Report on the old-growth nomination within Warrup forest block – compartments 02 and 08

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Conservation Commission
WESTERN AUSTRALIA

Summary

On 6 March 2012, the Conservation Commission accepted a request to review potential old-growth forest within Warrup forest block compartments 02 and 08.

The subsequent assessment has shown:

- an area of 219 hectares within Warrup block compartments 02 and 08 meets the criteria for jarrah old-growth forest and is therefore unavailable for timber harvesting
- the remainder of the area assessed—approximately 500 hectares—does not meet the criteria for old-growth forest and remains available for timber harvesting.

1.0 Background

As outlined in the *Forest management plan 2004–2013* (FMP), the Conservation Commission is responsible for carrying out specific actions that relate to the management of old-growth forests. These actions were included in the FMP to address a high level of public concern about the reliability of old-growth forest mapping data. Therefore, in 2005, the Conservation Commission developed a process to provide transparency to old-growth forest assessments (see *Assessment criteria and process for the Conservation Commission review of old-growth amendments*). This process involves full public consultation and reporting. It enables members of the public to request the Conservation Commission to assess whether areas on the indicative timber harvesting plan should be classified as old-growth forest.

1.1 Definition of old-growth forest

The *National Forest Policy Statement* (Commonwealth of Australia 1992) defines 'old-growth forest' as forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading and clearing. The definition focuses on forest in which the upper stratum or overstorey is in a late mature or senescent growth stage. This definition implies that two conditions must be met for a stand to qualify as old-growth: (a) ecological maturity, and (b) minimal unnatural disturbance.

The Conservation Commission of Western Australia is guided by the definition of old-growth in the FMP, which is the same as that used in the *National Forest Policy Statement*. The FMP further details the criteria for inclusion of old-growth forest in the Department of Environment and Conservation's (DEC) corporate database:

> Areas greater than two hectares of ecologically mature forest, where the overstorey is in a late mature to senescent growth stage, and where the effects of disturbance (e.g. dieback, timber production, grazing) are either absent or now negligible.

Under the *Western Australian Regional Forest Agreement* (RFA 1998), the working definition for old-growth jarrah forest is uncut forest or forest subject to minimal disturbance and that is not affected by *Phytophthora cinnamomi*. This definition is a notable departure from the *National Forest Policy Statement*—the requirement for ecological maturity has been omitted. The working definition was developed as a pragmatic response to the constraints posed by available spatial information; in particular, the limitations of growth-stage mapping undertaken in the 1960s for timber assessment. It also has a reasonable biological basis—most jarrah stands that meet the minimal disturbance criterion also have a high proportion of ecologically mature stems. However, regrowth-dominated stands with minimal unnatural disturbance are occasionally observed. Under a strict interpretation of the RFA working definition, these stands would be considered old-growth forest.

The Conservation Commission's assessment process for old-growth jarrah forest uses the FMP's definition of old-growth. According to the Commission's established process (*Assessment criteria and process for the Conservation Commission review of old-growth amendments*), the effects of disturbance are considered more than minimal where changes to the structure of the overstorey caused by these disturbances are still evident, or where changes to the overstorey or understorey are irreversible. To qualify as old-growth a stand must satisfy a disturbance threshold *and* an ecological maturity threshold.

In this report the descriptors of disturbance are dieback status and the density of stumps. For ecological maturity, stands must comprise a high proportion of mature or senescent stems in the upper stratum. Thresholds for these two attributes are described in this report as well as the assessment methodology and the data collected by the assessment team.

2.0 Assessment

This report summarises the Conservation Commission's findings based on its consideration of available records and inputs, as well as on field sampling undertaken by Conservation Commission audit staff.

2.1 Public nomination of old-growth

As required in the FMP and further detailed in the Conservation Commission's paper *Assessment criteria and process for the Conservation Commission review of old-growth amendments*, there is a process for members of the public to request that the Conservation Commission assess whether areas on an indicative timber harvest plan should be classified as old-growth forest in DEC's corporate database. Such a request was received on 6 March 2012 in relation to portions of Warrup forest block – compartments 02 and 08.

