Shared Arctic Variables in Wildfire Preparedness

SAV: WILDFIRE

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The definition of shared variables is based on the first expert workshop on Arctic Wildfire Preparedness, held in Tähtelä, Sodankylä on 15-16 September 2022. The workshop is part of the IBA Arctic Wildfire Preparedness Project.

Northern Sami terms
Eananbuollin = wildfire; (under)ground fire
Vuovdebuollin/meahccbuollin = forest fire
Lavdnjebuollin = peat/mor fire
There is no equivalent Sami term for prescribed burning. It can be described indirectly e.g. “boaldit boares šaddogeardi” = to burn old layer of vegetation…
Some reindeer terms are hirvas = male reindeer and vaadin/vaami = pregnant female reindeer

This document defines three potential measurable basic variables in Arctic wildfire preparedness. They are

A. Ignition site / hazardous fuel (tussock grass fire) (Ignition risk)
B. Soil/vegetation moisture
C. Prescribed burning
   Protection needs

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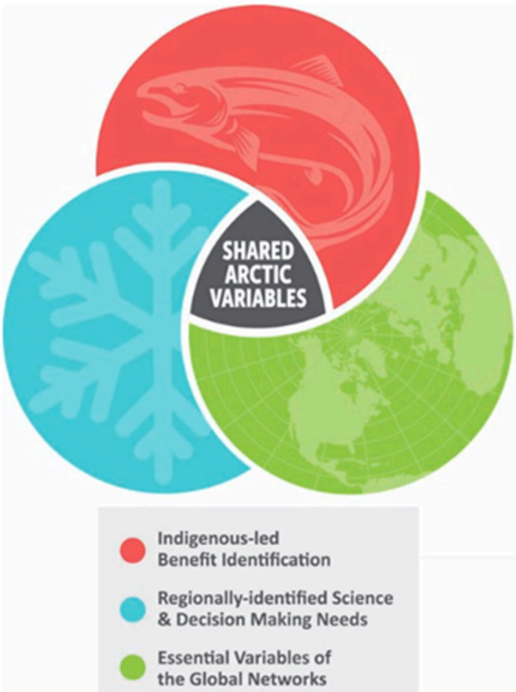
1. Introduction

Due to global warming, the increased risk of wildfires requires closer global cooperation. This project develops longer-term preparations for wildfires and produces a service that predicts wildfire risks in the Arctic region for the coming season. Part of the EU's Arctic Passion project is the development of the 'Integrated Fire Risk Management (INFRA)' pilot service led by Italy, which the Finnish Meteorological Institute is expanding with long-term seasonal forecasts. Regarding wildfires, also observable basic variables (of SAVs) are defined and this knowledge is discussed and shared based on global, local and indigenous needs (Figure 1). In the SAV process, the representatives of the working groups of the A7 countries of the Arctic Council evaluate and guide the SAV development together.



Picture 1. The interconnectivity of Shared Arctic Variables

Long-term preparedness forecasts for wildfire indexes are created on the basis of six-month ensemble forecast data from the European Center for Medium-Range Weather Forecasts (ECMWF). They are bias-corrected with recent climate statistics, and wildfire indexes are calculated from them for the arctic region of the northern hemisphere. For this, a SmartMet server will be set up and production routines will be created for wildfire index calculation. The demonstration of the operation of the online service will begin from the end of 2023, and quality tests will be carried out with the rescue service of Lapland. In order to improve the final product, the function of the interface is evaluated and the bias correction method is further developed. The project includes participation in the Global Wildfire Information System (GWIS) session at GEO Week.

During the project, research and development work in the small climate model is carried out. The work is related to the testing of a mechanical microclimate model (microclimf) in various landscape windows in the boreal forest zone, utilizing existing, very comprehensive microclimate measurement data from Finland (Aalto et al. 2022). The testing focuses especially on temperature and humidity variables, and it is possible to further improve the modeling based on the tests. The spatial data materials needed for the modeling (e.g. accurate terrain and vegetation data) and the calculation codes are already available at the Finnish Meteorological Institute. In addition, the project will experiment with combining seasonal forecasts with a microclimate model, which enables very accurate weather and climate forecasts with a high regional resolution (10 m) weeks and months ahead. If successful, the new combination developed will support local and regional preparedness for wildfires. As a result of research and practical dialogue, the work produces a forecast service that supports preparing for the effects of weather and climate change in northern environments.

