MELALEUCA SURVEY OF THE NORTHERN TERRITORY.
DOCUMENT 1

METHODOLOGY, VARIABLES and FIELD SHEET

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15/10/92

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Proposed Melaleuca Forest Survey of the N.T.

1. Introduction

Funding was obtained from the National Forestry Inventory to undertake a survey of the Melaleuca forests in the Northern Territory. The N.F.I. definition of forest is "woody vegetation, usually with a single stem, having a mature or potentially mature stand height exceeding five metres with existing or potential projective cover of overstorey strata about equal to or greater than 30%". This definition has since been extended to include woodlands with a projective cover of 10-30%.

2. Project outline:

There are three main components to the project

1. Distribution and Classification of the Melaleuca Forests. (Stand density classes and/or floristics).


3. Analysis, map production and Report.

2.1 Distribution and Classification

Objective:

2.1.1 To produce 1:250 000 topographic maps with mapped boundaries of significant Melaleuca communities.

2.1.2 A classification of the communities for both floristics and stand characteristics.

2.1.3 Digital output (ARC/INFO) of map boundaries with related attribute files.

2.1.4 A file containing information as to reliability of the mapping to be stored on ARC/INFO.

Methods:

2.1.1 Mapping distribution

Mapping the distribution of the communities will entail a search of information already available as well as interpretation of landsat or aerial photographs to determine mapping boundaries in areas not adequately covered. The smallest mapping area at the 1:250 000 scale should be a square 2*2 millimetres (ie on the ground 50 * 50 metres or 0.25 hectares.

Incorporation of existing information.

It is proposed to use existing information to produce linework which will then need to be checked against other material to determine feasibility of that linework. The approach when using this information is to produce all the possible map boundaries and eliminate those that do not fit the criteria by comparing them with landsats, aerial photos etc or other surveys. For NFI purposes the owner, scale and accuracy of any mapping used for the survey must be recorded and becomes information attached to the map coverage. Smallest mapping polygon area should be 2500 square metres. Stream-line vegetation may need to be represented by lines rather than polygons.

Land unit and Land system reports.
A number of landunit and landsystem maps have been digitised on ARC/INFO. Relevant units containing Melaleuca species have been identified for each LU or LS survey. The boundaries of the selected units need to be plotted at 1:250 000 scale and transferred to 1:250 000 topographic maps to determine geographic accuracy of the line-
work. This information to be checked against aerial photographs or landsats to determine if the initial boundaries are correct and to remove and/or add linework were necessary.

Problems: 1. The accuracy of the geo-referencing of the LU or LS digitised coverages.
2. The different scale of the LU and LS surveys will result in different complexities of linework for different surveys.
3. The inability to determine what percentage of a LU or LS that is occupied by a particular vegetation community.

Monsoon vine-forest
J. Russell-Smith as part of the survey of monsoon forests in the N.T., using aerial photos, mapped areas which appeared to be either Melaleuca forests or riparian forests. This information was transferred to 1:250 000 topographic maps and then digitised in to ARC/INFO. Both polygon and line features were digitized. This information is available although there is no differentiation between the melaleuca forests or mixed species riparian forests. This information to be used in a similar manner to the LU/LS information.

Problems: Differentiating mixed species riparian forests from melaleuca forests.

Landsat or Photo-interpretation of boundaries
Landsats at 100 000 or 250 000 scale to be interpreted for melaleuca community boundaries and information transferred to 1:250 000 topographic maps. The CCNT has a number of landsat images although it would be necessary to borrow some 1:250 000 colour landsat images from the Mines & Energy Dpt. (contact Bob Richards)

High level photogrhaphy where available may also be used for initial boundary definition or used in conjunction with the landsat images.

Problems: 1. It may be difficult to determine and accurately define what constitutes a melaleuca community from other forest communities such as monsoon-vine or riparian when using both landsats and aerial photographs. Only experience will tell. Some field checking of photo patterns might be necessary.

