

A photograph of a forest fire in a pine forest. The lower half of the image shows intense orange and yellow flames rising from the ground, with thick blue and white smoke billowing upwards. Several tall, thin pine trees stand in the foreground, some with charred trunks. The upper half of the image shows a clearer view of the pine trees against a hazy, light-colored sky. A white rectangular text box is centered over the middle of the image.

Fire management practices in Sweden

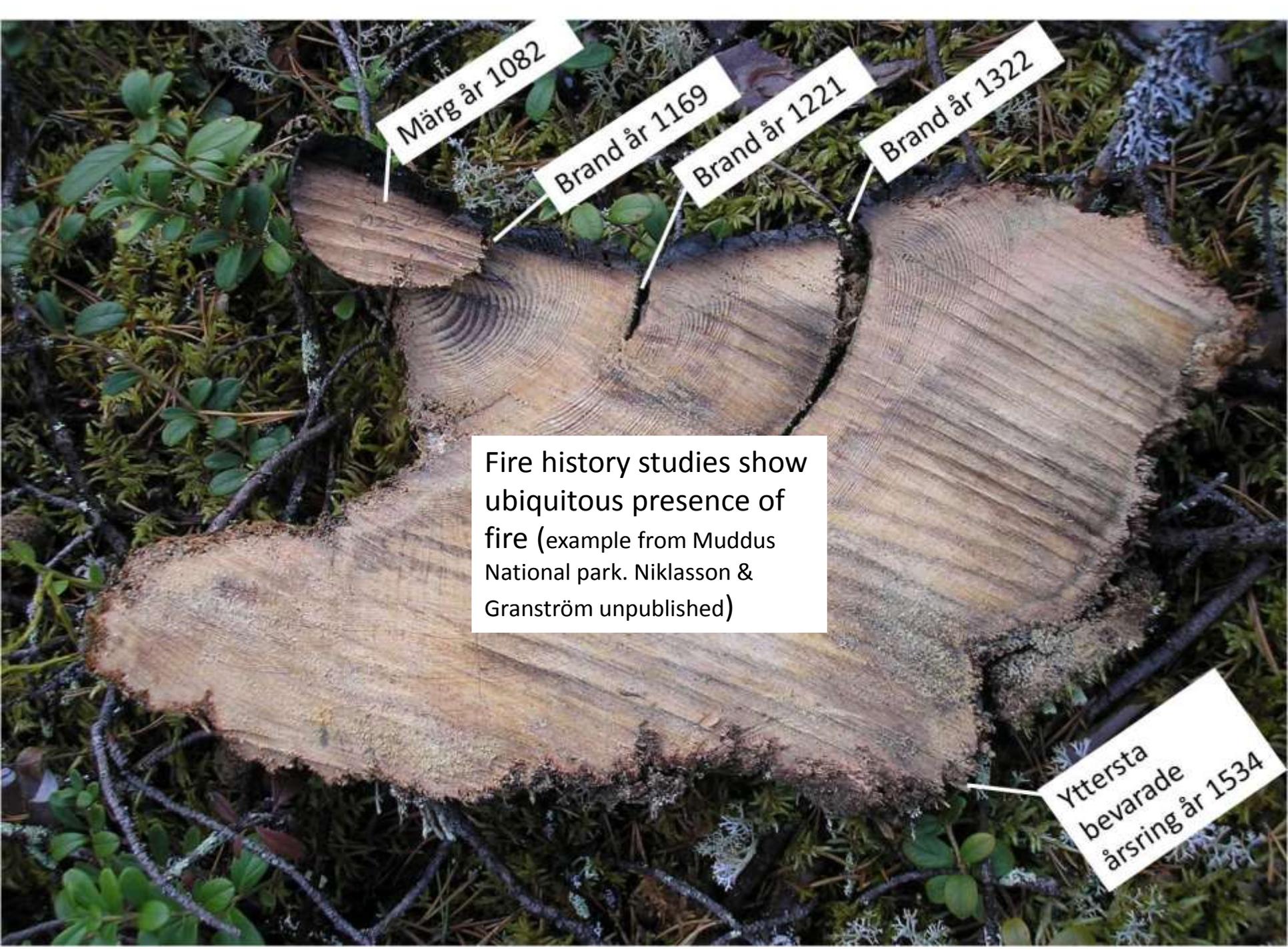
Anders Granström
SLU, Umeå

Effective fire suppression makes
prescribed fire a necessity!



Role of fire in conservation recognized
in Sweden from early 1980s. Impetus
from USA

Some action in late 1980s.
Slowly growing from then.
Still increasing



Märg år 1082

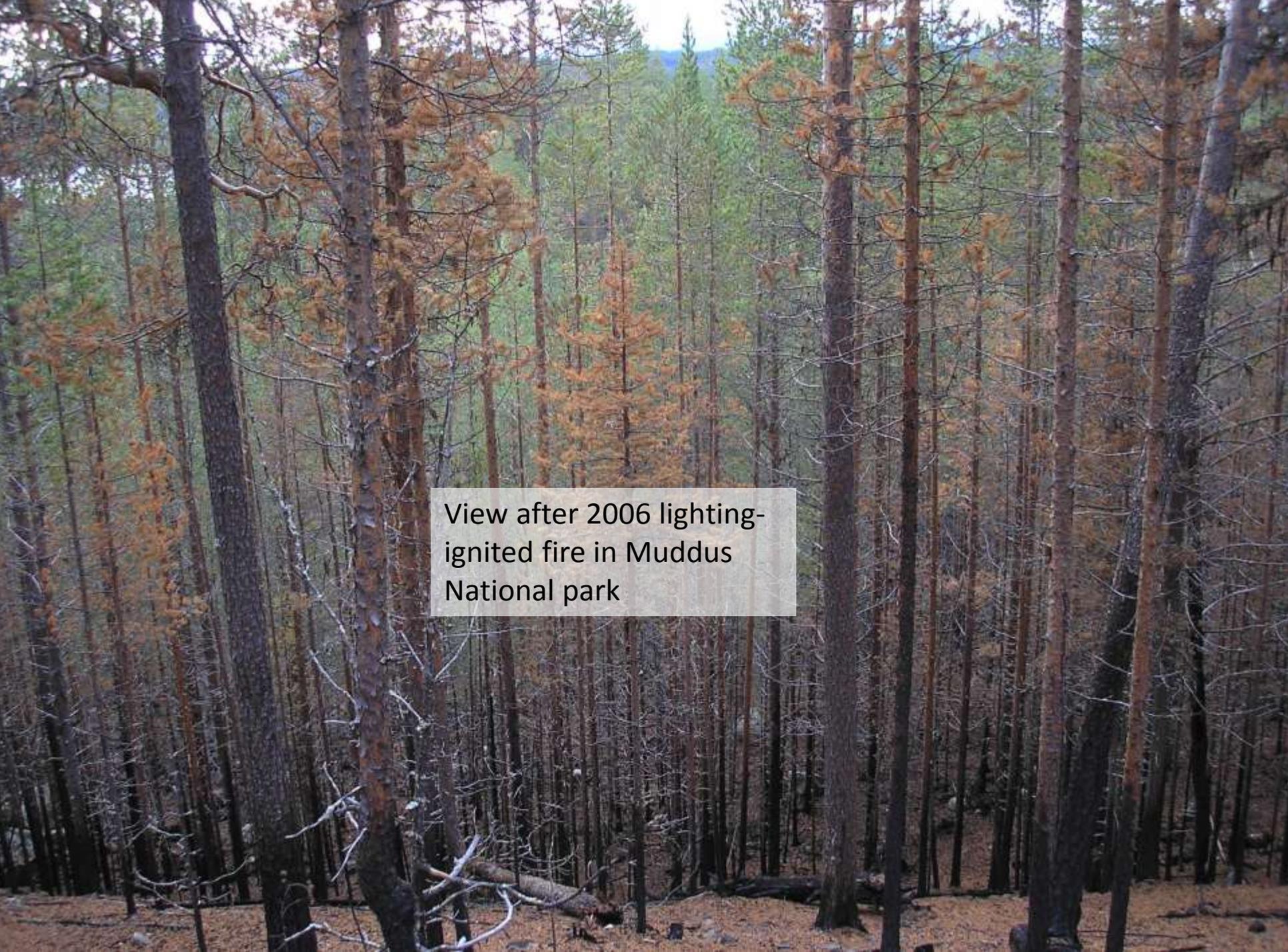
Brand år 1169

Brand år 1221

Brand år 1322

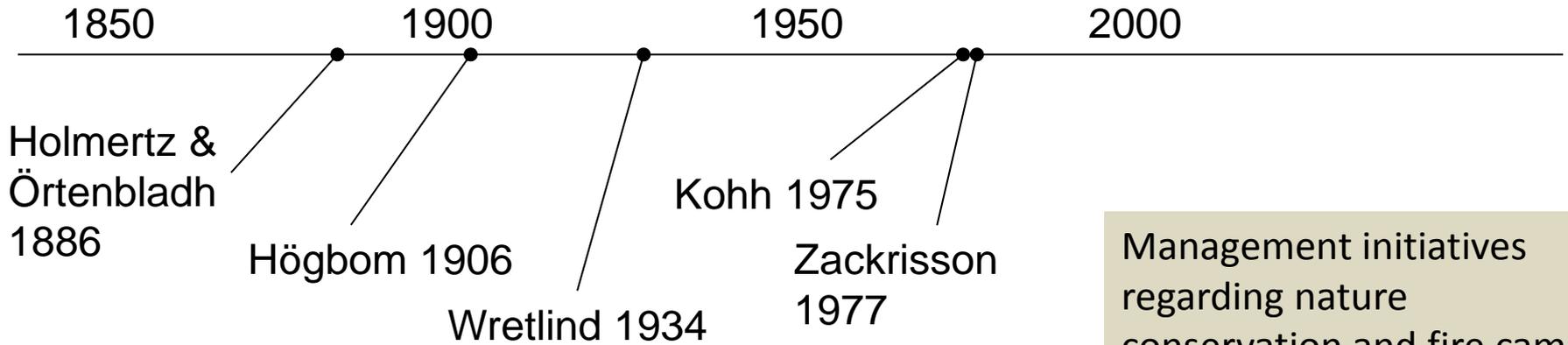
Fire history studies show ubiquitous presence of fire (example from Muddus National park. Niklasson & Granström unpublished)

