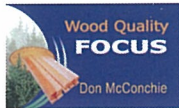


**A GUIDE TO  
UNDERSTANDING  
NECTRIA FLUTE  
CANKER-RELATED DEFECT  
IN MATURE TREES**



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IN MATURE TREES**

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## OBJECTIVE OF THE GUIDE

The primary objective of this field guide is to assist in the identification and assessment of defect caused by *Nectria flute canker* in mature trees, with particular reference to pre-harvest inventory of pruned stems. A secondary objective is to provide an assessment method for quickly checking the value of batches of sawn timber.



## INTRODUCTION

Nectria flute canker is a stem disease of radiata pine characterised by long, narrow cankers, or 'flutes' that can extend for several metres above, and for a shorter distance below, a pruned branch stub. Although tree crowns generally remain healthy, the defect in the log that results from infection significantly reduces the commercial value of the timber. The pathogen associated with this disease is *Neonectria fuckeliana*, a northern hemisphere fungus previously known only as a weak wound invader of spruce and fir. *Neonectria fuckeliana* was first reported in New Zealand in 1996, however it is apparent that it has been present for some years before this. Due to the relatively recent arrival of this pathogen, trees with Nectria flute canker are only just beginning to reach harvest age.

The guide illustrates a range of defect types found in mature trees thought to be associated with previous infection by *N. fuckeliana*. In addition, a method for assessing the incidence and severity of Nectria flute canker defect is outlined which could be used both on standing trees during inventories and on logs prior to processing.



The information provided in this guide is based on a number of studies carried out in the Southland and Otago regions of New Zealand. During these studies more than 120 mature trees from three different forests were felled and examined. As a level of site to site variation was observed between the three forests studied, it is possible that the categories of *Nectria*-related defect described in this guide may not apply to all sites. This is especially the case with sites at higher altitudes, particularly cold sites and regions where *N. fuckeliana* is a very recent introduction. For this reason, caution in applying the principles of the guide is suggested and a preliminary destructive sampling effort is recommended to ascertain the level of *Nectria* defect present in mature trees prior to inventory.



## DESCRIPTIONS OF DEFECT TYPES

The symptoms of *Nectria* flute canker are usually most severe in the years immediately following pruning. As trees age, those with low to moderate levels of flute canker will generally recover and the cankers can occlude. The most severe flute cankers are unlikely to occlude and these can remain visible on the tree until harvest. In mature trees, defect arising from an earlier *N. fuckeliana* infection can range in size from narrow, almost completely occluded bark cracks, through to deep, wide cankers which may extend for several metres in length. Decay fungi and wood boring insects can also invade flute cankers over time. Fruit bodies of *N. fuckeliana* are not usually present on mature trees unless the level of disease is very severe.

Not all defect observed on mature trees will be the result of *Nectria* flute canker. In particular, basal fluting is not thought to be a consequence of *N. fuckeliana* infection. Many unrelated defects such as mechanical wounds, weather-related injury, resin bleeding and insect borer holes can be found on mature trees.

The following pages contain photographs and descriptions of symptoms which may be present in mature trees as a result of *Nectria* flute canker and are given to assist with assessments of wood quality and value loss. In each case, the type of external defect is described, followed by some indication of the level of internal wood degrade which may be associated with this external defect. A number of other common defects are also discussed.

## DEFECT TYPES

### Absent

Minor depressions, indentations or bark cracks less than 15cm in length and associated with a normal branch stub are rarely found to relate to internal wood defect. Current recommendation is to ignore such minor features during forest inventory.





## Flattening or Large Stem Depressions

Stem flattening or depressions may or may not be related to *Nectria flute canker*. In mature trees these rarely result in internal wood defect. Sometimes these wide depressions can be associated with decay or huhu beetle damage, however this is not common and is usually visible externally. Current advice is to ignore stem flattening or depressions during inventory unless there are signs of decay associated with them.



## Bark Cracks

These are narrow and inconspicuous bark cracks or very narrow, almost occluded flutes, atypical of normal bark features. Often, narrow bark cracks seen on the outside of the stem indicate the presence of encased bark inside the stem which can run all the way from the knotty core through to the outer bark. These appear to have resulted from the closure of deep, narrow *Nectria* flute cankers.



## Bark Cracks



## Flute Cankers

Flute cankers can range from shallow or narrow fluting in the stem through to deep flute cankers which may extend for several metres in length and can follow the spiral grain of the tree. Evidence of insect borers and decayed wood is often visible on the surface of the stem. Inside the stem, flute cankers are frequently associated with both encased bark and large internal decay columns. Very occasionally, flutes are apparent on mature trees that prove to have clear wood inside with no stain or decay beyond the knotty core.



