


RENEWABLE REINDEER

Revising and re-structuring the renewable energy system in Norway
while preserving wild reindeer habitat functionality


Norwegian Research Council – ENERGIX




- **Proj leader:** Manuela Panzacchi, NINA
- **Project duration:** 4 years, Aug 2015 – 2019
- **Disciplines:** spatial ecology, mathematics, software development, social sciences
- **Web:** <http://www.nina.no/english/Research/Projects/Renewable-Reindeer>



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Documents

 [Video: Villy the reindeer - Nor](#)

- [Project Description](#)
- [Prosj.Presentasjon_norsk](#)
- [Kick-off meeting - Manu](#)


Need to print? 

Project lunch? 

Renewable Reindeer

Revising and re-structuring the renewable energy system in Norway while preserving long-term wild reindeer habitat functionality

Knowledge-building project for the business sector. 2015-19




Financial and R&D partners, Røros, 2015

Partners

R&D Partners

- [Manuela Panzacchi, NINA](#)
- [Bram Van Moorter, NINA](#)
- [Olav Strand, NINA](#)
- [Jørn Thomassen, NINA](#)
- [Audun Ruud, SINTEF](#)
- [Siri Bøthun Naturforvaltning](#)
- [Villreinsenter, Villreinsrådet](#)

Financing Partners


With funding from
The Research Council of Norway

- [Norwegian Water Resources and Energy Directorate, NVE](#)
- [Norwegian Environment Agency - Miljødirektoratet](#)
- [Sira Kvina Kraftselskap](#)
- [Villreinprosjektet i Setesdalsheiene v/ Statkraft](#)


Academic Partners

Calendar


Today

14/10/2015


September		October		November	
2015					
Mon	Tue	Wed	Thu	Fri	Sat Sun
28	29	30	1	2	3 4
1	1				





[Siri Bøthun](#)
Naturforvaltning





NVE























WHO

R&D PARTNERS	AFFILIATION
Manuela Panzacchi, Bram van Moorter, Olav Strand, Jørn Thomassen, Audun Ruud (Christer Rolandsen)	NINA, Norwegian Institute for Nature Research
Siri Bøthun	Siri Bøthun Naturforvaltning
Lena Romtveit, Marianne Singasaas, Anders Mossing..	Wild reindeer centres, Wild reindeer Council

FINANCING PARTNERS	CONTACT
Norwegian Environment Agency	Kari Bjørneraas – Erik Lund
Norwegian Water Resources and Energy Directorate	Jan Henning L'Abée Lund
Hydropower Company: Sira Kvina	Per Øivind Grimsby
<p>Wild reindeer project in Setesdalsheiene</p> <p><i>Consortium of stakeholders:</i></p> <p>Statkraft- Norwegian electricity company (state owned)</p> <ul style="list-style-type: none"> - Norwegian road authority - Railroad authority - Norwegian Tourist Industry - Land owners - Wild reindeer area steering group - Hydropower companies (a number of-) 	Kåre Paulsen