2. APPROVING AND REVIEWING THE SAV VARIABLES

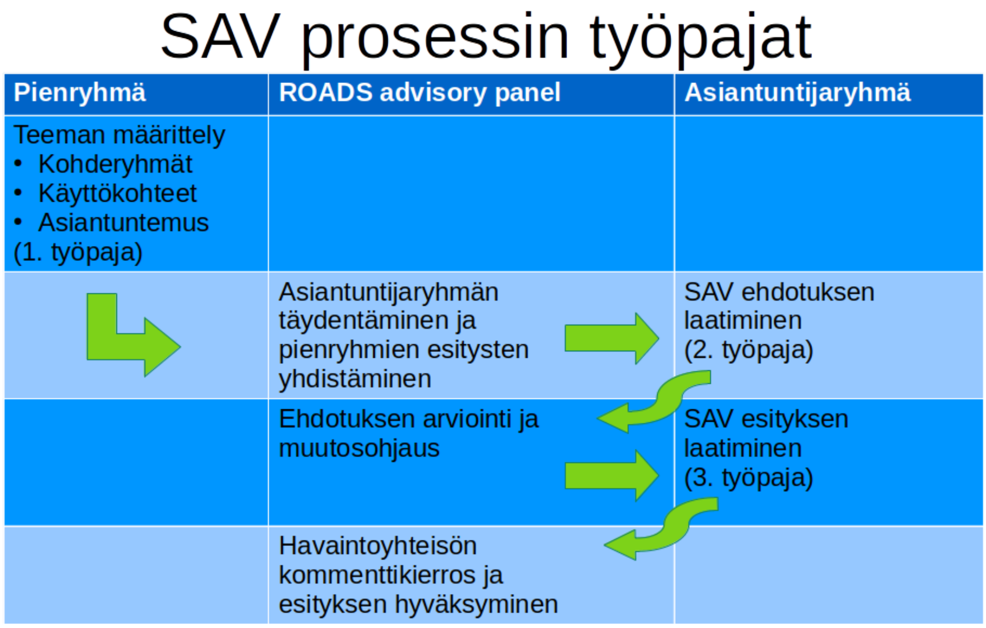


Figure 2. The process of defining and negotiating the SAV. Workshop 1 September 2022, workshop 2 March 2023 and workshop 3 September 2023.

3. CONCEPT DOCUMENT

WILDFIRE as a basic arctic variable can be divided into several variables whose meaningfulness and measurability needs to be studied as a local, regional, national and global variable.

3.1 A brief description of the proposed variables

3.1.1 Ignition site and protection needs (in infrastructure)

In the Sámi region, the potential ignition points are in areas with human activity, i.e. livelihood activities, both natural sources of livelihood as well as, for example, tourism. For example, dry forest heaths are particularly sensitive ignition sites. These are fragile habitats and the loss of grazing land after a wildfire can be substantial (e.g. case Norway summer 2022 Figure 3). Also fells, forested hills, rock lands and ridges with a lot of lightning are potential ignition sites. The ignition sites are in the reindeer herding areas of the reindeer herding cooperative (*paliskunta*) with other natural sources of livelihood (fishing, picking berries and tourism).

However, the risk of wildfire is higher in forested areas than in open fields. Large wilderness areas and national parks are challenging areas for wildfires. For example, tussock grass fires are very difficult to put out, and a peat fire has sometimes smoldered through the winter. Careless use of fire is often the cause of ignition, and the fire starts smoldering easily from the campfire or an open leant-to of the camping area. As fire can spread from any campfire site, it is important to educate tourists, hikers and young people.

The place of ignition can also be a part of the infrastructure, e.g. a slaughterhouse or herding shelters with stove heating. For the Sámi, the loss of scarce infrastructure is a big loss. Fire can also ignite from everyday working vehicles such as snowmobiles and ATVs (all-terrain vehicles) as well as from forestry machines, tractors and off-road motorcycles.

3.1.2. Soil and vegetation moisture

The Sami culture uses storytelling to convey information about the characteristics of the terrain and the moisture of the vegetation. Culturally shared stories, remembering and landscapes are important in the so-called landscape memory (e.g. Klemetti Näkkäläjärvi's dissertation).

The Sámi observe e.g. wind and wind direction, which is important in anticipating the movement of reindeer and weather conditions, and generally traveling in the wilderness. They transmit information for example about pasture conditions and snow composition etc. that affect reindeer grazing/reindeer food (mainly lichen in winter), or factors that affect travel, such as the humidity of the terrain, whether one can cross the area (wetlands), or whether the ice is durable in water bodies.

“Silent knowledge" plays an important role and is linked to everyday interaction and observing nature. It is based on traditional know-how in reindeer herding and the trust that each reindeer herder has sufficient basic skills and knowledge which are applied according to the situation and observations.

Local preparedness work must take into account the drying of the terrain and vegetation increase which increases the risk of forest fires. This expansion of global drought areas is described in the IPCC report.

3.1.3. Prescribed burning

Prescribed burning means intentional and controlled burning of the terrain. (Tuli metsässä -sanasto 2022). The Sámi and other locals aim at making their fires in the same places.

3.2. The societal significance of SAV (extent and purpose) in wildfires

3.2.1 The extent of ignition site variable

Human activity causes the majority of wildfires (90%), and lightning-ignited wildfires account for about 10% (add source). The ignition points recognized by the Sámi and other locals can start, for example, in connection with off-road parking of ATV and other vehicles, when heated engine parts and especially exhaust pipes touch vegetation. Local people use ATVs to get around, and an ATV fire can start, for example, when soil from the mor starts to smolder and eventually burns on top of the exhaust pipe. In the winter season, people move around by snowmobile, but the increasing lack of snow increases the need for ATVs, for example in reindeer herding tasks. In addition, other sparking machines and cross-country hikers can cause wildfires. Roads and paths are a key monitoring target with resting places as the main hot spots.

Identifying ignition sites is key to preparing for wildfires. For example, tussock grass fires are particularly dangerous. During the dry season, the tussocks that are elevated from the ground dry out quickly. Tussock grasses are typical in peatlands and especially peat fires are difficult to put out, because the fire smolders underground.

The increase in ignition sites is problematic for the entire Arctic region, and this is also linked to the permafrost variable. In Finland, permafrost does not actually occur, except only in the cores of *palsa* mires. As a result of global warming, new ignition sites appear. Hence it is important to identify the ignition sensitivity and the changes in it.