Yttersta bevarade årsring år 1534



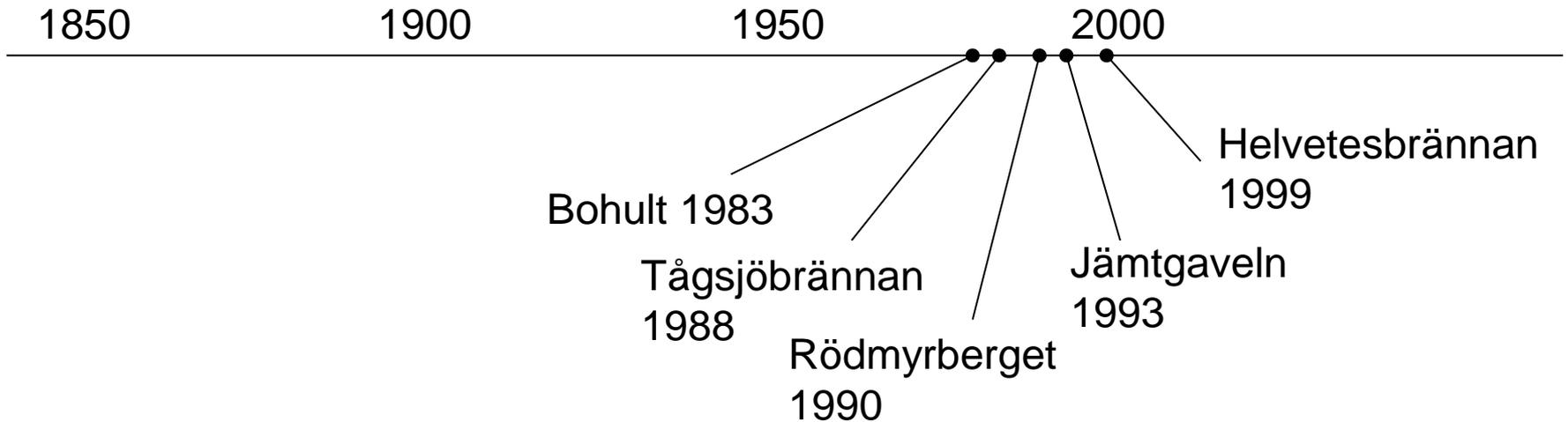
View after 2006 lightning-ignited fire in Muddus National park

SCIENTIFIC UNDERSTANDING



Management initiatives regarding nature conservation and fire came several decades after role of fire in the forest was acknowledged

MANAGEMENT INITIATIVES



MoDo

Skog & Virke

Tidning för

MoDo Skogs intressenter

Nr 3 • 1995

Han tändar för mångfalden

SIDORNA 8-9



RÖJSPECIAL

Røj för
volym
och
kvalitet

SIDORNA 6-7



Åke jobbar
för nordisk
certifiering
SIDAN 15



Många
fördelar med
skärmen
MITTEN

“He lights up for biodiversity”

Information journal issued from MoDo Skog (now Holmen) to its customers 1995.

Already in the early 1990s forest companies agreed on the need for management fires

FSC- process in Sweden

Hearings with the scientific community
around 1995

Standard agreed on 1997

Fire clause in the first standard: 5% of cut
area to be burned.

Revised standard (ca 2012) gave premium
for burning forest stands



- **Leave >15% of original volume before burning. Count as area x 1,5**
- **Leave >30% of original volume before burning. Count as area x 2**
- **Leave >50% and set aside from production after burning. Count area as x 3.**

All forest companies have joined voluntary forest certification schemes (Mainly FSC).

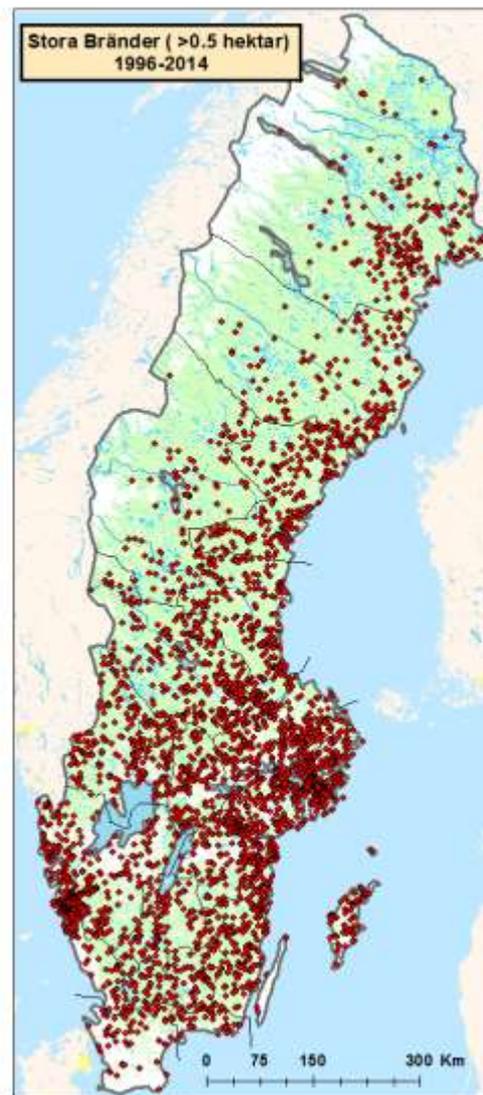
5% of annual cut area =ca 4000 ha/year

Today they select primarily set-aside forests for burning. Perhaps in total 2000-3000 ha(?) burnt by companies

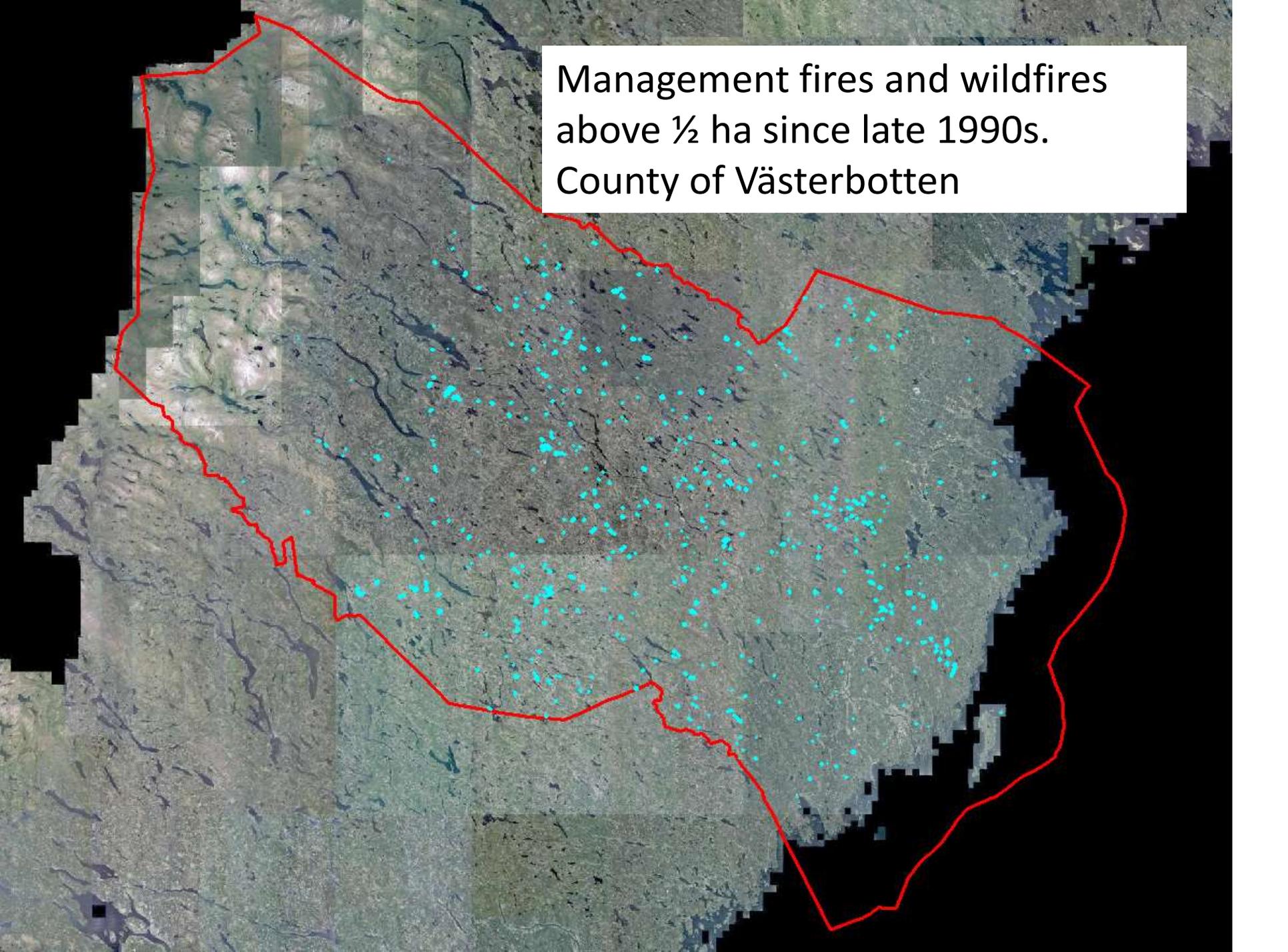
Of all burned forest today in Sweden, the majority is due to management fires (estimated figures)

- Wildfire 1500 ha (?)
- Prescribed burning by forest companies 2-3000 ha
- Prescribed burning in nature reserves 1-2000 ha

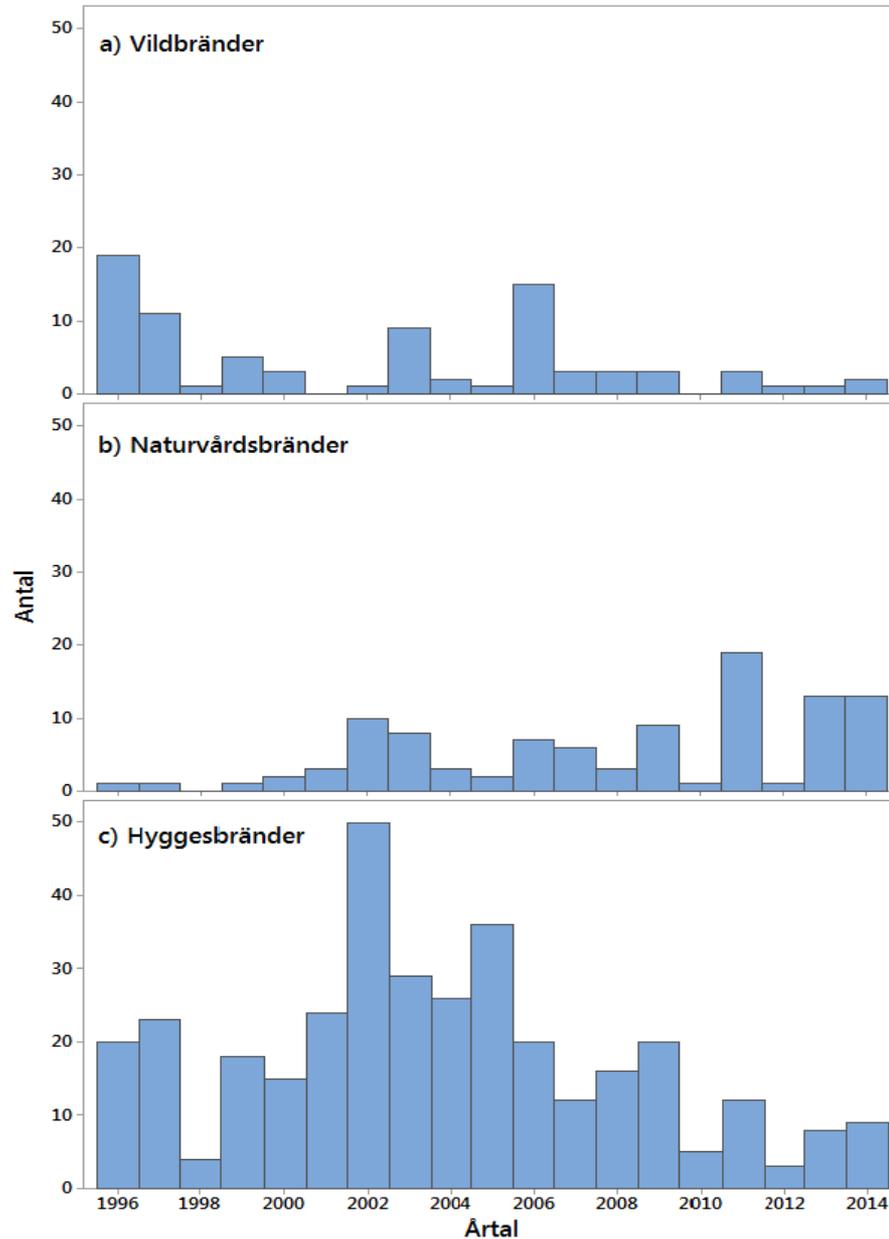
Wildfire distribution. Grass fires and forest fires



