This is a translation of the article Etiënne Thomassen wrote for Nature Today:

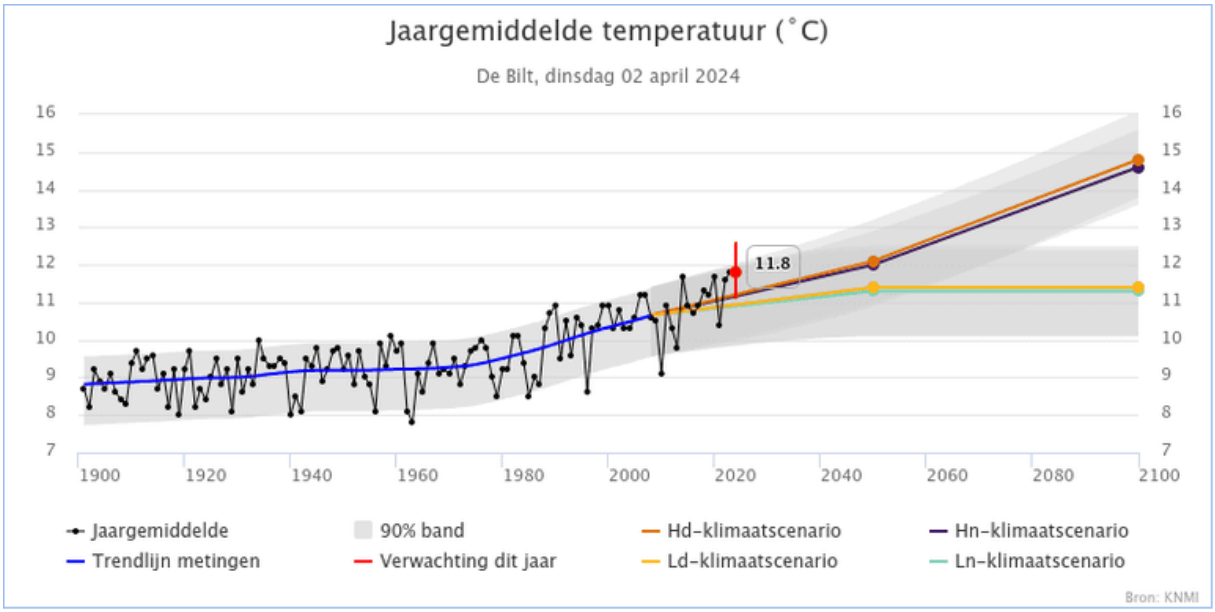
Climate Change and the Necessity of Forest Adaptation

APR-2-2024 – ***Now is the time for forest managers to consider how to address climate change. Climate change and other environmental changes are causing site conditions to change at a pace and scale that our forests and trees cannot easily keep up with. Forest managers and owners must ask themselves whether and how they want to respond to these changes.***

"Uncertainty makes it difficult to determine a strategy, but measures to enhance forest resilience are available. To ensure these measures take effect on time, it is crucial to start the process today," says Etiënne Thomassen, forest ecology and management expert at Bosgroep Zuid Nederland. On behalf of de Bosgroepen, Etiënne is involved in the LIFE project Climate Forest. In this article, he explains the need for forest adaptation and how forest managers can take action.

New Site Conditions

Due to changes in climate and soil, our forests can no longer be compared to past references. Forest managers often use such references of well-developed forest types as templates for the future. Unfortunately, this is incorrect, as by the end of this century, site conditions will have shifted even further from what would be fitting the vegetation we considered natural.



The average annual temperature in the Netherlands is already significantly higher than at the beginning of the 1900s and could rise to nearly 15 degrees Celsius by 2100. (Source: KNMI)

In its driest and hottest scenario, The Royal Netherlands Meteorological Institute (KNMI) predicts an average temperature of 14.9 degrees Celsius for the Netherlands by 2100, which is warmer than Marseille around 1950. Summers are expected to become hotter and drier, with droughts like those in 2018 or 2020 becoming the new normal in that scenario. Winters will become warmer and wetter. The chance of frost after the first bloom will persist but decrease. Extreme heat is also a concern for vegetation, as it directly damages leaves. In extreme scenarios, temperatures of 40 degrees Celsius could occur every other year, with 35 tropical days each year.

Our forests face not only climate change and lower water availability but also environmental pollution, leading to nutrient deficiencies and soil acidification, especially on dry sandy soils. This releases aluminium, reducing the vitality of the trees. Another significant change is the high availability of nitrogen. Our forests originally developed in conditions where limited nitrogen availability restricted plant growth, but that is no longer the case. The site conditions of our forests have permanently changed.

