Landbúnaðarháskóli Íslands

# Soil warming effects on fine-root turnover in a mature Sitka-spruce forest in southern Iceland

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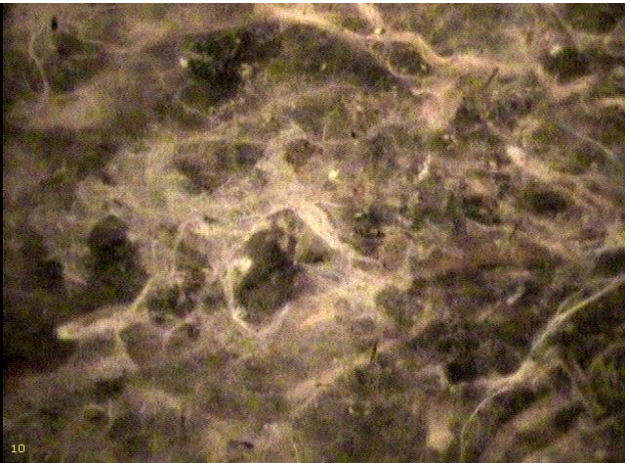
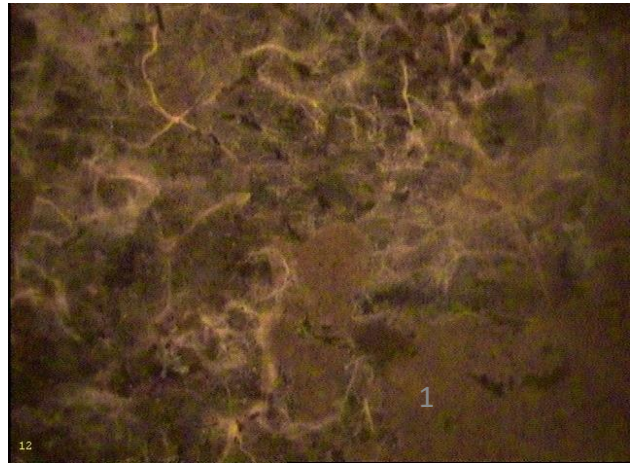


# The aims of the talk

firstly – what is the balance between aboveground and belowground litter input in normal (cold) soils?

secondly – how does this balance change with soil warming?

- MAT in Iceland has increased by >+1.5°C over the last 30 years.
- future warming is expected


The ForHot-forest study site.

Dead spruce trees indicate areas where mean annual soil warming has risen > +10 °C

**Methods and site**

- in 2008, as a result of an earthquake, geothermal systems near Hveragerði (S-Iceland), were disturbed and moved to previously unwarmed areas.

The study area is a planted forest of 50 years old sitka spruce (*Picea sitchensis* (Bong.) Carr.), 12 m high.

Measurements started in 2013.

