

## CHAPTER 3 - SITING AND LAND USE OPTIONS

Contributing authors K. Snowden, Ingleby Coxe and Ian Nicholas

### LAND USE OPTIONS



Traditional New Zealand farm practices are impacting on the environment in several situations. Examples include the catchments of Lake Taupo and several Rotorua lakes, where lakes suffer from lower water quality because of leached nitrogen and phosphate, which increase algal bloom levels. Issues

associated with emissions of excess nitrogen will become wider in extent, affecting rivers and streams. Solutions are being sought by land owners, resource planners, statutory bodies and managers that will enable commercial land-use that has a lower impact on the environment.

Establishing forest crops is not a short-term commercial solution, but should be viewed as an important component of a portfolio of land uses. Forest crops provide a low-cost opportunity for landowners to develop assets that have long-term options. Low cost does not imply low skill requirement, sloppy management, or low value. Rather, wise and well applied crop selection, establishment, and silviculture will underlie success.

Cypresses offer landowners the opportunity to develop cash flow from their land in the long term. Pruned cypress provides land owners with the opportunity to produce high-value wood with strong demand. Ex-farm sites should provide the opportunity to establish sound crops of cypress, though choosing appropriate species for the crop is important.

## SITING

Cypresses are site demanding. Key attributes of sites include soil fertility, latitude, aspect, and sunshine hours. Cypresses, including Leyland cypress, macrocarpa and lusitanica, favour fertile and well-drained soils. Damp feet do not encourage a healthy crop.

Cypresses do best on well-drained soils of at least moderate fertility (A horizon depth approximately 10 cm or more) which do not suffer extremes of seasonal moisture fluctuation. These sites typically occur on lower slopes and valley bottoms, or in low-lying, undulating country. A well-distributed rainfall in excess of approximately 800 mm annually is required, with lusitanica preferring mild winters also. The altitudinal limit of about 350 m may also be extended on sites with good air drainage. The best timber form will develop on sheltered sites. Macrocarpa tolerates more exposure than lusitanica - the latter species suffers major damage when exposed to salt-laden winds.

Clonal planting stock has become more readily available, but usually at a premium. Cypress growers are advised to plant tested clonal stock on high-quality uniform sites, in order to achieve a good return on the initial high investment. Poorer-quality variable sites will tend to nullify some of the potential uniformity

of clonal stands. (Clonal deployment is discussed more fully in Chapter 5).