The question of preparing for wildfires is always also a cross-border preparation. For example, in the Itä-Saariselkä region across the border, south of the Lutto river, Russian loggers burned already felled and stacked logs when the loggers' salaries were unpaid in the early 2000s.

The place of ignition is directly linked to the functions in the community. The Arctic region has warmed more than four times more than the average Earth as a result of global warming. Warming has increased weather and climate risks, for example an increase in dry seasons and snowlessness and ice burning (Gregow et al. 2021). In Norway, in the Haukijärvi (Hávgájárvi) area (approx. 5 km from the Finnish border at the "Finnish maiden's biceps"), about 100,000m2 of lichen winter pasture land burned in the summer of 2022, perhaps due to lightning. This causes a big problem for the reindeer herders using the area in the coming winters, because lichen, the reindeer's most important winter food, is gone due to the fire and the reindeer cannot be taken there for the winter. Figures 3 and 6 and Appendix 1.

– Dát lea váivi ja stuora r

VÁIVI: Lákkonjárgga badjeolmmoš Anders Nils N. Buljo ja su bearaš leat massán dálveguohtuneatnamiid maŋŋel meahccebuollima Hávgajávrris. Son lohká dán stuora vahágin buot Njullošlákku guda siidaossái. Priváhtagovva

GUHKES BARGOBEAIVI: Guovdageainnu buollinveahka čáskadii meahccebuollimiid 12 diimmu mannan lávvardaga. Čáskadanhoavda muitala ahte dá lea hástaleaddji bargu ja ahte dárbbašit helikopterveahki go meahcis buollá. Govven: Geir Clemet Hætta/Guovdageainnu buollinveahka

MEAHCCEBUOLLIN: Guovdageainnus ledje guokte meahccebuollima mannan vahkkoloahpa, ja dás leat váikkuhusat bo

Njullošlákkuid siida lea massán stuora oasi iežaset dálveguohtuneatnamiin maŋŋel meahccebuollima Hávgajávrri guovllus, Guovdageainnu suohkanis.

Mannan lávvardaga čáskadedje guokte meahccebuollima Guovdageainnus. Álggos ožžo diehtu buollima birra mii dealvidii davábealde riikageainnu 92 gaskal Gievdneguoikka ja Láhpoluobbala. Dan maŋŋel ges šadde čáskadit dolaid Hávgajávrri lahkosis Anárjogas.

Meahccebuollimiin leat stuora váikkuhusat boazodollui. Njullošlákkuid siiddas eai diede mo galget birget. Sii leat massán stuora oasi iežaset dálveeatnamiin Hávgajávrri guovllus.

– Gal dát lea váivi ja stuora roassun midjiide. Mii leat massán guovddáš dálveeatnamiid mat gokčet birrasiid 70 spábbačiekčanšillju, lohká siidadoalli Anders Nils N. Buljo.

Váttis birget

Boazodoallu lea jo garrasit gillán goavvejagi geažil, ja njullošlákkohasain lea vuot lossa dálvi vuordimis.

– Mii leat massán stuora oasi iežamet dálveguohtuneatnamiin ja boazu gal ii bisán báikái gos lea buollán. Dát dagaha ollu lihgebarggu. Lea bahá masttadit ja mii šaddat ollu eanet vuodjit go dábálaččat, čilge Buljo.

Hávgajávrri guovllus bulli birrasii 100 000 m^2 eana. Dál sávvet guovllu badjeolbmot ahte ásahuvvojit doaibmabijut vai birgejit dálvet.

– Mun in diede mo galgat dán dustet, muhto mii áigut váldit oktavuođa stáhtahálddašeaddjin ja bivdit veahki. Čuovdus soaittášii gilvit jeahkáliid maid viežžá dakkár guovllus gos eai leat bohccot. Doaibmabijuid haga gal sáhttet gollat badjel logi jagi ovdal go jeagil fas šaddá. Dieđán lei olu jeagil ja lei ge min buoremus báiki, loahpaha Njullošlákku siidda Anders Nils N. Buljo.

> – Mii leat massán stuora oasi iežamet dálveguohtuneatnamiin ja boazu gal ii bisán báikái gos lea buollán.

Čáskadedje 12 diimmu

Guovdageainnu buollinveagas lei maš olu bargu mannan vahkkoloahpa, muitala čáskadanhoavda Kenneth Mortensen.

– Buollinveahka lea čáskadan meahccebuollimiid 12 diimmu, guktot báikkiin geavahedje birra-

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Ávvir 122.nr. – gaskavahkku, suoidnemánu 6.b. 2022

Figure 3. A news article about a wildfire in a Sami area in August 2022, Ávvir Sami newspaper

The operating environment of reindeer herding has been changing. Nowadays, reindeer have to be fed extra/emergency food almost everywhere in Finnish reindeer herding areas. E.g. pellet fodder, hay, lichen and reeds are used as supplementary food. When a reindeer learns to eat especially industrial pellet feed, it can even cause a certain kind of "addiction" to the reindeer.

In addition, there are a lot of tourists and hikers in Finnish Lapland, posing a wildfire risk if the campsite is not handled carefully. Hence, focusing surveillance brings significant economic benefit in preventing wildfires.

Finnish Lapland is a large area and there are many uninhabited regions. Therefore, regular flight controls are important in detecting the latest ignition locations. In Finland, forest fires are monitored by regular flights (Figure 4).