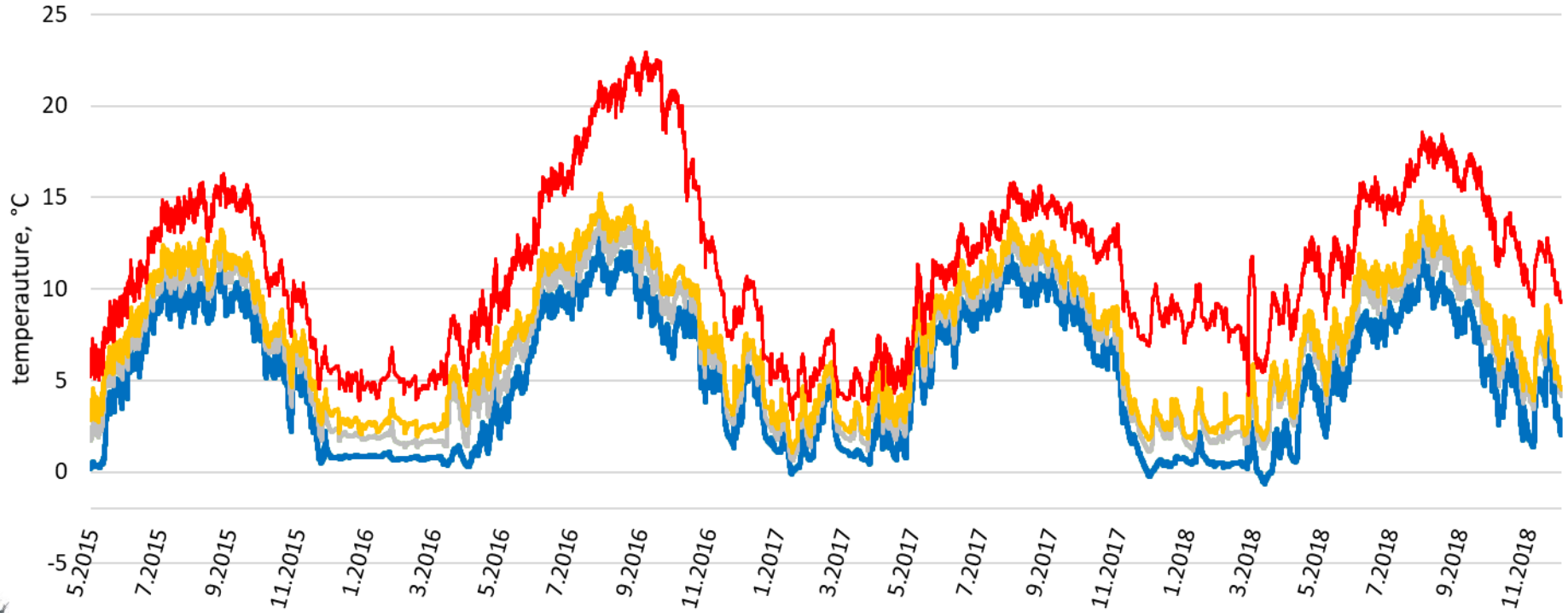
**+5,5°C**

**+2,3°C**

**+1,5°C**

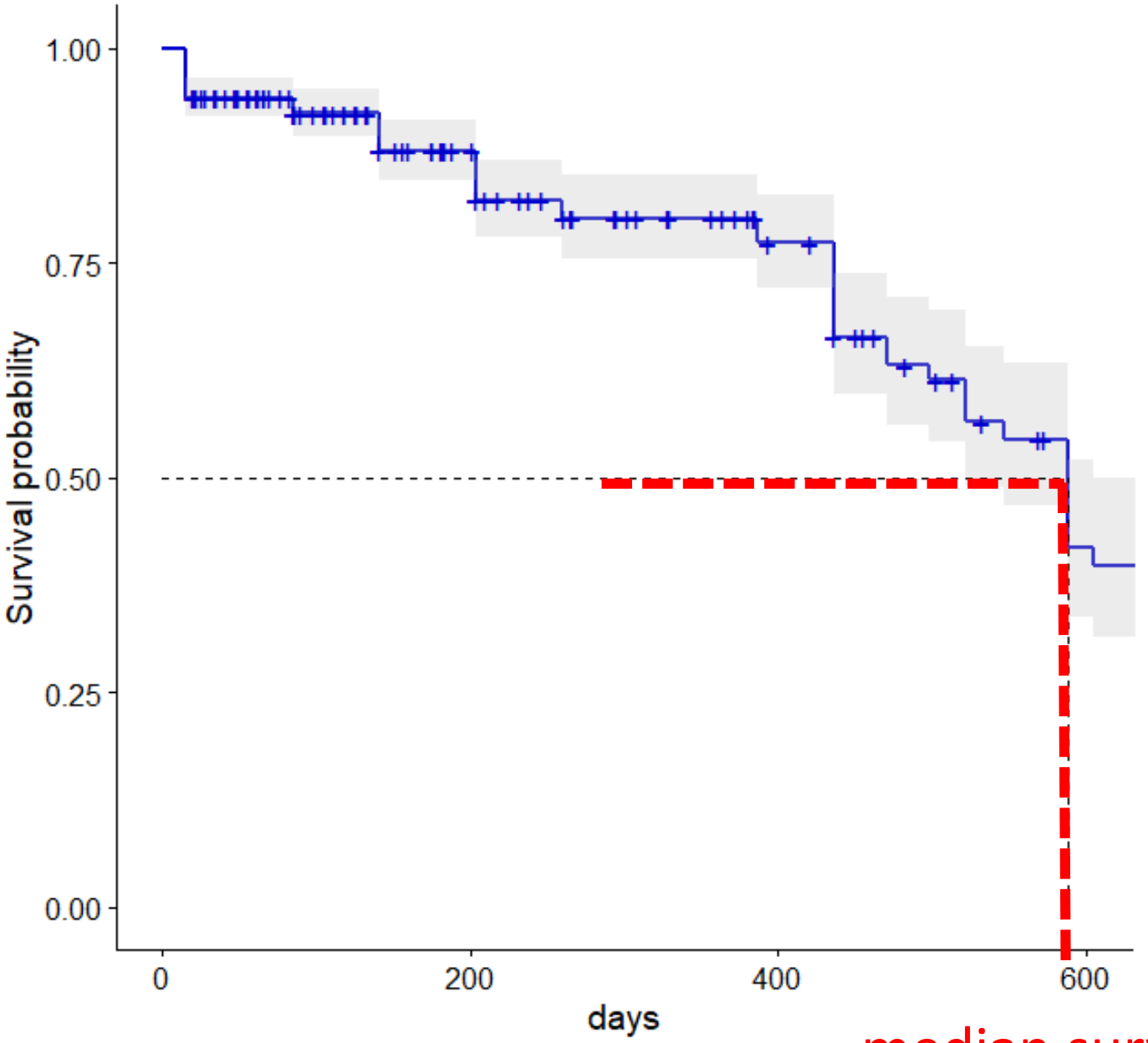
**4,9°C**

**(ambient / unwarmed)**




To measure the belowground litter input, **minirhizotron** tubes were installed 2013, and imaging done in 2017 and 2018.

To measure the aboveground litter input, **litter traps** were installed in the forest floor.