2.1.2 Classification of Mapping boundaries
Once the mapping boundaries have been decided upon they need to be classified into preliminary groups based on stand density and/or floristics. This may require additional linework to be placed within the mapping boundaries. This will be a fairly difficult thing to do and some idea of the classifications should be obtained before the field work (to reduce the number of field sites). After and during field-work the classification may be modified. Although stand density (and heights) cannot be easily measured using remotely-sensed data some idea of the canopy cover can be determined. Determining the broad floristic groups that occur (from the landsats,photos) might be almost impossible without further information. When classifying the map boundaries average figures may need to be produced (ie Paper bark open-forests vary from 30-70% canopy cover and thus stand density will vary). Methods available at present include:

1. Tonal variation in Landsats
   The tonal variation in the landsats may be used to determine the different densities of Melaleucas. Preliminary reconnaissance in the field to characterise what tone corresponds with what density (canopy cover) would be necessary. Landsats of a scale greater than 250 000 may also be used to compare patterns.

Problems: 1. Tonal variation between landsat images.

2. Aerial photographs
   If of sufficient scale, aerial photographs could be used for a first approximation (determine canopy cover by using a clear grid overlay and determining percentage area of crown cover versus non-crown cover).
1. Vegetation attributes

These are collected at each site and on completion of survey and classification of map units these are related to the digital coverage via the map unit number. Codes are assigned as per site specific variables) These attributes should be collected in conjunction with the Site specific attributes (core data requirements) and the wood attribute data. The vegetation attributes include the following for each map unit:

- Growth form
- Height
- Cover
- Floristics (dominant species in low strata as well)
- Stems per hectare
- Basal area
- Gross standing volume
- Condition

Where possible access will be by vehicle although in some instances this will be impossible, thus requiring aerial transport. The floristic survey should be undertaken while moist conditions prevail (sometime in the wet season). However the stand volume (ie forestry) component may be undertaken at a later date when the Melaleuca communities are adequately defined and when the ground conditions allow vehicle or foot access through the forests as transects will be needed to adequately assess the stand correlates. Whether the floristic and wood transects can be assessed at the same time will depend on seasonal conditions and will have to be decided upon nearer the field survey period. If the floristic survey and forestry survey are carried out at different times both plot and survey should be located adjacent to each other if possible.

2.2.1. Floristic survey

Objectives:
- To adequately assess the resource for floristic and structural characteristics and determine discrete communities.
- To adequately assess the geographic range and types of the Melaleuca forests.
- To assess the present status, threats and conservation of the Melaleuca forests (condition & dynamics).

Methods:

Floristic information.
Plots are located according to the initial interpretation and distribution map and reassessed in light of subsequent field survey. Plot location will be designed to cover the community variation and geographic range of the perceived Melaleuca communities. Plots to have a discrete number and referenced to topographic maps by AMG co-ordinates.

Floristic plots will be a 20m by 20m quadrat. At each plot, data will be collected on species abundance (basal area/percent foliage cover sensu Carnahan 1976) as they occur in the upper, middle, and ground layers. Ground layer species abundances measured as percent cover abundances. Heights will be measured by clinometer. Where possible full floristic lists will be compiled for each plot.

Lifeform information will be recorded (cover and height) in 15 generalised categories. (see attachment 2 and floristic field sheet Attachment 3), together with dominant lifeform, total cover and average height for each stratum.

Environmental information noted at each plot includes landform element and pattern, slope, aspect, rock outcrop%, bare ground(%), water depth etc.

The dynamics of the Melaleuca forests will be measured once appropriate measurement criteria has been decided on.

Site specific variables
The following site specific variables are required for the NFI. Some are constants and do not need to be measured in the field but are required in the final database. (not highlighted). All highlighted variables need to be filled out in the field.
Water cond
1. Fresh, fast flowing
2. Fresh and moving
3. Fresh and still
4. Stagnant
5. Brackish
6. Salty

Water-period
Water periodicity
1. Permanent
2. Intermittent

Water-bed
General composition of water body bed
1. Sand
2. Mud
3. Algae
4. Grass
5. Sedge
6. Rock
7. Gravel
8. Aquatic vegetation

Run-off
Run-off category
1. No run-off
2. Very slow
3. Slow
4. Moderately rapid
5. Rapid
6. Very rapid

Surface_text
Based on field texture grade

Organic
Organic layer if present Y=Yes N=No
% cover of site.
Depth of organic layer (in centimetres).