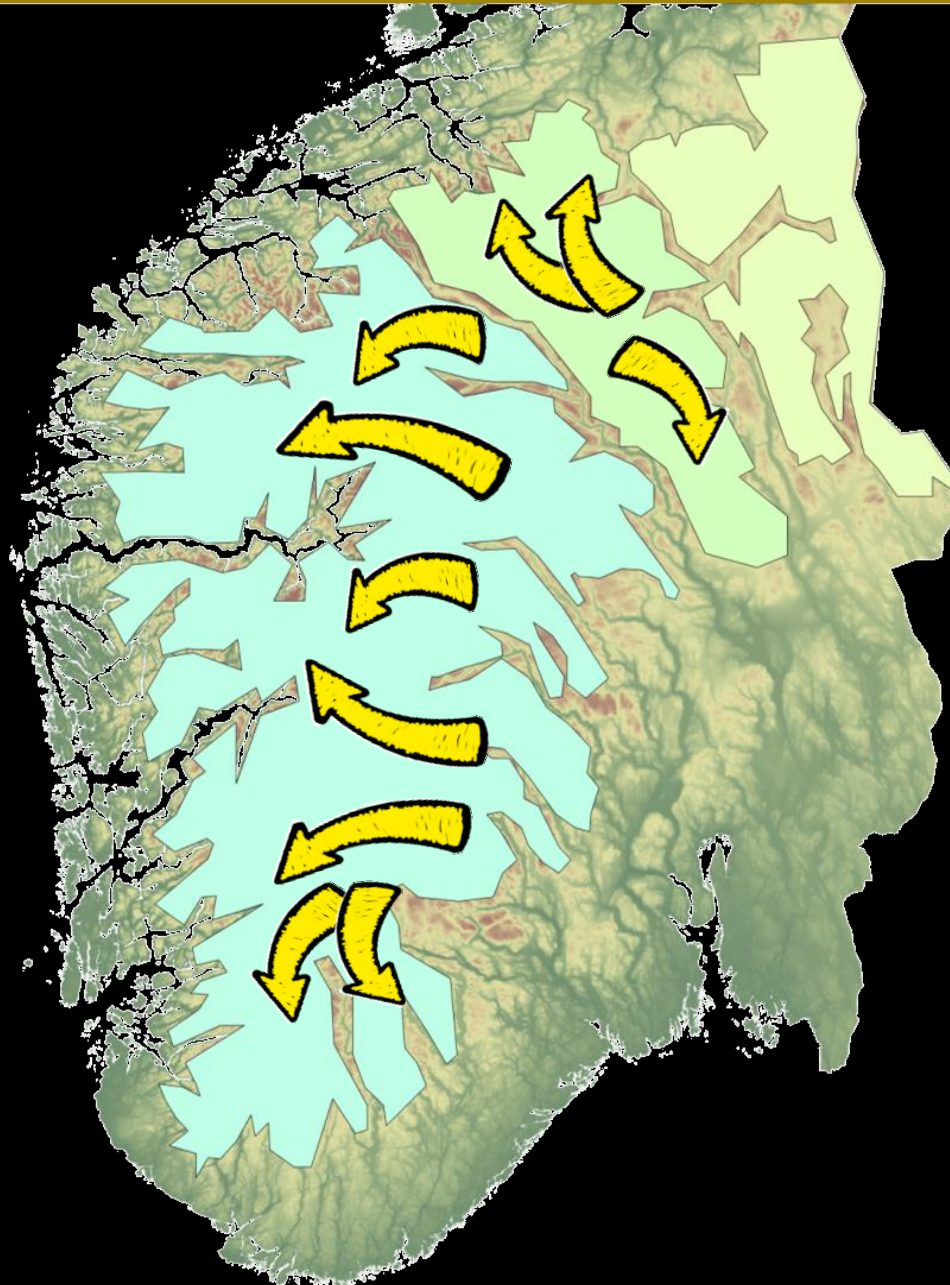
ACADEMIC PARTNERS	AFFILIATION
Prof. Subhash Lele	University of Alberta, Canada
Prof. John Fryxell	University of Guelph, Canada
Prof. Marco Saerens	Universite Catholique de Louvain, Belgium
Prof. Ferdinando Villa	Basque Centre for Climate Centre, Bilbao, Spain

2 PhD students:

- Ilkka Kivimäki, in collaboration with University of Aalto, Helsinki, Finland and Universite Catholique de Louvain, Belgium (2015-16)
Topic: develop a “Habitat Functionality” metric, to measure at the same time habitat loss and fragmentation due to infrastructure development
- Rebecca Viejou, in collaboration with University of Guelph, Canada (2016-2020)
Topic: measure consequences of habitat loss and fragmentation on long-term reindeer population viability

WHY?