Management fires and wildfires
above ½ ha since late 1990s.
County of Västerbotten



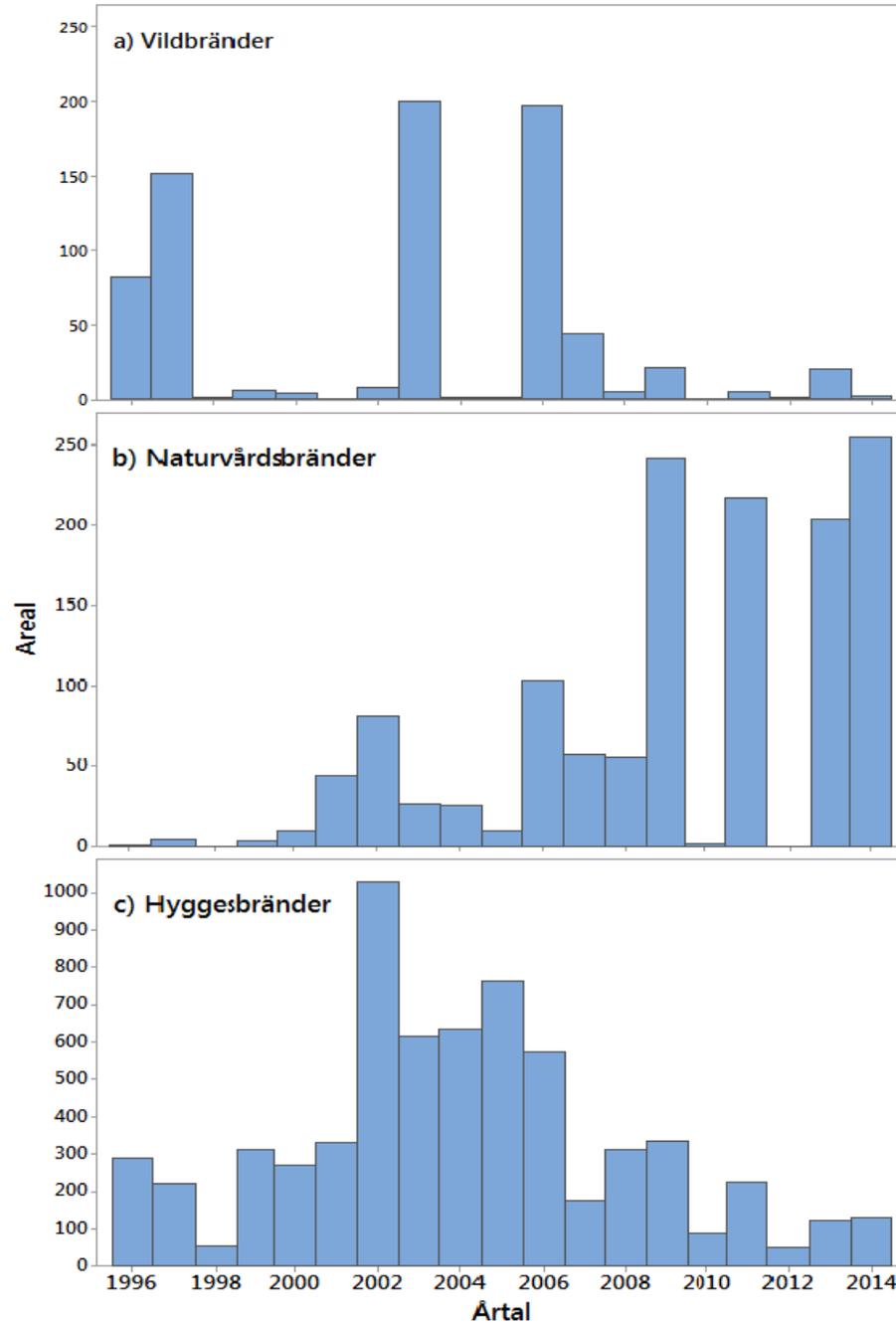
Antal bränder



Number of fires in Västerbotten 1996-2014, by category

Wildfire,
Rx-fire in forest,
Rx-fire on cut areas

Areal bränd mark



Area burnt forest land in county of Västerbotten from 1996 to 2014 split by category: Wildfires, "Naturvårdsbränder" and Rx-fire on cut areas.

Note different scale for the latter.



Prescribed fire – asset or threat for fire protection?

- Increased overall fire competence in society
- The rescue service can see and learn how fire operates (if they want to)
- Relatively few fires are lost (most often during the mop-up phase)

Organize a yearly get-together in the region before the fire season

- Fire chiefs, burn entrepreneurs, forest company reps, aerial surveillance reps, Alarm service.
- Discuss what happened last year.
- Present your plans for the coming season (where to burn etc)
- Discuss new developments (organization, equipment etc)
- Get to know each other (circulate contact lists....)

What type of habitats?

- Anything that can burn would have burnt and should burn
- Today focus on restoring pine-dominated, multi-storied forests

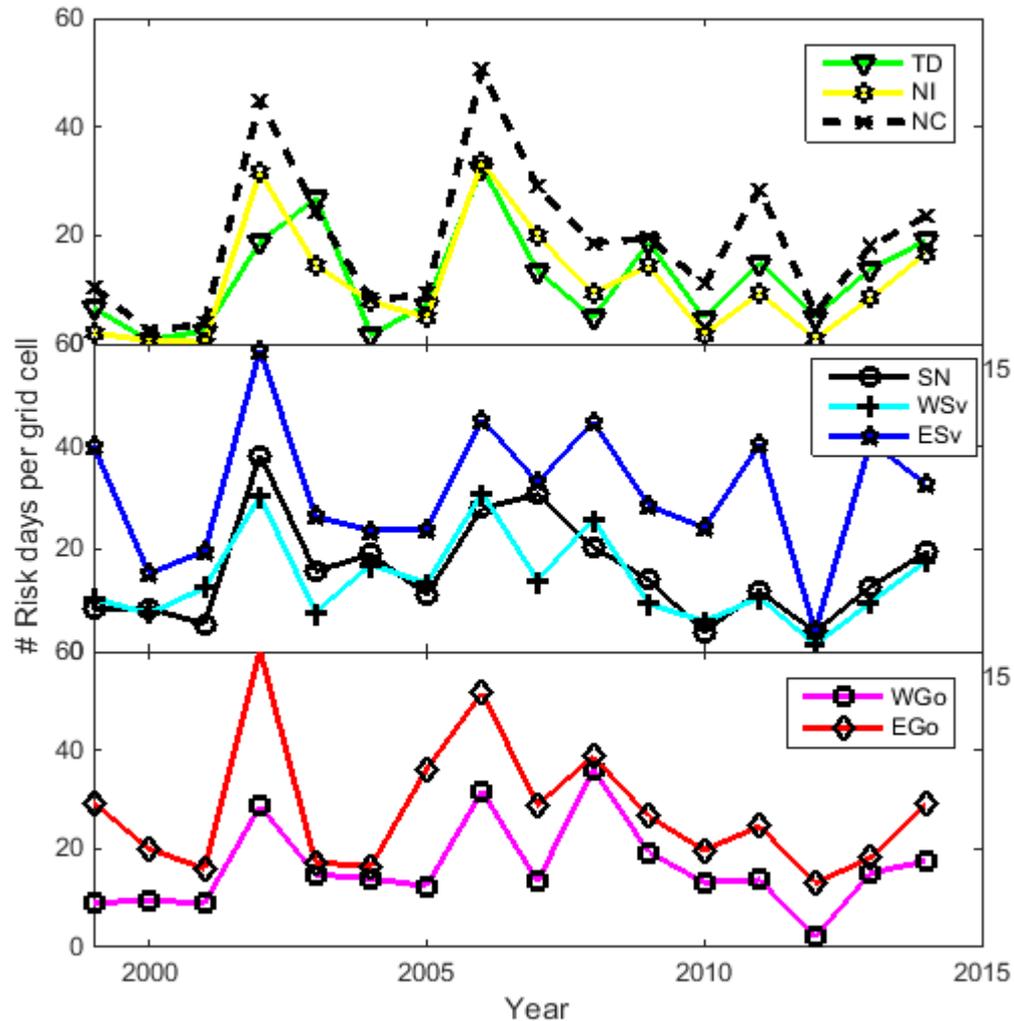


Conflicts?

- Public opinion ususally not a problem. They accept fire
- Nearby summer-cottage owners can object (smoke)
- Lichen-rich forest within Reindeer grazing areas are off-limit. Particularly for the forest companies (FSC)

Weather can be a problem

Days with FWI>15



Last Wednesday.....

Photo: Johan Sjöström



A substantial amount of burning is also done on military training grounds.