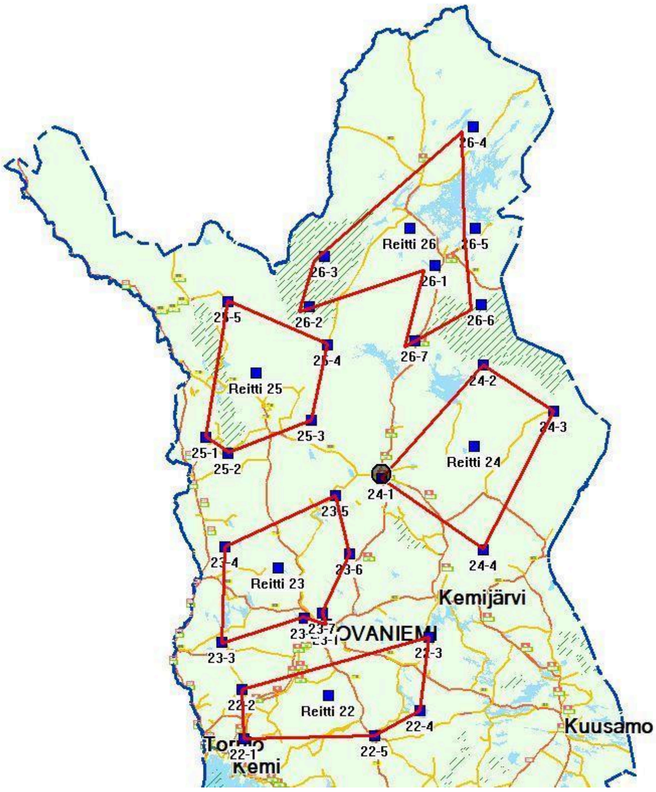


Figure 4. Wildfire monitoring flight map of the rescue service

The Finnish Meteorological Institute has daily forecasts and analysis of forest fire risk based on weather forecast models. When the forest fire index is over 5, the surveillance flights are always made at a certain time. When the index is 6, flights are made twice a day. The Sodankylä aviation club operates flights with one plane. Northern Finland's AVI (Regional Administration) decides the coverage of the routes. Enontekiö conducts wilderness flights, which complements the data. In addition, Finnair collects data on its scheduled flights and also data on e.g. air temperature during ascent.

Modern monitoring happens also from satellites which carry thermal imagers. They can spot unusually hot sites as an indication of a wildfire. Also more abundant optical satellites can detect burnt area and smoke. Clouds cause gaps in satellite data. In addition, satellite interpretation makes it difficult to detect the extent of a wildfire, because it is difficult to judge whether it is cloud or smoke. During surveillance flights, photos/videos are sometimes taken with a mobile phone. A video or a still image taken from the monitoring flights complements the satellite data and helps in mapping the locations.

3.2.2. The extent and societal importance of soil and vegetation moisture

The increasing shrubification (*pusikoituminen*) of terrains has led to increased risks of wildfires. The growing season has lenghtened and the demand for firewood decreased, resulting in increased fire load in forests. This may, however, change rapidly, for example when the energy crisis hit Europe in 2022 and skyrocketed electricity prices.

Extreme weather conditions increase (e.g. snowfall in July in Enontekiö in 2017, yet extremely dry summer with 50 forest fires in Lapland in 2018).

The variation in terrain and vegetation creates a plethora of problems to be dealt with. The conditions may change, ice may turn fragile in common paths due to melting, and winter footwear needs to be changed to waterproof one. Reindeer pastures may suffer from mold caused by moisture collecting to the surface and not visible to the naked eye. This excessive mold has even caused reindeer deaths.

Forests destroyed by the autumnal moth (*Epirrita autumnata*) are said to be more sensitive to wildfires. The amount of decaying matter caused by standing rotting trees (birch stands), but also by ground trees, is many times more than that affecting the forest (mountain birch) in general.

Fire weather indicators are all based on different types of vegetation being present and their moisture which is related to how the matter can ignite.

3.2.3 The extent and societal significance of prescribed burning

There is no Sami word for prescribed burning, which suggests that its meaning is culturally new. However, the need for additional feeding for reindeer has increased, and some reindeer herders manage their fields by traditional burning, which can be a wildfire risk.

In the municipality of Sodankylä, prescribed burning and garbage burning must be reported to the local rescue service. Private people burn yard meadows, and the older generation burns cured grass in the spring. In addition, Metsähallitus (former Forest and Park Service) carries out prescribed burning and is allowed to burn small forest areas in times of forest fire danger, for example in large redevelopment areas, and they have their own equipment for that. The main motivation is to take out the low vegetation on the forest ground, so a fire is unlikely to get ignited or a ground fire can't find a way to reach the tree canopies. Trunks generally burn poorly at the surface without allowing fire to grow higher.

As satellite monitoring detects hot spots, it is nowadays used to trigger an alarm at local fire brigades. Only by knowing all controlled burning unnecessary actions can be avoided.

3.2.3.1 Correcting and complementing the ignition site variable

In order to act in the change, it is necessary to act proactively on the ways of operation of different communities and collect information needs as well as follow-up on how to anticipate different ignition situations.

The lightning tracking is top-notch, and the burning hot spots are visible from satellites, for example the 2022 Kalajoki forest fire area. Climate change makes ground and vegetation dryer than we are used to allowing easier ignition and faster burning.

