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Preparing for the change: Megatrends – navigating New Zealand's future forestry challenges and opportunities

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Abstract

The world is changing rapidly, and this will impact existing forests well into the future. Therefore, managers and policy-makers will be challenged to explore their desired future and shape it within the context of rapid and turbulent change. This paper outlines the global megatrends influencing the future of not only the world but, consequently, forestry in New Zealand. We also identify the various methods necessary to understand potential implications for New Zealand's forestry sector to ensure resilience and preparedness for the future. This paper concludes by identifying research gaps and new potential tools for forestry to capitalise on the benefits of embracing megatrends.

What are global megatrends?

Megatrend is a broad term often used in scenario planning literature. John Naisbitt (1929–2021) was the first who coined and popularised the concept in his book *Megatrends: Ten New Directions Transforming Our Lives* published in 1982, which he believed was the most important direction of change in the USA economy at the time (Naughtin et al., 2024; Pęciak, 2016). Naisbitt defined megatrends as the most important transformation processes observed in societies (Naisbitt, 1984). Since then, many individuals and organisations have adopted and applied the concept as a strategic foresight approach (European Environment Agency, 2023; KPMG, 2012; PWC, 2014). Megatrend is defined as trends that are global and

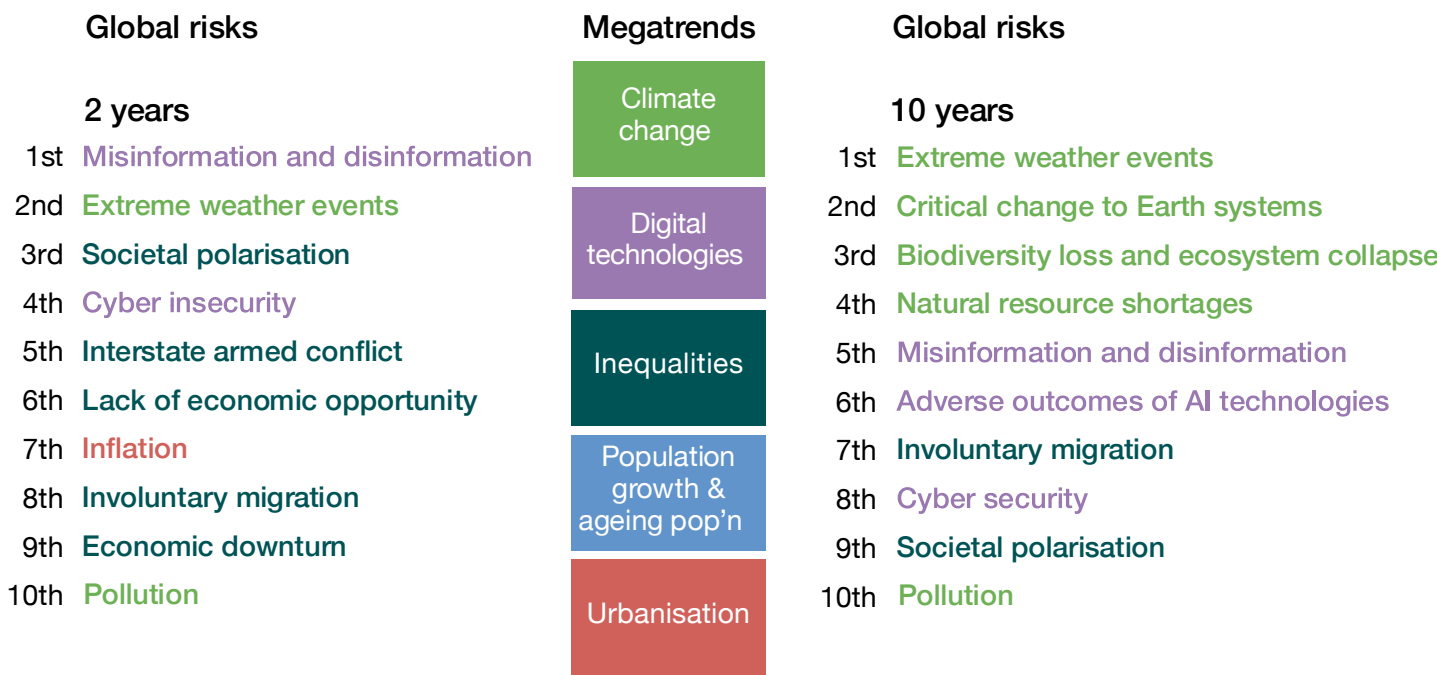| Global risks	Megatrends	Global risks
2 years	Climate change	**10 years**
1st Misinformation and disinformation		1st Extreme weather events
2nd Extreme weather events	Digital technologies	2nd Critical change to Earth systems
3rd Societal polarisation		3rd Biodiversity loss and ecosystem collapse
4th Cyber insecurity	Inequalities	4th Natural resource shortages
5th Interstate armed conflict		5th Misinformation and disinformation
6th Lack of economic opportunity		6th Adverse outcomes of AI technologies
7th Inflation	Population growth & ageing pop'n	7th Involuntary migration
8th Involuntary migration		8th Cyber security
9th Economic downturn		9th Societal polarisation
10th Pollution	Urbanisation	10th Pollution