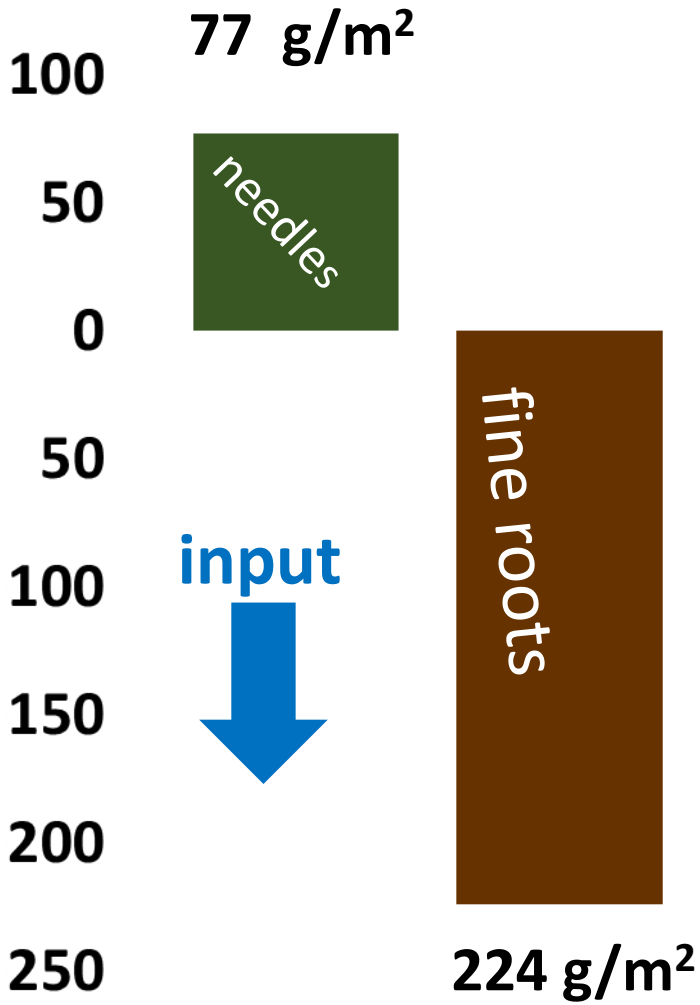



Fine root longevity (by Kaplan-Meier survival curve) and turnover rate

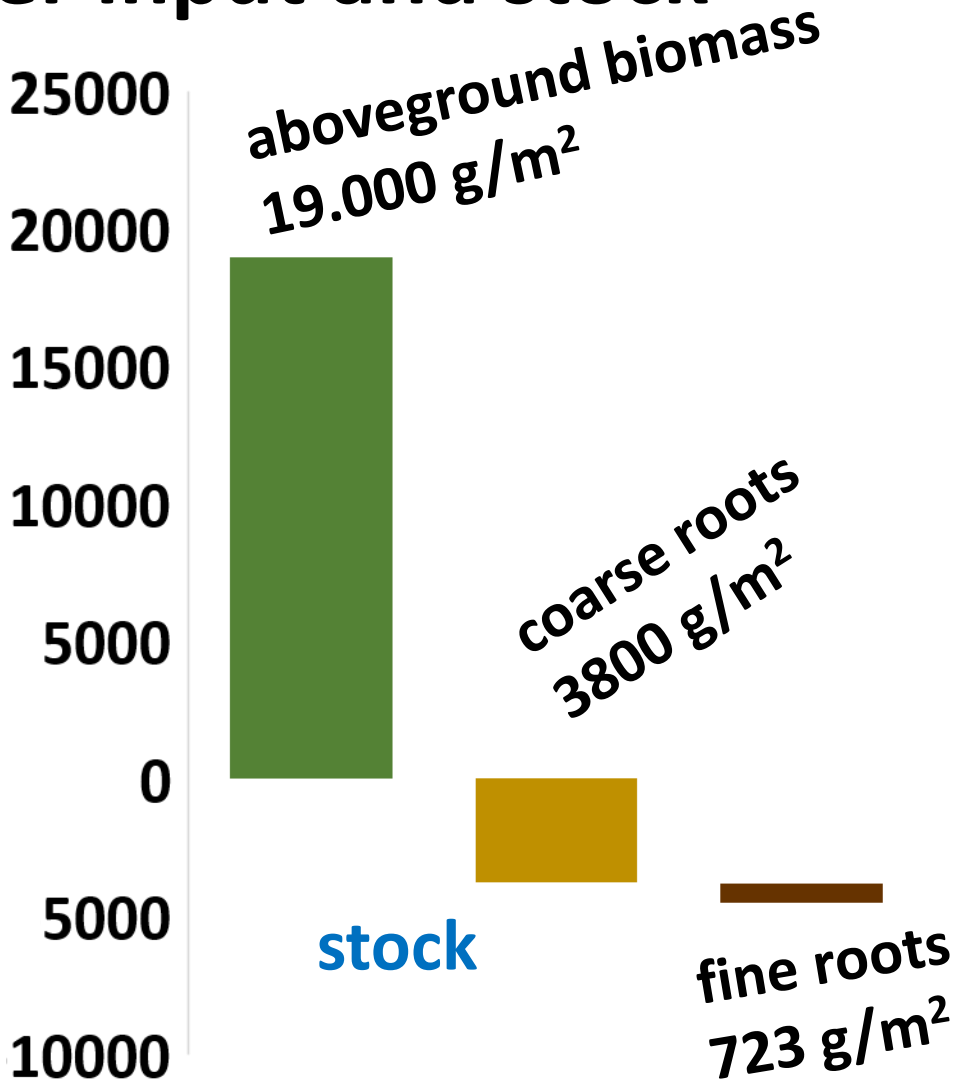
Turnover rate: 0.62 $year^{-1}$

median survival – 588 days

