Forest Research

Demonstrating climate change adaptation in Alice Holt Forest

Courtesy of Forestry England

Alice Holt Forest is in northeast Hampshire (southeast England) and is managed by Forestry England. An ancient woodland complex, the forest covers more than 850 ha, and comprises both plantation on ancient woodland sites and ancient semi-natural woodland. Much of the forest has been selected as being of county/regional significance for its biodiversity interest as a Local Wildlife Site/Site of Importance for Nature Conservation. The mix of broadleaf tree species and coniferous woodland provide many benefits for the local community, the environment and for the forestry sector. The forest receives more than 650 000 day visitors each year. The work undertaken at Alice Holt Research Station is of international importance and is the site of historic research trials dating back to 1943. It is therefore essential to retain a healthy and productive forest for the changing climate.

Three demonstration areas have been set up to show climate change adaptation in woodland typical of the southeast of England. Those interested in woodland management visit areas to see different adaptation measures being applied and discuss what measures might work best in their woodlands.

Management objectives

Alice Holt Forest has multiple management objectives, including recreation, wildlife conservation, timber production and education. The demonstration areas, co-developed by Forest Research with Forestry England, show aspects of adaptive practice on the public forest estate to inform future forest management in Alice Holt Forest and other sites in this part of England. These areas help us to better understand the process and impact of implementing adaptive practice and share learning about adaptation actions in forestry. They also inspire adaptive management in the forestry sector and improve the resilience of forest stands to environmental change.

Risks and opportunities

Main climate change risks

The climate projections for Alice Holt Forest include milder winters and hotter, drier summers, and consequently more frequent drought episodes that could impact many tree species.

Find detailed information in UKFS Practice Guide *Adapting forest and woodland management to the changing climate*.

Information on the UK Forestry Standard and supporting guidance is available at www.forestresearch.gov.uk/ukfs

Vulnerabilities

The likelihood of drought occurring is projected to increase by between 10 and 50% by the 2080s. Many tree species are susceptible to drought, but repeated episodes of drought, as well as longer, more intense droughts, have been found to increase tree mortality in a number of species. More frequent severe droughts could lead to reduced tree growth, loss of biodiversity and a failure to achieve management objectives, such as those relating to carbon uptake and storage to help mitigate greenhouse gas emissions.

Identifying and selecting measures

The adaptation areas were chosen after a review of the management objectives for Alice Holt Forest. The adaptation measures were selected following an analysis of species suitability under future climate conditions using ESC, the **Ecological Site Classification decision-support system** for each area. *Successful Underplanting* (Kerr and Haufe, 2016) informed various decisions about the shade tolerance, planting density and tree spacing. The new areas were then incorporated into the latest Forest Design Plan for Alice Holt Forest (2016–26) and subjected to the Forest Design Planning Process, which included public and statutory public consultation. Following this, prescriptions for each measure selected were developed by the forester and researchers from Forest Research.

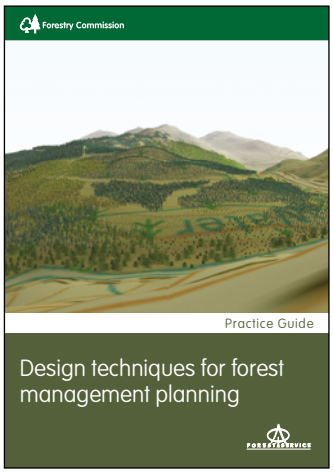
Implementing adaptation measures

In one area, a stand of mature Corsican pine growing on sandy soil was underplanted with a pair of species—hornbeam and beech—in the spring of 2018. Both species are currently present in Alice Holt Forest, although hornbeam is much less common than beech but has a higher drought tolerance than beech. These species were planted to show that while some tree species are expected to perform better in hotter, drier conditions, current species that are expected to suffer as a result of drought, such as beech, need not be omitted, but might be planned to contribute a lower percentage of the future species mix.

In the second area, young Corsican pine has been thinned to two different intensities. Hotter, drier summers increase competition for water so there should be less competition and less drought stress evident in trees where heavier thinning has been undertaken. An additional benefit is that this may reduce the impact of some tree diseases due to the increased airflow through the stand.

The third area is situated under a mature beech stand. This area demonstrates a comparison of natural beech regeneration with underplanting with oak of native origin and from a more southerly provenance. Tree provenances from a more southerly climate may perform better in the future; however, we need to find out more about how trees will grow under different conditions, such as new rainfall patterns and the interaction with the heavy soils in this area.

A mixture of provenances should also provide some insurance against uncertain conditions in the future and will widen the genetic base to enhance the long-term adaptive capacity of the developing stand. We expect that the new plantings will, in time, show a contrast in the growth and performance of the local and introduced provenances. This demonstration area should highlight impacts of provenance selection, whether positive (e.g. improved growth and survival) or negative (e.g. increased susceptibility to late spring frost or pest outbreaks).



Forestry Commission Practice Guide *Design techniques for forest management planning*

Beech (*Fagus sylvatica*) underplanted in a stand of Corsican pine (*Pinus nigra*) in Alice Holt Forest.

The other benefits of this adaptation measure are increased tree species diversity within the stand and a wider range of tree ages.

Monitoring and assessment

Detailed baseline assessments of environmental factors were undertaken prior to implementing measures, including an assessment of soil type and moisture, vegetation, tree density, stem diameter and stand height. Monitoring of the beat-up rate (i.e. the number of trees that need to be replaced due to mortality), soil moisture and tree growth are ongoing. The response of the mature Corsican pine to high-wind events, now the canopy is more open, is also of interest.

In the second area, tree stem radial and height growth and soil moisture content are being monitored to better understand the effectiveness of the approach to adaptation, particularly during dry periods. Feedback from visitors to the demonstration is providing useful insights into current understanding of adaptive practice and its application.

Lessons learnt

The adaptation measures identified were to avoid negative future impacts of climate change and benefit from any opportunities, for example, reducing disease risk. Several barriers to the adaptation actions were identified. These include the cost of fencing, sourcing planting material, a variety of information concerning how to approach adaptation and the practicalities of removing mature Corsican pine after underplanting.

A self-guided **climate change adaptation trail** takes in the demonstration areas. Other points of interest along the trail include historic research trials and the Alice Holt Arboretum, which are today of renewed interest to those considering how to best adapt woodland to the changing climate. Adaptation in the Holt Pound Enclosure is explained in more detail in the worked example.

Intended future outcomes

The practical experience of a range of adaptation measures in Alice Holt Forest, and the monitoring of their impacts on stand resilience, will inform the adaptation of other woodlands across the public forest estate in the southeast of England. This will support efforts to increase awareness of the range of adaptation measures available and the process of adaptation decision-making. This will help the forestry sector to confidently implement adaptation measures and shift away from a business-as-usual approach.

This case study is one of a number supporting the UKFS Practice Guide on *Adapting forest and woodland management to the changing climate*

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