

Project information

Keywords

Tundra, scenarios, biological diversity, topic modelling, fuzzy cognitive mapping, grazing, climate

Project title

EcoShift - Scenarios for linking biodiversity, ecosystem services and adaptive actions.

Year

2019

Project leader

Vera Hausner

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

EcoShift is pan-arctic, but fieldwork, scenario-and foresight analysis will be tested at the Varanger peninsula. Coordinates · 70°29'01"N 29°32'26"E / 70.48361°N 29.54056°E

Participants

**UiT:** V. H. Hausner (PI), I. G. Alsos, L. Munoz & F. J. Ancin-Murguzur + PostDoc; **NINA:** P. Fauchald. **International participants:** Johan Olofsson, **Umeå University**. Laura Epp, **Alfred Wegener Institute**, Helmholtz Centre for Polar und Marine Research, Douglas Nakashima, **UNESCO**, Paul Leadley & Samuel Roturier, **Université Paris Sud**, **CNRS**, Marie Roué, **National Museum of Natural History (MNHN)**, **CNRS**; **Administrative responsible:** Terje Aspen, BFE. Terje.aspen@uit.no

Flagship

Terrestrial

Funding Source

**For 2019**

**FRAM: 450 000**

**Own funding: 247 000**

**EU BioDiversa: 787 000**

Summary of Results

- 1. Summary of results, including 2-3 highlights from the project (max 1 A4 page, figures can be attached separately):**

**Literature review**

We have performed a topic modeling approach to identify the

main research trends regarding climate change in tundra connected to herbivory based on a corpus of 2496 articles. This approach allows us to assess the current status of the research and hot topics to get a deeper insight on how does current research address climate change.

In addition, we are developing an automated review process to extract the mechanisms and relationships between the different actors in the landscape to create causal correlations via fuzzy cognitive mapping (FCM), which plays a key role in scenario development. FCM allows to estimate equilibrium values of the actors (e.g. temperature, nutrients and grazing) when a set of them is modified (increased, decreased or disappeared), which provide with evidence-based mechanistic scenarios that will improve the management effectiveness

### Highlights

- **Topic modeling** shows that there are 50 main research topics related to climate change in the tundra, which can be summarized into 11 overarching topics.
- **Automated review** is based on a simple grammatical rule of “*A (the driver) increases/decreases B (the affected actor)*” (e.g. *temperature increases plant productivity*). This simple rule identifies the major mechanisms that are represented in the abstracts: this process is performed on a sentence-to-sentence basis. Although more complex grammatical sentences are not detected with this method, the main causal relationships in a system are repeatedly mentioned throughout the literature, and will be captured. However, a validation set of abstracts will be analyzed to estimate the recall capacity of the algorithm we have developed. The result is a complex FCM that needs manual pruning to harmonize similar words (e.g. plurals or similar concepts expressed differently –*grazer* and *herbivore*, for example-). A simplified result based on 100 abstracts is shown in figure 1.



Master and PhD-students involved in the project

MSc Carl-Michael Heimo Andersson will work with his MSc project using Marxan to create vegetation scenarios on the Varanger peninsula.

For the Management

We do not have findings yet that can easily translate to relevant findings for management. We will construct scenarios of relevance to the Norwegian Arctic tundra in 2020/21 involving stakeholders in the process.

Published Results/Planned Publications

Ancin-Murguzur et al. Developing fuzzy cognitive maps of the causal relations in the tundra using a natural language processing approach (to be submitted 2020)

Ancin-Murguzur et al. Unraveling latent research topics in the tundra using topic modeling (To be submitted 2020)

Communicated Results

Communication of scenario work FATE workshop, Konstanz, oct 17-18<sup>th</sup>.

ESP 10th World Conference in Hannover, Germany, 21-25 October 2019. Title of presentation: Ecosystem services research in a rapidly disappearing cryosphere

Interdisciplinary Cooperation

Ecoshift is coupled to the JPI BioDiversa project FATE which build on scientific expertise in paleoecology, system ecology, anthropology and modelling, and that integrates indigenous-and local knowledge in building models and scenarios to systemize information about future changes in tundra regions. The main aim is to integrate ILK, modern experimental data and palaeoecological data to explore

the range of vegetation changes that can happen depending on climate scenarios. Interdisciplinary collaborations is necessary to build such scenarios that is relevant for local communities and for climate adaptation. The main challenge of this particular project is the change in mindset from thinking about current and past changes to explore future trajectories. A scenario development plan will be necessary to effectively systematize scenarios and to use the right kind of information.

Budget in accordance to results

1. We finished the topic modelling and fuzzy cognitive mapping of literature as planned to identify the relative weight of drivers. A manuscript will be submitted before 31st december.
2. designed the first steps to create scenarios incl the selection of different cases circumpolarly and started to work with models.
3. identified knowledge gaps for delphi survey 2020

Could results from the project be subject for any commercial utilization

No

Conclusions

Scenario methodology need to be developed to explore possible consequences of future climate changes. Scenarios are developed using climate models and shared socioeconomic pathways in IPCC and IPBES, and is also relevant for initiatives in the Arctic Council. PI will participate in scenario methodology workshop that according to the plan will develop a handbook/guideline for developing scenarios. We are also developing new methodology to systematize expert knowledge by use of topic modelling and fuzzy cognitive mapping (see above). These methods are currently tested on scientific literature, but can also be used to integrate other sources of information and knowledge, which is relevant for the rest of our scenario work.

A MSc student has also been recruited and will work with Marxan models to create vegetation models for the Varanger peninsula.