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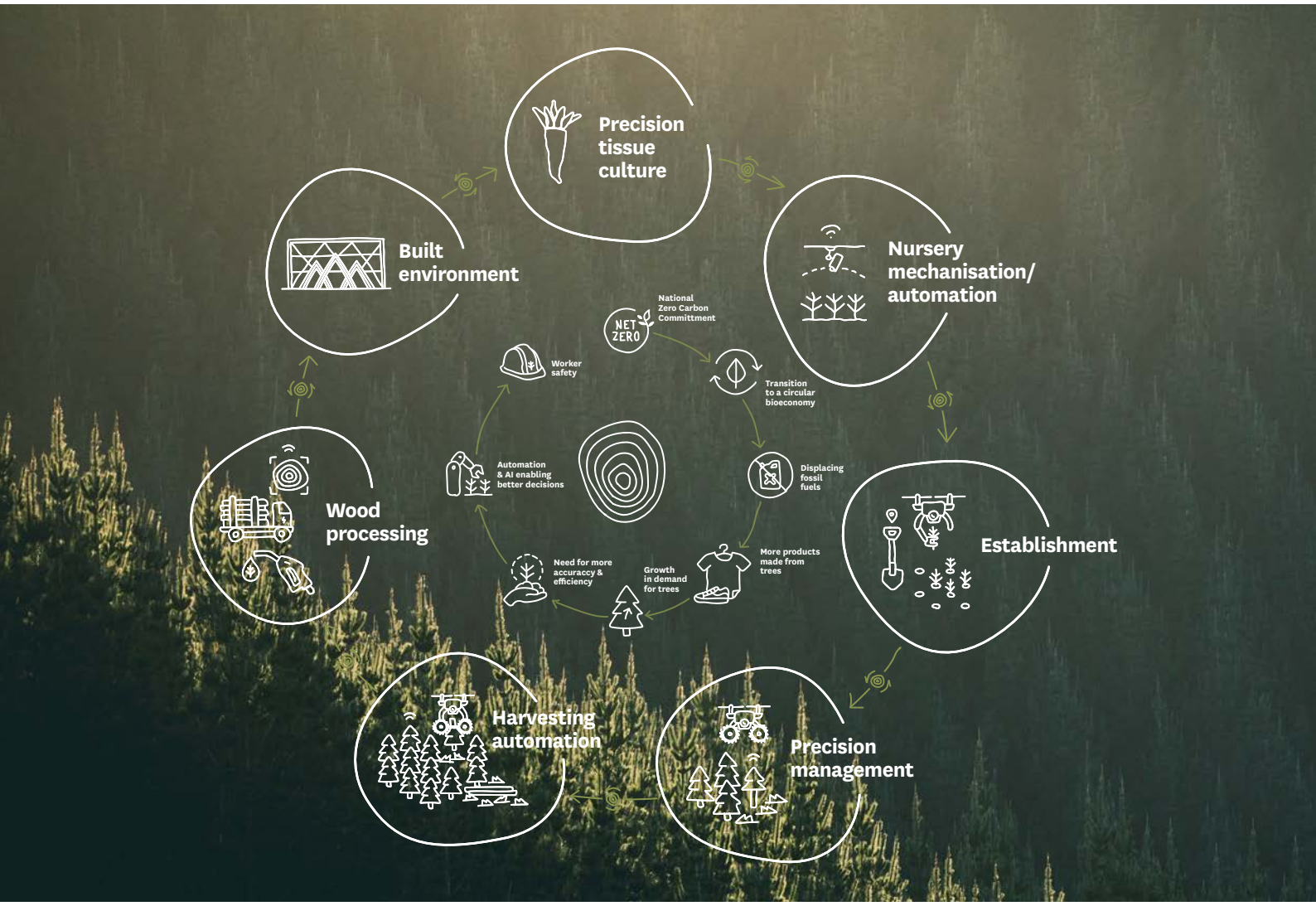
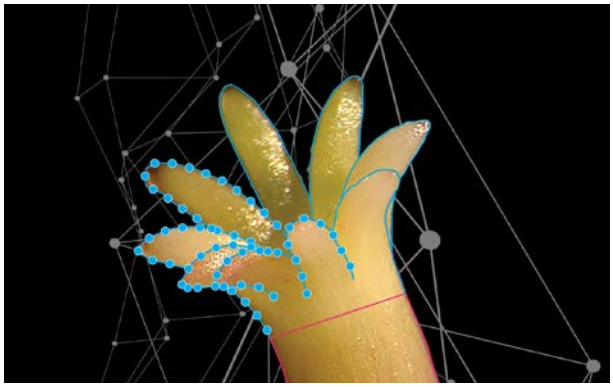