Micro-relief
Micro-relief refers to relief up to a few metres about the plane of the land surface.
(see W&S p69-73)
0. None
1. Gilgai
2. Hummocky
3. Biotic
4. Other

Comment

Rock_outcrops
% cover of plot

Coarse_frag
% cover of coarse fragments
Type
Dominant type of coarse fragments
0. Not present
1. Fine gravelly
2. Medium gravelly
3. Coarse gravelly
4. Cobbly
5. Stony
6. Bouldery
7. Large boulders

Bare-ground
% area of bare ground in plot.

Wood-shelter

Litter-depth
Depth of Litter (average depth cm)

Hollow-trees
The number of hollow trees measured with the basal area wedge to give Number/hectare.
<table>
<thead>
<tr>
<th>Strata-mid-cv</th>
<th>% canopy cover of middle stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strata-mid-lf</td>
<td>Dominant lifeform of middle stratum</td>
</tr>
<tr>
<td>Strata-mid-struc</td>
<td>Dominant structure of middle stratum as per table (attach ?).</td>
</tr>
<tr>
<td>Strata-mid-sp</td>
<td>Dominant species in the middle layer. Four letter code for Genus and Species.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strata-low-hi</th>
<th>Upper height in metres of ground stratum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strata-low-cv</td>
<td>% canopy cover of ground stratum</td>
</tr>
<tr>
<td>Strata-low-lf</td>
<td>Dominant lifeform of ground stratum</td>
</tr>
<tr>
<td>Strata-low-struc</td>
<td>Dominant structure of ground stratum as per table (attach ?).</td>
</tr>
<tr>
<td>Strata-low-sp</td>
<td>Dominant species in the ground layer. Four letter code for Genus and Species.</td>
</tr>
</tbody>
</table>

**Temporal Disturbance Attributes**

<table>
<thead>
<tr>
<th>Logging-int</th>
<th>Number of cut stems in 50 metre radius of plot. Record the number. 0 if no logging</th>
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</thead>
<tbody>
<tr>
<td>Logging-time</td>
<td>Time of logging event. 0=unknown 1=within 1 year 2=2-5 years 3=&gt;5 years</td>
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<tr>
<td>Fire-intensity</td>
<td>Fire damage. 0=not evident 1=minor impact, fire scars on some trees 2=minor impact, fire scars on most trees 3=some trees killed 4=most trees killed</td>
</tr>
<tr>
<td>Fire-frequency</td>
<td>0=no fire. 1=evidence of fire in last dry season. 2=fire greater than 1 year.</td>
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<tr>
<td>Geo-protection</td>
<td>Geo-morphic protection from fire. 0=all patch margins exposed 1=up to 50% of margin protected 2=&gt;50% of margin exposed.</td>
</tr>
<tr>
<td>Disturbance</td>
<td>Type of disturbance (might be more than one disturbance in any area.) 0=no disturbance 1=Wildfire 2= logging s=sawlog u=pulp 3=Grazing 4=Cyclone/wind-storm 5=Prescribed fire 6=Timber stand improvement 7=Insect damage 8=Dieback 9=Mining 10=Feral animals 11=Exotic weeds 4=Salinity</td>
</tr>
<tr>
<td>Biotic disturbance</td>
<td>Biological agents causing disturbance. 1=Animal(pig, bovine) 2=Man 3=Bird 4=Termite 5=Ant 6=Vegetation 7=Other</td>
</tr>
<tr>
<td>Disturbance freq</td>
<td>Frequency of disturbance 1=little evidence of disturbance over the past 30 years. 2=Single major disturbance in period 10-30 years. 3=A few disturbances, all &gt; 10 years ago. 4=Single recent disturbance 1-10 years. 5=Frequent recent disturbance, 1-10 years.</td>
</tr>
</tbody>
</table>
Wood volumes

Species

DBHOB

Bark thickness

Blaze

Merchantable Height

Stump height

Sawlog length

Pulplog length

Pole length

Logclass

Defect

All trees with a diameter of 20 cm or greater will be measured for wood volumes. The following information will be recorded.