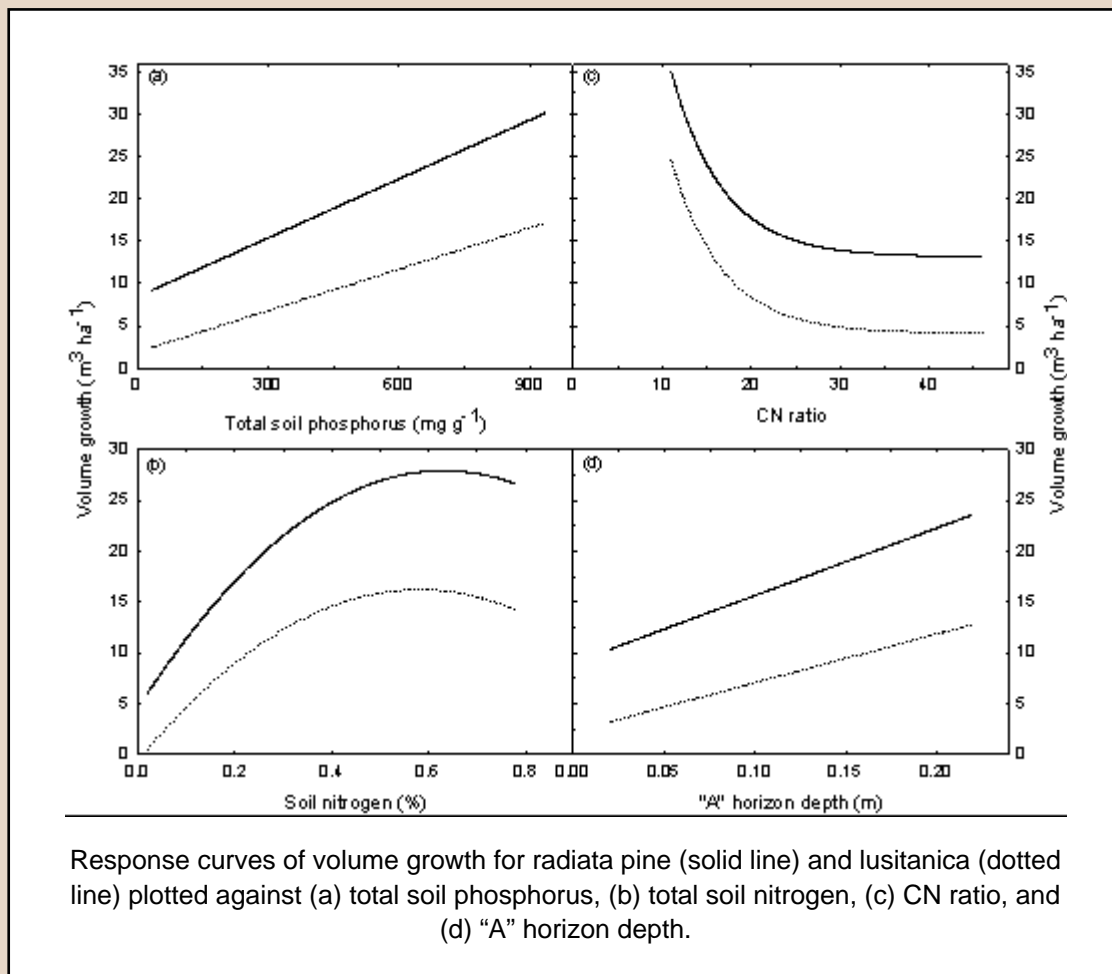
A young stand of well-managed macrocarpa at Millers Flat, Otago. Trees that became infected with cypress canker were regularly removed.

## Site variables influencing stand productivity

Nation-wide study of 31 macrocarpa plantations and 18 lusitanica plantations were assessed, for growth and site variables, by Bruce Glass of Forest Research Institute in the early 1980s. He found that soil fertility, soil texture and physiographic features, and the degree of exposure to local and prevailing winds were the main site variables influencing stand productivity and crop selection for both macrocarpa and lusitanica. Fluting in macrocarpa appeared to be related to exposure and temperature, and was also linked to spiral grain. Cypress canker was also strongly linked to exposure.

### Preliminary analysis of radiata pine and lusitanica site quality plots (Watt *et al.* 2005)

A preliminary analysis, including all tree growth data from thirty-one 2-year-old plots spread from Northland to Southland, showed that radiata pine had a 56% larger tree volume than lusitanica. After climate was accounted for, growth of both species was also significantly affected by the CN ratio, soil nitrogen, phosphorus, and depth of the A horizon (see below).



## NUTRITION

There is little information on cypress nutrition for New Zealand conditions, although there was a surge of interest in the 1980s in determining some base foliar levels. In the information provided below, nitrogen, sulphur, manganese, boron, potassium, calcium, magnesium, iron, zinc and phosphorus are abbreviated as N, S, Mn, B, K, Ca, Mg, Fe, Zn and P, respectively.

### Tree size and foliar nutrients

A study of the size of trees and foliar nutrition of 16-year-old *lusitanica* trees near Whangamata, found that tree size tended to increase with increasing foliar N, S, and Mn concentration, and decreasing B, although the correlations between tree size and foliar nutrient concentrations were not very strong. Of the nutrients determined, nitrogen was considered to be the most likely to be growth limiting. From the foliar N and S concentrations found at this site, it was inferred that concentrations of at least 1.2% N and 0.12 % S are desirable in the foliage of this species for achievement of satisfactory growth rate.

### Species comparison

In a study comparing other species and radiata pine, cypresses at 2.5 yrs old had higher foliar K and Ca concentrations, but lower S and Mn concentrations than the other four species (radiata pine, *Eucalyptus fastigata*, *E. fraxinoides*, and *Acacia melanoxylon*).

### Nursery study

A study of nursery seedlings found that the foliage and seedling tops of containerised stock had higher levels of N, P, Mg and Zn, and lower levels of Ca and Fe than bare-rooted seedlings,

but there was a species difference between *macrocarpa* and *lusitanica*.