Figure 1: Aligning the global risks ranking by severity over the short (2 years) and long term (10 years) (based on The Global Risk Report 2024 of the World Economic Forum) with five megatrends (central pillar)

call for strategies for adaptation (Retief et al., 2016). The United Nations identified global megatrends as significant, transformative forces that shape the world and have far-reaching consequences for societies, economies, environments and individuals (UN, 2022).

Megatrends are considered gradual in their influence, but also powerful trajectories of change that can potentially throw big companies and businesses into freefall (Hajkowicz, 2015) if they are not considered in business plans. Five global megatrends that are significant, transformative forces with far-reaching consequences for economies, the environment and individuals have been identified (UN, 2022). They are climate change, demographic shifts, income inequality, technological progress and urbanisation. These megatrends are such extraordinary events that they tend to have lasting and permanent effects. According to Robinson (2023), in today's business environment, all companies must comprehend their socio-political market and adapt to geopolitical changes to ensure long-term survival and success in their business operations.

Considering these global trends is a first step into the future for the New Zealand forestry sector. Megatrend analysis is an example of foresight that complements traditional forestry sector outlook studies (Robins & Kanowski, 2019). The relevance and significance of these megatrends are reinforced by the top risks (or threats) identified by the World Economic Forum and their severity (Figure 1). Scenarios can also help further our understanding of the interlinkages (Figure 2) and consequences of the megatrends and global risks (e.g. the CSIRO 2024 outlook for agriculture). An urgent in-depth analysis of the New Zealand forestry sector is necessary to prepare for the disruptions caused by these megatrends.

How will megatrends impact New Zealand's future forestry sector?

Megatrend analysis is increasingly used to explore future scenarios in forestry (e.g. medium and long-term effects) (Bengston et al., 2024; Robins & Kanowski, 2019). Understanding megatrends provides a basis for understanding the drivers of change and how these trends might shape the future of forestry in New Zealand. Below are some examples of how these megatrends can impact the future of New Zealand's forestry sector.