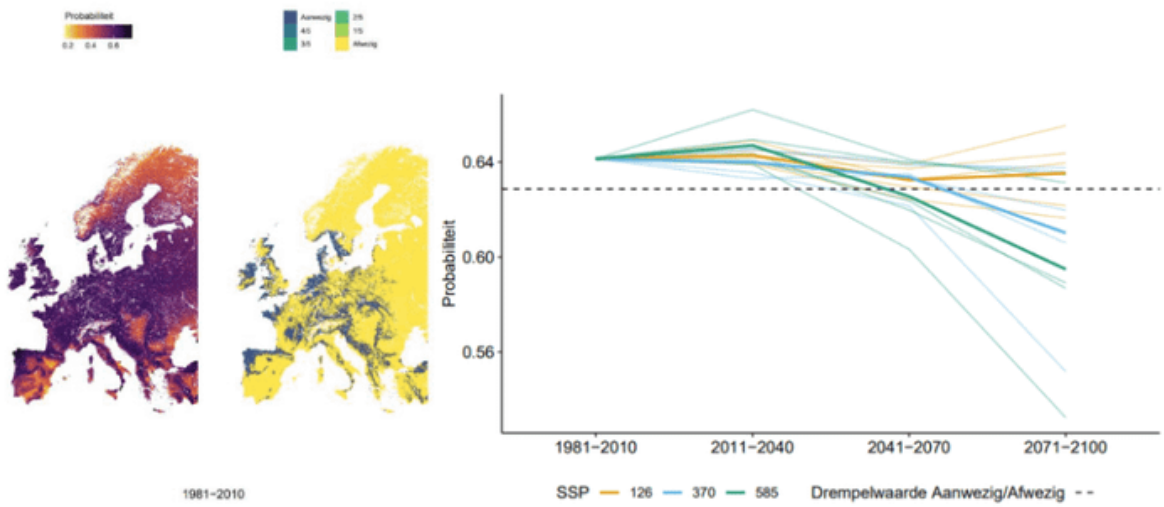
A New Forest

Forest managers are very much aware of the changes in climate and the issues of nutrient depletion, nitrogen enrichment, and drought. At the same time, there is still great confidence in nature and the resilience of tree species. The assumption is often that indigenous tree species have experienced it all, are perfectly adapted to the situation, and will likely cope with future changes as well. Unfortunately, this is no longer accurate. It is true that since the last Ice Age and the colonization of tree species from the south, there have been relatively warm and cold periods. However, it is now warmer than it has been in the past 2 to 3 million years. By 2100, it is likely to be 3 degrees Celsius warmer than before industrialization, which would be warmer than in the past 5 million years, and warmer than humanity has ever experienced. The last Ice Age ended approximately 12,000 years ago. The current temperature rise is estimated to be ten times faster than what usually occurs after an Ice Age. Neither we nor our trees have experienced this before.

In the vicinity of Karlsruhe in Germany, beech, Scots pine, and birch trees are dying in dry and nutrient-poor habitats. This region is clearly drier and about 2 degrees Celsius warmer than the Netherlands is currently. (Source: Bart Nyssen)

Research into Distribution

Extensive research has been conducted on the current and future distribution of tree species under climate change. For many native tree species, habitat suitability may decrease, while conditions improve for several southern European tree species. Some native tree species, such as birch, Scots pine, and beech, are predicted to struggle under significant climate change. These warnings may seem overly dramatic, but similar predictions were made about Norway spruce 20 years ago which now prove to have been correct.



In the Climate Trees project, the future growth of many tree species under different climate scenarios was modeled. This is the prediction for the distribution of the beech. More than half of the scenarios fall below the dashed line, indicating that Flanders will no longer be suitable for this species. The beech may become a high-risk species by the end of this century. (Source: Desie et al. 2024)

These remain predictions, but the risk is undeniable. Important tree species may be lost. Are these consequences manageable or acceptable, or do we want to mitigate this risk? And if we want to take action, what options do we have to reduce the risk?

Management Focused on Adaptation

The main problem for forest managers regarding climate change may be that we are uncertain about what the future climate will look like, making it difficult to respond effectively. However, since trees and forests develop very slowly, we cannot wait until it happens if we want to mitigate the risks. Essentially, forest managers can do two things: ensure the forest is as healthy as possible and maximise diversity. A forest on a healthy soil with vigorous trees is best equipped to resist stress, and a forest with high diversity better prepared to adapt.

In this small-scale forest management, various deciduous tree species are given space to develop under a canopy of black pine. (Source: Etiënne Thomassen)

In a healthy soil, moisture and nutrient supply are in order. Forest managers can support this by helping trees with neutral and rich litter to expand. Stimulateand plant drought- and heat-tolerant tree species, but do not actively remove species that are expected to struggle. Avoid being too dogmatic, as you may for example later appreciate an exotic species like black pine as Scots pine could face difficulties in the future. Small-scale testing and careful monitoring of new tree species and southern provenances can help future generations make informed choices.

By planting small groups of trees in gaps, species composition can be enriched. Here, field maple has been planted, which produces good litter and improves humus formation. (Source: Etiënne Thomassen)

Missing tree species are best introduced through underplanting in existing forests. The forest climate buffers the impact of extreme (heat) conditions. Therefore, the canopy of tree crowns should be preserved as much as possible. Ensure the forest can naturally regenerate under this canopy across the full range of existing species. This often requires wildlife protection measures, but forest regeneration is the natural drive of forest ecosystem adaptation. Regeneration does not need to be abundant everywhere but should include a wide variety of species spread across the forest area.

Finally, in 76 years it will be 2100 already , much less than the lifespan of a tree. The time to consider whether you should and how you could mitigate the risks for your forest is now. Many of the potential measures to enhance forest resilience to climate change can be considered no-regret measures. The demonstration forests of LIFE Climate Forest showcase how such measures can be implemented.