BACKGROUND: TRADITIONAL RANGE & MIGRATIONS

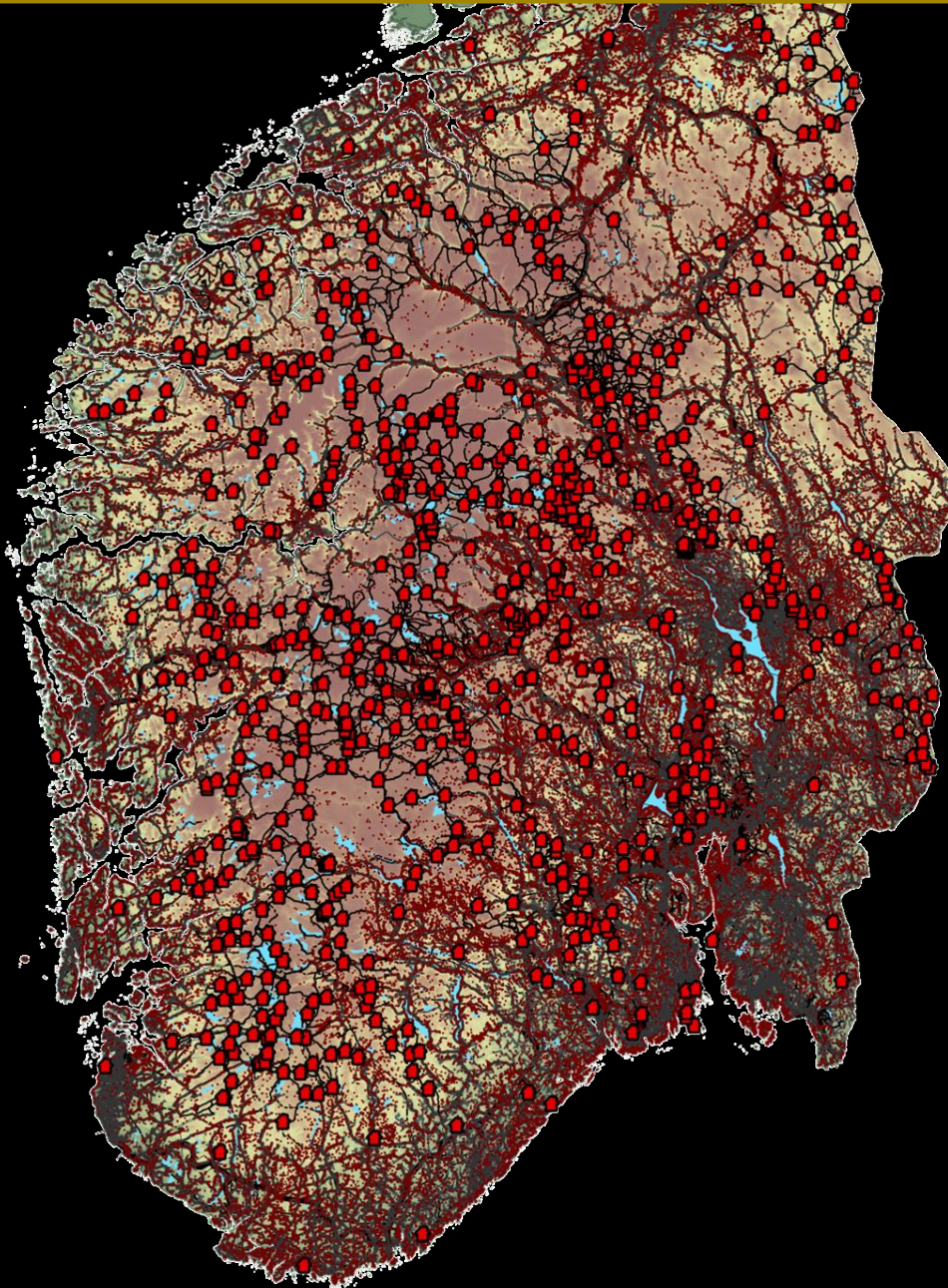


UNTIL ca. 1900-50

Few interbreeding,
migrating populations

*based on large dataset of
archaeological data - pitfall traps*

BACKGROUND: HABITAT DEVELOPMENT



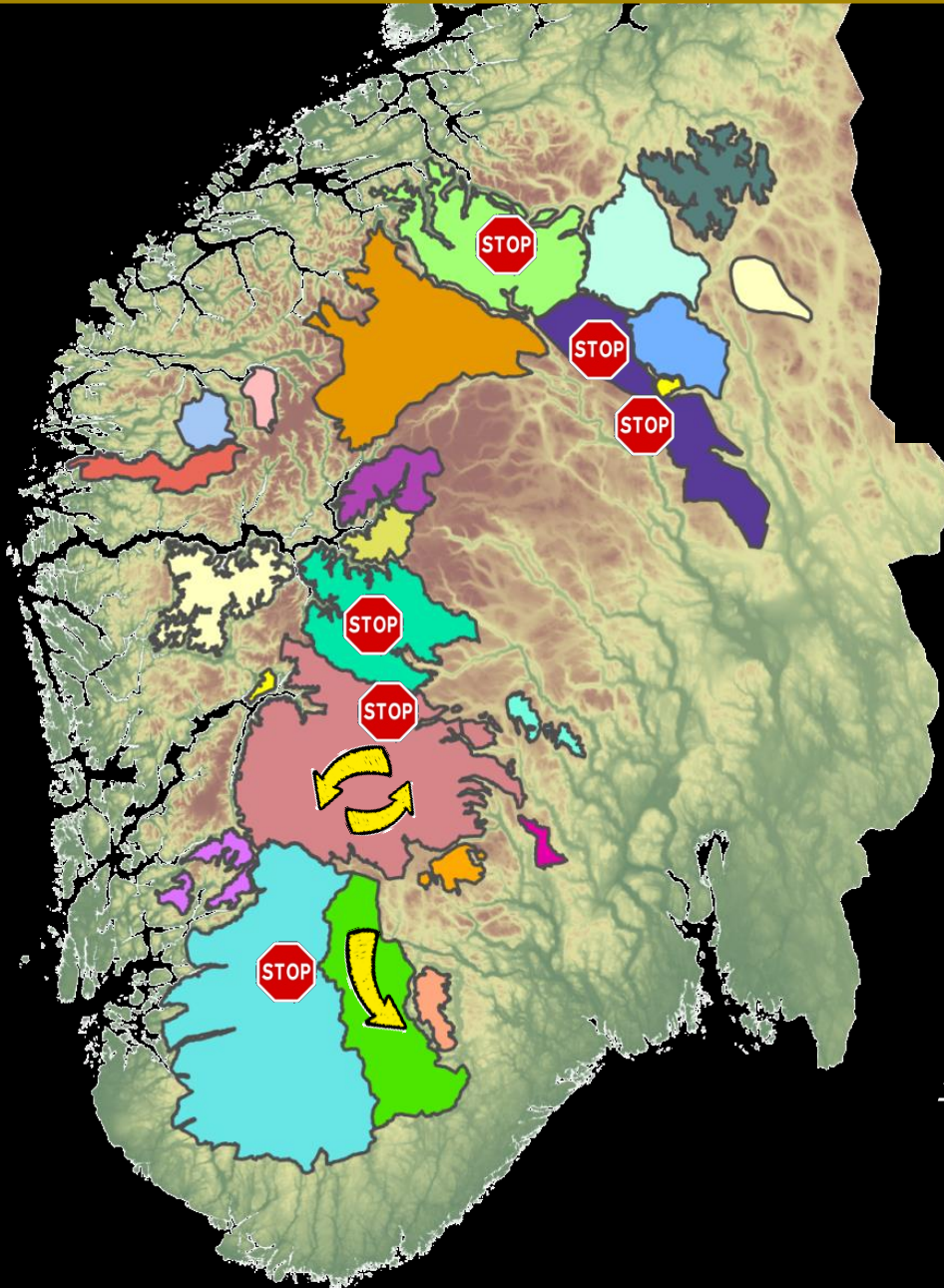
DURING THE PAST CENTURY

- Major roads
- Railways
- Hydropower stations
- Power lines
- Minor roads
- Tourist cabins
- Private cabins
- Trails
- ... snow scooter, skiing, snowkyting, fishing..



**HABITAT BECAME RAPIDLY
FRAGMENTED**

BACKGROUND: RANGE DEVELOPMENT



Now

- 23 isolated sub-pop. (officially)
- Fragmentation rapidly ongoing
- Few (?) migrations left

*Last remaining populations
in Europe*

*⇒ international responsibility
for conservation*

BACKGROUND: HYDROPOWER IN NORWAY

- Hydropower developed *extensively* during the last century
- Concessions were granted *before* the legislation on Environmental Impact Assessment
- Most concessions are/will be subjected to a *relicensing process aimed at increasing focus on sustainability*



- EEA Countries are expected to *increase their share* of renewable energy to 20% by 2020
- Norway is asked to contribute to Europe's transition to a renewable energy system by serving as a "*Green Battery*" through pumped-storage hydropower

BACKGROUND: ENVIRONMENTAL ISSUES OF HYDROPOWER

Well-known and well-studied effects of hydropower
on freshwater ecosystems (~ salmon)



Foto © Bengt Finstad/NINA



Foto: Jarle Lunde/Suldal.no

RenRein is the first study on effects of hydropower on terrestrial ecosystems in Norway

EFFECT OF HYDROPOWER: 1. HABITAT LOSS

Construction of reservoirs ⇒

- Direct habitat loss – due to area flooding
- Indirect hab. loss - due to avoidance and reduced suitability of “island” habitat



EFFECT OF HYDROPOWER: 2. HABITAT FRAGMENTATION

Unsafe ice, steep banks, strong current \Rightarrow barriers, habitat fragmentation



We estimated that in spring the probability of reindeer walking on a reservoir is only 2% (barriers), while it is 24% higher for natural lakes