The digital services of the future can enable a lot of new methods to prepare for wildfires. For example, FMI researchers are registered as drone users to monitor wildfires from above – a new opportunity in networks in the modern age. Satellite service products can be improved e.g. adding information about wildfires through machine learning. This is mainly by having a more detailed knowledge of what vegetation is present and how moist is it. However, wildfire variables are so local that everything necessary can not yet be seen from satellites. Citizens' observations are needed in order to build a connection between the coarser digital image and the actual detailed terrain.

For example, higher resolution local information can be sourced then a satellite observation is connected to a camera image of the terrain captured simultaneously with the overpass. The place and time tells the satellite data that can be used in the development of more detailed vegetation maps.

In order to correct the shortcomings, a discussion is needed about the structure of observation and information systems and their functionality.

The importance of microclimate in wildfire

Forest fire indexes and fire spread models help rescue services to assess the ignition risk of the ignition site and predict the dynamics of fires, enabling e.g. optimal placement of extinguishing and control resources. The current country-wide forest fire indexes are based on regionally rough climate data, often with an accuracy of more than one hundred square kilometers (Figure 5a). Within such a range there can be considerable variation in sensitivity to ignition due to e.g. the type of growth site, terrain shapes and forest structure. These factors create small variations in temperature and humidity, i.e. microclimates. Considering these microclimates helps us to understand the true fire sensitivity of our forests now and as the climate changes.

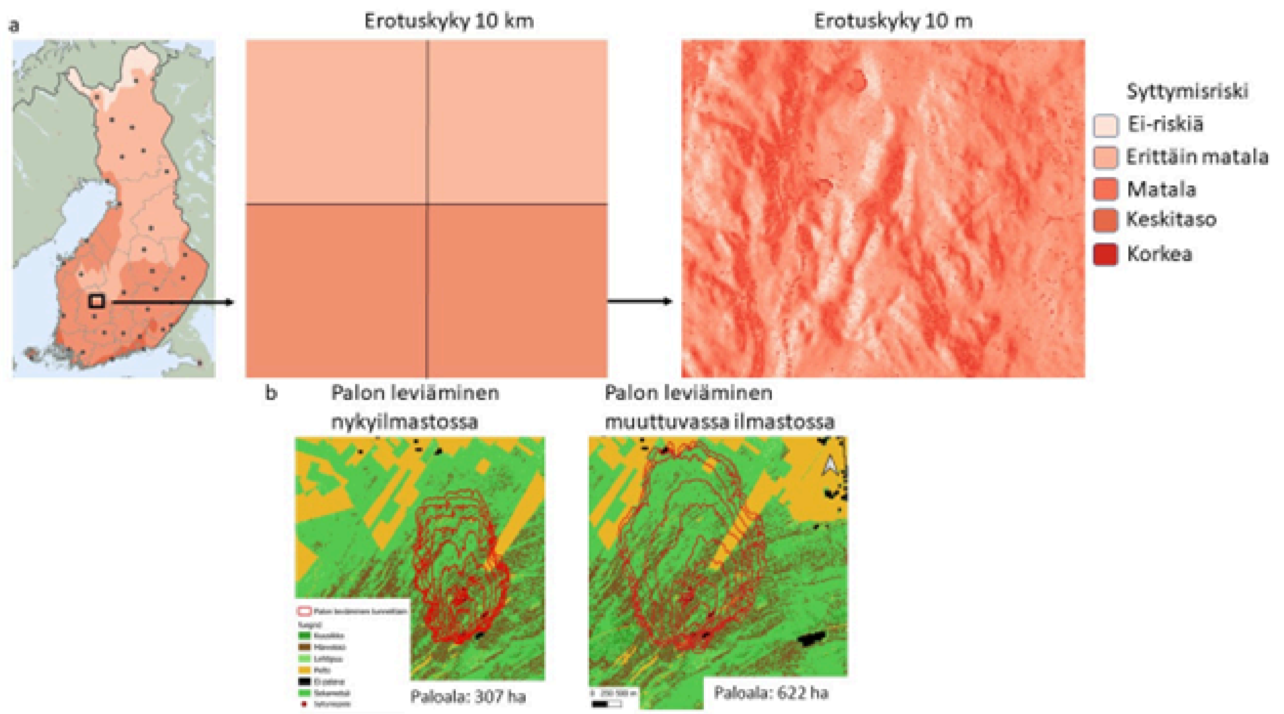
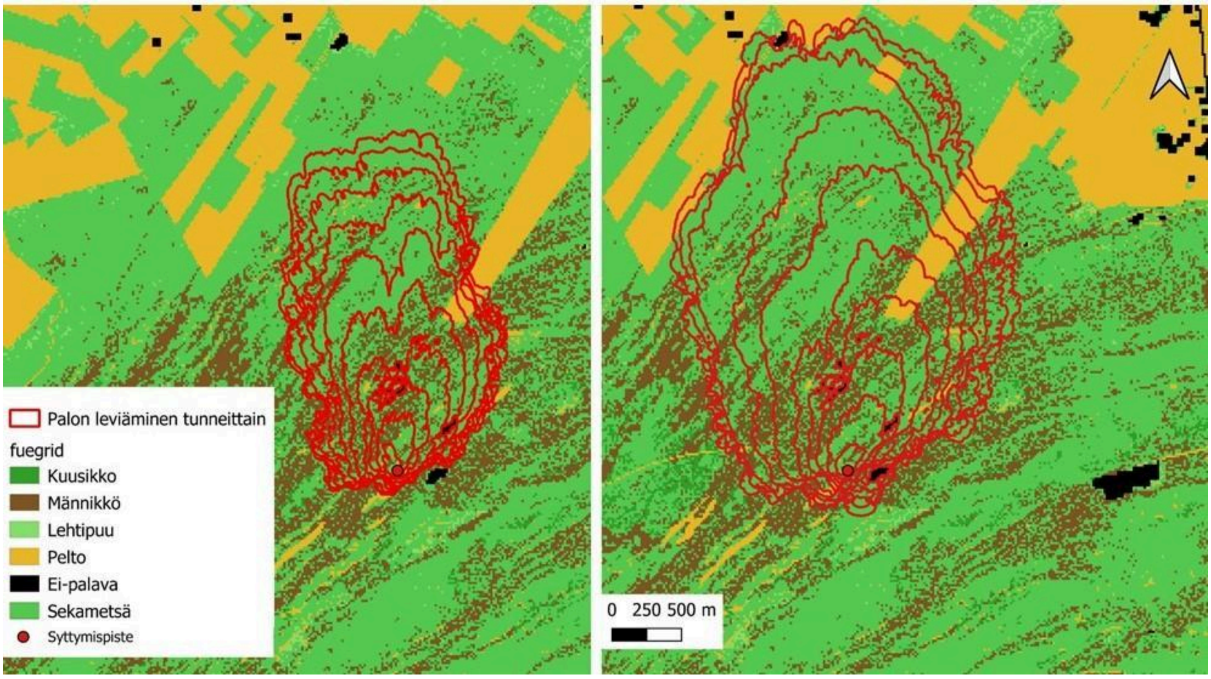