Photo: Johan Sjöström



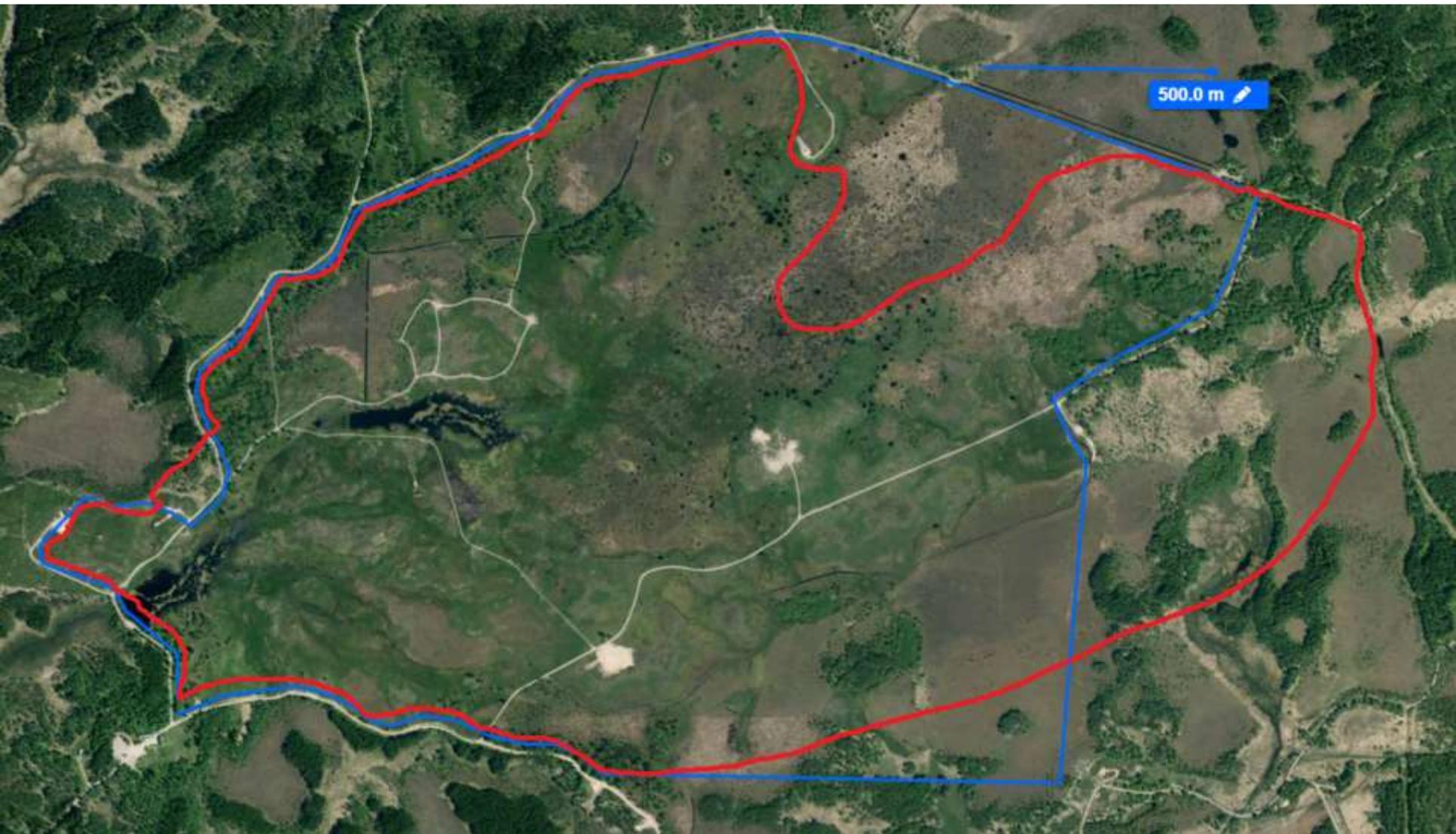
Photo: Johan Sjöström



Photo: Johan Sjöström



Photo: Johan Sjöström



Sandlife
20th of
March 2017
Test.....



Photo: Johan Falck



Photo: Johan Falck



Photo: Johan Falck

What about the legal framework in Sweden?

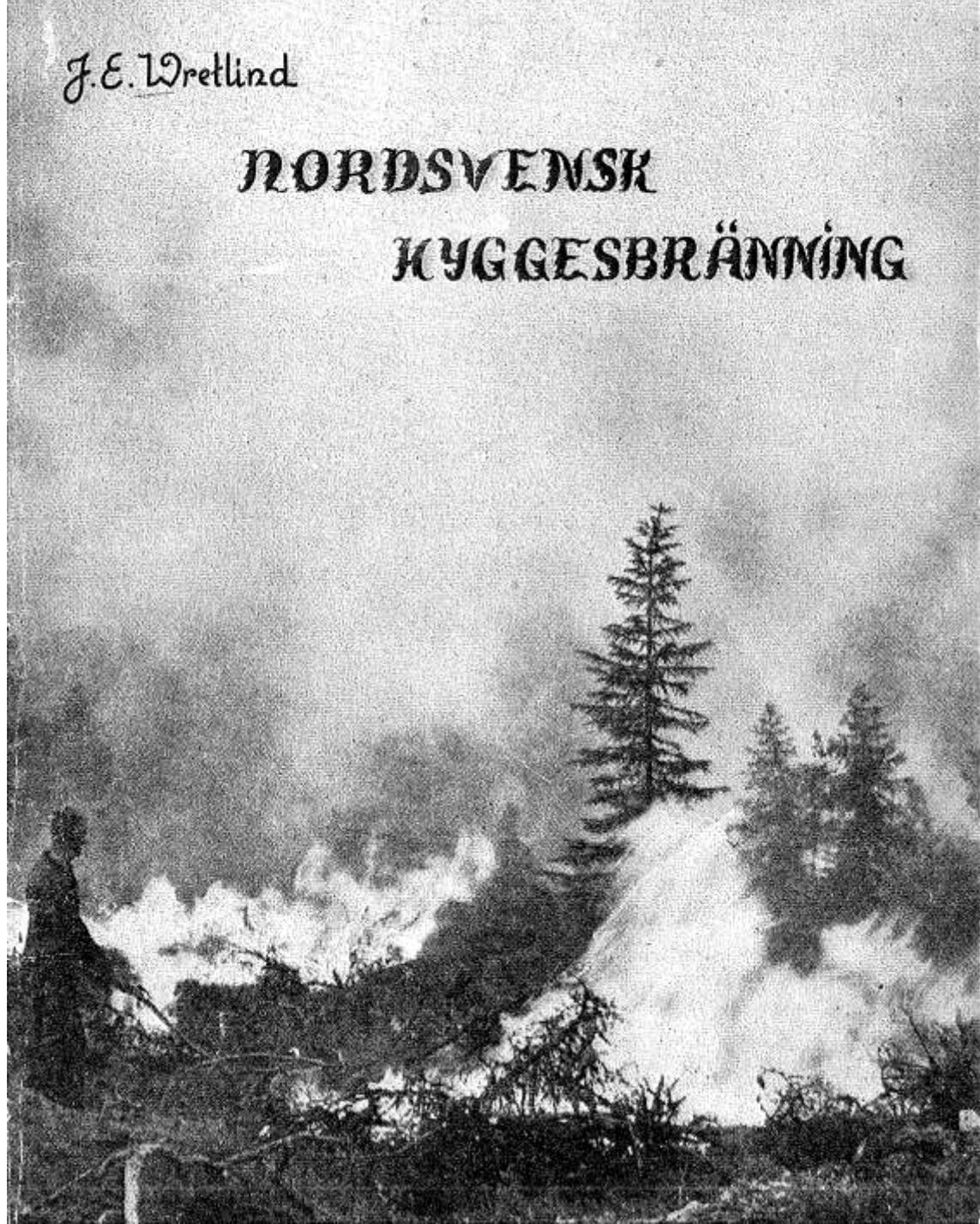
- Anyone is allowed to burn on their own property
- But you are responsible for your actions (although there is no strict economic.....)
- A burn ban is (sometimes) issued after several days of high fire risk. Open fire is then prohibited.
- If there is a burn ban you need to have an exemption from the fire chief (thus you need to establish good contacts with him!)

First half of 1900s a lot of
prescribed burning for forest
regeneration
(40 000 ha/year)

J. E. Wretling

NORDSVENSK

KYGGESBRÄNNING



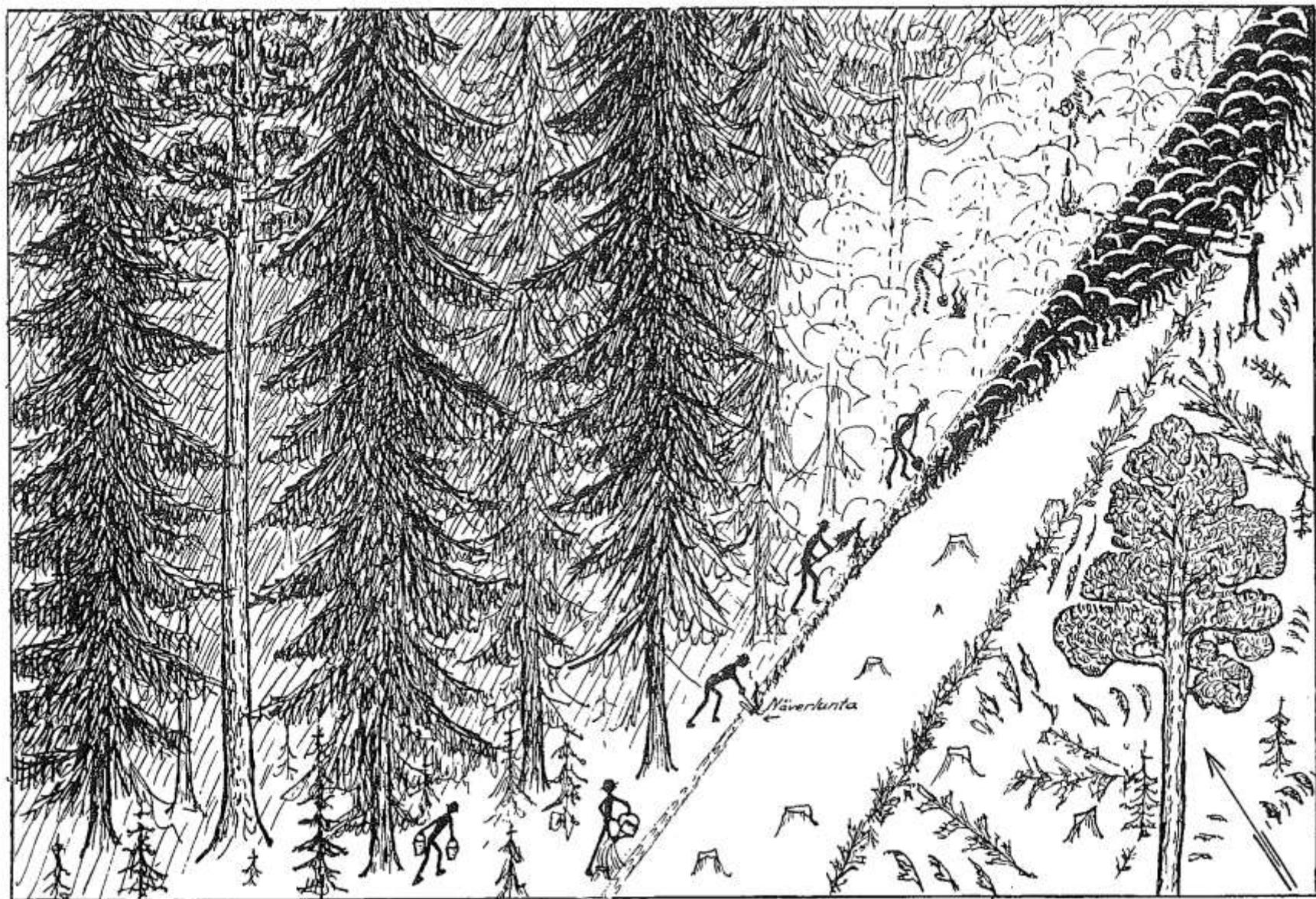


Fig. 3. Perspektivskiss från skyddsavbränning av läbrandgata med stöd av mineraljordsträng. Pilen i nedre högra hörnet anger vindriktningen.