## Basal Fluting

Basal fluting is sometimes recorded in field surveys of Nectria flute canker. *Neonectria fuckeliana* is rarely isolated from these flutes, which usually have clear sapwood, and as a consequence they are not thought to be a result of the Nectria flute canker disease. Instead the flute probably reflects a root problem or other defect in the affected quadrant. Internal wood defect such as encased bark is rarely associated with these basal flutes.



## Decayed Wood

In severe cases, columns of internal decay within the stem can be associated with *Nectria* flute canker damage. This is especially the case for flute cankers in mature trees. Although *N. fuckeliana* does not decay wood, infection can facilitate the entry of decay fungi which can lead to the formation of pockets or columns of decay. This decayed wood is attractive to insects such as huhu (*Prionopus reticularis*) though these do not tend to colonise beyond the decayed region of the stem.



## Very Badly Affected Trees

Some trees with very severe Nectria flute canker at time of pruning may not produce much merchantable timber. While Nectria flute canker does not usually kill trees, severe disease can reduce growth and may result in stem breakage. Current recommendation is not to recover the pruned stem from mature trees with very severe flute cankers covering extensive regions of the pruned stem.



## ASSESSMENT PRIOR TO HARVEST

The incidence and severity of *Nectria* flute canker varies between sites. As a result, it is recommended that log grading rules be verified before they are applied to new sites. This could be done by felling and destructively sampling a few stems with typical types of *Nectria* damage ahead of harvesting.

The following is an example of how this may be done. During studies to examine the effect of *Nectria* flute canker on wood quality in mature trees, several trees were selected with visible external symptoms that fell into one of the categories described earlier in this booklet. After the trees were felled, sections were cut through the region of the defect to examine the effect of *Nectria* flute canker on internal wood quality. At least five sections were cut for each defect and particular attention was paid to examining the wood immediately above the affected branch stub where symptoms are likely to be most severe.





## USING THE KAITUNA METHOD TO ASSESS LOGS AT THE SAWMILL

The Kaituna Method provides an accurate and cost effective method for evaluating the clearwood quality of pruned logs. Initially developed to assess resinous characteristics, it is equally well suited to assess lumber degrade due to the presence of *Nectria*-related defect.

Briefly, the method involves the rapid grade assessment of the sawn surfaces of logs as they are cut at the headrig. Alternatively assessment of the sawn surface of boards further along the processing chain can also be used to establish batch average values. Faces are assessed as Clear, Moulding or Shop grade with respective weighting of 100%, 60% and 20%. The log or batch average rating is obtained by multiplying the faces assessed by their respective weighting and dividing by the total number of faces assessed.

### **Note:**

1. To achieve Moulding grade the requirement is for 70% of the surface being assessed to be Clear in widths 1 inch (25 mm) and wider and 10 feet (3 m) or longer. Shop is regarded as any face or sawn surface that fails to meet Moulding or Clear grade.
2. All characteristics other than those associated with *Nectria* are ignored.

The Kaituna method can be used to establish batch averages for groups of logs representing specific harvest locations, specific log grades or specific log classifications such as those presented in this field guide. Kaituna ratings can be used as a standard to compare sites within the zone affected by *Nectria* flute canker and to assist with establishing values for log grades specific to *Nectria*-related defect.

## EXAMPLES OF DEFECTS IN SAWN TIMBER



Large bark pockets associated with *Nectria* observed at the headrig carriage during primary breakdown.



(a) Bark pocket observed during primary breakdown at the headrig. (b) The same bark pocket shown in (a) following removal of a further 25 mm flitch i.e. one board further into the log.

## EXAMPLES OF DEFECTS IN SAWN TIMBER



Central cant during sawing showing large infected branch with associated bark pockets.



Large bark pocket associated with an infected whorl in the central cant of a pruned log.



An example of infected branches and associated bark inclusion.

## EXAMPLES OF DEFECTS IN SAWN TIMBER



Knots showing evidence of infection - discolouration, associated bark pockets and increased levels of resin.

## EXAMPLES OF DEFECTS IN SAWN TIMBER



Infected knot with associated bark pocket. The bark pocket is larger than would normally be expected for an uninfected branch of this size.



Localised infection contained within the branch.

## SAMPLE COLLECTION

To confirm the presence of *Nectria flute canker* in suspect trees or in new areas, it is important to collect samples from which the fungus, *N. fuckeliana*, can be cultured in the laboratory. Successful culturing can be enhanced by sampling the most appropriate portion of a stem and by careful treatment of the sample following collection.