Melaleuca species

Diameter breast height over bark measured at 1.3 metres above ground level.

Four measurements of bark thickness at breast height equidistant spacing around the stem. Total bole ht=Height in metres to tip of bole (trunk).

Tree to be blazed with axe or corer.
Pink blaze=1
Other =0

Merchantable height of the tree in metres.

Stump height in centimetres.

Length of sawlog in metres.
Length of pulplog in metres.
Length of pole log.

Classification of the tree.
1=sawlog only
2=pole log only
3=sawlog and pole log
4=pulp log (gross bole volume)
5=Unmerchantable

Defect categories
1=nil defect
2=Blown top
3=Ant infected
4=Fire damaged
5=Buffalo/cattle damage (ie exposed roots, bark removal etc)
6=Twisted (spiral grain)
7=Bowed or bent
8=Multi-stemmed
9=Dying
10=Recently dead
11=Long dead
12=Salt intrusion

3. Data Analysis

Objectives:

For N.F.I.

1a. Digital storage of distribution maps of the Melaleuca forests (ARC/INFO) for N.F.I.
1b. Environmental and stand information files linked to spatial cover for N.F.I.
1c. Report of survey methodologies and variable descriptions to accompany the digital database.

For CCNT

2a. Vegetation database in DECODA containing all the variables measured in the survey.
2b. Report and Map (1:250 000 scale) of the Ecology and Distribution of Melaleuca communities in the N.T.
2c. Report on Stand variables and Logging volumes.
2d. Digital information on ARC/INFO as for N.F.I.
### Regeneration

<table>
<thead>
<tr>
<th>Height</th>
<th>0 - 100m Frequency</th>
<th>Total</th>
<th>100 - 200m Frequency</th>
<th>Total</th>
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<tbody>
<tr>
<td>&lt;0.1m</td>
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<td>0.1 - 0.5m</td>
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<td>0.5 - 1m</td>
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<td>1 - 2m</td>
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### Small Tree

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<th>DBH OB (cm)</th>
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<td>5 - 10cm</td>
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<tr>
<td>10 - &lt;15cm</td>
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<tr>
<td>15 - &lt;20cm</td>
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### Wood Volume

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<tr>
<th>Species</th>
<th>DBHOB</th>
<th>Total Bole Ht.</th>
<th>Merch Ht. (m)</th>
<th>Stump Ht. (cm)</th>
<th>Saw Lgth</th>
<th>Pole Lgth</th>
<th>Bark th. (cm)</th>
<th>Aver. Bark thick</th>
<th>Log Class</th>
<th>Def.</th>
<th>Blaze</th>
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<td>Site</td>
<td>Wood</td>
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<th>L.Patt</th>
<th>Slope</th>
<th>Aspect</th>
<th>%Rock</th>
<th>%Bare</th>
<th>C.Frag.</th>
<th>Par.Mat</th>
<th>M.Rel</th>
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<tr>
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<th>Y N</th>
<th>Floodmark</th>
<th>Y N</th>
<th>Near.Water</th>
<th>Water stat</th>
<th>Run-off</th>
<th>Salt</th>
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<tr>
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<th>Organic</th>
<th>Y N</th>
<th>Litter</th>
<th>Y N</th>
<th>No. in Plot</th>
<th>Mimosa</th>
<th>%Cov:</th>
<th>No.</th>
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<tbody>
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<td>Depth</td>
<td>Stumps:</td>
<td>Termite:</td>
<td>Logs:</td>
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<tr>
<th>Logging</th>
<th>Y N</th>
<th>Fire</th>
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<th>Disturb.</th>
<th>Y N</th>
<th>Biotic Dis.</th>
<th>Y</th>
<th>Basal Cnt</th>
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### Height Class (metres)

<table>
<thead>
<tr>
<th>Diameter (cm)</th>
<th>0-5</th>
<th>5-10</th>
<th>10-15</th>
<th>15-20</th>
<th>20-25</th>
<th>25-30</th>
<th>30-35</th>
<th>Total</th>
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### Stems in Plot

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- Sapling:
- Pole:
- Mature:
- Ov.mature:
- Senescent:
- Total: