Remote sensing – evolution or revolution?

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A few years ago, a young acquaintance of mine having decided to study engineering came looking for some insights into what engineering practice would become his focus. His own investigation had whittled the choices down to civil and forest engineering and he wanted to know which I thought he might be best suited for. Keen to capture a good mind for the cause I engaged. A bit more questioning clarified that he loved thinking that involved numbers rather than words and phrases (good start), but his preference was for mathematics rather than statistics (oh dear). When I questioned him about why that was the case his answer centred on certainty: he liked to know his thinking was correct with a small but known risk of being incorrect. When I explained to him the level of uncertainty imposed on forest engineering decision-making by imperfect knowledge about tree size, stem breakage points and landform he decided to go with civil engineering.

However, I am not sure that I would now respond in the same way. The increasing availability of remote sensing technology is making that insight obsolete and disrupting the practice in the process. No longer can we say with certainty that measurement of all trees within a crop is too time-consuming, expensive and unlikely to be correct, and that using statistics to estimate key crop attributes is likely to produce a more cost-effective and reliable answer. Tasks like post-harvest assessments, or post-establishment stocking assessments that were once assigned to the 'eyeometer' or the 'walk-over' (due to the lack of a cost-effective and reliable plot-based alternative), now have remote sensing alternatives that could make measurement-based assessment more practicable.

And if that is the case, what does it say for the future of the actual work that forms the basis of the field forester's practice? Where does plotting fit in that future? Will that work be replaced by flying UAVs as a skill requirement for early career foresters? What will the time balance be between the office and the field? What level of investment in technology will now be required for forest management consulting practices? And those questions only scratch the surface. If the measure of a disruptive shift in practice is the level of uncertainty that shift creates about the future of current practices, then remote sensing technologies are giving the practice a good old shake.

This shift in practice is the sub-text to this edition, which sets out to explore some of the ways in which remote sensing technologies are overcoming the barriers to increasing the level of certainty over the imperfect information that drives the practice, and to consider what that might mean for the actual work done as part of the practice. Aaron Gunn kicks things off by outlining the experience of Port Blakely Tree Farms in implementing a LiDAR (Light Detection and Ranging)-based inventory system across a relatively variable resource, and in the process replacing a key activity within the practice (plot-based inventory) with a way of providing better quality information with several different benefits.

Then there are more papers that feature activities that are only made cost-effective and reliable through remote sensing technologies. Mark Bloomfield continues with the use of LiDAR to estimate the capacity of catchments to develop debris flows and their runout distances. Luke Riedinger and Campbell Harvey use a different technology to generate Digital Elevation Models (DEMs) and look at the potential of Structure-from-Motion photogrammetry (SfM) for determining the bulk volume of piled harvest residues. Gunn notes in his article that SfM could replace LiDAR in some inventory applications, given the ease of access made possible by its UAV platform. Finally, Jim Walsh and Rien Visser explore the use of satellite imagery to assess post-harvest soil disturbance. These are all applications with a more environmental focus, but the emphasis on minimising erosion and sedimentation in the National Environment Standards for Plantation Forestry makes having ways of quickly and cheaply assessing post-harvest residues and soil disturbance critical risk management tools essential.

While the focus of the edition is on what's new in the remote sensing world, it is worth reminding ourselves that foresters have a history of adopting remote sensing technologies to meet our management needs. Murray Dudfield, Grant Pearce and Geoff Cameron provide an interesting review of what 40 plus years of weather station data can tell us about forest fuel availability for combustion. The paper highlights the capacity of large digital datasets to tell a story over time.

Finally, contrary to its relatively conservative reputation, foresters in New Zealand have always been rapid adopters of new technology. The very existence of radiata pine as a commercial forest crop is proof of that. I am sure that the adoption of remote sensing technologies (and all its acronyms) will prove to be just another turn of that wheel. I hope this edition conveys a real sense of that opportunity.

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