Standing trees with suspected *Nectria flute canker* should be sampled using an increment core borer, approximately 5 cm above the branch stub within the area of the flute canker/symptom. If trees have been felled and dissected, small wood chips or pieces of wood may also be taken from white/grey stained or damaged wood inside the tree. Samples should be wrapped in plastic film or placed in a small plastic bag, kept cool and forwarded to Scion for diagnosis as soon as possible. Information on the forest, stand, site, coordinates (e.g. lat/long or NZ Mapgrid), silvicultural regime and symptoms should be recorded. This information, along with the collector's name and contact details, should be included with the sample.

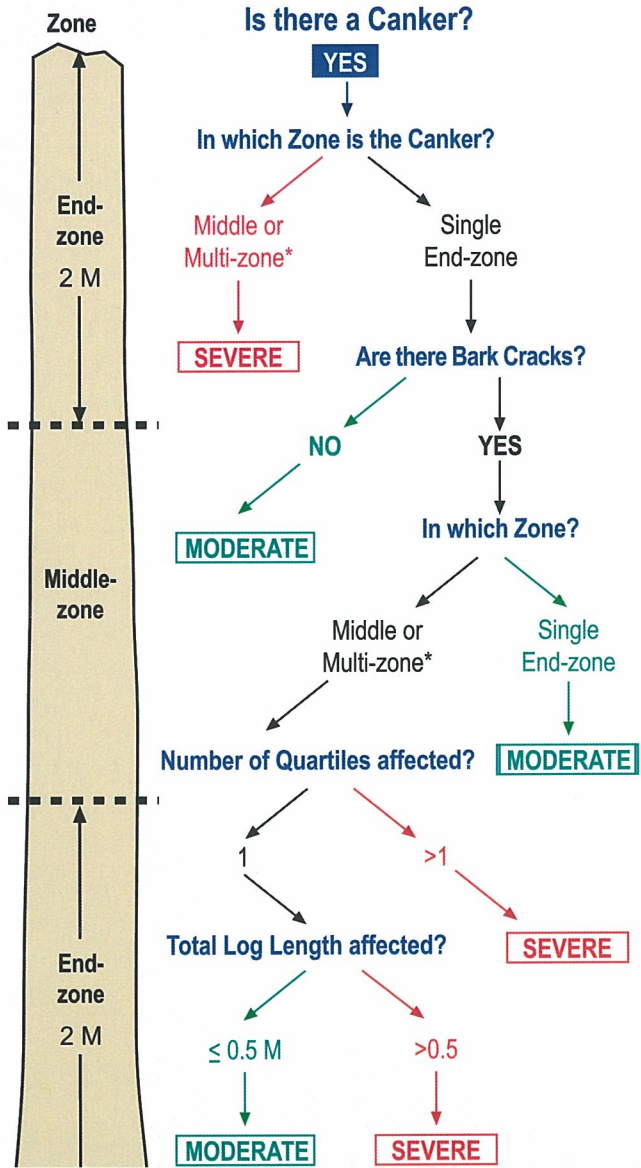
## PRE-HARVEST INVENTORY



The following pages show a series of decision pathways designed for use in pre-harvest inventory to quantify the effect Nectria flute canker damage may have on mature trees. While the decision pathways are applied to individual trees, they are designed to estimate Nectria-related defect at the stand level and thus to predict the effect on overall pruned log quality and clear board recovery. The pruned classification pathways are applied to the entire pruned section, while the unpruned classification applies just to the section of Nectria defect.

