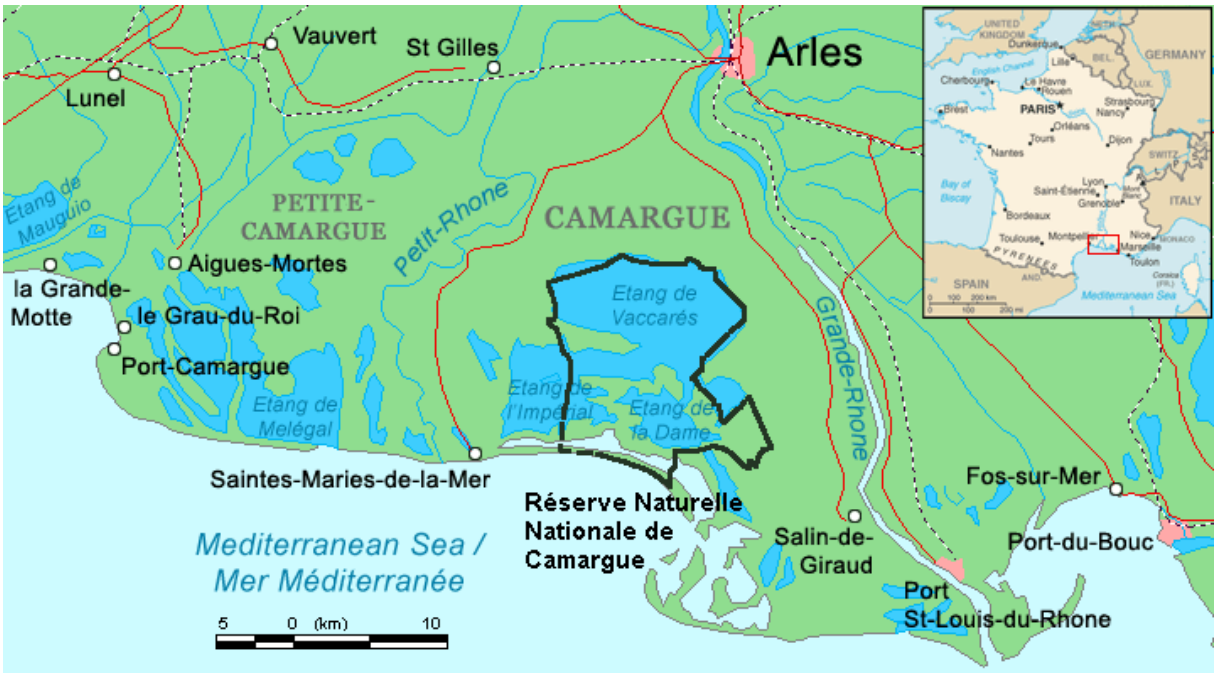
MABH i Camargue 9-12 maj, 2017

Innehållsförteckning

Reseberättelse MABH i Camargue 2017

Vi var 14 personer som åkte till Camargue 9-12 maj 2017 för att besöka forskningsstationen Tour du Valat och titta på Camargue med omgivningar. Huvudsyftet med resan var att fördjupa kontakterna med forskarna vid Tour du Valat och diskutera möjliga forskningssamarbeten. Camargue är precis som Kristianstad Vattenrike ett UNESCO biosfärområde, vilket gör det särskilt intressant ur ett MABH-perspektiv att utveckla samarbete med forskare i detta område. Resan förbereddes framför allt av Pär Söderquist. Från MABH följde även med Hristina Bodin, Gunnar Gunnarsson, Johanna Grönroos, Ingvar Holm, Lars Jonsson, Ingemar Jönsson, Jean Lacoursière, Ola Magntorn, Lennart Mårtensson, Ann-Sofi Rehnstam-Holm, Nils-Olof Svensson och Lena Vought. Med följde också Anders Hallengren från Länsstyrelsen i Skåne (i stället för Arne Halling som tyvärr var tvungen att stanna hemma). Johan Elmberg, som tillsammans med Pär är den som har haft mest tidigare kontakter med Matthieu Guillemain och andra personer på Tour du Valat, fick bilhaveri på väg till Kastrup och blev tyvärr tvungen att stanna kvar i Sverige.



Karta över Camargue (Wikipedia).

Med en yta på ca 930 km² är Camargue ett stort floddelta. Området består av en alluvial slätt som inrymmer stora saltlaguner som är avskurna från havet genom sandbankar och omgivna av marskland. Detta är i sin tur är omgivet av stora odlade arealer med bl.a. risodlingar. Ungefär en tredjedel av Camargue består av våtmarker. Området runt Étang de Vaccarés har varit skyddat sedan 1927 och är sedan 2008 en del av Parc naturel régional de Camargue.

Flygresan 9 maj Kastrup-Marseille med mellanlandning på Schiphol gick bra. Två minibussar hyrdes på Marseilles flygplats. Med dessa tog vi oss till vårt hotell, Hôtel Cheval Blanc i den antika och vackra staden Arles. Kvällen ägnades åt kulturella och kulinariska upplevelser i Arles. Kvällsmål på trevlig marockansk restaurang. Staden är anlagd (enligt vissa) av Julius Ceasar, där floden Rhône rinner ut i deltat, ut i Camargue. Den är känd för en stor amfiteater från romartiden som fortfarande används, bl.a. som tjurfäktningsarena. Det var i Arles som

Vincent van Gogh hade sin mest produktiva tid som målare och också där som han skar av sig sitt ena öra. Stan har idag drygt 50000 invånare.

Gunnar vid amfiteatern i Arles. Foto: Pär Söderquist.

Amfiteatern i Arles. Foto Nils-Olof Svensson.