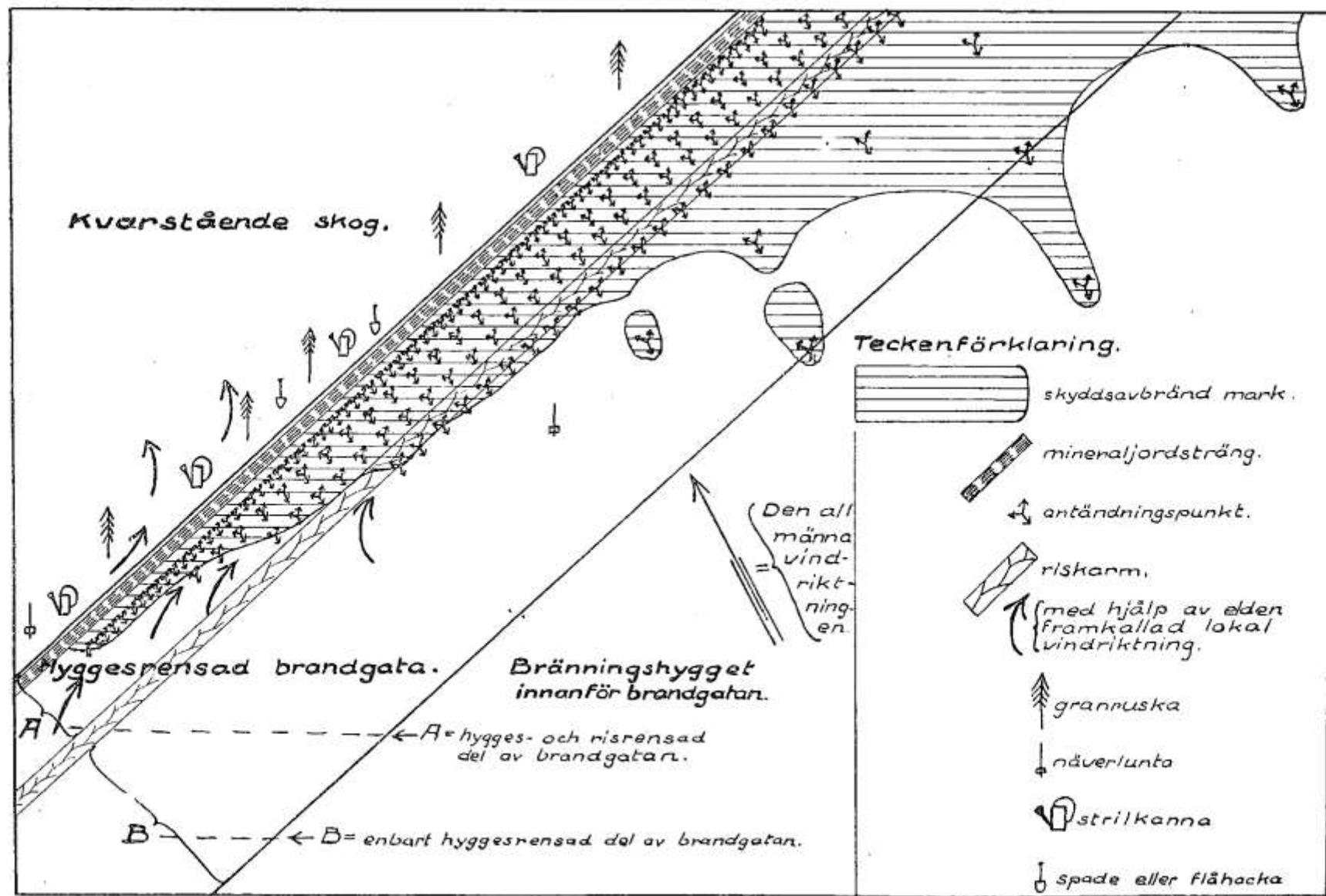
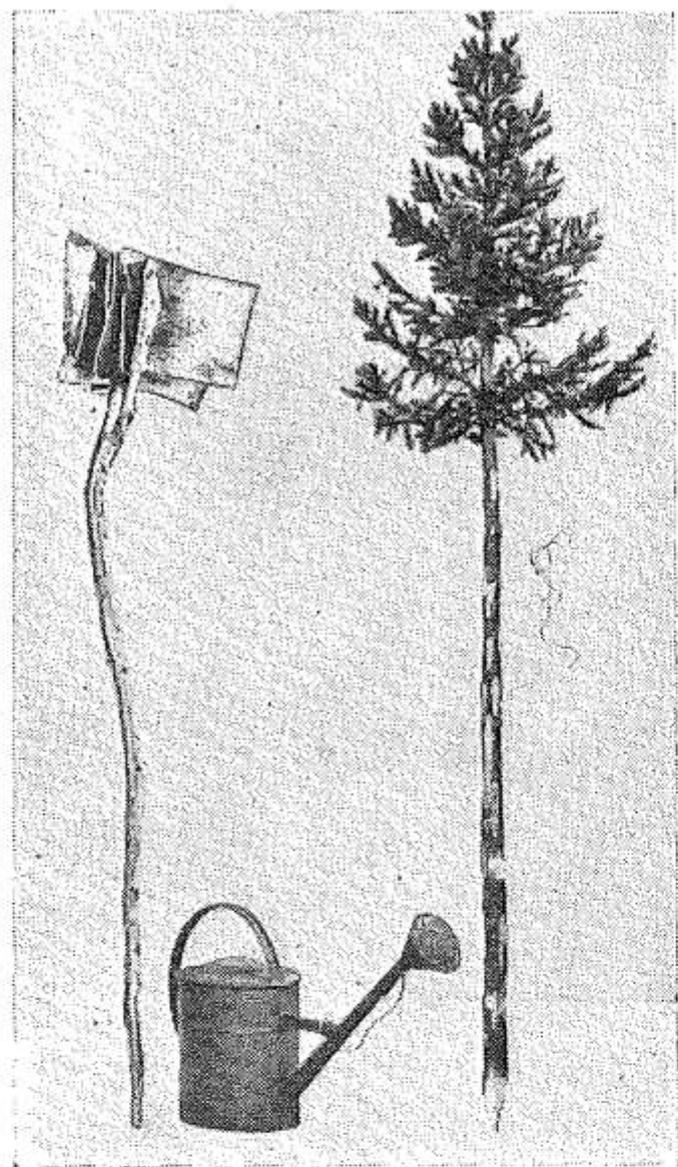


Fig. 4. Stilerad planskiss över skyddsavbränning av läbrandgata med stöd av mineraljordsträng.

Fig. 8. Redskap för hyggesbränning.
Längst t. v. tändlunta, tillverkad av några kraftiga näverflak, fastklämda i en i grovänden kluven, rå björkslana. I mitten strilkanna med stril av lämplig konstruktion. Obs. att strilen är fäst vid kannan med ett stadigt snöre så att den inte tappas bort. T. h. ruska av senvuxen gran, kvistad och avputsad samt tillspetsad i nederändan så att den lätt kan ställas upp vid brandgatan.



How do you learn the trade?

Fire Management I 7.5 ects

The course gives theoretical and applied knowledge of fire in northern forests. The objective is to provide basic skills for the use of fire as a tool in nature conservation and silviculture.

7th June – 2nd July 2017



Swedish University of
Agricultural Sciences

Course Code: SG 0176

Prerequisites: equivalent of 60 ects Biology or Forest management

Website: <http://www.slu.se/utbildning/program-kurser/kurser/?sprak=sv&anmkod=50019.1617>

Teacher: Anders.Granstrom@slu.se

SLU Fire Competence building programme 2011-2014.

Free-of-cost courses at three levels.

Financed by Skogsstyrelsen (EU funds), Naturvårdsverket, Holmen Skog, Sveaskog, SCA, Bergvik.

- **1. Basic fire knowledge.** 2 days. Theory and field training. Aimed at mop-up personnel etc. Summa ca 250 participants.
- **2. Advanced fire knowledge.** 3 days of theory and field training + 3 days of active burning. Participants expected to have some practical experience. Aimed at future burn bosses. Summa ca 120 participants.
- **3. Planning and executing prescribed burns.** 3 days theory + 3 days excursions. Summa ca 60 participants.
- Yearly **symposia** to foster exchange and trust between the rescue services and those doing prescribed fire







Benefits of a "formal" course structure

- Establish a common world view (fire knowledge, terminology, goals)
- Increase contacts within the field