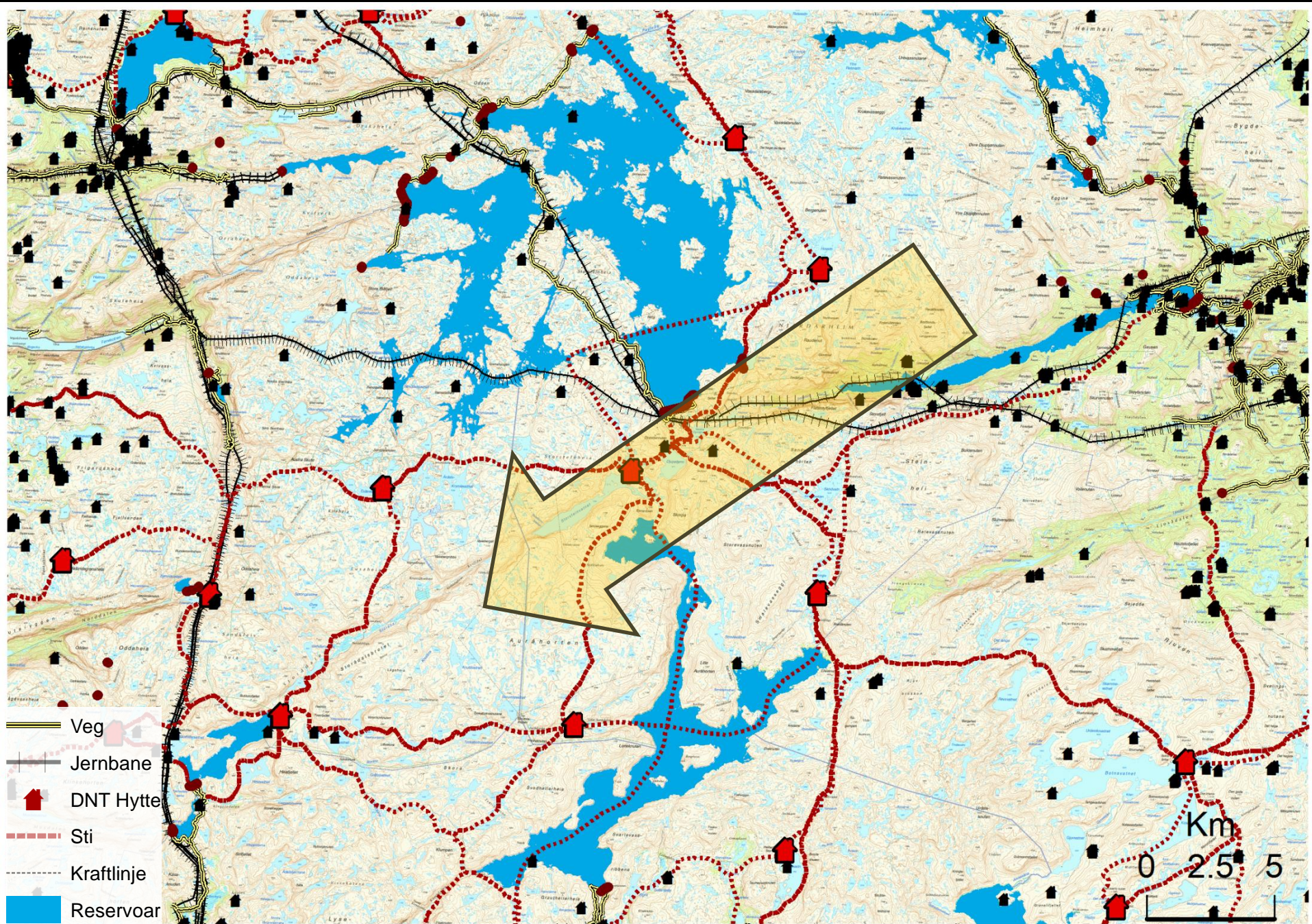
Panzacchi et al, Journal Animal Ecology 2015

INDIRECT EFFECT: 3. PIECEMEAL DEVELOPMENT OF INFRASTRUCTURES => HAB LOSS & FRAGM

Reservoirs trigger piecemeal development of industrial, transportation & touristic infrastructures => major hab loss and fragmentation



EX. INFRASTRUCTURE NETWORK IN ONE STUDY AREA (BJÅSJØ)



THE PROJECT

PROJECT AIMS

We aim to predict impacts of the network of infrastructures associated to hydropower on wild reindeer conservation, and to assist the ecological and socio-political process of identifying concrete, cost-efficient and socially accepted options for increasing sustainability in the renewable-energy system

Sub-goals:

- Identify high quality areas and movement/migration corridors
- Develop an approach to quantify the cumulative impact caused by the *network* of infrastructures in terms of both **HAB. LOSS & HAB. FRAGMENTATION (Habitat Functionality Metric)**
- Develop **simulation tools** to predict changes in reindeer movement corridors and habitat functionality under scenarios of changes in the infrastructure network
- Promote solution-oriented stances and identify mitigation options through dialogues and scoping processes
- Identify possibilities for improving regulatory frameworks and multilevel governance to support processes leading to increased sustainability