Tour du Valat ligger centralt i Camargue. År 1954 grundades det av schweizaren Luc Hoffmann som ett icke-vinstdrivande forskningsinstitut för att skydda de mediterrana våtmarkerna från att förstöras, och för att se till att våtmarkerna sköttes på ett hållbart sätt (http://www.tourduvalat.org/). På Tour du Valat arbetar ett 60-tal personer varav ca hälften är våtmarksforskare specialiserade på många områden, ornitologi, hydrologi, limnologi, mikrobiologi, socioekonomi, etc. Området där institutionen ligger är på 2600 hektar varav 1844 är naturreservat.

Diskussion på symposiet på Tour du Valat. Foto: Ingemar Jönsson.

På onsdagen 10 maj, kl 9-17, och torsdagen 11 maj, kl 9-12, hade vi och Tour du Valat ett gemensamt symposium med ett stort antal presentationer. Förutom de intressanta presentationerna så minns vi de utmärkta flerrätterslluncherna i kantinen på Tour du Valat och de härliga omgivningarna som vi besökte när tillfälle gavs. Biätare, skatgök och vita camarguehästar var en del av det vi såg. Anders hade t.o.m. turen att få se en genett. Efter presentationerna på onsdagen tog vi en runda i en del av övriga Camargue för att se landskapet och förhoppningsvis något av det fågel- och djurliv som området är berömt för. Vi blev inte besvikna utan fick se både flamingos, kohägrar, egretthägrar och många andra djur.

På spaning i Camargue. Foto: Gunnar Gunnarsson.

Efter lunchen torsdagen den 11 maj åkte vi tillsammans med Matthieu norrut till kalkbergsområdet Alpillerna där vi i regn tittade på lämningar från romartiden och besökte vingården Mas de Gourgonnier där solen till slut tittade fram.

På besök i vingården Mas de Gourgonnier där det även odlades oliver. Foto: Pär Söderquist.

Resan fortsatte till den märkvärdiga medeltida bergsbyn Les Baux de Provence som både är tjusig, ligger vackert och har storslagna vyer. Uthuggna ur kalkklipporna finns både medeltida hus och en mäktig borgruin. Den ”ligger utomordentligt vackert i Chaine des Alpines, n. ö. om Arles och har nästan fullständigt bevarat sitt medeltidsutseende, med till större delen ur kalkklippan huggna hus i vacker renässansstil” (Nordisk familjebok, 2:a uppl., 1904). Idag är Les Baux en turistfälla med mängder av turistaffärer i de gamla husen men fortfarande värd ett besök, särskilt utanför turistsäsongen. Bauxit som man använder för att framställa aluminium har fått sitt namn från Les Baux. Brytning av bauxit har skett länge i området.

Nils-Olof bredvid minnesstenen i bauxit. Foto: Lars Jonsson.

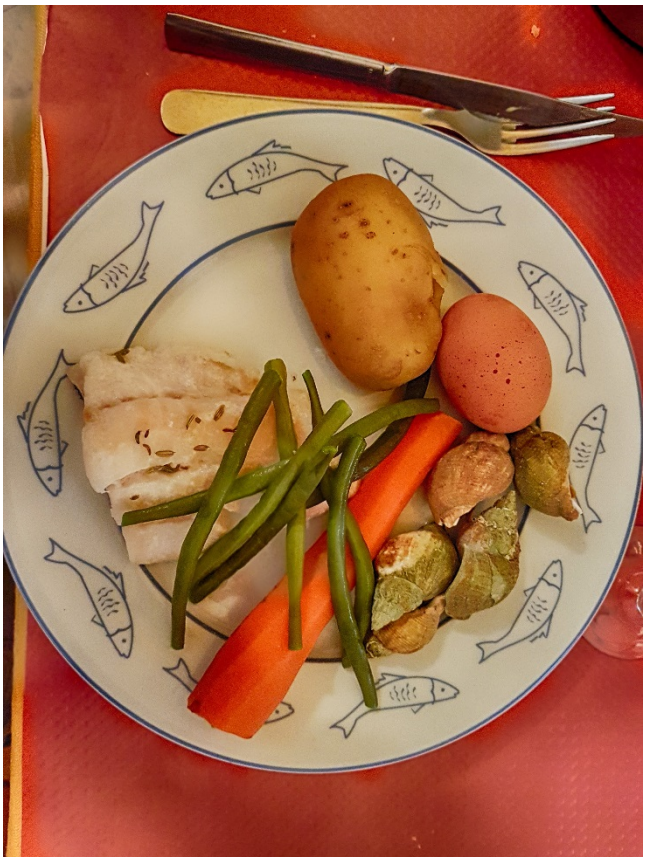
På kvällen blev det ett trevligt restaurangbesök i Arles. Vi besökte Restaurant Pizzeria La Mamma som Ingemar som ung fågelskådare hade besökt 1979 och hade trevliga minnen ifrån. Den var fortfarande bra även 38 år senare.

Fredagen 12 maj var bokad för exkursioner i Camargue. Förmiddagen ägnades åt en långsam färd på hästsläp i Marais du Vigueirat (http://www.marais-vigueirat.reserves-naturelles.org/en/). Mycket fick vi se under turen, bland annat många olika arter hägrar, bronsibis, styltlöpare, den sydamerikanska invasiva sumpråttan (nutria), svarta nötkreatur av Camargue-ras. Tjurarna används till den sydfranska varianten av tjurfäktning. Strax före vidarefärden hjälptes vi åt att leta efter lövgrodor, med gott resultat.

På spaning i Marais du Vigueirat. Foto: Johanna Grönroos.

Lövgroda i Marais du Vigueirat. Foto: Lars Jonsson.

Lunch på den mycket franska restaurangen L'Estrambord i byn Le Sambuc (http://www.lestrambord.fr/). Utmärkt och mycken mat gjorde oss mycket mätta och nöjda. I lunchen ingick valthornssnäckor, något de flesta av oss åt för första gången.



Lunchen med valthornssnäckor på Restaurant L'Estrambord. Foto: Nils-Olof Svensson.