2.2 Site description

Warrup forest block is located approximately 25 kilometres north-east of the town of Manjimup. The area is situated towards the eastern edge of State forest and is surrounded by farmland.

2.3 Forest types

Jarrah-dominant forest. Vegetation types[1] are mainly Wheatley and Bevan 2, as depicted in Map 1 of this report.

3.0 Sampling process

3.1 Remote analysis

The sampling method is based on the process outlined in *Assessment criteria and process for the Conservation Commission review of old-growth amendments*. The nomination area was reviewed and a sample area was chosen using the following background information:

- digitised aerial photos and data layers—used to confirm forest and non-forest structural boundaries and make general observations in relation to forest structure
- the latest available records of harvesting, soil types and vegetation types—provided by DEC
- the latest available dieback sampling and mapping—provided by DEC
- historical aerial photo imagery—provided by DEC
- a full stump location enumeration—undertaken by DEC and provided for this analysis.

1 *Delineation of landscape conservation units in southwest region of Western Australia*, CALM 2004

Records of previous harvesting suggest that the entire area of Warrup 08 was harvested in the 1960s. Similarly, records of previous harvesting suggest the entire area of Warrup 02 was harvested in the 1960s, with a small area on the western boundary harvested again in the 1980s.

The most recent mapping of *Phytophthora cinnamomi* occurrence indicates that a small area adjacent to Telephone Track in the north is infested with *Phytophthora cinnamomi*. One other small infestation was reported at the southern end of Telephone Track. There were three areas classed as uninterpretable—one area on the western boundary and two on the southern boundary associated with creek vegetation. All other areas were classed as uninfested. The most recent dieback samples taken within Warrup 02 show no infestations of dieback.

Ground evidence of disturbance (the presence of tracks and stumps) is clear and indicates that harvesting activity was focused primarily on Bevan 2 vegetation complex (see Map 1).

3.2 Stratification

In order to estimate and record changes to the structure of the overstorey caused by this disturbance, the Conservation Commission has undertaken canopy sampling. When identifying potential sampling locations, the Conservation Commission stratified site components of similar type to reduce sampling error. The types were stratified as follows:

- **locations of known stump intensity.** In measuring ground disturbance on these sites, the Conservation Commission was provided with the full stump enumeration by DEC. Therefore, as stump numbers were known, it was possible to target sampling in particular areas of the coupe.

- **vegetation complex.** A reduction in stump intensity is observable between vegetation complexes. This reduction is most likely a reflection of the lower quantity and poorer quality of timber (in areas such as the Wheatley vegetation complex) and hence limited timber harvesting in the past. Similar observations have been made in previous assessments in Warrup forest block which indicate that vegetation complex can be a useful method of sampling stratification. There are also areas of non-forest vegetation around upland depressions and streams. These non-forest areas are normally identified by DEC as diverse ecotype zones (DEZ). Both old-growth forest and DEZ are types of informal reserves unavailable for harvesting.

This report uses the proportion of mature or senescent stems in the upper crown as an indicator of ecological maturity. Sites must satisfy a threshold figure of 50 per cent mature or

senescent crown cover to be considered ecologically mature (and can be considered old-growth if they also satisfy the minimal disturbance criterion). The threshold figure was derived using data captured at uncut old-growth forest benchmarking sites (see graph below).