5 WORK PACKAGES

«ECOLOGY»



WP 1 – Habitat suitability and fragmentation:

- Quantify hab. preferences / avoidance of infrastructures => HABITAT QUALITY MAP
- Quantify landscape permeability to steps => HABITAT PERMEABILITY MAP



WP 2 – Predictive tools for Corridors & Habitat Functionality:

- Identify movement corridors given the network of infrastructures => CORRIDOR MAP
- Develop HABITAT FUNCTIONALITY METRIC to measure together habitat loss and fragmentation
- Develop **SIMULATION TOOLS** to predict reindeer response to mitigation measures / development plans, in a scenario approach



WP 3 – User involvement (Ryfylke, Nordfjella, Snøhetta)

- Promote public participation at all stages
- Ensure realism and relevance for the models developed in WP1-2
- Suggest socially-accepted mitigation measures whose efficacy for reindeer will be assessed in WP2

«SOCIETY»



WP 4 – Science-policy interface, multilevel governance

- Is the legal/regulatory framework adequate to support reindeer-oriented EIA and mitigation measures?
- Which strategies and stances do energy companies adopt in the revision process?

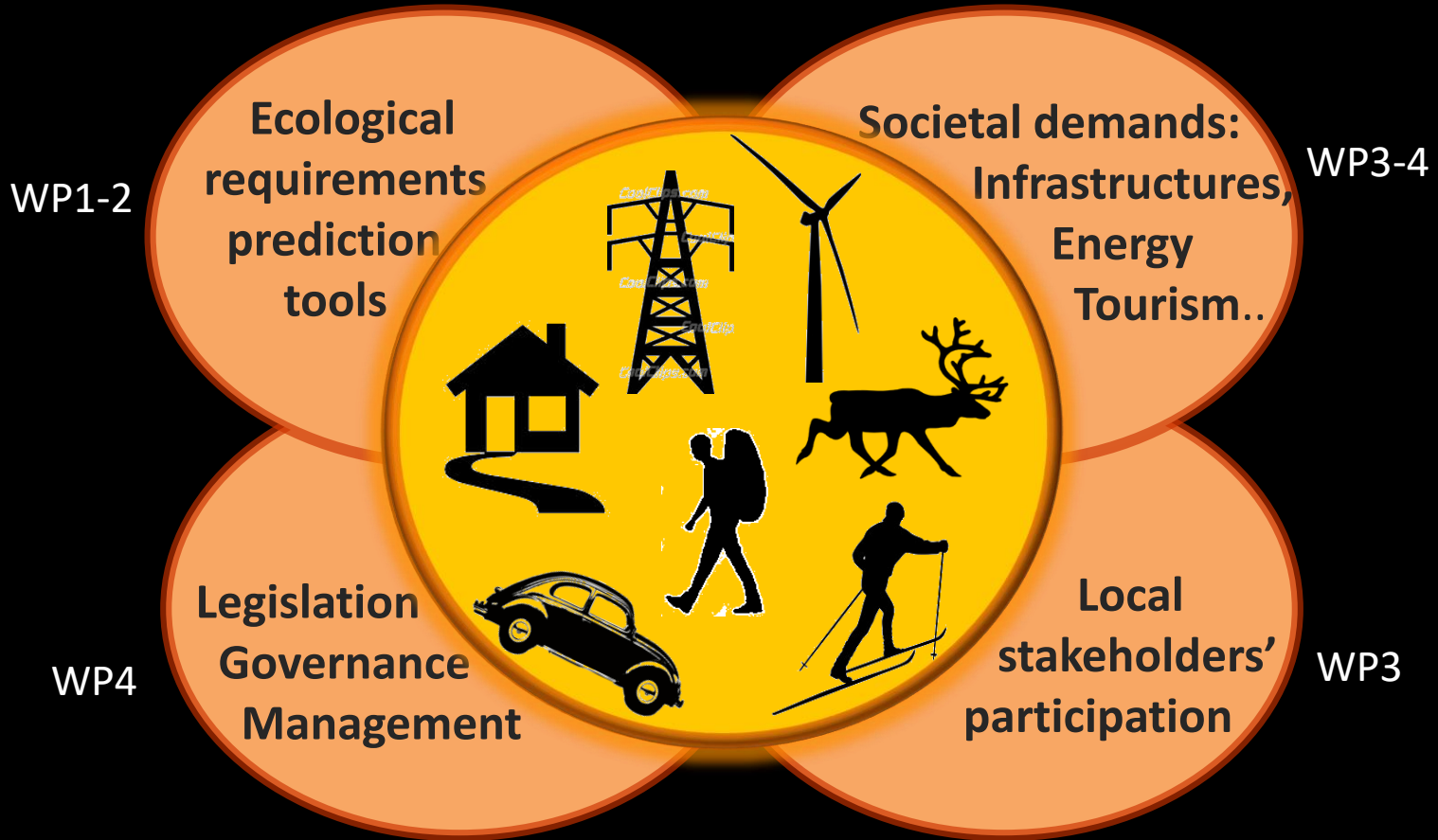


WP 5 – Dissemination, guidance and support for Environmental Impact Assessment