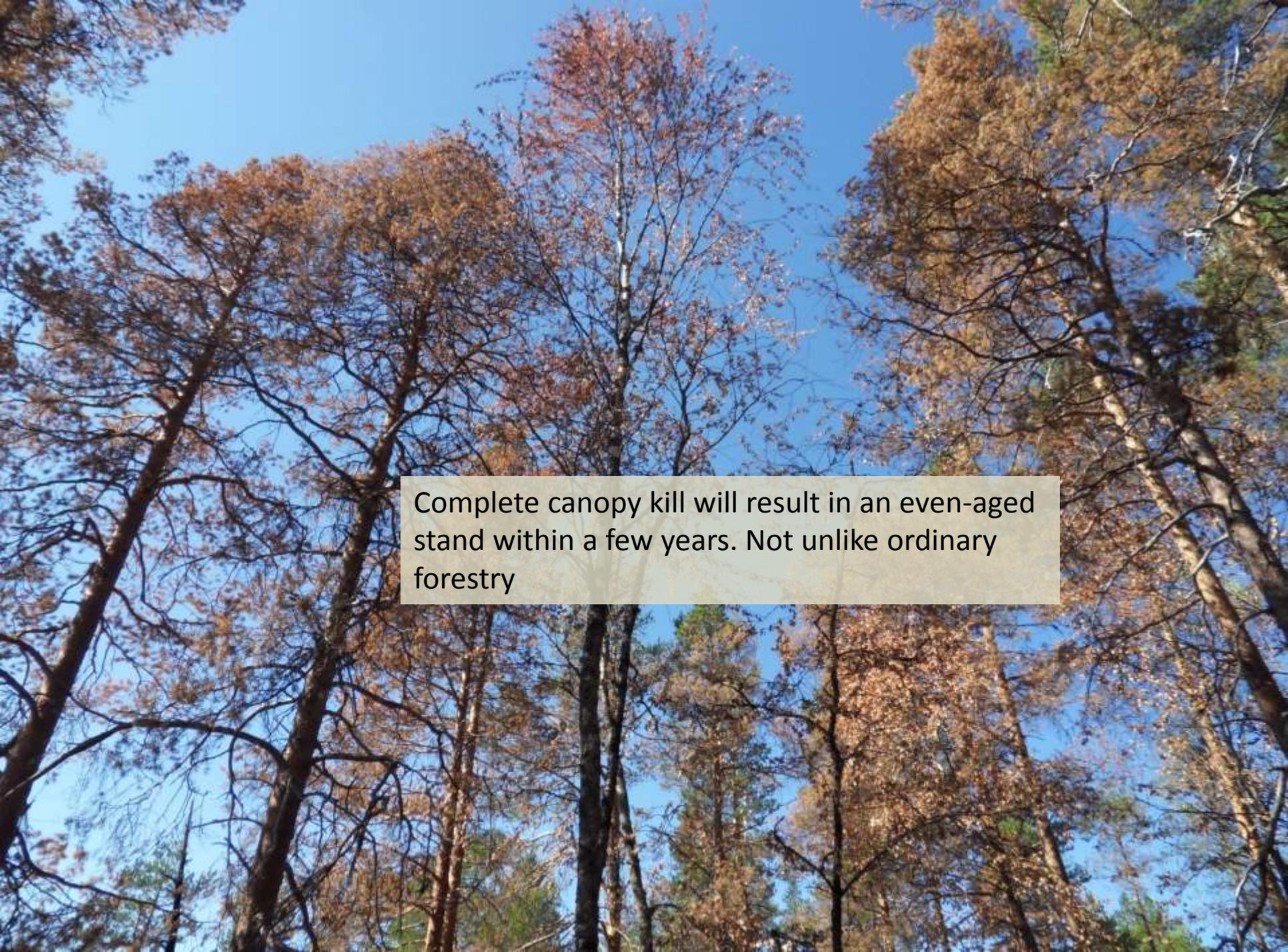


Beware what you ask for



Fire opens for ecological change

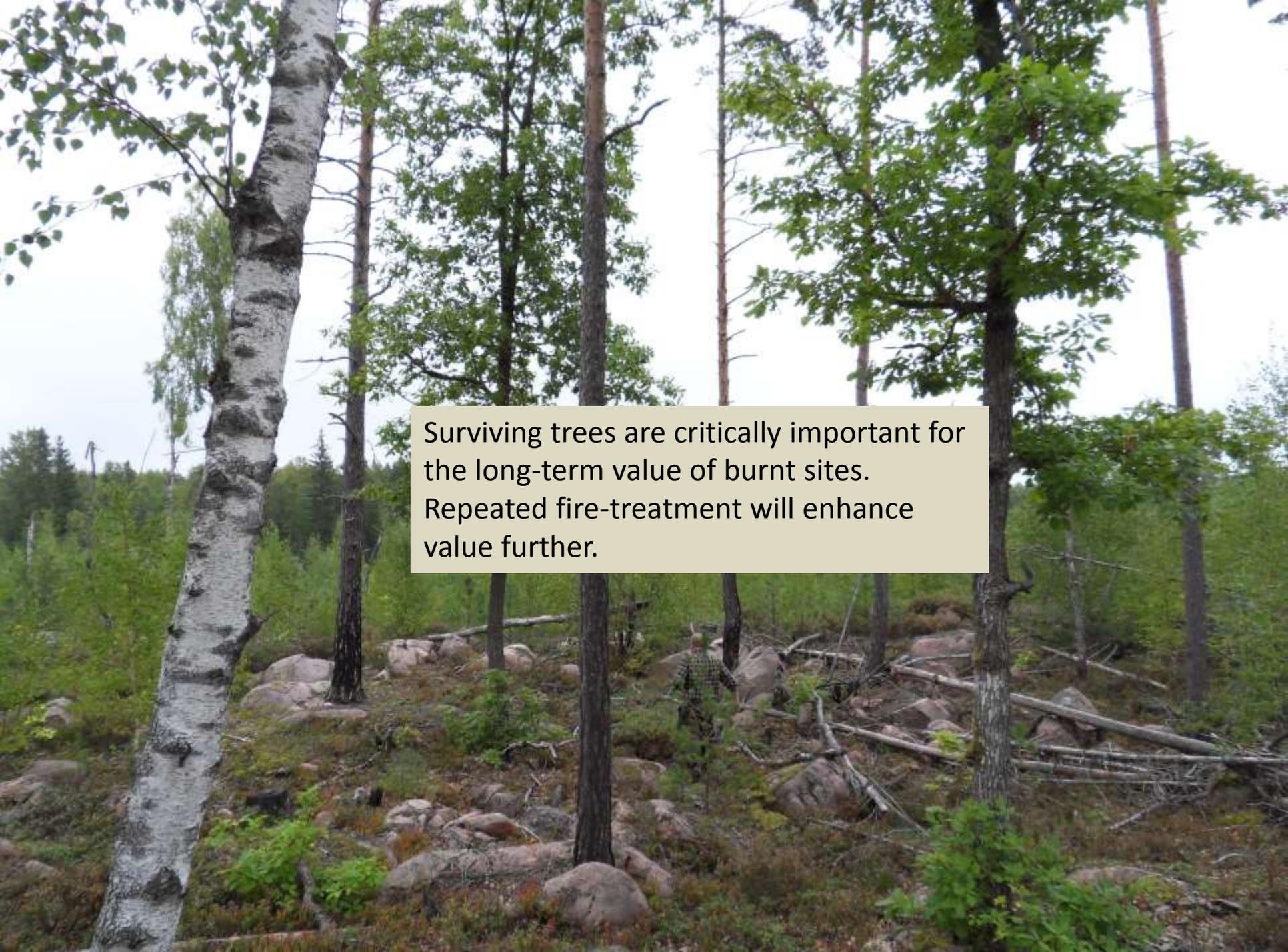
- Be prepared for surprises
- Be prepared for increased future need for management



Complete canopy kill will result in an even-aged stand within a few years. Not unlike ordinary forestry

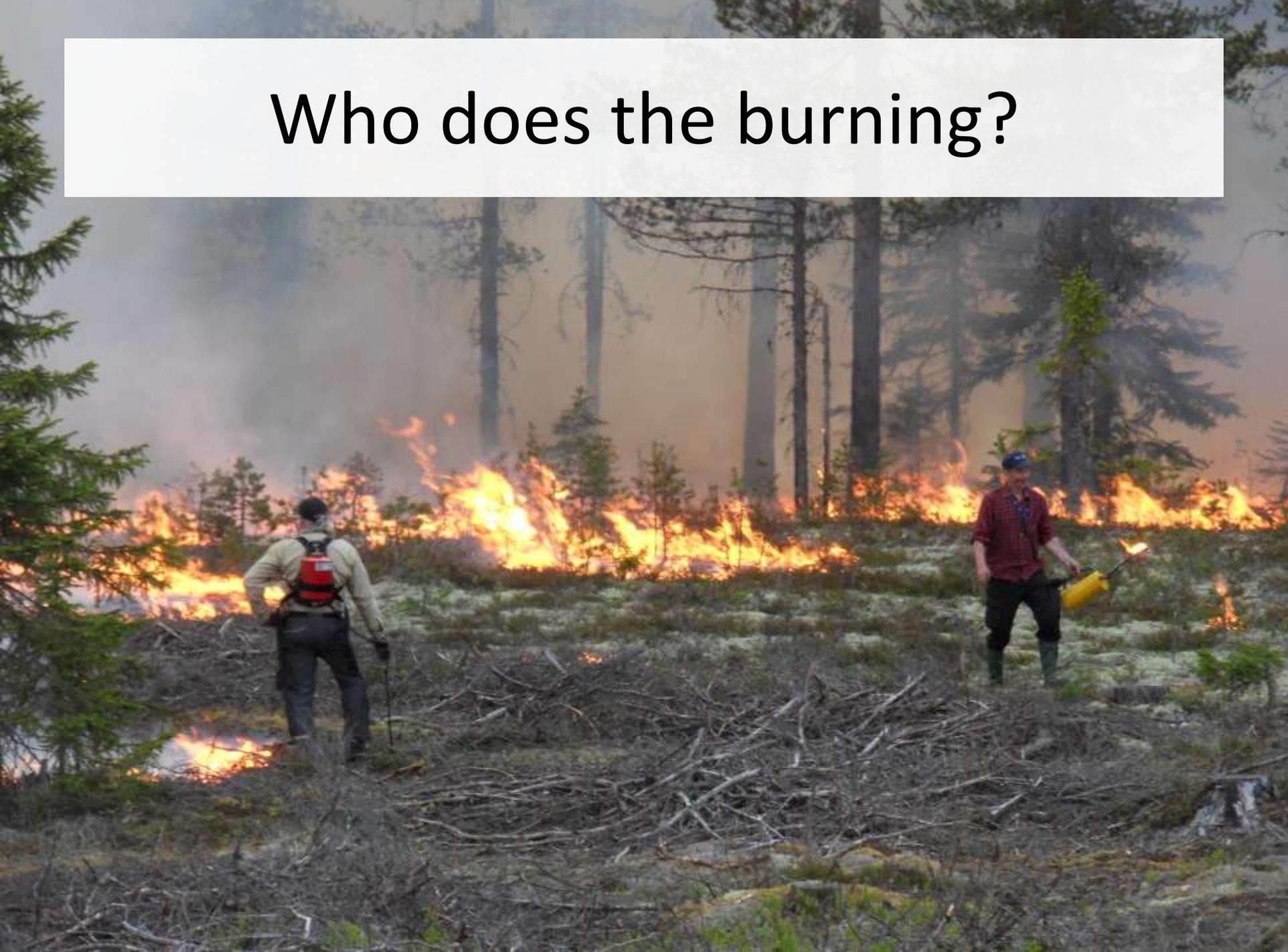






Surviving trees are critically important for the long-term value of burnt sites. Repeated fire-treatment will enhance value further.

Who does the burning?