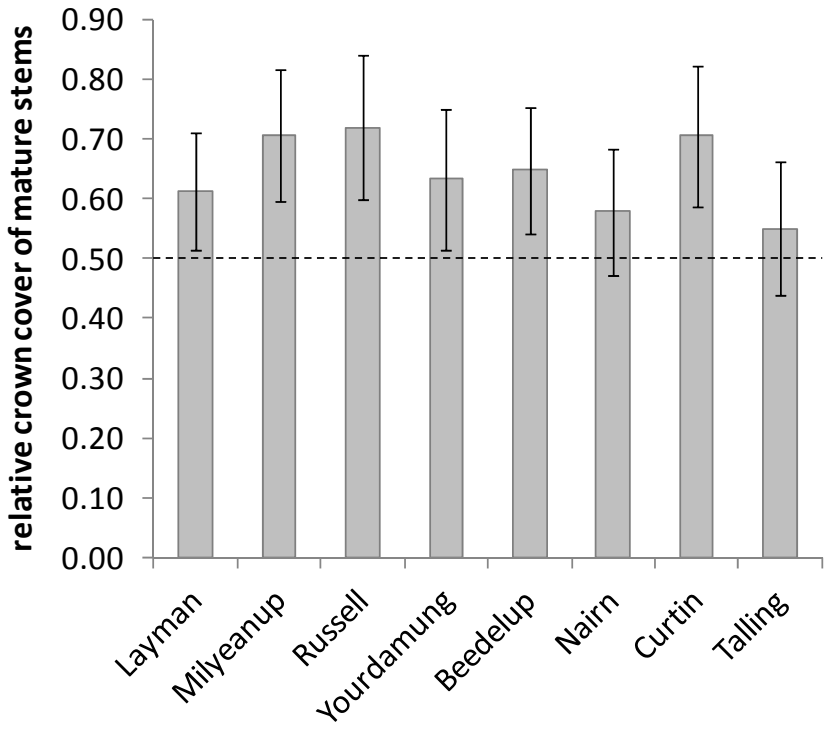


Figure 1. The relative crown cover of mature and senescent stems in uncut forest used for benchmarking. Error bars are 95 per cent confidence intervals. The dashed line at 50 per cent represents the threshold for ecological maturity.

As can be seen on the graph, best estimates for the sampling in the locations depicted above exceeded 50 per cent. Based on these sites, the Conservation Commission determined that, for delineating old-growth, the threshold for the proportion of mature or senescent stems in the upper crown should be 50 per cent. Sites with a value less than 50 per cent are non old-growth.

3.3 Field results

The stump location data provided by DEC provides a general overview of past harvesting intensity and gives a basis for canopy sampling stratification (as outlined above in section 3.2 – Stratification). The Wheatley vegetation complex is generally situated lower in the landscape and associated with the minor watercourses as depicted in Map 1. There are few or no stumps associated with this vegetation complex, with some low-intensity harvesting apparent on the

margins between Wheatley and Bevan 2 vegetation complexes. The borders between the two predominant vegetation complexes on the site were the main locations chosen for sampling. Two smaller areas of higher-intensity stump presence (group 1 sampling sites) were selected for comparison, but the main sampling effort was applied in areas with low stump numbers (group 2 sampling sites). Results of this sampling are presented in Appendix 1 and summarised in tables 1 and 2 below.

Table 1: Field check results for groups 1 and 2 sampling sites

	Average stumps per hectare within sampling sites	Estimated proportion of mature or senescent trees in upper crown
Group 1 sampling sites	6.5	40%
Group 2 sampling sites	2.8	51%

As shown above, the sample sites within group 2 averaged 2.8 stumps per hectare. The estimated proportion of mature or senescent trees in the upper crown for the group 2 sampling sites is 51 per cent, which meets the criteria for ecological maturity. With an average of 6.5 stumps per hectare and an estimated proportion of mature or senescent trees in the upper crown at 40 per cent, the group 1 sampling sites did not meet the criteria. Further detail on the group 2 results is provided in the table below.

Table 2: Detailed results for group 2 sampling sites

Estimated number of stumps per hectare	Estimated proportion of mature or senescent trees in upper crown	Estimated proportion of regrowth trees in upper crown	Estimated total upper crown cover
2.8	**51%**	49%	67%

4.0 Finding

In summary, stratified canopy measurements have been used to estimate the relationship between stump density and the proportion of mature or senescent stems in the upper stratum. Data from this assessment—along with data obtained by the Conservation Commission in previous assessments—implies a stump threshold of 3 stumps per hectare as the threshold for old-growth forest at this site.