Figure 5. a) The importance of regional accuracy in the risk of forest fire. b) An example of the effects of climate change on fire spread using the forest fire spread model.

Scenario 1 describes the spread of fire in the current climate, while in scenario 2, the increased temperature due to climate change and the dryness of the terrain lead to a faster spread of fire in the area.

With the help of mechanistic microclimate models, current coarse-resolution weather and climate data can be refined to an accuracy of less than ten meters. This makes it possible to take into account small-scale variations in climate and environment in the fire risk and spread modeling of boreal forests. The new microclimate data, combined with accurate, laser-focused data on topography and forest stand data, such as canopy height and the amount of fuel, enables pinpointing e.g. current drought forecasts and the forest fire index to the local level. In addition, regionally accurate fire spread models can be used to assess the effects of changes in climate and land use on the spread speed and intensity of forest fires (Figure 5b).



The production of high-resolution microclimate data requires regionally accurate information about tree cover (forest type, tree height, canopy, etc.), weather (temperature, relative humidity, etc.) and topography (terrain height, soil types, etc.). We can calculate values related to tree cover and topography from MML laser scanning data, and we get weather-related values from the Finnish Meteorological Institute and the European Center for Medium-Range Weather Forecasts (ECMWF). The most central challenges of microclimate modeling are related to accurate information about soil materials and the accuracy of laser scanning data.

Pictures 3-5 connect to each other in an interesting way. The wildfire that burned the reindeer winter pasture area ignited near the Finnish border, the control flight map did not extend to the area, and in addition, figure 3a showed that there would be no risk of ignition in the area.

The first expert workshop also discussed the Kalajoki summer 2022 wildfire, some of whose extinguishing workers came also from Lapland. In an interesting way, the satellite data (Add source!) shows how the original ignition site could not be put out during several days. The fire spread and re-ignited from the area of the original ignition site.

Speaking at the final seminar of the Forest Fire IBA 2021, Anders Granström described the lesson learned from the forest fire in Sweden in 2018. The real reason for the extent of the forest fires was not that they did not know how to put out the fires quickly and efficiently, but that there was a failure in the post-fire surveillance. In practice, the fires re-kindled. Peat fires, tussock grass fires, in particular, may remain smoldering, and the importance of guarding them is paramount (Granström et al. 2021). In a changing climate, attention must be paid to the cooperation and participatory training of rescue authorities, indigenous peoples and the local population.

3.2.4. The societal significance/relevance of the Ignition Site variable

[According to the International Arctic Observing Assessment Framework (IAOAF), potentially relevant societal benefit areas for ignition site change. The SAON document contains key objectives that expert panels could use when considering the societal significance of the developed SAV (SAON 2017)].

The resilience of Arctic communities, i.e. the ability to tolerate change, can be increased by developing foresight and fire safety related to ignition sites. Wildfires cross borders, so it is essential to develop cooperation between Arctic Sámi cultures. The decrease of the snow season is a cultural change for the Sámi, and it requires a rewording of the situation and strengthening of foresight abilities and disaster preparedness. Local communities have experience-based knowledge of the conditions in the area, for example how ATVs are understood as part of the reindeer herding infrastructure and what kind of risk dry conditions and hot exhaust fumes cause. Environmental conditions are changing, and connecting qualitative changes in the environment to a basic understanding of arctic systems is important.

When wildfires ignite, they cause considerable smoke gasses and intensify the greenhouse effect and global warming. Therefore, the anticipation of wildfires and the ability to extinguish wildfires immediately at the point of ignition is of paramount importance. Wildfires destroy Arctic natural resources, such as reindeer pastures, berry fields and forests (Figure 6). as the fire risk increases, the knowledge base of sustainable Arctic communities must be enhanced.