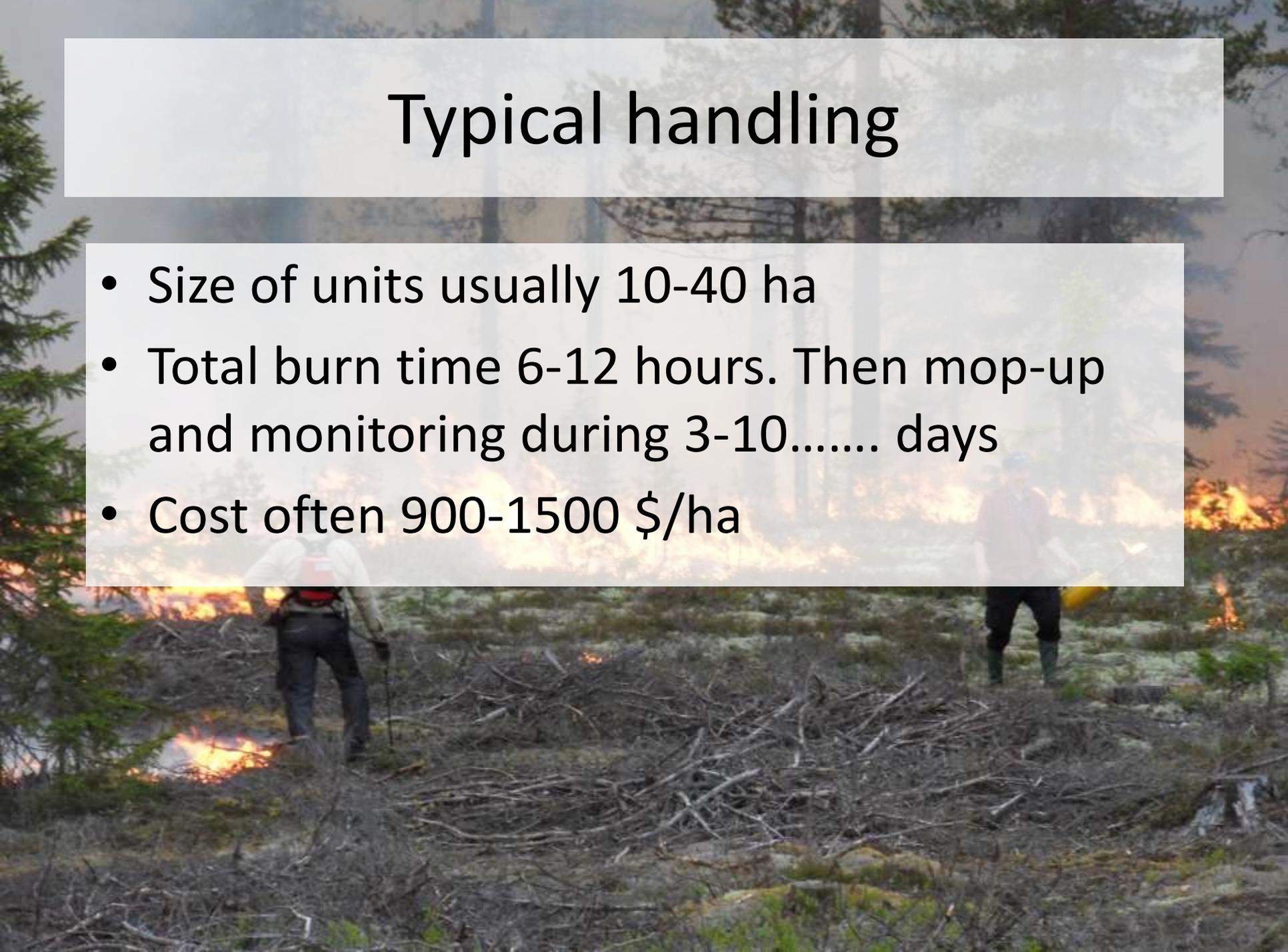
Who does the burning?

- Company-employed, State reserve managers or independent entrepreneurs (including Skogsstyrelsen, the forest service).



Typical handling

- Size of units usually 10-40 ha
- Total burn time 6-12 hours. Then mop-up and monitoring during 3-10..... days
- Cost often 900-1500 \$/ha



Crews

- If helicopter-assisted, minimum three persons on the ground
- If no helicopter, 6-12 persons on the ground.



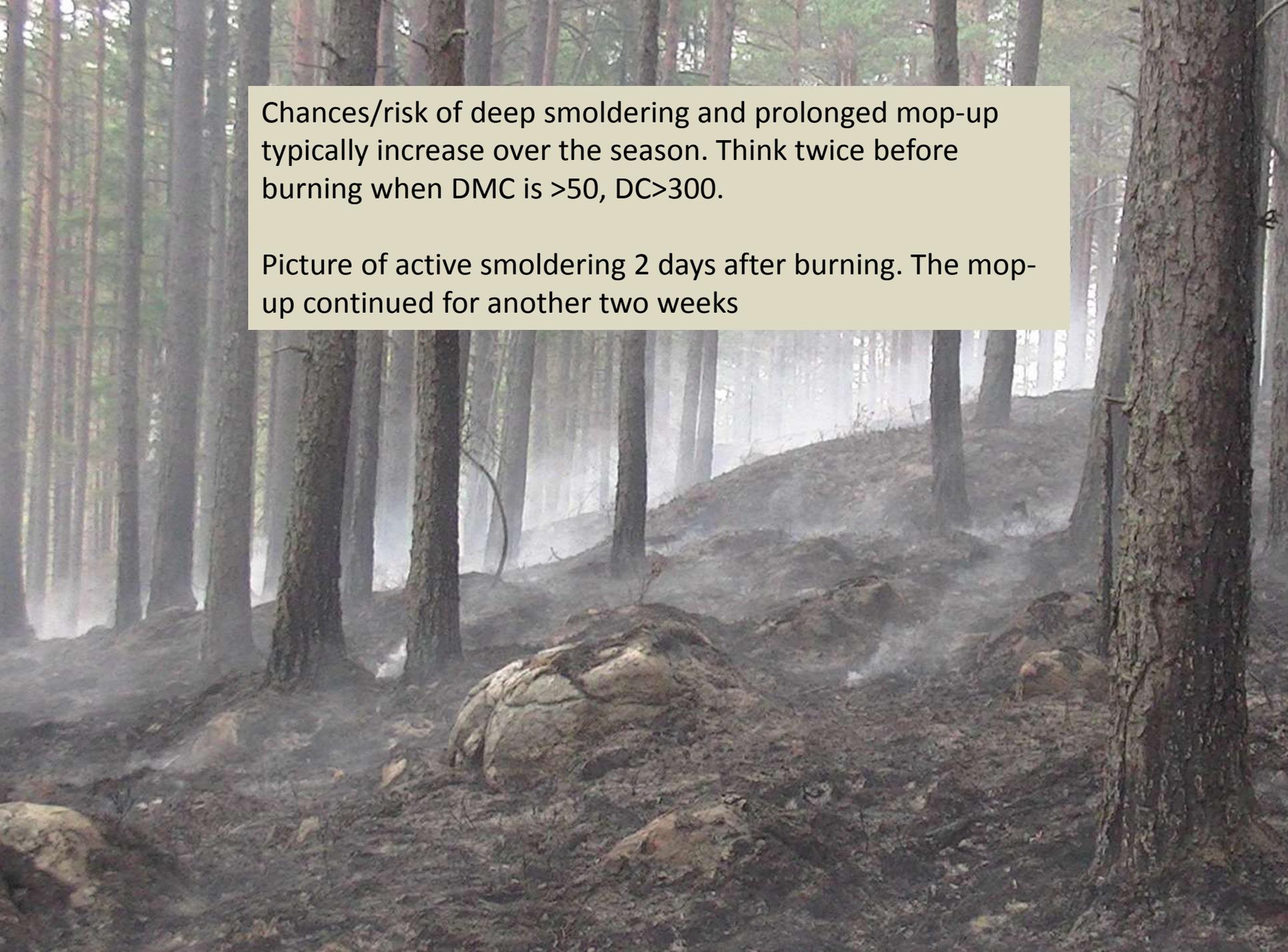
Prescriptions?

- DMC 30-50
- Rh 30-45%
- Wind <5 m/sec
- Intensity will be controlled through ignition pattern. Desired flame lengths usually 1-2 m
- Time of day depends on Rh. Usually start after 11. Sometime burn into night (June)
- Season from late May to late August. Rapidly deteriorating during August

In reality..... Check it out

- Moss/litter "dry" down to (at least nearly so) the bottom of the moss/litter layer in closed forest
- Rh not under 30%
- Wind not over 5 m/sec
- What about the humus layer?



A photograph of a forest with smoke rising from the ground, indicating active smoldering. The smoke is thick and white, rising from the forest floor. The trees are tall and thin, with dark trunks. The ground is covered in dark, charred material and rocks. The overall atmosphere is hazy and smoky.

Chances/risk of deep smoldering and prolonged mop-up typically increase over the season. Think twice before burning when DMC is >50 , DC >300 .

Picture of active smoldering 2 days after burning. The mop-up continued for another two weeks



Keep monitoring to a minimum, but.....

- Document on a map the burn as it progresses: weather (wind, wind direction, temp, Rh) and position of the fire-line every 30 min
- And note the index values afterwards
- Archive for the future

Tools

Canadian FWI-system has been used in Sweden since 1996.

11 km grid, soon 4 km.

Works reasonably well, but.....

- Solar radiation not accounted for
- Canopy effects on evaporation not accounted for
- Diurnal m.c. changes not well covered
- Re-moistening of surface fuels from moist humus not accounted for