By applying this stump threshold to the stump distribution, an area of previously unmapped old-growth forest has been determined. This additional area of old-growth forest is depicted on Map 2.

The 219 hectares[2] identified as additional old-growth forest will be added to the old-growth forest layer and will not be available for timber harvesting.

[2] As noted in section 3.2 – Stratification, included in this figure is approximately 20 hectares of diverse ecotype zone (DEZ). Both old-growth forest and DEZ are types of informal reserves unavailable for harvesting.

Appendix 1

Field observations for group 1 sampling sites

Sample number	Canopy	Species	Diameter (cm)	Development	Qualitative
981	Yes	Jarrah	25	Regrowth	Mixed
982	No		0	Gap	
983	No		0	Gap	
984	Yes	Jarrah	0	Regrowth	
985	No	Gap	0		
986	Yes	Jarrah	55	Mature/senescent	Mostly upper
987	Yes	Jarrah	55	Mature/senescent	Mostly upper
988	Yes	Jarrah	60	Mature/senescent	Mostly upper
989	Yes	Jarrah	50	Regrowth	Mostly upper
990	No	Gap	0	Gap	Mixed
991	Yes	Jarrah	30	Regrowth	Mixed
992	No	Gap	0		
993	Yes	Marri	40	Regrowth	Mostly upper
994	No	Gap	0		Mixed
995	No	Gap	0		
996	No		0	Gap	Mostly lower
997	Yes	Jarrah	35	Regrowth	Mixed
998	No		0	Gap	Mixed
999	No	Gap	0	Gap	Mixed
1000	Yes	Marri	40	Regrowth	Mixed
1001	Yes	Jarrah	55	Mature/senescent	Mixed
1002	Yes	Jarrah	20	Regrowth	Mixed
1003	Yes	Jarrah	40	Regrowth	Mixed
1004	Yes	Jarrah	50	Mature/senescent	Mostly upper
1005	No	Gap	0		Mostly lower
1136	Yes	Jarrah	40	Regrowth	Mixed
1137	No		0	Gap	Gap
1138	Yes	Jarrah	65	Mature/senescent	Mostly upper
1139	Yes	Karri	65	Mature/senescent	Mostly upper
1140	Yes	Jarrah	70	Mature/senescent	Mixed
1141	No		0	Gap	Mixed
1142	Yes	Marri	80	Mature/senescent	Mostly upper
1143	Yes	Marri	40	Regrowth	Mixed
1144	Yes	Jarrah	40	Regrowth	Mixed
1145	Yes	Marri	80	Mature/senescent	Mostly upper

1146	No		0	Gap	Mixed
1147	Yes	Marri	80	Mature/senescent	Mostly upper
1148	No		0	Gap	Mostly upper
1149	Yes	Marri	25	Regrowth	Mixed
1150	Yes	Jarrah	40	Regrowth	Mostly upper
1151	Yes	Jarrah	30	Regrowth	Mixed
1152	Yes	Jarrah	20	Regrowth	Mixed
1153	Yes	Jarrah	45	Regrowth	Mixed
1154	Yes	Jarrah	35	Regrowth	Mixed
1155	Yes	Jarrah	55	Mature/senescent	Mostly upper