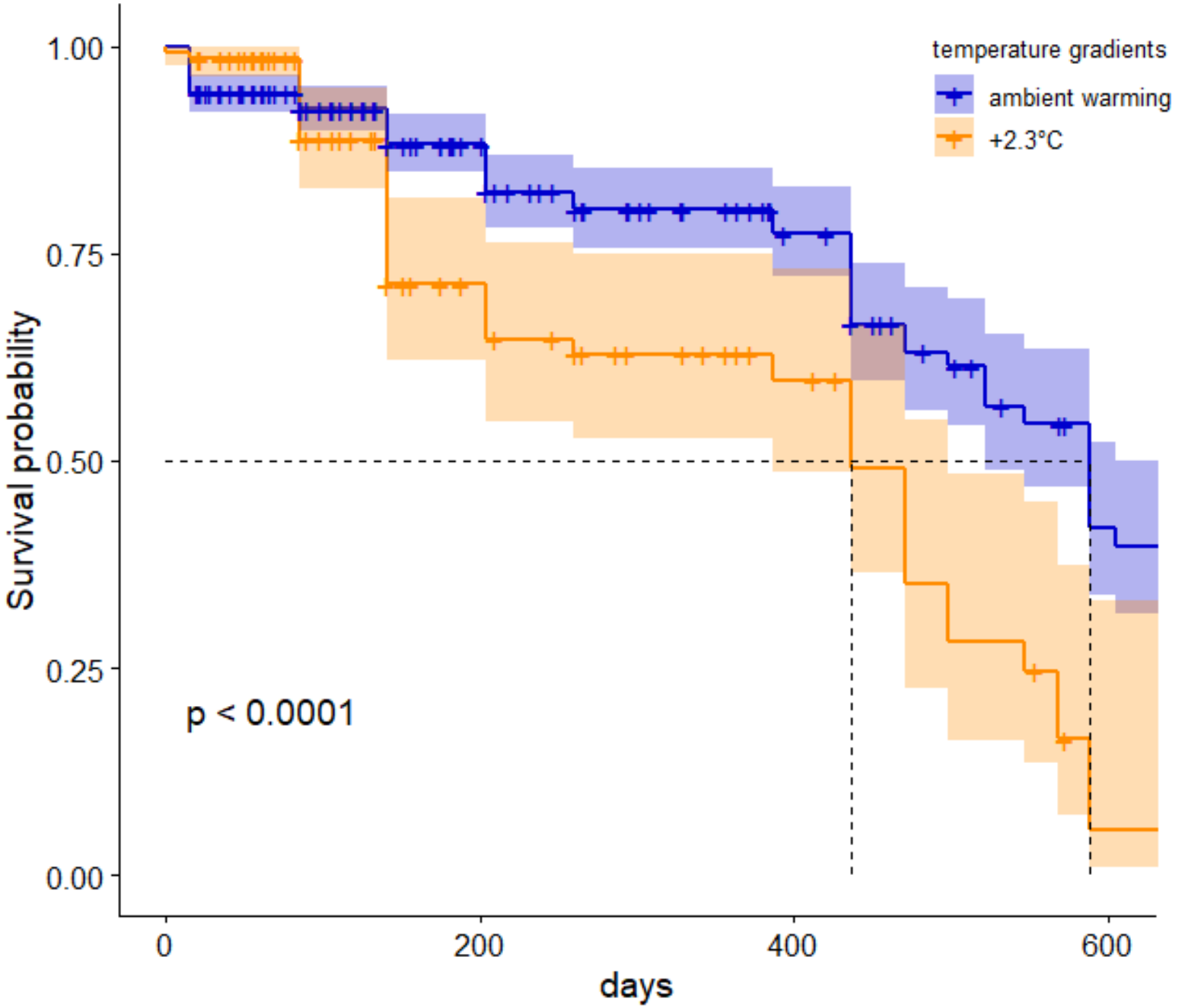
# Aboveground and belowground litter input and stock




A better understanding of carbon dynamics in our forests, both below- and aboveground, is essential