Making every tree count

Making every tree count requires a paradigm shift towards precision. The forestry industry will need to continue the transition from highly manual systems and processes to digitisation, automation, mechanisation and the ability to draw insights from big data.



Precision tissue culture utilising AI.

Some of the drivers for precision forestry are...

- The potential for productivity gains from precision forestry to increase forestry sector revenue by $300m per year.*
- A national 2050 net zero carbon commitment and the transition of New Zealand to a circular bioeconomy.
- Displacing fossil sources for energy and products to meet future consumer demand.
- Increased tree plantings for production forestry, carbon and energy.
- Greater data-led decision making through more precise and wider-scale measurement and greater connectivity and automation throughout the value chain.
- Improving worker safety to ensure that every worker in the forestry industry makes it home safely.

What are the innovations that will create a paradigm shift?

Precision tissue culture. We use advanced tissue culture to multiply our best trees and genetically select elite trees for the greatest tolerance to future conditions. We use AI for monitoring of mature somatic embryos to predict germination success.

In the future, computer-controlled 3D printing could enable tissue scaffolds to grow plant cells or even assist printing wood to specification. We would also need large scale cryogenic facilities to transform our access to best genetics.

Nursery transformation. Advanced sensing technology helps us monitor the nursery environment and automation is underway to remove manual tasks. Data tools enable more interconnectivity and traceability.

In the future, greater deployment of autonomous vehicles for remote management of nurseries will occur. We will explore how to make better use of the land with the potential for vertical tree 'farms' for seedlings and 3D modelling could help us simulate the growth and environment from seedling to tree.

Establishment. We can now pinpoint individual tree location which can be used to automate establishment tasks and enable precision management of the tree through its life. We've just pioneered our first precision UAV spray craft and this is just the beginning. The future could see robot 'swarms' performing tasks such as planting.

Precision silviculture. Real time monitoring of the forest through remote sensing helps us understand inventory, tree growth, tree environment and which trees to thin or prune. Advanced technology in these areas is underway to help on ground workers make data-led decisions. We're developing a national-scale digital twin of our planted forest estate. Bringing together multidimensional data sets, models and real time data we will be able to simulate our forests under future conditions and best match trees to market. Enhanced wood performance testing through non-destructive sampling will make it quicker and easier to predict the best end uses for a tree.

Harvesting automation. With UAV and robot swarms conducting more tasks in the forest, trees could be selected for their best end use. There will be onsite processing enabling regional communities to build new local-scale manufacturing, reducing transport costs and making better use of forest residues.

Wood processing. The value chain will have even greater value, more resilience and lowered costs due to the use of transport and equipment electrification, localised manufacturing for a diverse range of end products and traceability of the tree from germplasm through to final consumer. Full value chain connectivity, feeding end-user data all the way will inform genetic selection.

The built environment. There is the potential for recognising the value of embodied carbon inside timber products (such as buildings) where the carbon is sequestered for the life of the product.

References

* Gains that have been achieved through precision agriculture show productivity increases of 5-25% per annum [1]. Assuming a conservative 5% annual increase in productivity from precision forestry and using sector revenue in [2] would translate to revenue growth of $316M/year within the New Zealand forestry sector.

1 Choudhry, H., & O'Kelly, G. Precision forestry: A revolution in the woods. (2018). McKinsey & Company.

2 New Zealand Forest Owners Association. (2019). Facts and Figures. New Zealand Plantation Forest Industry. New Zealand Forest Owners Association, Wellington.

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