The Body Language of New Zealand Trees

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Introduction

In November 1998 Dr. Claus Mattheck of Germany visited New Zealand as a guest of the New Zealand Arboricultural Association. He presented a three-day seminar on "The Body Language of Trees", and the credit for much of what I present to you today must be given to him.

Claus Mattheck is a physicist with a deep interest in trees, and in particular the mechanical engineering aspects of trees - what holds them up, and what causes them to fail structurally and fall over. The message he brought us last year opened our eyes and taught us a whole new way of observing trees.

Over the past two decades Claus has developed his Visual Tree Assessment (V.T.A.) method. This teaches that trees show external symptoms of internal characteristics, and just as doctors do with humans, we need to learn to read and analyse the body language of a tree to know what is happening inside. The symptoms show up mostly in the bark, so we learnt to "read the bark". But they also show in the morphology or general shape or visible structure of a tree.

A key feature of the European research was the flow-on benefit of using it to predict, in advance, structural failures in trees (or the potential risk of same) and so enable remedial action to be taken before a crisis occurred. Claus himself has become renowned as an expert witness in the German Courts, giving evidence on tree matters (usually *after* the crisis!).

The New Zealand link

Almost all the slides Claus Mattheck showed us were of European deciduous trees— oaks, elms, ash, chestnuts; and European beech, which has a particularly expressive bark. And a limited range of conifers - pines and spruces.

I never doubted the veracity of Claus' findings in Europe ; but I did begin to wonder if the range of symptoms and clues that his trees showed, would automatically show up in our native species. What about our conifers, for example, that have excoriating bark that constantly flakes off ? Would a structural fault inside a fork of a miro show up after a few years of shedding bark ?

Indeed, there is an obvious and understandable gap in Claus Matthecks research, simply because he had never been to New Zealand before and never been exposed to our native species. Perhaps someone should attempt to fill in the gap?

I was interested in recording on film all the body language I could find amongst our native trees, so I began to take my camera everywhere.

Horticultural vs. Engineering approach

Claus Mattheck is not a horticulturalist; sometimes he was unable to identify the species of tree he showed us in his slides. He presented his slides as a mechanical engineer would - grouped according to the mechanical or structural problem they illustrated. For example, shear fractures all together; descending branches all together ; fibre collapse all together. He jumped from one species to another.

On the other hand, I am not a mechanical engineer. I find that the first thing I do on arrival at a tree site (and I believe most other horticulturalists or arborists would do likewise) is to identify the species of the tree I'm dealing with.

This is sometimes easier said than done, especially in dense bush where foliage is intertwined, and where one is squinting upwards against the light. So I am teaching myself to identify from the bark and the trunk morphology, as much as from the foliage or flowers of our native trees.

As an aside, I now realise why noted academics such as John Salmon devote so much space in their books to photographs of bark and tree trunks - knowledge of them is an integral part of knowing the tree.

My experiences show me that it is *vital* to correctly identify the native tree, before reaching conclusions about its condition. I believe my slides illustrate this point several times over, today. I am a confirmed advocate of a horticultural approach to reading the body language of trees.

I suspect we have a fundamental flaw, in general terms, in our horticultural industry in this country - we don't emphasise plant identification skills enough. Subsequently our management of trees and shrubs is less than what it could be.

Work to Date

I have photographed over 300 native trees, covering some 35 species. Photographing and learning to read the body language of New Zealand native trees is not as simple as I imagined. I realise now that it was a little naïve of myself to begin the task without expecting some complications.

Incidentally, the species that have proven to be the most expressive and easiest to read have been tawa, karaka, and puriri. I recommend these to beginners. The trees that have been most pleasurable are the giant kauri of the Coromandel.

All the common structural weaknesses and faults that Claus Mattheck describes in European trees, can be identified in one or more of our native species.

In most cases this body language is clear and unequivocal. But .....

What is "normal"?

I have discovered that there are certain patterns of body language that are a feature of New Zealand trees, found repeatedly enough, and across a wide enough range of species, that they could be described as "normal". That's "normal" in the dictionary sense of the word, i.e. standard / usual / typical / natural / conforming.