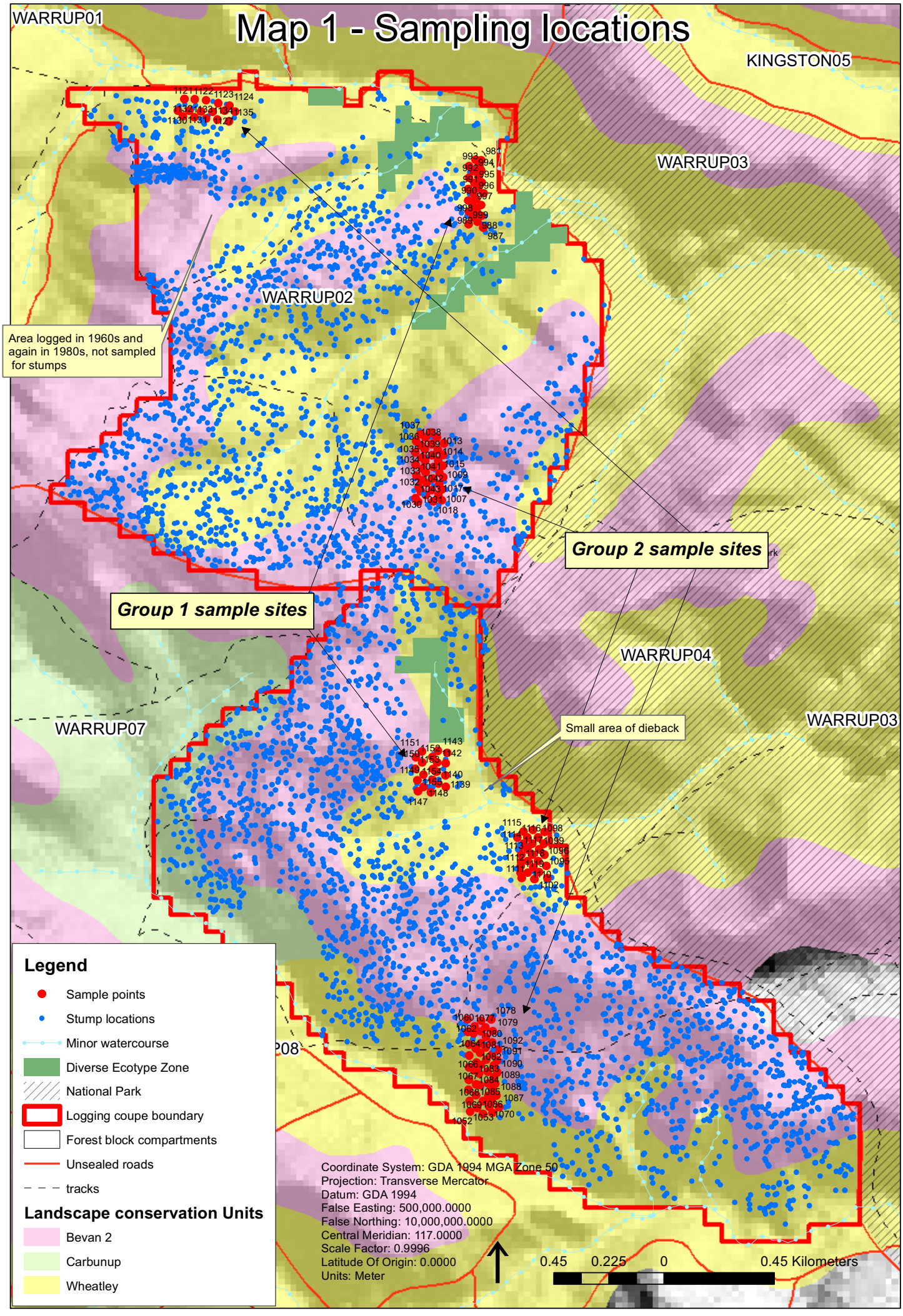
Field observations for group 2 sampling sites