### Glasshouse study

In a glasshouse trial the concentrations of Ca and Mg in the tops of cypress seedlings, raised with a full supply of all nutrients, were much higher than in radiata pine seedlings. This suggests that seedlings of both cypress species have higher requirements of these two nutrients than seedlings of radiata pine. In terms of both height growth and dry matter productivity, the cypress seedlings were more sensitive to drastically restricted N or P supply than the radiata pine seedlings.

### Fertiliser Trial

Assessment of a *macrocarpa* fertiliser trial at Mahinapua on the West Coast of the South Island, showed that height and root collar diameters for the N+P diammonium phosphate (DAP) treatments 1 year after planting were consistently more than double those of the P only treatment, indicating a clear need for both N and P at this site. Height and diameter increased in response to fertiliser up to an optimal level and then decreased, with the highest rate causing slight growth depression. The optimum rate of DAP (18-20-0) was 90 g/tree, while the optimum rate of Triple Superphosphate (0-20-0) was 85 g/tree. Triple super at 80 g/tree was less effective than DAP, with increments averaging half or slightly less than half those for the equivalent DAP treatment.

### Foliar levels

Foliar nutrient levels are presented in Table 2. The data are from the national average for foliar nutrient levels in *lusitanica* foliage

Table 2: National figures and data from a nationwide project.

Element	N %	P %	K %	Mg %	Ca %	B ppm	Mn ppm	Zn ppm	Cu ppm	Fe ppm
National levels	1.19	0.13	0.90	0.14	1.31	17.4	47.7	11.3	3.3	69
Site quality project	<b>1.41</b>	<b>0.17</b>	<b>1.65</b>	<b>0.17</b>	<b>0.81</b>	<b>19.50</b>	<b>45.35</b>	<b>15.81</b>	<b>7.19</b>	<b>49.66</b>

More analysis is required to determine optimum or deficient levels, but these values provide a benchmark.

suggested by the Veritec Forest Nutrition laboratory, and also from average foliar levels of 20-month-old young *lusitanica* trees from a national site quality survey of 129 plots across 31 sites.

### Site and health interactions

Cypress canker (*Seiridium cardinale* and *S. unicorn*) is a health issue for cypresses that should be managed by species selection and choice of appropriate sites. Use of macrocarpa in areas with a high canker risk is not recommended - macrocarpa should not be sited in areas that are warm and moist. There is some evidence that incidents of cypress canker are increasing in the South Island, emphasising the need for care in establishing species that are susceptible to cypress canker.

Leyland cypress appears to be not quite as susceptible to cypress canker as macrocarpa, but not as resistant as *lusitanica*.

Ensis (formerly Forest Research) has been actively breeding for canker resistance in macrocarpa. Growers interested in macrocarpa should maintain contact with this programme to ensure that suitable stocks for planting become available. More information on this is presented in Chapter 4.

### Latitude

Cypress canker affects macrocarpa more than *lusitanica*. Because cypress canker is more prevalent in northern latitudes of New Zealand, siting cypresses for the impact of canker is valid. Generally, it is recommended that *lusitanica* is established in the North Island because the species is more resistant to cypress canker. It is unclear whether cypress canker has less impact in cooler zones of the North Island such as Taupo District. Macrocarpa appears to grow well where higher frost frequency limits the development of cypress canker, but some experts maintain that there is still risk of infection on such sites.



Macrocarpa showing damage from canker



Toppled 6-year-old lusitanica in wet, heavy soils in Tongaporutu, north of New Plymouth.

## Aspect

The southern therefore cooler aspect is favoured for cypress species other than lusitanica, as a means of limiting cypress canker.

## Farm activity and cypresses

Cypresses can induce abortion in cattle if wilted foliage is digested. Farmers should avoid allowing in-calf cattle to graze in or alongside stands of cypress species.