En aning dästa, fortsatte vi till Musée de la Camargue. De flesta av oss gick in och blev visade runt av en guide. Efterhand lämnade vi muséet och gick en längre njutbar runda i landskapet.

Iberisk murödla i Camargue. Foto: Lars Jonsson.

På hemvägen på Marseilles flygplats. Foto: Lars Jonsson.

Resan gav oss mycket kunskap om Camargue som kan användas i både forskning och undervisning, nya kontakter med forskare och andra på Tour du Valat, möjligheter att starta olika samarbeten och inte minst gjorde det att vi lärde känna varandra bättre med de utvecklingspotentialer det kan ge i framtiden. Se också trevlig artikel om resan på Högskolans websida: http://www.hkr.se/nyheter/2017/resan-knot-samman-camargue-och-kristianstad/.

Gruppdiskussioner och möjliga framtida samarbeten

Under den sista dagen av symposiet delade deltagarna in sig i fyra grupper för fortsatta diskussioner om presentationerna samt för att diskutera möjliga framtida samarbeten. De fyra olika grupperna delades in i Hälsa, Fåglar, Akvatiska ekosystem och hydrologi samt Strategiska framtida samarbeten. Nedan följer en engelsk sammanfattning från de fyra gruppernas diskussioner.

Health

Participants: Ann-Sofi Rehnstam-Holm, Marion Vittecoq

Both within MABH and at Tour du Valat there are ongoing research on antimicrobial resistant bacteria. In Kristianstad the focus is on bacteria present in water while in the Camargue the focus is on resistant bacteria carried by wild birds and mammals. A first and interesting way to build a bridge between our projects could be to connect the current analysis of bacteria carried by rodents in twelve different sites across the Camargue with the parallel exploration of the bacteria present in the water at these sites. This would allow us to investigate the contamination of the delta throughout a gradient of anthropisation and to compare bacteria spread within the wetland network and wild populations. We will explore the possibility to fund and co-supervise a Master 2 project. The student could spend the first weeks of his (her) work in the Camargue collecting water samples and gain knowledge about the local context as well as antimicrobial resistance in wildlife. He (she) would then go to Kristianstad to analyze the samples and learn more about antimicrobial resistances in water. This would be a feasible and interesting way to start a potentially fruitful collaboration.

Ann-Sofi Rehnstam-Holm and Marion Vittecoq discussing the possibility of a common project on antibiotic resistance in the Camargue. Photo: Pär Söderquist

Birds

Participants: Ola Magntorn, Gunnar Gunnarsson, Johanna Grönroos, Jocelyn Champagnon

The discussions mainly focused on two ongoing projects on avian migration, one conducted at Tour du Valat, particularly using the Eurasian spoonbill *Platalea leucorodia* as a model study, and another project on terns (black tern *Chlidonias niger* and common tern *Sterna hirundo*) conducted at Kristianstad University.

Types of track devices used to follow migration routes were discussed with their pros and cons. Also the different routes taken by each species and the relevance of stopover sites were addressed.

Discussions on bird research at Tour du Valat and Kristianstad University. Photo: Pär Söderquist

Aquatic ecosystems and Hydrology

Participants: Lena B.-M. Vought, Hristina Bodin, Brigitte Poulin, Olivier Boutron, Lars Jonsson, Lennart Mårtensson and Jean O. Lacoursière

The main discussion focused on the removal of pesticides using constructed or managed wetlands, one of Tour du Valat's problematic presently addressed in their project "*Restoration of the Camargue saltflats lagoons and marshes*". Associated with this project is also a plan to use conservative tracing to validate the hydrological model they developed for the Camargue, enquiring if MABH can also assist in further developing this model.

One of the key outcomes (following further discussion during lunch) is a suggestion of exploiting the in-flow channels as long treatment systems using floating rafts made of dried reeds and macrophytes with long roots system, such as those tested by Kristianstad University (HKR) in Southeast Asia. Possibility of already involving HKR students in a development phase was discussed. There was also great interest in "piggybacking" micro-pollutants projects (such as HKR's ongoing pharmaceuticals, microplastics and antibiotic-resistance ones) on any project since none of the discussed methodologies have been used so far in the Camargue.

When it comes to assisting in Computational fluid dynamics (CFD) modelling, HKR offered to put Tour du Valat in contact with colleagues from Warwick and Sheffield Universities (UK) who are already involved in a joint study on constructed wetlands modelling. In this effect, Tour du Valat offered their expertise in hydrological modelling for HKR projects.

Discussions on how the research platform MABH and Tour du Valat could collaborate within projects on aquatic ecosystems and hydrology. Photo: Pär Söderquist

Future collaboration

Participants: Ingemar Jönsson, Matthieu Guillemain, Pär Söderquist, Ingvar Holm, Nils-Olof Svensson

This group discussed the possibility to develop a more formal cooperation between the Man & Biosphere Health (MABH) research platform and Tour du Valat, in order to facilitate development of joint research projects and to obtain funding. Our two organisations have many common interests.

We discussed the strategic option and value to build a formulation of partnership/cooperation to our locations within UNESCO biosphere reserves (Camargue and Kristianstads Vattenrike, respectively), connecting to the "support" function of research in biosphere reserves. Projects related to biodiversity conservation, ecosystem services, and eco-tourism would nicely fit into such partnership frame. The Camargue biosphere reserve management seems to have a rather complex structure with many organisations involved, quite different to the case of Kristianstad Vattenrike, and it may therefore be difficult to include the biosphere reserve organisations in a partnership agreement.

An initial way to promote collaboration would be to arrange for student exchanges between our institutions, where students could perform thesis work, placement studies (VFU), or other projects. The facilities at Tour du Valat are excellent to provide short-term visits for collection of data. Kristianstad University has several educational programs that would fit into such exchange, including programs in biology, landscape science, and biomedical laboratory science. Tour du Valat research station is not formally connected to a university, but host many researchers affiliated with University of Montpellier. Kristianstad University currently has an Erasmus agreement with University of Montpellier for student exchange in the field of business administration, and the possibility and interest to establish similar agreements in more environmentally oriented fields should be investigated.