These patterns cut across genus and family lines. Some of them confirm Claus Mattheck's teachings; but others, at first glance, appear to defy or even discredit some of his ideas.

The questions that arise are:

1. Are these patterns a result of something peculiar to New Zealand? Our windy climate? A deficiency in our soils ? The fact that our position on the Earth's geomagnetic grid is different to Europe?
2. Why do the patterns show up in so many unrelated species? And why, within any one species, are there always at least a few trees that don't conform to the pattern and so suggest that it is not "normal"?
3. If this body language is normal in a New Zealand species, does it signify anything wrong or faulty with the tree? Is there really a potential risk of structural failure in such a tree?
4. If this body language is normal and natural, and the tree is structurally sound, how can the tree manager distinguish between these characteristics and those that Claus Mattheck teaches us are indicators of potential biomechanical faults ? Can both show up on a tree at the same time ?

I shall be honest with you and tell you that I do not know any of the answers. All I seem to have done is uncovered the need for more research and scientific analysis of our native trees.

Pattern One: Vertical fluting

These are ridges, more-or-less vertical, non-spiralling, running up and down the trunk.

They are not "branch shadows" which are generally faint depressions found running vertically below a major side branch. Sometimes the vertical fluting is literally connected to a buttress root; but as yet I have not found a consistent relationship in any species, between a buttress rooting habit and a vertical fluting habit.

Species this pattern is observed on:

Tawa
Pseudopanax
Karaka
Rewarewa
Puriri
Kohekohe
Pittosporum tenuifolium/P. crassifolium
Hoheria

Pattern Two: Spiral fluting

The crown of the tree appears to be turning clockwise or anticlockwise, which results in ridges of raised wood spirally around the trunk. Claus Mattheck prescribed this sort of pattern to the effects of wind on a lop-sided tree canopy. This is a remarkably frequent characteristic amongst N.Z. trees.

In the vast majority of all the species I have observed, the spiralling indicates the crown is turning clockwise, when viewed from below and looking up at the crown of the tree. So much so, that one could speculate that clockwise is normal, and possibly caused by the Southern Hemisphere gravitational pull. Thus, if an anticlockwise turn is observed, the alarm bells should ring because it is not normal and could indicate spiralling growth caused by wind pressure.

The complication with this idea is that I have seen and photographed, within a 100 metre diameter in Totara Reserve, Pohangina, a large Totara with a clockwise spiral; one with an anticlockwise spiral; and one that is perfectly vertical with no spiral! All in dense valley-bottom bush with a consistent wind direction.

If spiral fluting is normal in a species, it may be necessary to dissect a tree or two to determine how the spiralling affects the structure and strength of the tree. Claus Mattheck teaches that spiralling indicates fractures caused by twisting or tearing by wind or some other cause.

I have not yet seen both clockwise and anticlockwise spiralling on the one tree - but I'm keeping an open mind on the possibility.

Spiral fluting should not be confused with distortions or bark patterns caused by constricting vines: once again, these are always clockwise! All vines seem to twine clockwise around themselves, too.

Species this pattern is observed on:

Clockwise:	Anticlockwise:
Totara	Totara
Pohutukawa	Pohutukawa
Pseudopanax	

Rimu
Melicytus
Ngaio
Kauri
Pittosporum crassifolium

Pattern Three: Horizontal girdling wrinkles and/or colour bands

Horizontal wrinkling is common; and varies a lot in severity and size between species. I do not think it signifies fibre collapse, or if it does, it is on such a small scale that it may not be structurally faulty. It gives the impression that it is wrinkles in the bark alone, not in the underlying wood.

I have only ever seen three native trees in which I suspected fibre collapse of the type Claus Mattheck illustrated: one tree each of karaka, *Myrsine australis*, and *Cordyline australis*.

Colour banding is equally common, but appears to be more frequent where a stem is shaded. Some colourations are probably algae or similar, but possibly not all. Why they are horizontally-aligned is not known.