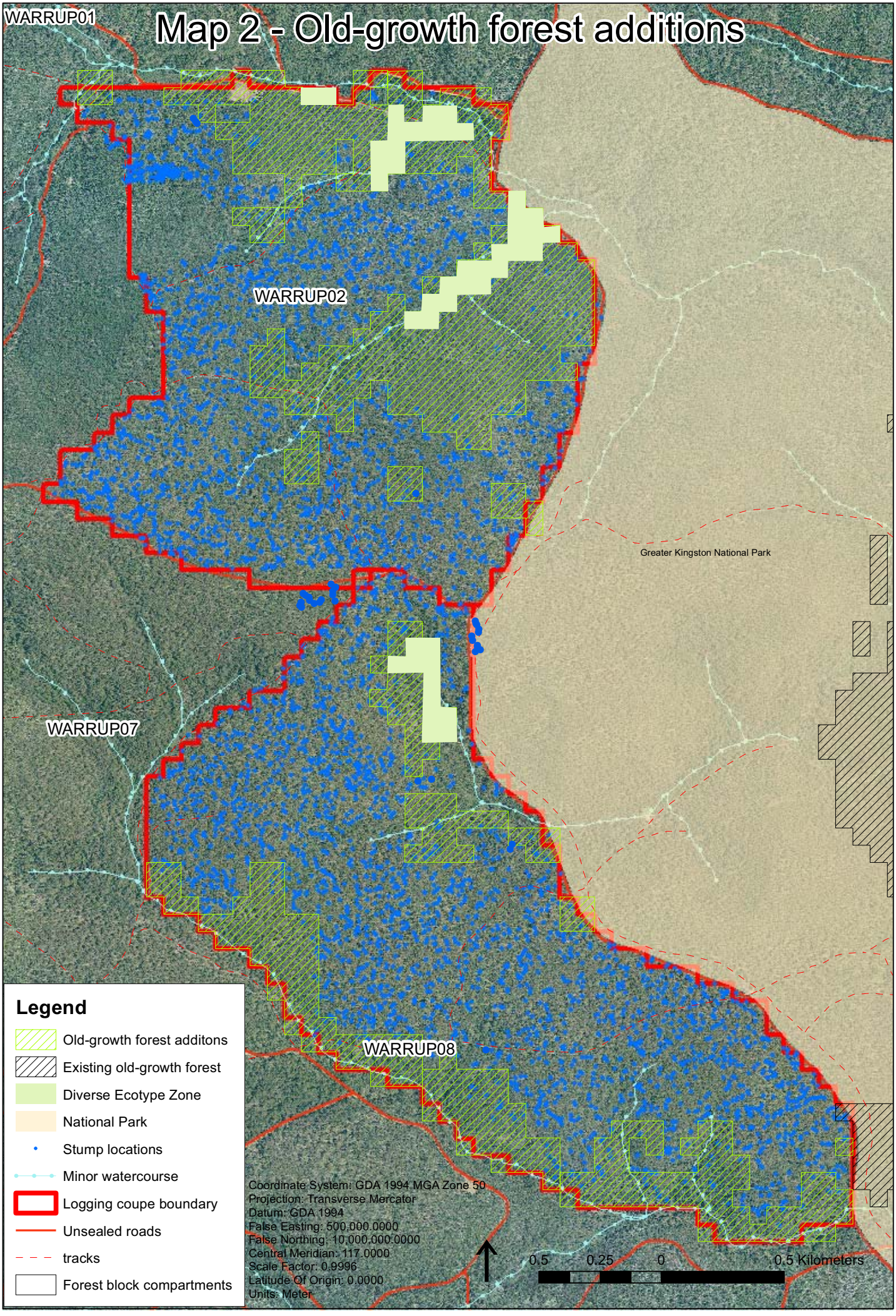
Sample number	Canopy	Species	Diameter (cm)	Development	Qualitative
1006	No		0	Gap	Mixed
1007	Yes	Jarrah	50	Mature/senescent	Mostly upper
1008	Yes	Jarrah	20	Regrowth	Mostly upper
1009	Yes	Jarrah	20	Regrowth	Mixed
1010	Yes	Jarrah	60	Mature/senescent	Mixed
1011	No		0	Gap	Mostly upper
1012	Yes	Jarrah	65	Mature/senescent	Mixed
1013	Yes	Jarrah	40	Regrowth	Mostly upper
1014	Yes	Jarrah	24	Regrowth	Mixed
1015	No		0	Gap	Mostly upper
1016	Yes	Jarrah	40	Regrowth	Mostly upper
1017	No		0	Gap	Mixed
1018	Yes	Marri	25	Regrowth	Mixed
1019	Yes	Jarrah	30	Regrowth	Mixed
1020	Yes	Marri	50	Mature/senescent	Mixed
1021	No	Gap	0	Gap	Mixed
1022	No		0	Gap	
1023	Yes	Jarrah	60	Mature/senescent	Mostly upper
1024	No		0	Gap	Mixed
1025	Yes	Jarrah	40	Regrowth	Mostly upper
1026	Yes	Jarrah	30	Regrowth	Mixed
1027	Yes	Jarrah	25	Regrowth	Mixed
1028	Yes	Jarrah	20	Regrowth	Mostly upper
1029	No	Gap	0	Gap	Mixed
1030	Yes	Jarrah	45	Mature/senescent	Mixed