The group agreed that establishing a formal collaboration agreement or partnership would be desirable, and that such process should be initiated once the written report of this first meeting between Tour du Valat and MABH has been completed.

Discussions on the opportunities of developing a more formal collaborative partnership between MABH and Tour du Valat. Photo: Gunnar Gunnarsson

Abstracts

MAB France

Raphael Mathevet

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The history of UNESCO MAB programme was presented as well as the organization of Biosphere Reserves (BR). The organization of the French MAB Committee was described as was the Camargue BR. There is a French network of BRs. There is also a network of Delta BR (Ebro and Po together with Camargue). Own research: Participatory modelling (agent-based modelling, KISS and KILT, Computer based role playing game).

Kristianstad vattenrike Biosphere Reserve

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The presentation introduced Kristianstad Vattenrike Biosphere Reserve which became an UNESCO Biosphere Reserve in 2005 and is approximately 100.000 ha, inhabits about 90.000 people and encompasses almost the whole Kristianstad Municipality. The reserve includes forests, farmlands, the Helge River and its wetlands, and a part of the Baltic Sea where the Helge River meets the sea. The work in the Biosphere Reserve is coordinated by the Biosphere Office with Naturum as the visitor center. The ever changing landscape of wetlands, meadow shores, sandy grasslands, and deciduous forests makes Vattenriket to a hotspot for threatened species. It covers less than two promille of the area of Sweden and is yet home for 20% of Sweden's threatened species.

The motto of Kristianstad Vattenrike Biosphere Reserve is for benefit of man and nature. In Vattenriket the biosphere office works together with organizations, local companies and landowners to come up with sustainable solutions to both preserve and make use of the values in the landscape. For example wetlands are created and sandy grasslands are kept open. Some examples of projects in the biosphere reserve are: crane management, outreach activities, education of biosphere ambassadors, and catfish reintroductions and monitoring.

The Man & Biosphere Health research platform at Kristianstad University

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The presentation gave an overview of Kristianstad University and the Man & Biosphere Health Platform (MABH). Kristianstad University is one of the smallest universities in Sweden, located about 100 km north East of Malmö in the southernmost part of Sweden. The university was established in 1977, but builds on a much longer educational history in teacher and nurse education which goes back to the 19th century. Today it has 14.000 students in a variety of programs, including some natural science oriented programs in biology, biomedical laboratory science, landscape science, water/wastewater system and management, and environmental science/strategic resource use. The research platform MABH at MABH, established in 2009, is directed towards environmental science, but with a very broad profile. It has a multi-disciplinary natural science base but also includes several members from social science. MABH has an ambition to further strengthen the social science component of the group, in order to cover a broad spectrum of social-ecological research competence. This ambition connects to our aim of being a knowledge support for the biosphere reserve Kristianstad Vattenrike. MABH currently has 32

members. Activities within MABH includes, e.g., monthly meetings, workshops, seminars, guest researchers/lecturers. The visit to Camargue and Tour du Valat represents our first platform-level activity abroad, and from the shared location context of our two organizations - wetlands of high biodiversity within UNESCO biosphere reserves - we hope this meeting will be a starting point for exchange of knowledge and experience, and development of long-term collaboration between MABH and Tour du Valat.

Collaborations across borders

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Building on our ca. 20-year relationship, this presentation highlights some aspects of what we believe can help establishing and maintaining long-term scientific collaboration. First, any occasion should be used to get in contact with new colleagues, from manuscript reviewing to online networks and international conferences. Research groups do not necessarily have to get big quickly, nor members have to necessarily only collaborate within the group. Like in any relationship, mutual respect and freedom are key to long-lasting collaboration. The speciality of each group member should be recognized, but there is a benefit in appearing as a solid group of complementary scientists. Long-term scientific collaboration does not necessarily have to involve heavy administration or application to big European funds, as long as the financial abilities and limits of each group member is recognised.

Simultaneously assessing the influence of plants and entrance conditions on hydraulic retention time and nutrient removal efficiency in wetlands/ponds

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The presentation centred on the message that wetlands may not be working as you think when considering nutrient removal efficiency. It introduced an ongoing research involving the simultaneous use of 3 assessment approaches: 1) successive grab-sampling of the inflow and outflow; 2) the use of conservative tracing to obtain an outflow water sample at the actual hydraulic retention time of the wetland, which is then compared to the inflow sample taken at the start of the trace; and 3) a regression based mass-balance established on a 10 days 2 composite-samples per day sampling rate of the inflow and outflow, with each composite made of 4 distinct samples taken every 3 hours over a 12-hours period. Preliminary results indicate that, although efficiency derived from the 3 methods concur most of the time, a surprisingly high variation (CV% 10-600%) exist over the sampled period. Wind direction and intensity seem to have an influence greater than vegetation driven dispersion pattern. Finally, when the entrance condition was changed from the recommended diffused to a side-oriented high velocity jet one (to introduce gyrating circulations in a bid to obtain nominal retention time), a decrease in removal efficiency was observed when $RT_{nominal}$ was almost achieved instead of the widely expected improvement dictated by reactor-mixing theory. A third manipulation set (jet to diffused entrance) is on-going. The presentation concluded by showing that the conservative tracing approach is well suited for the wetlands and irrigation channels of the Camargue, in a way similar to that used by HKR along a 15km long wetland complex in Vientiane, Lao PDR.

Monitoring the Camargue trends over recent decades

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Can we measure if/how the delta evolves? Longitudinal data from several sources is being compiled. Results show more frequent, high Rhône flows, regular loss of natural habitats, but with a recent slow-down. There is a tendency towards coastline regression, but also some growth. Nitrate and lead levels are decreasing, pesticides increasing. There is a loss of farmland diversity. Habitats are partly “fixed” but still capable of evolving. Gradual, slow changes give impression of stability. Not only local drivers but also national/European/global.