MEAHCCEBUOLLIN: *Unjárggas buollái eana Suolojávrri guovllus mannel go álddagasttii. Govven: Máttа-Várjjat buollinvealhka*

Figure 6. Wildfire in mountain birch area in Norway in August 2022. The area was accessible to some fire-fighting equipment. Ávvir -a Sami newspaper

A quick extinguishing of the ignition site minimizes health risks to people, both from smoke gasses and from the spread of wildfires. The ignition sites can be far away from roads and waterways. Knowing how to extinguish the ignition by smothering can be an important option. For example, in the summer of 2018, Metsähallitus trained forestry personnel to build a fire swatter (*hosa*) that can be used to suppress the ignition. In dry seasons, the availability of fresh water can also deteriorate, and therefore communities' understanding of the limitations of natural resources is crucial.

3.2.4.1 How does the location of a wildfire connect to the UN's sustainable development goals

The location of a wildfire can vary as conditions change, but a devastating wildfire can cause poverty and malaise, destroy nature and natural resources, and accelerate climate change. Preventive education is of paramount importance.

Figure 7. The ignition site can be directly or indirectly connected to several UN sustainable development goals

It is essential to connect wildfire preparedness with the monitoring of sustainable development, so that foresight skills are strengthened in Arctic communities (Figure 7). Combining research and practical observations together with indigenous peoples and regional agents is connected to the monitoring of sustainable development.

Pressure from tourism is constantly increasing in the Sámi region. The camping culture in Lapland is closely related to making a fire and spending time by the fire, as well as cooking food, partly on an open fire, partly with a camping stove. Some tourists may be unfamiliar with the use of fire and at least lack local knowledge, as well as knowledge of the conditions of the northern coniferous forest and the sensitivity of the terrain to ignition. Education would thus play a big role, specifically targeting the growing tourist community. Here, Metsähallitus, together with tourism operators, would have a great responsibility and task. Also, e.g. when training tourism professionals, vocational training organizers should take into account that previously prevailing conditions may have changed and people have become alienated from nature and the traditional fire-making culture. Moreover, there are now also people with little or no experience in off-roading moving in forests. This emphasizes the importance of cooperation between regional stakeholders in preventing wildfires.

Goal 1: Eradicate poverty in all its forms everywhere.

Sub-goal: 1.5: By 2030, build the resilience of the poor and vulnerable and reduce their exposure to climate-related extreme events and other economic, social and environmental shocks and disasters.

Monitoring: For example, the adaptation of indigenous peoples' livelihoods to a changing climate is crucial, and it is necessary to know how to anticipate the emergence of new ignition sites.

Monitoring of changes in conditions is emphasized in the Arctic region. Monitoring measures include, for example, training materials and the number of trained personnel to extinguish wildfires (numbers, people). Information on the extent of damage caused by wildfires (hectares, persons, units) and their costs (€).

Goal 6: Ensure water supply and sustainable use and sanitation for all.
Sub-goal 6.6 By 2020, protect and restore water-related ecosystems, such as mountains, forests, wetlands, rivers, groundwater and lakes.

Disturbances in the water cycle and seasonal dryness escalate in the Arctic region, which increases the number of ignition sites. As the Arctic region warms, arctic species face shrinking habitats, which increasing forest fires shrink further.

Monitoring: In which areas wildfires occur, for example map monitoring, monitoring of microclimatic conditions.

Goal 13: Act urgently against climate change and its effects.

Sub-goal 13.1 Improve the ability of all countries to adapt to climate-related risk factors and natural disasters.

13.2 Integrate climate change measures into national policy, strategies and planning.

13.3 Improve training related to climate change mitigation, adaptation, and early warning; increase knowledge and the capacities of citizens and institutions

13.b Promote mechanisms to raise awareness of effective climate change planning and management in least developed countries and Small Island Developing States (SIDS), with particular focus on women, youth and local and marginalized communities.

Monitoring: Number of training materials, guides, trained personnel/indigenous representatives. The degree content of the education center of the Sámi region (especially tourism, natural economy, reindeer herding) should take into account the increased pressure from tourism and the fact that there are more and more people moving in the terrain who are not used to handling open fire and the risks associated with it.

Goal 15: Protect land ecosystems, restore them and promote their sustainable use; promote the sustainable use of forests; combat desertification; stop soil depletion and biodiversity loss.

Sub-goal 15.1 By 2020, ensure the conservation, restoration and sustainable use of land and inland freshwater ecosystems and their services, especially forests, wetlands, mountains and dry areas, in accordance with the obligations of international agreements

Monitoring: The warming of Arctic areas causes an increasing wildfire risk, which must be monitored as part of human activity. Areas destroyed by wildfires (ha), infrastructure (pcs, €), growth in foresight skills, avoided risks, experience database.

3.3 Extension to the wildifre expert panel
The expansion of the Finnish team that wrote this concept will happen in the frame of the EU Horizon 2020 Arctic Passion project. Topics that need to be strengthened are the international organizations that provide services related to wildfires and practitioners in other regions dealing with wildfire issues. Researchers in Finland can be used to dig deeper into fire behavior.

3.3. SAV Expert-panel

3.4. Timetable

3.5 Funding

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Appendix 1

ɔassun midjiide

:odollui.