- 2 Booklets: “Assessing and mitigating impacts of renewable energy on reindeer: ecological, social & regulatory dimensions”; “Reindeer - infrastructures Handbook: Conflict Prevention, Mitigation, Compensation & Monitoring”
- NINA web-GIS to make available maps, project results, simulation tool
- Online SharePoints in Villreinsenter to disseminate project results and detailed info on revision process
- National Seminar with industries and Training Courses for the use of the simulation tool
- International workshop

*Holistic approach,
Network of
infrastructures*

*Vision,
Team-work,
Interdisciplinarity*



*High scientific
standards*

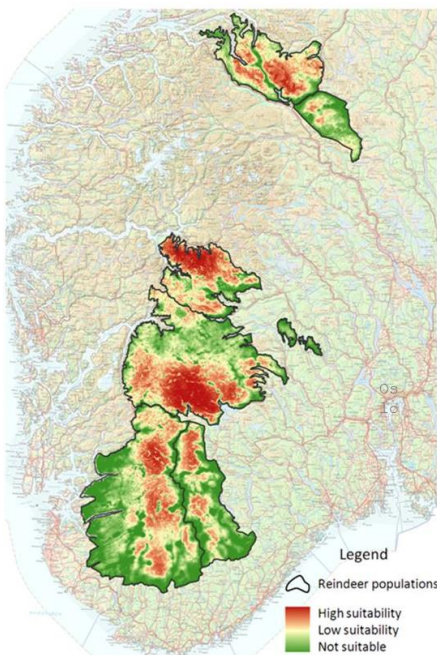
*Long-term
engagement:
Capacity Building*

WP 1-2: "ECOLOGY"

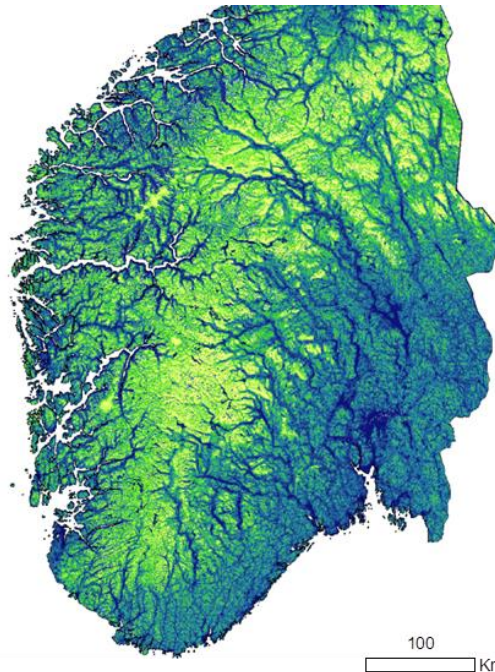
1. Model **habitat suitability, barriers and corridors** to movements
2. Develop a novel **Habitat Functionality** metric synthesizing the cumulative effects of infrastructures in terms of **habitat loss** and **habitat fragmentation**

Habitat Functionality Metric

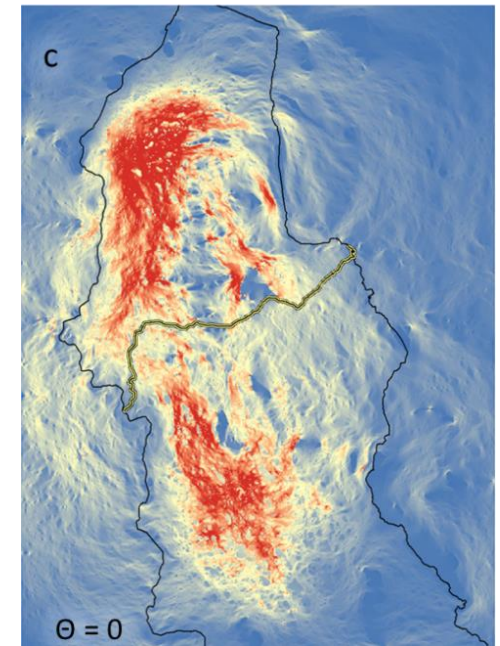
Habitat preference



Permeability to movement steps
(barriers & corridors to steps)