Biomass from wetlands as substrate for industrial biotechnology

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A very important goal in our project is to find a rational and economical viable way to make biogas from wetland biomass, including biomass from other conservation worthy areas of high biodiversity. Moreover, the residues from biogas process used as bio-fertilizer to the fields, so that nitrogen and phosphorus is returned to the farm land. The biomass can be used for the production of biogas or for extracting valuable platform chemicals in bio refineries. These valuable chemicals may be potentially useful for making future plastic materials, i.e. bio plastics. The work will involve research in the areas of environmental engineering and landscape science and includes studies of biodiversity and water treatment function of the landscape. Finally, it is important to stress that mowing of wet meadows will most likely result in a better capacity of such meadows to retain nutrients from water passing through them. Wetland with wet meadows and similar vegetation types will be more efficient in cleaning water and thereby fight eutrophication in the recipient.

Mediterranean wetlands: a gradient from natural resilience to a fragile social-ecosystem

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Biodiversity degradation in Mediterranean wetlands is a major problem. The wetlands contain a number of endangered endemic species. There is an increased demand for and use of ecosystem services. The aim is to measure the resulting decreased functionality of the ecosystems.

Design of riparian buffer zones with regard to aquatic ecosystems

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Riparian buffer zones have been studied with regard to water quality, nutrient content in soil and in stream biodiversity. Experiments have been conducted to determine the nutrient (N, P) removal efficiencies in surface runoff of different types of riparian buffer zones, where the buffer zone with mixed vegetation (grass/brush) were most efficient in removing P. Soil in the buffer zone have commonly been found to be saturated with P, which could reduce the efficiency of the nutrient removal in this zone. In streams surrounded by mixed vegetation, the number of taxa and individuals of the benthic community were higher than streams with only beech or alder in the buffer zone. The results suggest that the zones

need to be managed to increase plant diversity and to reduce P-build up to optimize the effect on the aquatic ecosystem.

Educational aspects and ecoturism in Cévennes reserve

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The Cevennes are characterized by agropastoralism and dry-stone architecture. The area consists of an open habitat with deep valleys and plateaus. Griffon vultures have been released to reestablish a free-living population. The vultures will function as a formal way for the elimination of carcasses, thus avoiding other and more costly measures. In another project, captive individuals of Przewalski's horse, the only extant wild horse species has been trained in the Cevennes to live in the wild before reintroduction in Mongolia (TAKH project).

Implementation of the ecosystem services concept in municipal planning and decision making

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In Sweden, governmental decisions and integration into environmental quality objective of the ecosystem services concept have created a strong incentive to implement this concept in planning tools and political decisions at municipal level. This presentation described a transdisciplinary research project aiming at a better understanding of the conditions for such implementation. The project was performed together with seven south Swedish municipalities and included interviews with politicians and officials in these municipalities, studies related to spatial planning and ecosystem-based adaptation, analysis of the transdisciplinary method used, and a number of local case studies. The presentation gave a brief summary of some of the results from these studies, concluding that there is a need for: (i) more knowledge and understanding of the ecosystem services concept/approach in municipalities, (ii) better coordination of the ecosystem services and ecosystem-based adaptation efforts, and (iii) more transdisciplinary collaboration between municipalities, researchers, and the business sector.

Extended beta-lactamase resistance in water systems

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We have studied the phenotypic and genetic pattern among Extended Spectrum Beta-lactamase (ESBL) producing bacteria in the aquatic environment, and have compared the result with clinical samples from the same area.

Water samples were collected at three different sites in the Helge river, Kristianstad community, Sweden. The first station is located before the outlet from the municipal sewage plant, the second just after the outlet and the third close to the Baltic Sea. Cultured bacterial isolates from the water and clinical isolates were analysed for phenotypic expression of ESBL related genes using the MAST-test, and genetically by PCR analyses of a set of ESBL genes, i.e. $bla_{CTX\text{-}M}$, bla_{SHV}, bla_{TEM}, and bla_{OXA}

Both clinical and environmental ESBL isolates were dominated by *Escherichia coli* and *Klebsiella pneumoniae*. Highest abundance of environmental ESBL isolates were obtained from the station close to the sewage outlet, the lowest close to the Baltic Sea. The gene cluster $bla_{CTX\text{-}M}$ was the most common

among all isolates (65%), followed by $bla_{TEM\ (30\%)}$. The bla_{OXA} and bla_{SHV} genes were more common in clinical isolates.

A majority of the ESBL bacteria were mediated by chromosomal genes, dominated by $bla_{CTX\text{-}M}$. However, bla_{OXA} .and bla_{SHV} were more common in clinical isolates. Further genetic analyses will be performed on more isolates, and on total bacterial community DNA.

Detection of an overall Persistent Organic Pollutants contamination of fishes community from the Vaccares Lagoon in the National Nature Reserve of Camargue

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PCB, HCH (insecticide), DDT, PAH spread through the atmosphere partly from oil refineries and other persistent and diffuse sources were analyzed. Eels were selected as bioindicators.

Removing pharmaceutical residues in water using constructed wetlands

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Currently, wastewater treatment plants (WWTPs) do not adequately remove pharmaceutical residues (PR) and thus these substances are now frequently detected in many aquatic ecosystems. Also, concentrations of many PR in treated effluents from WWTPs exceed proposed Environmental Quality Standards set by EU legislation. One resource-and cost efficient option for increasing PR removal from WWTPs effluents is to use constructed wetlands (CWs) as a polishing step. Still, research concerning how PR are removed in CWs is still in its infancy.