Fine roots are 3.8% and course roots are 20% of the aboveground biomass




# Fine root longevity (by Kaplan-Meier survival curve) and turnover rate

**Turnover rates:**

**ambient = 0.62 year$^{-1}$**

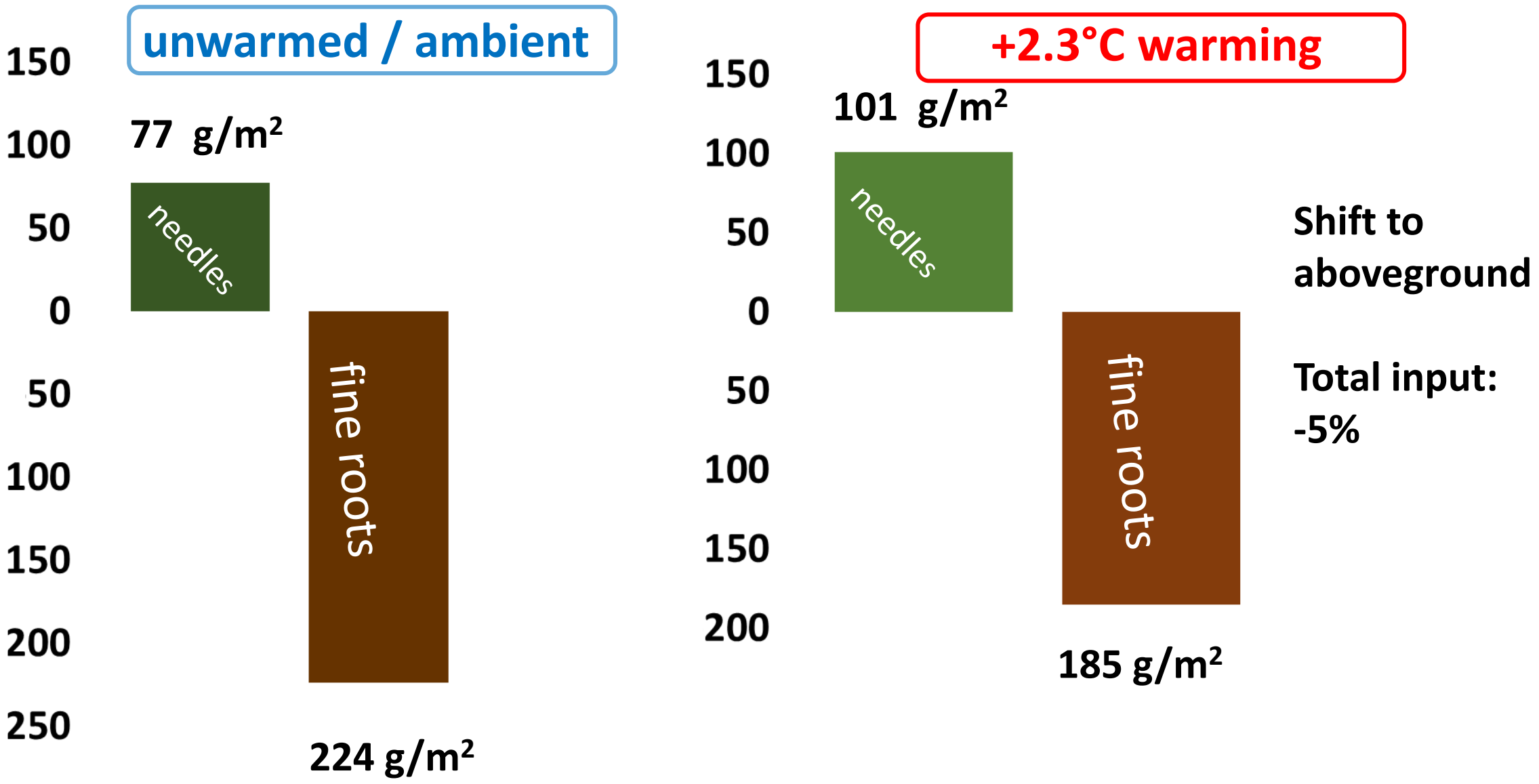
**+2.3°C = 0.84 year$^{-1}$**

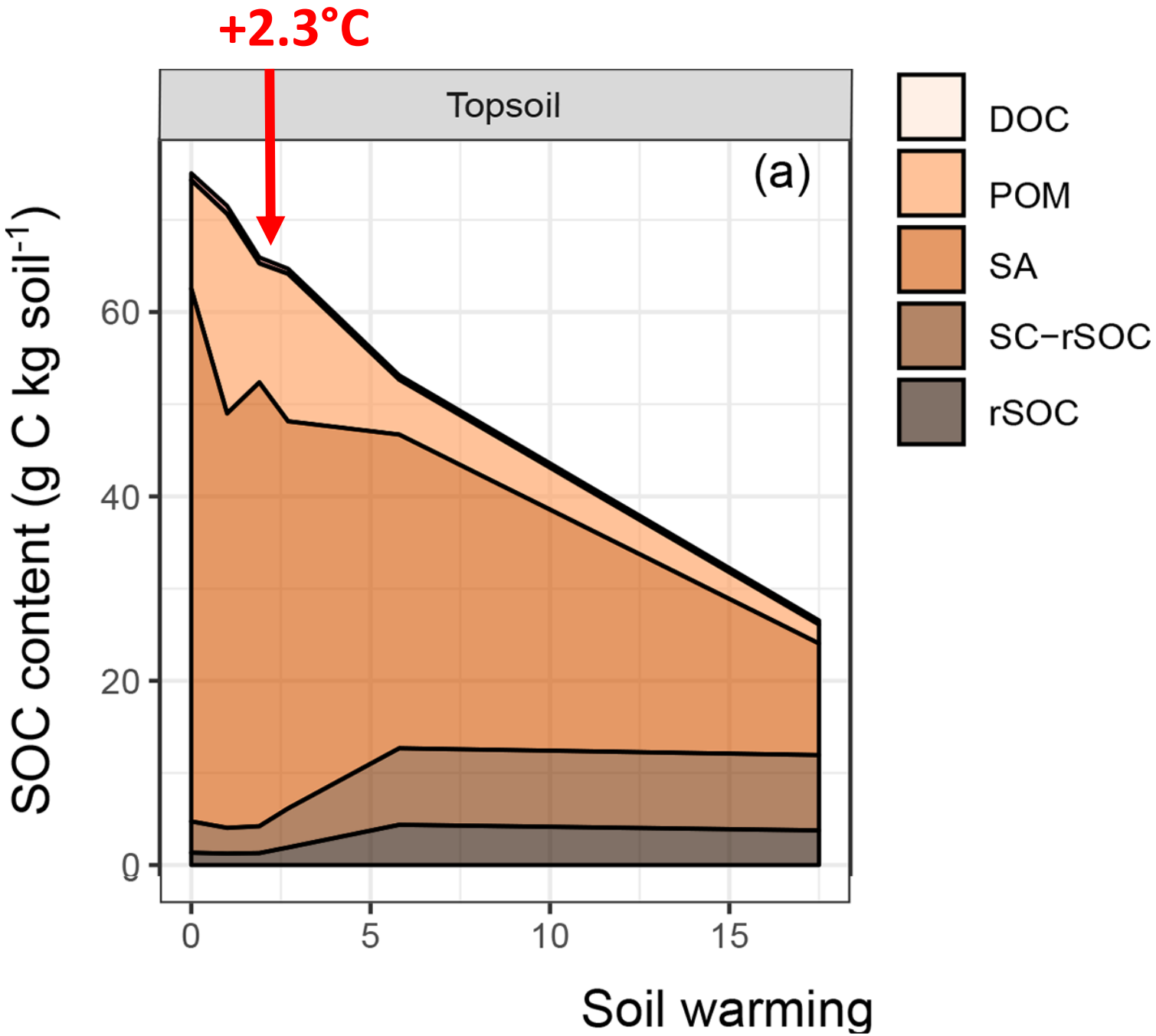
**longevity:**

**ambient - 588 days**

**+2.3°C - 436 days**

# Aboveground and belowground litter input and stock






**Total SOC amount in the upperst 10 cm of the soil.**

**The SOC decreases by 10% with +2.3°C warming.**

**The whole input is similar, but the SOC lowers because of more soil microbes activity.**

**from: Poeplau, Sigurðsson, Sigurdsson, 2020**

# Conclusions

- when the aim of the forest management is to mitigate climate change (-> sequester carbon) the belowground litter input becomes very important.

- we tend to think about soil carbon as a very stable C-stock, but our study shows that it can change significantly within 10 years.

- we need to do more research on forest management and soil C dynamics.