Ensuring planted forestry remains light on its feet as the planet warms

A warming world casts a shadow over our planted forestry estates. Climate change places tree productivity at risk and investment patterns make it harder for established forests to adapt.

Biological response rates and a long harvest cycle tend to make forestry a slower-moving primary sector that can be vulnerable to fast changes.

How best to respond? In 2005, SLMACC supported a wide-ranging research study led by Scion to investigate the effect of climate change on New Zealand's planted forests in the coming century, with a focus on impacts, risks and opportunities.

The collaboration involved local and international researchers across a range of disciplines, including environmental science and entomology.

The study first offered a snapshot of current knowledge on likely climatic changes and the impacts on plantation productivity. Second it reviewed how abiotic (wind and fire risks) and biotic (insects, diseases, weeds) factors could affect forests as the planet warms.

Their 2008 publication, *The Effect of Climate Change on New Zealand's Planted Forests,* also sets out an interdisciplinary framework to describe direct and indirect impacts, allowing the sector to identify important knowledge gaps and uncertainties, and find ways to address them.

Researchers concluded that adaptation options for future forests were mostly transformational, based on better, more resistant tree species matched to site-specific risks and environments.

Some direct climate impacts were seen as positive for tree growth. Higher concentrations of carbon dioxide in the atmosphere, for example, meant radiata pine productivity was expected to increase by an average of 19 percent by 2040 and 37 percent by 2090.

Storms, wind and fire could, however, seriously affect mortality and timber production. This was because of direct and indirect climate-induced changes to the wider forest ecosystem.

Wind posed a significant physical risk to forests. The degree of wind risk related to a stand's vulnerability to toppling or breakage.

Moderate increases in wind speed would not unduly affect many stands, but vulnerable stands will be susceptible to small changes in the wind climate.

Fire risk, arising from the combination of weather, ignition sources and fuel, was discussed. In a warming world, the frequency, intensity and activity of fires would change, extending both the fire season and area burnt.

Increasing temperatures, higher wind speeds and lower rainfall and/or humidity would see fire risk increase.

Browsing insects and pathogens could reduce productivity and degrade trees. Changes in temperature and rainfall could prompt sudden expansions in pest populations and their habitable range.

Climate would influence the growth and development of natural predators of pests, with consequent flow-on effects.

Weeds were expected to respond to increases in temperature and carbon dioxide, subject to constraints from rainfall and nutrient availability. Researchers concluded that, overall, this will probably result in warm-adapted weeds colonising new locations, and current "sleeper" species could become more of a problem.

Wider weed distribution, and more aggressive growth, would increase competition with trees for nutrient and water resources, and probably lower stand productivity.

Scion researcher and co-author Thomas Paul said the 2008 study was a useful overview of the then known implications of climate change on plantation forests, the foundation of a multibillion dollar export industry.

"Our report outlined the degree of vulnerability and risks that our plantation forests could face but also provided starting points to mitigate these risks (e.g., better fire-management)."

"It also highlighted potential positive effects that could be harnessed to our advantage in the future. It proved to be an important report to guide future research to help the forestry sector to adapt and to inform policy makers and practitioners alike."