Govven: Skoghrann Helikopter/Helitrans

sii guhtta diimmu. Lea hirbmat hástaleaddji čáskadit meahccebuollimiid, muhto lihkus leat meahccebuollin-helikopterat sihke Álttás ja Deatnus mat veahkehedje min. Romssas ledje maid gergosat boahtit go oaččuimet dieđu goalmmát meahccebuollima birra. Dát lihkus ii doallan dráivása ja lei sáhka seamma buollimis gos leimmet jo čáskadišgoahtán dolaid, lohká son.

Čáskadanhoavdda dieđuid mielde lea buollán 50 000 m² eana gaskal Gievdneguoikka ja Láhpoluobbala. Hávgajávri guovllus ges 100 000 m².

– Mii eat dieđe manin meahccebuollimat čuožžiledje, muhto Finnmárkkus leat registrerejuvvon olu áddagasat ja dat sáhttet dagahit ahte eana buollá. Hávgajávri goit lea dakkár guovlu gos dán áigge eai vánddar olbmot.

Guktii vásihan

Guovdageainnus ii leamaš meahccebuollin dábálaš, muhto sihke dán ja mannan geasi leat eatnamat buollán.

– Mun lean dáppe bargan 10 jagi, ja lean dušše guktii vásihan meahccebuollimiid. Nu ahte Guovdageainnus eai leat gal leamaš meahccebuollimat dábálaččat ovdal. Mannel diimmá buollima, de leat oastán rusttegiid maid lea álki fievrridit helikopteriin buollinbáikái. Dáppe leat viiddis guovllut ja helikopteriid ja rievttes rusttegiid haga eat birgešii, lohká Mortensen geas loahpas vel lea ráva olbmuide.

– Olbmot berrejit leat hirbmat várrogasa ja atnit muittus gildosa dolastit. Dál leamaš hirbmat goikkis ja dalle buollá eana jođánit. Dál leat lihkus eanaš leat arvi ja dat gal dárbbašuvvo, loahpaha son.

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Čáskadedje meahccebuollima badjel 16 diimmu

MEAHCCEBUOLLIN: Unjárggas buollái eana Suolojávrri guovllus maŋŋel go áldagastii. Govven: Mátta-Várjjat buollinveahkka

UNJÁRGA: Suolojávrris, Unjárggas bulii mannan lávvordaga okta mihttu eana. Jáhkkimis buollái eana alddagasa geažil.

– Oktiibuot lea buollán okta mihttu eana dán guovllus, ja jáhkkimis buollái guovllus alddagasa geažil, lohká Unjárgga buollinvárrehoavda Ole Petter Skoglund. Unjárgga buollinveahka fuomášii jođánit ahte eai beasa njealjejuvllatsihkkeliigain Suolojávrái

.

– Mii fertiimet dingot meahccebuollinhelikoptera mii doalvvui buollinveaga, čáhcepumppa ja čáhcejođđuid báikái. Meahccebuollinhelikopter veahkehii maid jáddadit dolaid, lohká Skoglund.

Šadde bivdit veahki

Unjárgga buollinveagas eai lean doarvái olbmot čáskadit meahccebuollima, buollinvárrehoavda muitala ahte ožžo veahki Mátta-Várjjat buollinveagas ja Siviilasuodjalusas.

– Go Unjárgga buollinveahka galggai bosihit, de válddii Mátta-Várjjaga buollinveahka badjelasas bargga. Mii fertiimet maid bivdit veahki Siviilasuodjalusas go dálki rievddai ja buollin fas badjánii. Ovttasbargu lea doaibman hirbmat bures ja mii nákciimet jáddadit dolaid, lohká Skoglund.

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Áššáskuhtton gii navdo goddán iežas áhči lea biddjon rájusgiddagassii

ROMSSAS: Davvi-Romssa ja Sáččá diggegottis . Govva: Jan-Morten Bjørnbakk / NTB Scanpix.

TROMSA: 26-jahkásaš dievdu, gean politiijat leat áššáskuhttán goddima dihte, biddjo rájusgiddagasii njealji vahkkui. Guovtti dain vahkkuin lea reive- ja galledangieldu. Nu bođii ovdan Davvi-Romssa ja Sáččá diggegotti riektecealkámušas.

– Dievdu ii leat foarpmas gažaduvvot. Dan lea maiddái dearvvašvuođabargit árvvoštallan, dadjá bealušteaddji Ken Olav Warth NTB:i.

26-jahkásaš lea áššáskuhtton goddimis iežas 62-jahkásaš áhči bearjadaga Romssas. Politiijat gávdne 62-jahkásačča vearrát roasmmehuvvan ásodagas Romssas ja son jámii dan geažil.

– Mii doaivut ahte mis lea buorre obbalašgovva dáhpáhusas. Mii leat hállan vihtaniiguin geat leat oaidnán osiid dáhpáhusas mii gravai olggobealde viesu, maiddái goddima, lea politiijaadvokáhtta, Lisa-Mari Ellingsen dadjan Nordlys aviisii.

Áššáskuhtton dievdu lei dubmejuvvon 90 beaivvášaš giddagassii 2018:s veahkaválddálašvuođa geažil politiijabargái ja nuppi divdui, go lei govven álásgovaid 15-jahkásaš nieiddas ja go sus leamaš bášša hálddus. (©NTB)

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