With the aim to investigate how vegetation type and water depth affects the removal of PR in CWs, a study was performed in a free-water surface CW system near Halmstad, Sweden. The study was a collaboration project between H. Bodin, at Kristianstad University (HKR) and S. Weisner, at the Wetland Research Centre (WRC) at Halmstad University (HH). The experimental design consisted of three different types of CWs (each 10x4 meter): 1) harvested CWs with a high mean water depth (0.55 m), 2) unharvested CWs with mixed vegetation and high mean water depth (0.55 m) and 3) same as 2) but with a low mean water depth (0.40 m). During the experiment, the hydraulic residence time (HRT) in the CWs was set to 7 days for the deep CWs and 5 days for those with low depth. The CWs were spiked with five different pharmaceuticals (sulfamethoxazole, carbamazepine, diclofenac and ibuprofen) during 14 days. Inlet and outlet samples were taken on day 0, 14, 21, 28, 42 and 56 after spiking. Samples were analyzed for concentrations of the mentioned pharmaceuticals, antibiotic resistant genes (ARG), nitrate-nitrogen, dissolved oxygen, temperature and pH.

Results showed no significant difference in removal of PR due to CW type. The relative removal (% decrease of inlet concentration) was, however, generally over 70 % for sulfamethoxazol and ibuprofen. For carbamazepine the removal was between 50 -70 %. Removal of diclofenac was between 60 – 75 %, which did not meet the European Environmental Quality Standard (EQS) of 100 ng/L for inland surface waters.

This project adds to the growing body of research which indicate that CWs may be very useful as polishing tools for decreasing concentration of PR in treated wastewater. Still, more research is needed to understand how the removal efficiency may be fine-tuned so that current and future EQS are met.

Parasites, bacteria, viruses and their resistances at the interface between wildlife, livestock and human populations in the Camargue

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We have experienced the emergence and re-emergence of a large number of diseases associated to pathogens originally circulating in wildlife such as HIV or Ebola virus during the last decades. Following these crises the links between veterinary and human medical studies with evolutionary and ecological researches have been constantly growing. The Tour du Valat has been involved in the development of these multidisciplinary approaches since 2005. At first the projects originated from successful partnerships established notably with ONCFS and CNRS and were often funded as a result of health crises such as the ones due to West Nile and avian influenza virus spread in France. The Camargue was identified as a potential hotspot of infectious disease emergence due to it situation, at the crossroads of several bird migration routes as well as intercontinental commercial axes. Our team has been since then developing studies on various pathogens with the same main goal: understanding the link between human activities and pathogen spatio-temporal dynamics at the interface between wildlife, human populations and livestock. Our three main projects are currently focusing on:

1) Liver fluke (*Fasciola hepatica*) dynamics in the Camargue. We aim at unraveling the functioning of the whole host-parasite system in our region involving the parasite dynamics within its intermediate host, a freshwater snail and its definitive host, cattle and wild mammals including nutria and wild boar. We also investigate the impact of anti-helmintic treatment on health and parasite carriage in cattle.
2) Antimicrobial resistant bacteria in wildlife. The aim of this project is to gain insight into the role played by wildlife in the dynamics of antimicrobial resistant bacteria. We address three main questions: i) Which resistant bacteria are currently circulating in wildlife within the Camargue ii) Are these bacteria related to those recovered from humans in the region? iii) Are there some habitats preferences or ecological traits that influence the risk of carrying such bacteria among wild species?
3) Avian Influenza Virus (AIV). Within aquatic bird populations AIV are transmitted either by direct contact or through the ingestion of water that has been contaminated by the feces of infected individuals. This second route involving environmental transmission has been shown to be of major importance. Thus understanding AIV fate within aquatic reservoirs is crucial. Our general objective is to gain information about the “blue box” constituted by the complex wetland network of the Camargue by coupling hydrological models, epidemiological data and knowledge of host dynamics.

We also collaborate with several teams leading projects on various others parasites and pathogens for which insight into “what’s going on in the Camargue” is interesting including Chlamydia spp., *Toxoplasmma gondii*, bird ticks etc. All our projects rely on long-term databases and innovative multidisciplinary approaches.

Vibrio in the environment

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Vibrio spp including non-cholera *V. cholerae* are important components of coastal ecosystems worldwide and in recent years, *V. cholerae* and *V. vulnificus* has caused several cases of wound and sepsis infections. These infections are more common during warm summers and the brackish waters in the southern part of the Baltic sea is under these conditions ideal for Vibrio growth.

We have in several projects studied occurrence and virulence among Vibrio strains isolated from both patients and the environment and can conclude that Vibrio that can infect humans are commonly occurring and virulence genes that occur in clinical isolates can also be found in the environment. Furthermore, several studies conducted on the south-west coast of India show that phytoplankton belonging to the diatoms promote Vibrio growth, but that single species can have other effects. A higher algal species richness also promoted growth. We could also conclude that despite stable temperatures and salinities during and between different time periods, *V. parahaemolyticus* abundances were on average six times higher in December, compared to February - March. *V. parahaemolyticus* abundance was found to be positively correlated to inorganic phosphate concentration and copepod abundance.

Sea-level changes and landscape changes in Southern Sweden, 6 000-9 000 BC related to species hunted and fished

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The studied former Lake Vesan is situated in the province of Blekinge in South Sweden. Before drainage and cultivation in 1927 the lake was shallow and surrounded by phragmites reeds and connected to the Baltic Sea through a c. 3 km long outlet river.

This region has a well-studied sea-level history showing that the global sea-level change since the last glacial here is surprisingly well balanced by the glacioisostatic uplift. The result is that the studied basin for the last 10 000 years repeatedly shifted between being a lake or a bay of the Baltic. For most of this time it´s shores were important for fishing and hunting, as well as for dwelling places. Later also activities like farming and burials left their traces.

In this archeologically rich environment it was decided to build a highway initiating extensive archaeological and paleo ecological studies of which this study is a part.