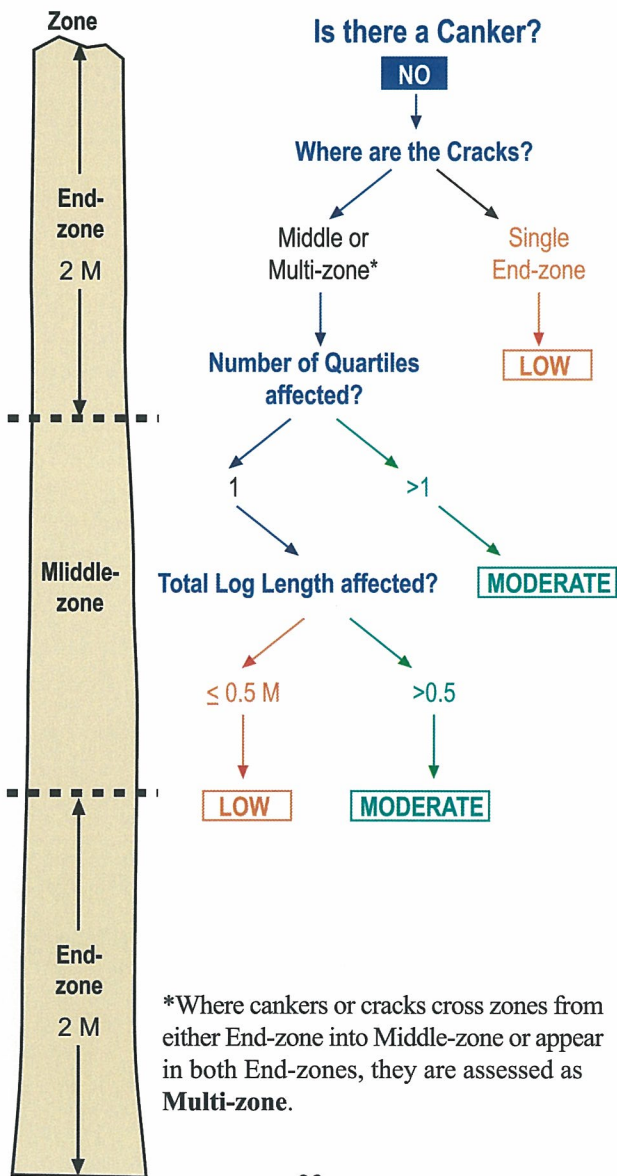
The decision pathways are based on findings from several forests in the Otago and Southland regions in New Zealand. The use of these decision pathways in other forests and regions should be undertaken in association with some level of destructive sampling for verification.

## Decision Path to Determine Classification where Cankers are present in PRUNED STEMS OVER 4 METRES



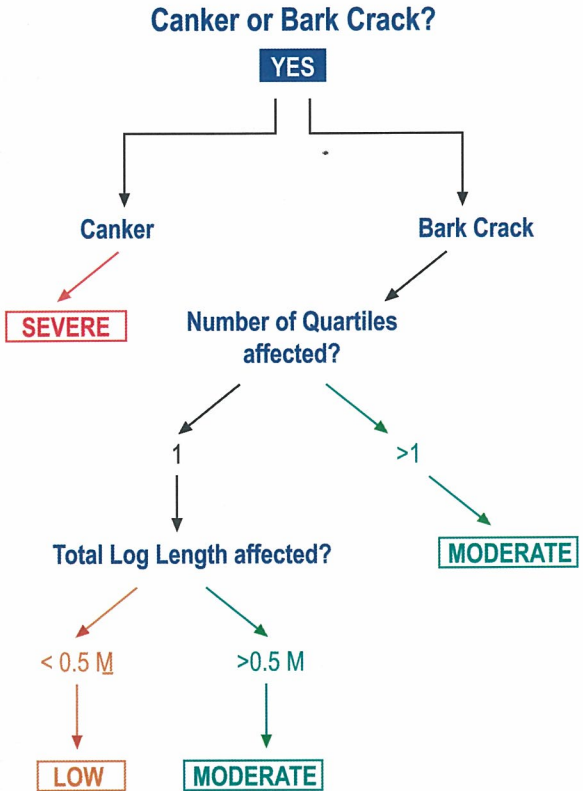


# Decision Path to Determine Classification where only Bark Cracks are present in PRUNED STEMS OVER 4 METRES



\*Where cankers or cracks cross zones from either End-zone into Middle-zone or appear in both End-zones, they are assessed as **Multi-zone**.

**Decision Path to Determine Classification  
where Cankers and/or Bark Cracks  
are present in  
PRUNED STEMS UNDER 4 METRES**



## Additional notes:

1. Where cankers or cracks cross zones from Bottom to Middle and from Middle to Top they are assessed as being in the Middle.
2. Where a canker is confined to the Bottom or Top zones giving Moderate classification but associated or additional bark cracks are present across zones then they are assessed separately. Where the associated bark crack is rated as Low, the log classification stays as Moderate but where the bark crack is rated as Moderate, the log classification is increased to Severe.

The suggested codes for Severe, Moderate and Low Nectria-related defect in pruned trees are NS, NM and NL respectively.



## UNPRUNED STEMS AND PORTIONS OF STEMS

Nectria-related defect, although more common and detrimental to grade and value in pruned logs, does occur in unpruned stems or the unpruned portion of pruned stems.

For inventory purposes it is suggested that occurrence of Nectria cankers in the unpruned portion of stems be handled within existing procedures as a point feature. NC is the suggested code for Nectria cankers as point features. This procedure will identify the incidence within stands and allow log cutting options to exclude affected portions.

**Note:** Bark cracks are more difficult to positively link to Nectria infection in unpruned material and their resultant bark pockets less damaging to grade recovery and hence value. For these reasons bark cracks are not identified during inventory for the unpruned portion of the resource.



# ACKNOWLEDGEMENTS

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**FIELD NOTES**