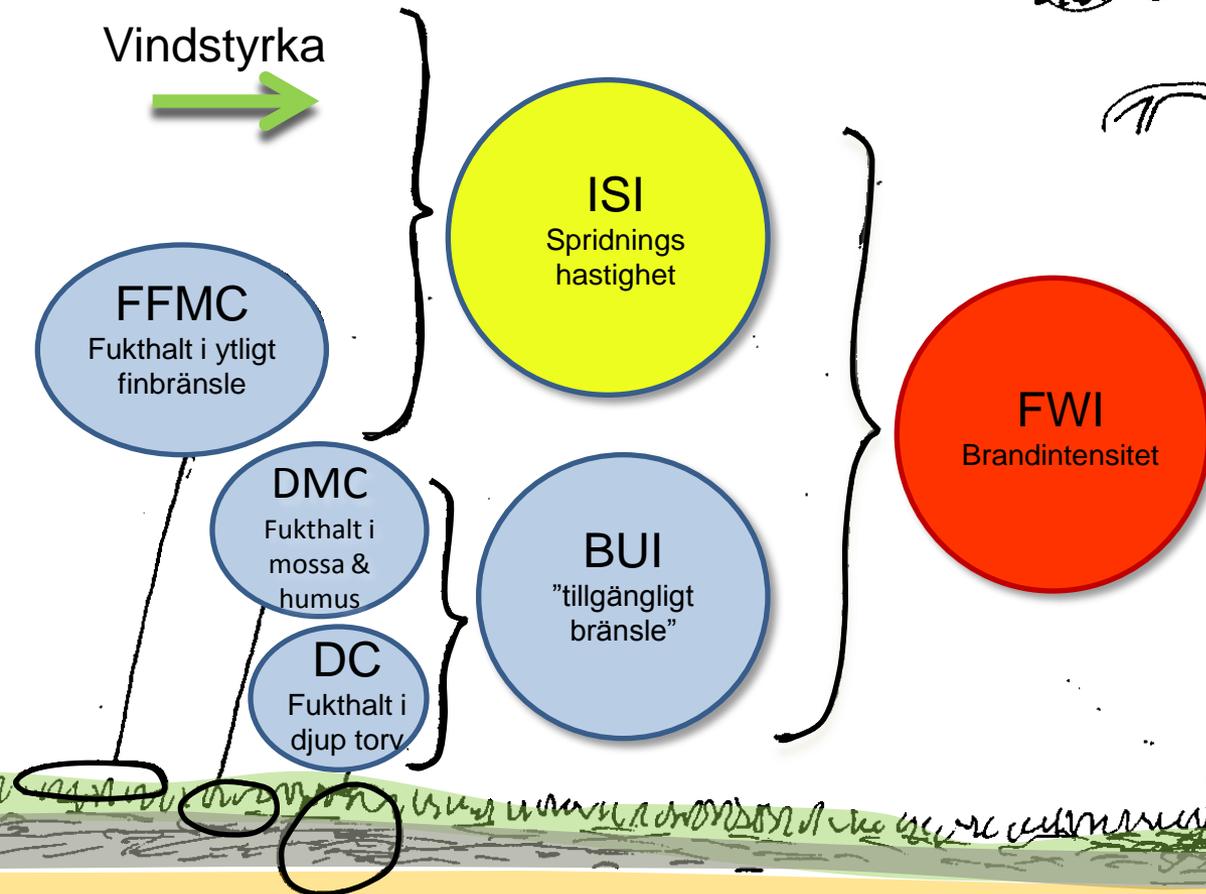
Structure of the Canadian FWI-system

3 indices for fuel moisture (FFMC, DMC, DC)

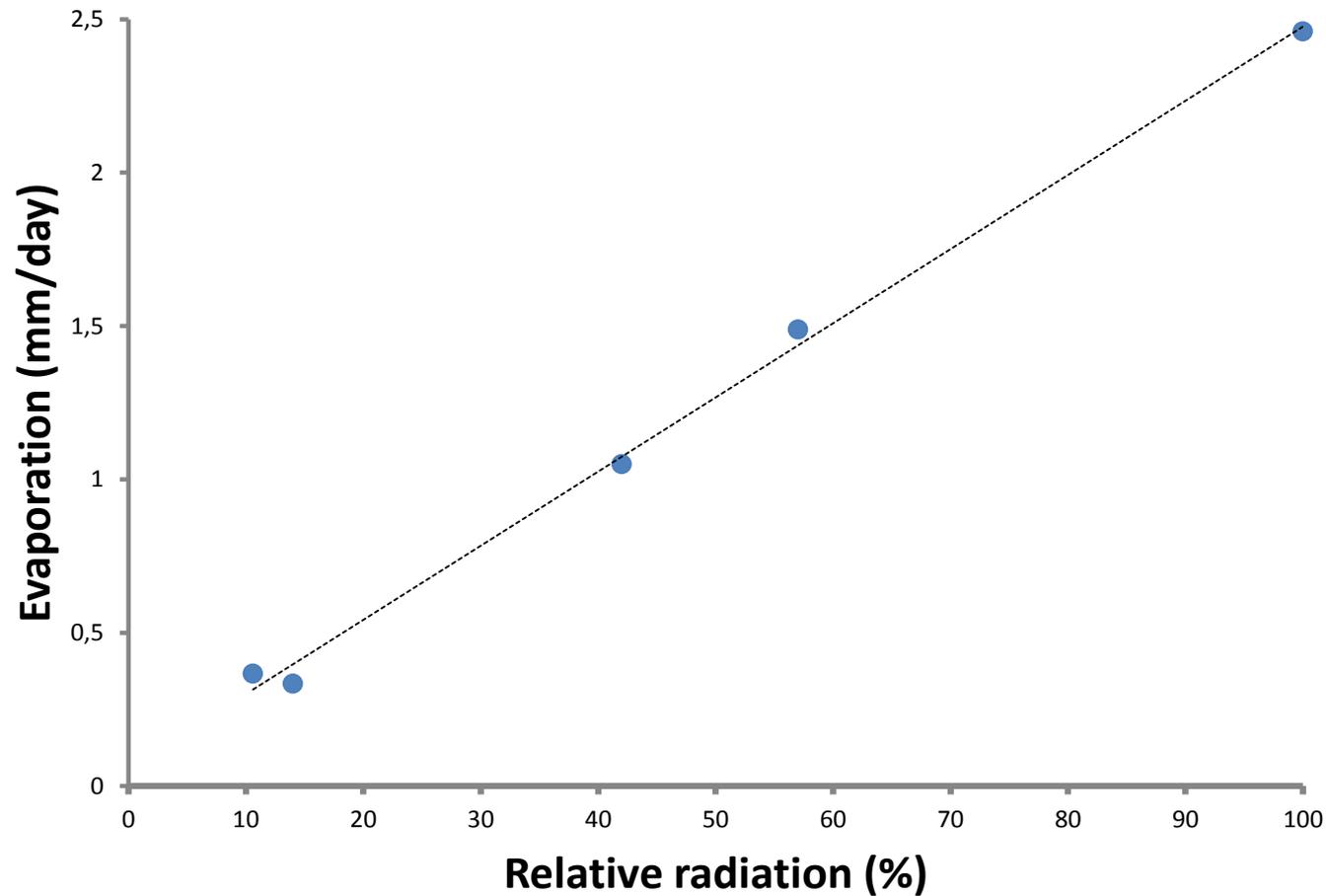
1 index for "rate of spread" (ISI)

1 index for "available fuel" (BUI)

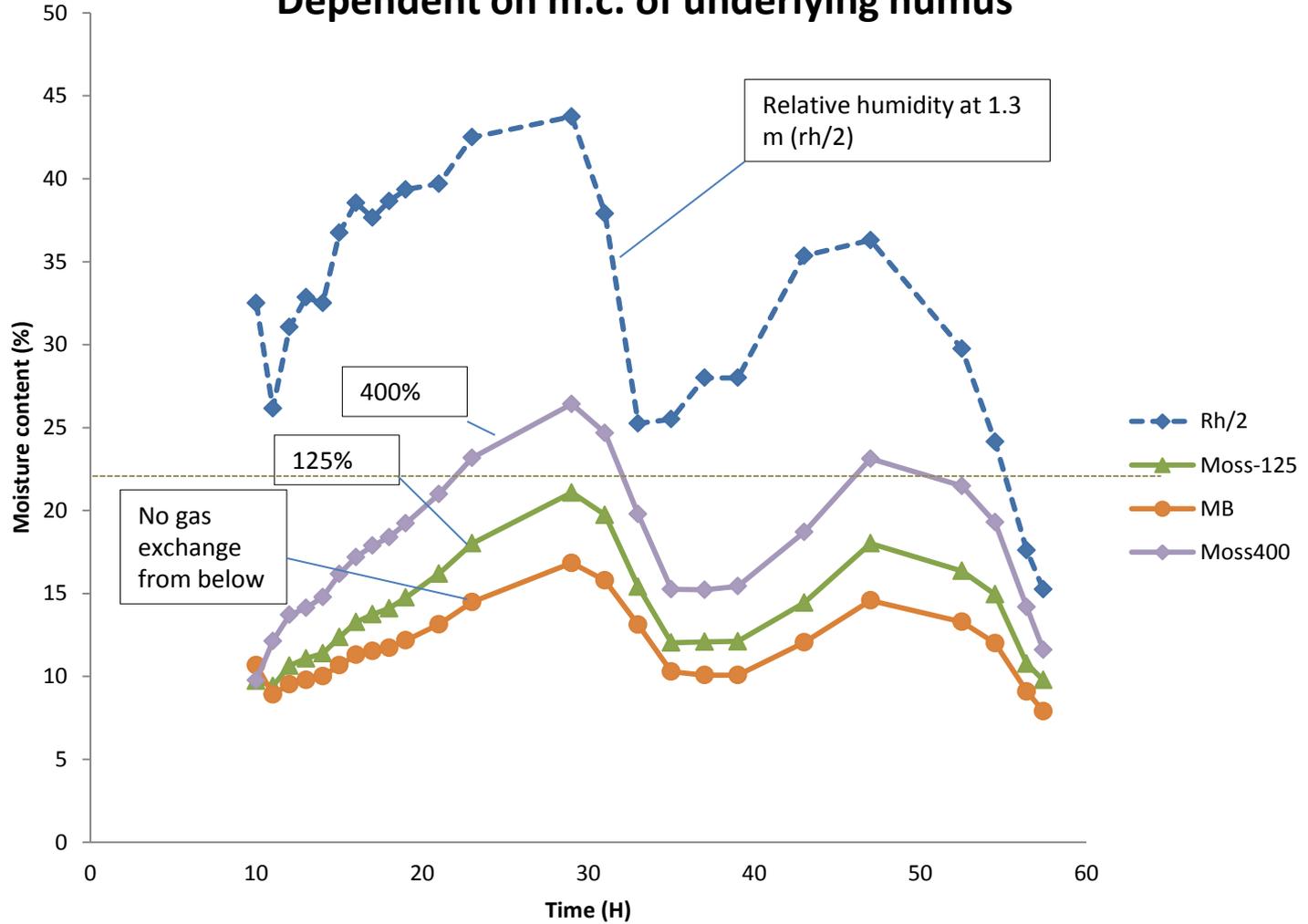
1 index for fire intensity (FWI)



Evaporation from water surface in relation to radiation at 1.3 m. 10-day period



Diurnal changes in rh and fuel moisture content. Dependent on m.c. of underlying humus



A photograph of a controlled fire burning in a forest at night. The fire is concentrated in a pile of brush and debris on the right side of the frame, with bright orange and yellow flames rising. Several tall, thin trees stand in the background, their silhouettes visible against the dark sky. The overall scene is dimly lit, with the fire providing the primary light source. A semi-transparent white text box is overlaid on the right side of the image.

Burning off-hours can be a solution if Rh is too low during the day



Kestrel



User Screen 2



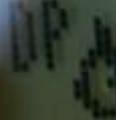
6.4

°C



23.0

%RH



-13.2

°C

Use
calibrated
instruments

Pre-fire cutting?

There are positives and negatives with any cutting. Important to assess the need carefully





Prepare for the unexpected



Pumps will malfunction

Strange things
happen





Helicopters will malfunction

A photograph of a forest fire. In the foreground, several tall, thin pine trees stand upright. The background is filled with intense orange and yellow flames and thick white smoke, indicating a large fire burning in the forest. The sky is hazy and grey from the smoke.

But the fire will burn