Species the horizontal wrinkles are observed on;

Tawa
Hebe
Kauri
Rewarewa
Totara - usually seen just above the buttress roots, but sometimes in between
Hinau - slight only
Myrsine australis -slight only, except for one tree at Otari
Pseudopanax
Nothofagus menziesii
Whau
Hoheria -slight only, and always in conjunction with colour banding
Nikau
Pittosporum tenuifolium
Phyllocladus
Weinmannia
Miro

Pattern Four : Warts or lumps

Warts and lumps by their nature vary tremendously, but I place them into two groups according to what I suspect causes them: man-made, or natural.

Man-made warts and lumps are common on trees near paths, or wherever population densities are high. They are probably more scar tissue than anything.

Species:

Ngaio
Melicytus
Rewarewa
Cordyline

Natural warts and lumps, usually seen high up on trunks and on trees in less populated bush areas. These would need dissection to determine their significance.

Species:

Kauri
Pseudopanax
Totara- gives the famous Totara Burr or Totara Knot wood
Karaka
Myrsine australis
Pittosporum crassifolium

Pattern Five: Close vertical stems

Close vertical multiple stem structure tends to be a frequent juvenile habit amongst native trees, and often leads to weak crotches as trees get larger. It is less frequent in trees in dense stands of bush, more frequent in trees in exposed sites; leading to speculation that wind damage (or other damage) to growing tips of tiny seedlings may be a contributing factor.

In some cases some stems die out, or are even pushed out, which may or may not leave inherent weaknesses in the root crown. In other cases a significant structural flaw can be seen persisting for many decades in what is perceived to be a single main stem. Characteristic symptoms include both bull-nose and elephant-ear swellings just below crotches.

This pattern observed in:

Totara
Miro
Tawa
Myrsine
Pohutukawa
Kohekohe
Pennantia
Karaka
Phyllocladus
Kauri
Hebe

Pattern Six : Other distortions or oddities

Keen observation has revealed occasional irregularities in New Zealand native species, as follows;

Sophora microphylla - large side boughs, tending to the horizontal rather than the upright, are distinctly flattened in cross-section. They lack the expected deep keel-like structure one would expect the tree to develop to carry their weight. Otari, March 1999.

Ngaio - *Myoporum laetum* - a species capable of the most extraordinary gravity-defying distortions, spiralling, warts and lumps. Best seen in very old trees.

Kelburn, Wellington, 1999.

Whiteywood - Melicytus ramiflorus — sometimes seen with girdling branches and what appear to be aerial roots - although these latter may be as a result of soil erosion from around an established plant.

Where to from here?

I am uncomfortably aware that my research is somewhat amateurish to date, and that I have raised more questions than I have answered.

I believe there are significant gaps in our knowledge of the structural characteristics, and hence the body language, of our native trees, and it is unlikely that any one person will be able to fill the gaps. I imagine that a team effort will need to be mounted, between horticulturalists, arborists, physicists like Claus Mattheck, and maybe others; and almost certainly the team effort will be based in or near a tertiary institution with research facilities. Funding will be critical, for any true research program will stretch over several years.

The research will need to involve the careful dissection and examination of dozens of native trees, just as both Claus Mattheck in Germany, and Alex Shigo in the United States have done. The supply of trees will probably come from the public, from contributing institutions, and local authorities. Perhaps ironically, some trees may come from the often-maligned "developers" who would otherwise turn native trees into firewood.

I have not done justice to the whole subject of Body Language and VTA today - time is against me. Those who wish to learn more about it are advised to read :

Mattheck, Claus, and Breloer, Helge, 1994

The Body Language of Trees; a handbook for failure analysis.

Strouts, Robert, (Transl.) and Lonsdale, David, (Ed.), 1994, Her Majesty's Stationery Office, London.

And quoting from this book:

"The tale of the tree warrior is not silenced with the giant's fall.
E'en when hostile life has long feasted on his bole and bough,
His lifeless frame yet tells of battles past with storm and tribulation .....
And to the understanding eye,
Tells silently where bold Achilles' heel lay waiting,
till death's arrow met its mark"

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