1031	Yes	Jarrah	65	Mature/senescent	Mostly upper
1032	Yes	Jarrah	65	Mature/senescent	Mostly upper
1033	No		0	Gap	Mixed
1034	No		0	Gap	Mixed
1035	Yes	Jarrah	45	Regrowth	Mostly upper
1036	No		0	Gap	Mixed
1037	Yes	Jarrah	55	Mature/senescent	Mixed
1038	Yes	Marri	55	Mature/senescent	Mostly upper
1039	Yes	Jarrah	70	Mature/senescent	Mostly upper
1040	Yes	Jarrah	55	Mature/senescent	Mostly upper
1041	No	Gap	0	Gap	Mixed
1042	Yes	Jarrah	45	Regrowth	Mostly upper
1043	Yes	Jarrah	60	Mature/senescent	Mostly upper
1044	Yes	Marri	40	Regrowth	Mixed
1045	Yes	Marri	35	Regrowth	Mostly upper
1046	Yes	Marri	55	Regrowth	Mostly upper
1047	Yes	Marri	30	Regrowth	Mostly upper
1048	Yes	Marri	20	Regrowth	Mixed
1049	No	Gap	0		Mostly upper
1050	Yes	Marri	70	Mature/senescent	Mostly upper
1051	No		0	Gap	Mixed
1052	No		0	Gap	Mixed
1053	No		0	Gap	Mixed
1054	No		0	Gap	Mostly upper
1055	Yes	Marri	65	Mature/senescent	Mostly upper
1056	Yes	Jarrah	0	Mature/senescent	Mixed
1057	Yes	Marri	80	Mature/senescent	Mostly upper
1058	Yes	Marri	65	Mature/senescent	Mostly upper
1059	No		0	Gap	Mixed
1060	Yes	Marri	60	Mature/senescent	Mostly upper
1061	No	Gap	0	Gap	Mostly upper
1062	Yes	Jarrah	50	Mature/senescent	Mixed
1063	Yes	Marri	60	Mature/senescent	Mostly upper
1064	No		0	Gap	Mostly upper
1065	Yes	Marri	25	Regrowth	Mixed
1066	No		0	Gap	Mixed
1067	Yes	Marri	20	Regrowth	Mixed
1068	No		0	Gap	Mixed
1069	Yes	Jarrah	20	Regrowth	Mixed
1070	No	Gap	0	Gap	Mostly upper