Cypress species can be vulnerable to animal damage. In an interesting case in an Ensis trial, rat damage was observed on the stem of young lusitanica trees. Apparently the rats came from a nearby corn field immediately after the corn was harvested. Considerable possum damage has also been observed in some lusitanica stands, resulting in stem malformation. Possum control is warranted if planting lusitanica in areas known to have high possum numbers. Cattle can also damage trees by stripping bark. Damaged trees are vulnerable to disease and insect damage. The heartwood of standing trees can sometimes be seriously damaged if larvae of either the

huhu beetle, or the two-toothed longhorn beetle, gain access via mechanical damage to the bark. More information on insect damage is provided in the chapter on health.

## Stability of cypresses

Cypress species, especially lusitanica, can be prone to toppling on some sites. Toppling of young trees can occur in the first 3 years after planting and it appears to be worse on fertile farm sites. Wet conditions, heavy soils, and exposed sites are also risk factors.

While some toppled trees resume upright growth, in the process the stem develops butt sweep and sinuosity, which results in differential stresses in the wood, causing distortion of sawn timber and reduction in log values.

Ingleby Coxe, a farm forester from Northland, has had considerable experience of toppling in both cypress and radiata pine plantings on her Waitotira clay loam property after serious storm events. Ingleby believes that prevention of toppling is easier than correcting it. In May

1998, every alternate tree in a block of 87 cypresses at Waiotira was wind-proof pruned, the rest were left untouched. The wind proofing involved pruning half the length of foliage from branches above half tree height. All the pruned trees remained straight and upright. All the unpruned trees showed varying degrees of toppling.

Windproofing treatments which have been researched have included pruning off half the branches and pruning back to half branch length. The success of these treatments depends largely on climatic events; they are best treated as insurance or protection from

wet and windy storm events on topple-prone sites. However, with severe storm events such as Cyclone Bola, most stands will be vulnerable to topple, regardless of the precautions taken. Fortunately, severe storm events like this are very rare.

Geoff Brann, a farm forester in the Bay of Plenty, recommends hedging young trees with motorised shears to windproof trees (this also keeps branch size small until clearwood lifts).

### Methods to prevent topple

Based on trials on clay soils at Waiotira, and discussions with other farm foresters, Ingleby Coxe has the following recommendations for establishing cypresses on a topple-prone property:

1. Match the species to the site, and avoid wet or badly drained areas. Cypresses tend to be unstable in waterlogged clay soils, especially with exposure to strong and changeable winds.
2. Choose well-drained, reasonably sheltered areas.
3. Good planting technique is essential, whether trees are sourced 'bare-root' from the nursery, or grown in containers. Roots should be spread out in a hole deeper than they were planted in the nursery or container, firmed gently, and pulled upwards slightly before the final firming.
4. On fertile farm sites, extra fertiliser should not be applied to young trees, unless specifically advised to correct deficiencies.
5. Wind-proof pruning before the first winter after planting reduces the sail area catching the wind, and gives a chance for the tree to establish a good root system.

While it is human nature to attempt various remedial measures to correct toppling in young trees, such as staking, supporting with strings, and turfing, they are often ineffective. Straightening toppled trees can also cause further damage to the root system. Instead, it is better that the number and distribution of the toppled trees be assessed. If enough potential final crop trees remain, toppled trees could be left to help control branch size and then thinned later, without incurring the costs

of remedial treatments. Ingleby has found it effective, with badly toppled *lusitanica*, to cut the main stem off above a low branch on the upper side of the stem, and let that develop into the new main leader. If done well, only the small amount of timber below the new leader will be unsuitable for the final log.

## Key Points

- Cypresses require fertile sites.
- *Lusitanica* is preferred where cypress canker is a risk. This generally means that *macrocarpa* should be restricted to cooler sites in the South Island, or should be sited on cool, south-facing slopes elsewhere.
- Beware of abortion in cattle.
- Cypress species can be vulnerable to animal damage. Damaged trees are subsequently vulnerable to disease and insect damage.
- Prevention of toppling is far more effective than undertaking remedial measures after toppling has occurred.
- To avoid toppling, choose suitable sites - well drained and reasonably sheltered.
- Don't use extra fertiliser on fertile farm sites, unless on expert advice.
- Windproof prune on topple-prone sites.
- If toppling is severe, replanting should be considered.

## Suggested reading:

Glass 1984

Hood *et al.* 2001

Nicholas and Hay 1990

Self and Chou 1994

Snowdon 2003

Van der Werff 1988

Watt *et al.* 2005