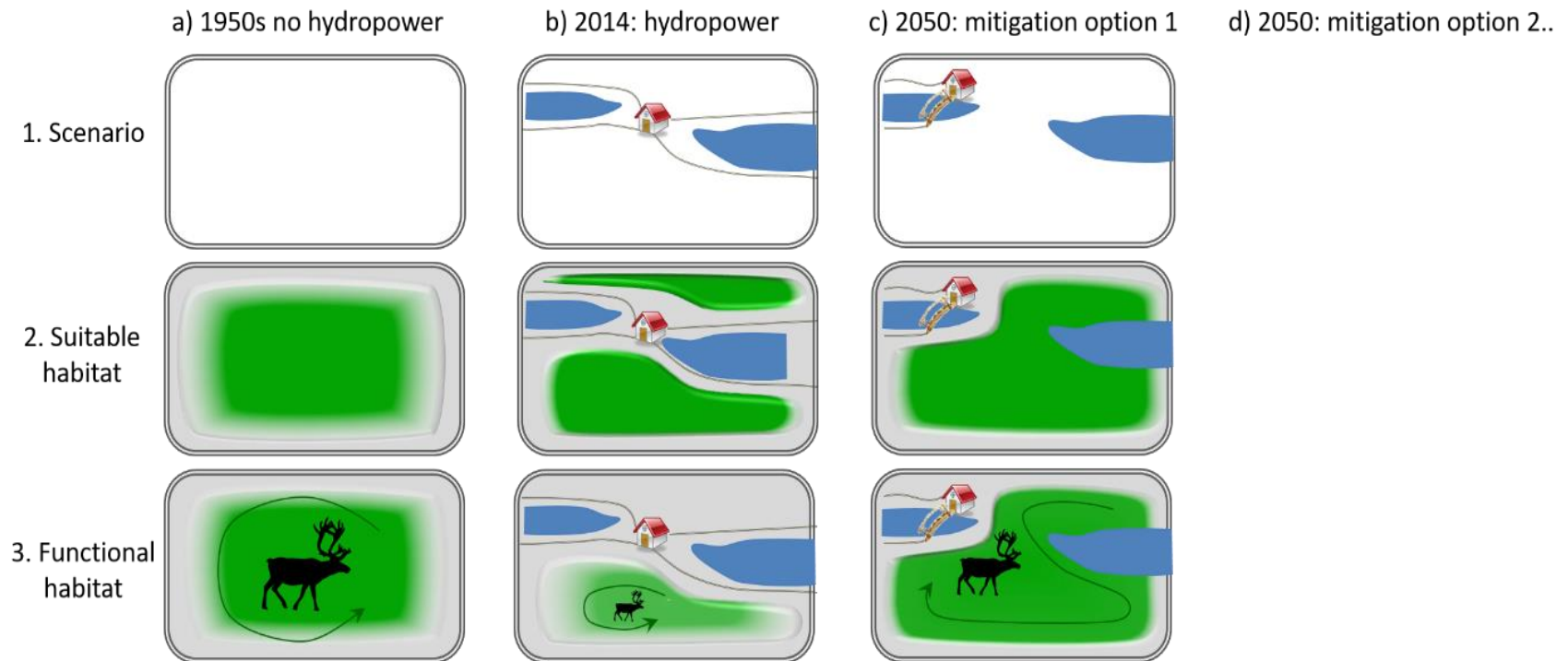


Movement corridors - RSP
(but connecting all pixels)
Barriers & corridors to movement flow



WP 1-2: "ECOLOGY"

3. Develop a **simulation platform** to predict the effects of mitigation measures on Habitat Functionality
4. **Rank mitigation options** based on their sustainability (*i.e.* gain in Hab Functionality) - scenario approach:



THANKS!

Thanks to an impressive list of collaborators, fieldworkers, volunteers, students, funding sources (e.g. NFR, Miljødirektoratet, wild reindeer projects in different areas, NVE, SiraKvina, Statkraft..), stakeholders, Norwegian Wild Reindeer Centers and management boards, Villreinrådet...

Photo credits:

Wild reindeer (NINA), O. Strand, P. Jørdhoy, M. Panzacchi