1071	Yes	Marri	40	Regrowth	Mixed
1072	Yes	Marri	30	Regrowth	Mixed
1073	No	Gap	0	Gap	Mostly lower
1074	Yes	Marri	80	Mature/senescent	Mostly upper
1075	Yes	Jarrah	60	Mature/senescent	Mostly upper
1076	No	Gap	0	Gap	Mixed
1077	Yes	Jarrah	20	Regrowth	Mixed
1078	No		0	Gap	Mixed
1079	Yes	Marri	60	Mature/senescent	Mostly upper
1080	Yes	Marri	45	Regrowth	Mixed
1081	Yes	Marri	30	Regrowth	Mixed
1082	Yes	Jarrah	65	Mature/senescent	Mostly upper
1083	Yes	Marri	20	Regrowth	Mixed
1084	Yes	Marri	20	Regrowth	Mixed
1085	No		0	Gap	Mostly lower
1086	Yes	Jarrah	50	Mature/senescent	Mixed
1087	Yes	Jarrah	70	Mature/senescent	Mostly upper
1088	Yes	Marri	75	Mature/senescent	Mostly upper
1089	No		0	Gap	Mostly upper
1090	No		0	Gap	Mixed
1091	No		0	Gap	Mixed
1092	Yes	Marri	20	Regrowth	Mixed
1093	No		0	Gap	Mostly upper
1094	No		0	Gap	Mixed
1095	Yes	Marri	35	Regrowth	Mostly upper
1096	Yes	Jarrah	80	Mature/senescent	Mostly upper
1097	Yes	Marri	60	Mature/senescent	Mostly upper
1098	No		0	Gap	Mixed
1099	Yes	Marri	65	Mature/senescent	Mostly upper
1100	No		0	Gap	Mixed
1101	Yes	Marri	75	Mature/senescent	Mostly upper
1102	Yes	Marri	30	Regrowth	Mixed
1103	Yes	Marri	60	Gap	Mostly upper
1104	Yes	Jarrah	70	Mature/senescent	Mostly upper
1105	No		0	Gap	Mixed
1106	Yes	Marri	45	Regrowth	Mixed
1107	Yes	Marri	100	Mature/senescent	Mostly upper
1108	Yes	Marri	60	Mature/senescent	Mostly upper
1109	Yes	Marri	70	Mature/senescent	Mostly upper
1110	Yes	Marri	50	Mature/senescent	Mostly upper

1111	Yes	Jarrah	65	Mature/senescent	Mostly upper
1112	No		0	Gap	Mixed
1113	Yes	Bbutt	35	Regrowth	Mixed
1114	No	Gap	0	Gap	Mixed
1115	Yes	Jarrah	75	Mature/senescent	Mostly upper
1116	Yes	Jarrah	55	Mature/senescent	Mostly upper
1117	Yes	Marri	40	Regrowth	Mixed
1118	Yes	Jarrah	50	Regrowth	Mostly upper
1119	Yes	Marri	30	Regrowth	Mixed
1120	No		0	Gap	Mixed
1121	Yes	Jarrah	30	Regrowth	Mixed
1122	No		0	Gap	Mixed
1123	Yes	Marri	55	Mature/senescent	Mixed
1124	Yes	Marri	30	Regrowth	Mostly upper
1125	Yes	Jarrah	45	Mature/senescent	Mixed
1126	Yes	Jarrah	50	Mature/senescent	Mixed
1127	Yes	Jarrah	30	Regrowth	Mixed
1128	Yes	Jarrah	20	Regrowth	Mixed
1129	No	Gap	0	Gap	Mixed
1130	Yes	Marri	20	Regrowth	Mixed
1131	Yes	Jarrah	20	Regrowth	Mixed
1132	Yes	Marri	90	Mature/senescent	Mixed
1133	Yes	Jarrah	60	Mature/senescent	Mixed
1134	No		0	Gap	Mixed
1135	Yes	Jarrah	35	Regrowth	Mostly upper


Map 1 - Sampling locations
WARRUP01
KINGSTON05
WARRUP03
WARRUP02
WARRUP04
WARRUP07
Area logged in 1960s and again in 1980s, not sampled for stumps
Group 2 sample sites
Group 1 sample sites
Small area of dieback
Legend
Sample points
Stump locations
Minor watercourse
Diverse Ecotype Zone
National Park
Logging coupe boundary
Forest block compartments
Unsealed roads
tracks
Landscape conservation Units
Bevan 2
Carbunup
Wheatley
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
False Easting: 500,000.0000
False Northing: 10,000,000.0000
Central Meridian: 117.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter
0.45 0.225 0 0.45 Kilometers


WARRUP01
Map 2 - Old-growth forest additions
WARRUP02
Greater Kingston National Park
WARRUP07
WARRUP08
Legend
Old-growth forest additons
Existing old-growth forest
Diverse Ecotype Zone
National Park
Stump locations
Minor watercourse
Logging coupe boundary
Unsealed roads
tracks
Forest block compartments
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
False Easting: 500,000.0000
False Northing: 10,000,000.0000
Central Meridian: 117.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter
0.5
0.25
0
0.5 Kilometers