1. Climate change

This is the most prevalent and far-reaching trend. It is expected to increase the frequency and severity of natural disturbances. These disturbances, including wildfires (Figure 3), windstorms, droughts, floods, bark beetles and root rot, are currently impacting European and other northern hemisphere forests (Vacek et al., 2023). These disturbances mainly affect forest product markets at regional and national levels and less frequently
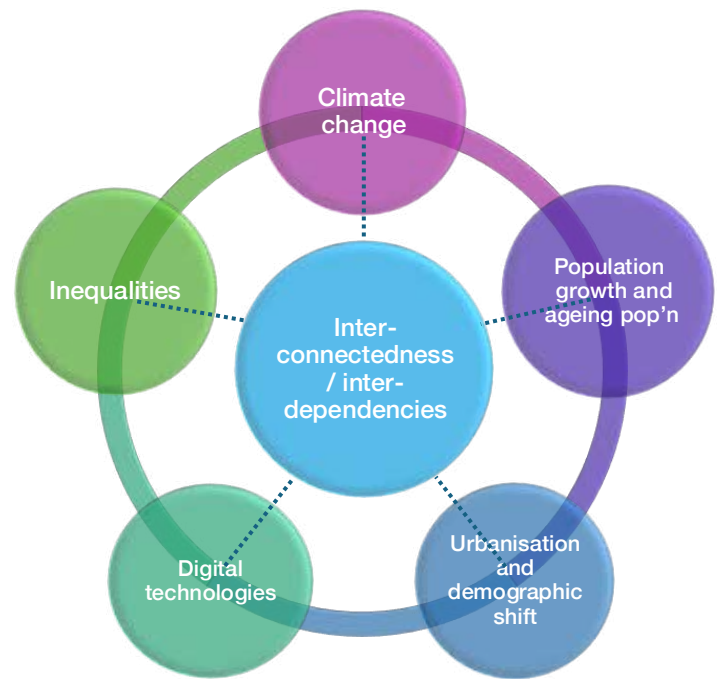

Figure 2: Interconnectedness and interdependencies of megatrends

at the international level. Furthermore, climate change will affect the growing condition and distribution range of tree species.

Challenges: Climate change can increase the frequency of disturbances like fires, droughts and storms, diminishing the role of forestry in the country's economic engine and its contribution to carbon sequestration. The decline in forest productivity will result in fewer forestry workers, leading to increased unemployment. Moreover, there is a rise in climate change-induced migration, as people from nearby Pacific islands (affected by sea-level rise) or due to flooding (like Cyclone Gabrielle) relocate to areas with lower vulnerability. This migration may have a significant impact on long-standing community residents, potentially resulting in conflicts and competition for resources.

Opportunities: Transformed forest landscapes and forest-based climate change mitigation and adaptation efforts, including wide-scale forest landscape restoration initiatives, are a projected response (addressing concentration risk or issues such as slash management). Genetically engineered trees are seen as a way to be scaled up sufficiently and are being used to enhance the carbon-capturing capabilities of trees (Bengston et al., 2024). Lab-grown wood is being proposed as a new solution that involves the selective cultivation of tuneable plant tissues using scalable, land-free techniques that are not limited by seasonality, climate or local resource availability (Beckwith et al., 2021; Bengston, 2021). Like lab-grown meat, the proof-of-concept of lab-grown wood can lead to the more efficient production of biomaterials,

Figure 3: Port Hills fire 2017

conservation benefits and a new approach to forest ecosystem management (Bengston, 2021).

2. Population growth and demographic trends

These have implications for the use of energy and materials and competition with food. Population growth alone (projected to be more than 9.5 billion people globally by 2050) will generate unprecedented pressure on goods and services provided by forests. It is projected that the biggest population growth will be happening in Africa and Asia. On the other hand, demographic trends, such as an ageing population, are predicted to continue until 2050 (UNDESA, 2020; WHO, 2024). As the population ages, household configuration (smaller number of household members) and living arrangements are affecting the demand for houses and how they are designed and built.

Challenges: Rural-to-urban migration of young people leads to more ageing people in rural areas, driving labour shortage for the forestry industry. It is projected that the working-age population will be shrinking until 2070.

Opportunities: Due to demographic shifts, demand for novel wood-based products will also shift in the future (Hurmekoski et al., 2018). Wood-based niche markets such as cosmetics, food additives and pharmaceuticals are expected to emerge. The fall in household size in high and middle-income countries and the increase in the elderly population may lead to increased housing demand in some regions (where housing facilities are old and outdated) (Baeumler et al., 2021).

3. Urbanisation

In 2014, 4.0 billion people were living in metropolitan areas and this number is projected to increase to 6.5 billion by 2050. According to the World Bank, regions such as Europe, Latin and North America already have high levels of urbanisation, but Asia and Africa are foreseen to have the greatest increase in urban dwellers by 2050 (Baeumler et al., 2021). The increase of megacities, such as in India (Bhagat, 2018), signals growing demand for natural resources, modifying the global supply chain.

Challenges: This trend will increase the urban-rural divide and the disconnect with the primary

Table 1: Summary of the potential impacts and effects of megatrends on New Zealand forestry

Megatrend	Impact		Potential effect or risk
	Direct	Indirect	
Climate change	Major	Minor	Impacts on forests and communities: wildfires, storms, increased susceptibility to pests and diseases; climate migrants
Population growth and ageing population	Minor	Major	Growing market/commodities demand, waste problem
Urbanisation	Minor	Major	Increased demand for building materials, waste and pollution
Digital technologies	Major	Minor	Resource efficiency and cost savings in forestry operations; business interruptions
Inequalities	Minor	Major	Social and political instability; natural resources access and demand; conflicts

production sector, including forestry. This trend has led to the loss of urban trees (Singh et al., 2018), which impacts the local hydrology and processes (such as interception, evapotranspiration and infiltration), along with the modification of urban heat profiles (Jones et al., 2020).

Opportunities: The shift to urban areas for most of the global population will open land up for new large industrial and agricultural/forestry projects in depopulated areas. Urbanisation will also massively increase the demand for building materials, creating opportunities for forest growers and processors.

4. Digital technologies (access and use)

Technological advancements are transforming the forest industry. Precision forestry, automation and remote sensing enhance efficiency and sustainability. This megatrend directly affects global trade flows through increased connectivity, efficiency and access to information. No region is close to being self-sufficient and all areas are mutually interdependent. However, with other

Figure 4: Petrochemical energy heavy transport industry cargo vessel tanker top-down aerial drone view. Docked bulk carrier ship along storage facility silos (energy gas and LPG petroleum commercial industry)

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forces, such as climate change and geopolitics, global value chains are projected to become more regionalised and concentrated (Figure 4).

Challenges: Competition for finite wood resources is imminent, but this trend may result in the increased production of new wood-based products (e.g. textiles, liquid biofuels, new biochemicals, plastics and packaging), further increasing demand for wood resources. Along with technological advancements comes the proliferation of disruptive technologies that may support illegal trade and 'greenwashing'.

Opportunities: More technologies will be applied in the forestry sector to address the labour shortage and operational costs. Precision forestry uses data and technology to optimise forest management, while drones and automation improve the accuracy and reduce the labour required for silviculture, forest monitoring and logging activities.

5. Inequalities

This refers to the unequal distribution of resources, opportunities, wealth, income, education and power within societies and globally. The middle class in low- and middle-income countries is expected to reach 4.9 billion people by 2030 (Oldekop et al., 2020). This trend will result in increased demand for commodities with significant forest footprints (commodity-driven deforestation such as meat, soy and animal-source foods) by the rapidly growing middle class, which is expected to exceed previous global estimates.

Challenges: This will create additional pressure on land and other resources, which is also anticipated to occur in New Zealand. This could be attributed to the expansion of large-scale, corporate-driven land acquisitions for production purposes.

Opportunities: Global integration has created opportunities for countries, including low-income countries, to grow and develop (UN, 2022). For example, foreign workers in forestry companies contribute through remittances. Cooperation with other neighbouring lower-income countries includes outsourcing materials to meet changing consumer demands for food and fibre production.

As summarised in Table 1, these megatrends can directly and indirectly (due to fundamental relationships between certain megatrends such as climate change and inequality) negatively impact the forestry sector and create more potential risks to society as a whole.

Preparing for a change – how to explore the future

These megatrends encapsulate society's biggest challenges and may have significant impacts lasting for decades. They can directly influence consumer behaviour that will flow through to decision-making in the forestry industry (see Box on left). Megatrends differ from trends because trends impact specific areas and are short-lived. In contrast, cycles are recurring patterns that follow a more predictable and repetitive path over time. For example, the impact of the Lunar New Year on the demand for timber in China is predictable, whereas the impact of a growing middle class in India on timber demand may be less so. For this reason, big companies actively track megatrends to keep ahead of their competition and spot where the next growth opportunity might be.