In the project my role was to study the stratigraphy excavated as well as a 5 m long sediment core for microfossils and physical parameters, aiming to reveal the environmental history of the basin and its surroundings. Pollen and algae are the primary subjects here. Diatoms give information both on nutrient levels and salinity in the water, important both for revealing local sea-level history and productivity. This information may allow discussing changes in abundance and species composition of the limnic and marine fauna foraged by man. The sediments shows initially a rather low but gradually increasing organic content, interpreted as low organic production during later part of the Ancylus Lake stage, and then increasing productivity as salinity in the Baltic increased due to a sea level rise over the inlet straits of the Baltic Sea

Further up in the sediments a color change and increase in organic content coincides with major changes in the algae flora, the green algae Pediastrum decreases at the same time as dinoflagellate resting spores becomes frequent. The diatom flora also changes distinctly, indicating higher salinity. The horizon is radiocarbon dated to 5900 BC (7900 BP) and coincides in time rather well with the shift to the fully marine part of the Littorina Sea stage of the Baltic Sea. The change to saline water coincides with the early phase of raising sea-levels here, the Littorina transgression, which soon culminates at an altitude of 7 m. At this elevation a distinct paleo shoreline is formed at places exposed to the sea.

One of the studied sites of the Mesolithic hunters yielded c. 35 kg of bones. This coastal dwelling place are somewhat older than the change to higher salinity in the nearby Baltic Sea. The excavated constructions and artifacts have been buried under transgression sediments and are thus unusually well preserved. The most common food remains were hazel nuts. The hunting prey, as finds of bones and teeth, represent most of the expected fauna at the time, some hunted for fur, others for meat. The dominating mammal was red deer, other notable finds were elk, aurochs, brown bear and wolf. Three species of seals represent the marine mammals and in addition large amounts of fish bones were found, but only from fresh or brackish water species.

Grazing pressure with links to invertebrates

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Several shorebird species have decreased in numbers during the last decades in northern Europe. This holds also for Kristianstads Vattenrike in southeast Sweden. In fact, some species are decreasing more dramatically there than elsewhere. Meadows in Vattenriket are grazed, which is a prerequisite for shorebirds to breed successfully. However, grazing pressure may be too high in some areas, especially in those where the increasing geese populations are major grazers. This study aimed at quantifying grazing, and study links to invertebrate abundance (i.e. food of shorebirds), on one of the most important (highest diversity) meadows in Vattenriket; *Håslövs ängar* (c. 200 hectares). Using enclosures in 2013-2016, grazing by geese (without cattle) and combined grazing by geese and cattle, was studied whole year around. Data on invertebrates inside and outside the enclosures were collected from April to June using pitfall traps. At most of the study sites on the meadow, vegetation was grazed to c. 5 cm during the breeding period of shorebirds, which is below the optimal level for most species (c. 10 cm). During the period when geese were the only grazers (November-May), there were no clear grazing effect at the enclosures. However, when cattle were released into the meadow in May, vegetation was clearly reduced to low levels. The abundance of invertebrates was considered high at all sites (with and without grazing), i.e. sufficient for shorebirds to breed successfully. The most common taxa were spiders, mites, beetles, springtails, flies, earthworms, hemipterans, and heteropterans (in that order). Most invertebrates were less than 7.5 mm, and for this size group there was a positive correlation between invertebrate numbers (all taxa combined) and vegetation height. However, on enclosure level, there was no clear differences in invertebrate abundance with and without grazing. The structure of vegetation is crucial for the success of shorebirds, and grazers are keystone species in shorebird communities. However, current grazing pressure is probably too high on some parts of Håslövs ängar, although this is probably not the main cause to declining shorebirds in the areas since the availability of suitable breeding habitats is still common. High predation pressure on eggs and juveniles (by fox, badger and corvids), and decreasing source populations are more probably causes.

Impact of mosquito-control using Bti on the non-target fauna in the Camargue

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Bacillus thuringiensis var. israelensis (Bti) is the most commonly used agent to control mosquitoes worldwide. This soil-dwelling bacteria is considered non-toxic to most organisms, at the exception of non-biting-midges (chironomids), a major prey item in wetland food webs. Yet, few studies have addressed the indirect effects of *Bti* through trophic interactions. This topic was addressed within a control program encompassing 2500 of the 25,000 ha of mosquito larval biotopes in the Camargue. Since 2006, *Bti* spraying occurs whenever *Ochlerotatus caspius* and *Oc. detritus* larvae appear in water bodies, totaling 30-60 aerial treatments annually. Various impact studies were implemented, being systematically based on the comparison of treated and untreated areas. A detailed investigation on breeding colonies of house martins revealed a shift in chick diet with less nematocerans, spiders and dragonflies taken in treated areas, translating into a 33% decrease in breeding success and a 26% decrease in colony size at treated sites. Likewise, reed-dwelling invertebrates serving as food to passerines suffer a 34% decrease, while richness and abundance of Odonata is reduced by 50%. Comparison of long term trends in water bird and passerine counts revealed a significant decline in 11 species amongst the most abundant, not observed at untreated sites. These multi-trophic impacts suggest a strong dependence of the non-target fauna on *Bti*-sensitive prey, while the observed persistence and proliferation of *Bti* spores in some marshes (up to 8 500 000 spores per gram of soil) suggests impacts on chironomids well extending the period of *Bti* spraying. Efficiency of alternative techniques to reduce mosquito nuisance adapted to the specific context of the Camargue (ie. small villages surrounded by wetlands covering large areas) are currently being tested. These include

mosquito trapping in inhabited areas and increased awareness of wetland managers to reduce unintentional production of mosquitoes.

Reading nature

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This presentation is part of a larger study on students' ability to read nature. Its focus is on ecology and the context is outdoors. Reading nature has to do with the ability to recognize organisms and relate them to materials cycling and energy flow in the specific habitat which is to be read. It has to do with authenticity where the natural world that we face outside is the book to be read and the tools we have are our experiences from previous learning situations both in and out-of-doors. This reports from a study in ecology teaching and learning and we have followed a teacher and two primary school classes (age 9-11 years). A teaching sequence was designed aiming at helping students to read nature in a sandy grassland ecosystem and in a river. The teaching sequence has a bottom-up approach taking its starting point on an indicator species – a horned dung beetle (Copris lunaris) found in sandy grasslands grazed by cattle and a common crustacean – (Gammarus pulex, common in every river in southern Sweden. From these organisms and their autecology the perspective is broadened to involve studies of the interrelations between the biodiversity and the human farming activities which many of the grassland species are dependent on. Regarding the discussions on sustainable development and the often negative critique of human influence on ecosystems these ecosystems are, on the other hand, highly dependent on human activities and of grazing cows in the terrestrial ecosystem in order to keep the land open and to host a specialized cultural flora and fauna.

A large part of the teaching took place out-doors since field activities often is regarded to be of great importance for ecology education. In an earlier study on teachers' views of the most important learning situations during an ecology course, the majority expressed that field work, and excursions to different ecosystems, were considered most important (Magntorn & Helldén, 2005). The main objective for these studies is to show how students express their developing ability to read nature and how they relate the organisms to the whole ecosystem and to sustainable development. The teaching started in April and ended in June with altogether three lessons for each class. The teacher is a nature school pedagogue from the municipality. We have used semi-structured interviews and each student was interviewed before and after instruction. The interviews took place out-doors in the ecosystem. During the interviews we focused on biotic objects related to the ecosystem such as living insects or plants as well as abiotic aspects such as the soil, water, air and local climate. The students were asked to describe what they observed, and to link these observations of biotic and abiotic components together in as many ways as they could and explain their ideas of these connections. We have interpreted each interview as a concept map and the level of reading the sandy ecosystem and the river has been analyzed based on the SOLO-taxonomy (see example of this method in earlier studies e.g. Magntorn & Helldén, 2007). The results illustrate how students' knowledge of a few organisms and their ecology together with the awareness of the human impact often helped them reason in a rich way about the whole ecosystem and its sustainability.

PROGRAM

Wednesday May 10

09.00-09.30	*Introduction – Welcome, and general presentation of Tour du Valat*	Patric Grillas (TdV)
09.30-10.00	*MAB France and the work of RM in Camargue*	Raphaël Mathevet (CNRS)
10.00-10.30	*Kristianstad Vattenrike Biosphere Reserve*	Pär Söderquist (MABH) + Skype (Vattenriket)
10.30-11.00	*The Man & Biosphere Health research platform at Kristianstad University*	Ingemar Jönsson (MABH)
11.00-11.15	**Break**	
11.15-11.45	*Collaborations across borders*	Johan Elmberg (MABH) & Matthieu Guillemain (ONCFS)
11.45-12.00	*Simultaneously assessing the influence of plants and entrance conditions on hydraulic retention time and nutrient removal efficiency in wetlands/ponds*	Jean Lacoursière (MABH)
12.00-13.30	**Lunch at the canteen TdV**	
13.30-13.45	*Monitoring the Camargue trends over recent decades*	Christian Perennou (TdV)
13.45-14.00	*Biomass from wetlands in biotechnology*	Lennart Mårtensson (MABH)
14.00-14.15	*Mediterranean wetlands: a gradient from natural resilience to a fragile social-ecosystem*	Ilse Geijzendorffer (TdV)
14.15-14.30	*Design of riparian buffer zones with regard to aquatic ecosystems*	Lena Vought (MABH)
14.30-14.45	*Educational aspects and ecoturism in Cévennes reserve*	Frédéric Joly (TdV)
14.45-15.00	*Implementation of the ecosystem services concept in municipal planning and decision making*	Ingemar Jönsson (MABH)
15.00-15.30	**Break**	
15.30-15.45	*Extended beta-lactamase resistance in water systems*	Ann-Sofi Rehnstam-Holm (MABH)

15.45-16.00	*Detection of an overall Persistent Organic Pollutants contamination of fishes community from the Vaccares Lagoon in the National Nature Reserve of Camargue*	François Ramade (Professor Emeritus Université de Paris-Sud)
16.00-16.15	*Removing pharmaceutical residues in water using constructed wetlands*	Hristina Bodin (MABH)
16.15-16.30	*Parasites, bacteria, viruses and their resistances at the interface between wildlife, livestock and human populations in the Camargue*	Marion Vittecoq (TdV)
16.30-16.45	*Vibrio in the environment*	Ann-Sofi Rehnstam-Holm (MABH)
16.45-17.00	Closure	
17.30	Go back to Arles	
19.30	Dinner in Arles L'Affenage	

Thursday May 11

09.00-09.15	*Introduction*	
09.15-09.30	*Sea-level changes and landscape changes in Southern Sweden, 6 000-9 000 BC related to species hunted and fished*	Nils-Olof Svensson (MABH)
09.30-09.45	*Grazing pressure with links to invertebrates*	Gunnar Gunnarsson (MABH)
09.45-10.00	*Impact of mosquito-control using Bti on the non-target fauna in the Camargue*	Brigitte Poulin (TdV)
10.00-10.15	*Reading nature*	Ola Magntorn (MABH)
10.15-10.45	**Break**	
10.45-11.45	*Discussions – Exploring potentials, brainstorming*	
11.45-12.00	Closure – Wrap up	
12.00-13.30	**Lunch at the canteen TdV**	
13.30-19.00	Excursion Mas de Gourgonnier (15.00) and Les Baux	
19.30	Dinner in Arles, no restaurants booked	

Friday May 12

09.45-12.00	Excursion Horse and carriage in Marais du Vigueirat
13:00-13.30	**Lunch at L'Estrambord**
14.00-18.00	Excursion Musée de la Camargue
19.30	Dinner in Arles L'Escaladou