Consequently, the future megatrends and their impacts are also uncertain and unpredictable. This is because these megatrends intersect directly and often act in combination (as some are interdependent on others), intensifying their impacts or co-benefits (see Figure 2). For example, urbanisation is closely linked to population change, while climate change influences demographic change (e.g. population growth and age structure determine carbon emissions) (UN, 2022). Therefore, simply tracking one or two megatrends may not be sufficient. However, research on the intersectionality and interdependencies of these megatrends is still emerging and urgently needs further research.

The reason that most standard forecasting methods rely on data from the past to project the future with the assumptions of a 'surprise-free future' (Bengston et al., 2024) makes a megatrend analysis differ from future forestry outlooks (UNECE & FAO, 2021). However, it becomes more challenging, particularly when incorporating abrupt climate change events, as a simple cost-benefit analysis will not be enough (Bengston et al., 2024; Lenton et al., 2019). Naughtin et al. (2024) recently reviewed the different methods of identifying and defining megatrends. These methods include the Delphi method, wild cards, game changers, scenario planning and quantitative forecasting. The most widely-used method combines the Delphi method with scenario planning, while quantitative forecasting and scenario modelling remain limited in application.

In forestry, the application of megatrend analysis remains limited. One example in the USA explored the impact of megatrends in forestry using horizon scanning (Bengston et al., 2024). This method identifies emerging signals of change in forestry. Horizon scanning provides insight into how and why the future could differ from today, focusing on changes in an organisation or a sector's external environment rather than internal changes (Benston, 2013). It serves as an early warning system to identify threats and opportunities. According to Hines (2009), these signals of change can potentially map plausible scenarios and pathways to the future.

Regarding scenario building and modelling, the main analytical tool for elaborating several 'what-if' scenarios for forestry to address megatrends is the Global Forest Products Model (GFPM) (Buongiorno & Zhu, 2015; Buongiorno et al., 2003). Through the model, changes in per capita income, rural population density and labour force per unit of forest area result in projections of forest area (total and planted) by country, which in turn drive trends in forest growing stock. However, a recent review of forestry models concluded that most of the existing models, such as a macroeconomic forecast (e.g. computable general equilibrium models) and macro-econometric models (including the GFPM), have a narrow set of factors (e.g. price factors, the interdependency of production factor,

policy factors and trade quantity) and did not account for megatrends such as the impact of urbanisation and climate change (Mathieu & Roda, 2023).

Thus, a new approach to scenario modelling is needed that captures the interconnectedness of different megatrends. The quantitative impacts on overall development, especially in the forestry sector, are still not well understood or established (Osakwe & Solleder, 2024). This will empower the forest sector to identify preferred futures that ensure increased resilience. This new scenario model will be able to answer the questions, "What are the future scenarios for the New Zealand forest industry in 30–50 years?" and "Where are the next opportunities for forest products trade?" Understanding the answers to these questions will help the forest sector stay ahead of potential challenges rather than catch them off guard.

Concluding thoughts and future directions for forestry

Megatrends will affect New Zealand's forestry either directly or indirectly. These megatrends will also interact with other risks, and their effects will be intertwined and interactive (such as Russia's sawn wood policy and China's urbanisation trend). As a result, business-as-usual is no longer a viable option, and waiting for the right circumstances is also no longer a viable strategy (cycle vs trends). Ultimately, the gravitas of individual megatrends will sway cycles (e.g. the rise of urbanisation in India) (Bhagat, 2018).

There is no single future, so we need to be able to model potential futures, as historical data and cycles are becoming less reliable. Any solutions will have to be multi-dimensional. However, we lack an understanding of the interconnectedness of today's megatrends and what this may mean in terms of positive and negative impacts on the forestry sector. Thus, a new modelling approach is required to capture the interconnectedness of megatrends, markets and global wood flows. Such a model could provide new insights into the opportunities to diversify the New Zealand forestry sector.

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