

METHODS USED IN AUSTRALIAN FOREST PLANNING IN 1987

by

Research Working Group No.2 - Mensuration and Management

Australian Forestry Council

Research Working Group No.2 (Mensuration and Management) is one of several groups set up by the Australian Forestry Council. It consists of one or two representatives from each state government forest service, from the Australian Capital Territory, private forestry companies, from universities and from C.S.I.R.O. Division of Forestry and Forest Products. Members of the group are concerned with forest mensuration and management; especially research into forest mensuration and methods of forest management, the development of tree, stand and forest models, forest inventory, and with the routine preparation and control of management plans.

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SUMMARY

Australian forest organisations have used a wide range of computer based techniques to facilitate the management of the nation's forest resources, ranging from the extensive management of uneven aged and even aged native forest to the more intensive management practised for many years in industrial plantations of both fast growing exotic and native species.

This paper summarises the methods used by the majority of forest owners in Australia for inventory, planning and yield control in 1987.

INTRODUCTION

Australia has over a century of experience with industrial plantations of fast growing exotic species, predominantly radiata pine (Pinus radiata D. Don.) and with the management of extensive areas of native forest, predominantly of Eucalyptus species. Australian forests cover a large geographic range and are managed by a large number of separate bodies primarily because land management is a state and not a federal responsibility. Because of this diversity, management practices have evolved differently in different areas due to different circumstances and needs.

This is reflected in the wide range of methods used by various forest organisations in the inventory, planning and yield control of the forests that they manage.

The methods used vary greatly in precision. For example, precision is generally lower in the mixed-age and mixed-species natural hardwood forests where inventory is difficult, growth rates are low, and management is commonly extensive. On the other hand, in the single species, fast growing and commercially valuable softwood plantations both inventory and management are intensive and growth and experimental data have often been collected over long periods.

The Australian Forestry Council, consisting of the relevant State and Federal Ministers of Forests, coordinates Australia's forestry activities. It is served by a Standing Committee consisting primarily of the heads of each state government forestry organisation who in turn are served by a committee of the directors of research.

There are ten Research Working Groups each consisting of about 15-25 representatives of forest organisations involved in research in a particular area. These groups have the responsibility to review the present state of knowledge in their areas, define gaps in that knowledge, identify areas where new work is needed, indicate priorities and consider how work can be rationalised and coordinated. The groups meet formally at about two yearly intervals, providing a report to both Standing Committee and the Directors of Research Committee. The meetings also allow workers to discuss current progress and problems and facilitate informal communications between workers in a field.

In 1978 Research Working Group No.2 (Mensuration and Management) contributed a paper to the IUFRO Steering Systems Project Group P4.02 meeting at Bucharest summarising the techniques used at that time in Australian forest planning.

This paper updates that information by presenting a brief summary of the methods currently being used by the owners of the larger forest areas in Australia in the management of the forest resources under their control. It is not intended to provide details about the methods but rather to indicate the type of methods used and who should be contacted if further details are desired. For convenience the methods have been divided into three groups; inventory methods, planning methods and yield control methods. Organisations are listed alphabetically within each section.

INVENTORY METHODS: A.P.P.M. NATIVE FOREST

Address of Organisation: Manager,
A.P.P.M. Forest Products,
P.O. Box 1541,
LAUNCESTON TAS 7250

Address of Contact: A.J. Warner,
C/- Associated Forest Holdings Pty. Ltd.,
P.O. Box 582,
BURNIE TAS, 7320

Summary of Forest Estate: 40,000 ha Eucalypt forest (E. delegatensis and E. obliqua), 17,000 ha Rainforest (predominantly Nothofagus cunninghamii), 7,000 ha mixed Eucalypt and Rainforest.

Sampling Techniques: Temporary 0.4 ha (200x20m) plots established continuously on parallel striplines spaced to give the number of samples required to give the desired sampling error of the assessment. Dbhob and merchantable heights recorded for all trees except small regrowth, these are tallied into 5 cm Dbhob classes and have Mean Dominant Height (25/ha) measured. Permanent 0.1 ha (50x20m) CFI plots are established in Eucalypt forest, and have Dbhob, bark thickness, and stump, merchantable and total heights recorded. Line transect method used for logging residue assessment.

Area Information: All areas derived from 1:25,000 base maps with roads etc located and mapped by survey with theodolite and EDM.

Output: Sawlog and pulpwood volume by species.

Application: Yield regulation, used in contractor logging rate setting, and contractor scheduling. Applied in major logging areas to provide old growth data for planning. CFI data are used for growth prediction and stand management.

INVENTORY METHODS: A.P.P.M. PLANTATIONS

Address of Organisation: Manager,
A.P.P.M. Forest Products,
P.O. Box 1541,
LAUNCESTON TAS 7250

Address of Contact: A.J. Warner,
C/- Associated Forest Holdings Pty. Ltd.,
P.O. Box 582,
BURNIE TAS, 7320

Summary of Forest Estate: 12,000 ha radiata pine and 8,000 ha Eucalypts (E. nitens and E. globulus) expanding annually by 3,000 ha.

Sampling Techniques: 0.04 ha (20x20m) temporary plots established on a grid system to give approximately 10 plots per sample area at age 13, (one year prior to first thinning). Dbhob, predominant height (at 2/plot and 50 trees/ha) are measured. Some of these plots are later converted to permanent CFI plots and then have Dbhob, a sample of tree heights, PDH, form and dominance recorded.

Area information: All boundaries surveyed to better than 1 in 500 for each compartment. Blanks >1 ha are excluded. Plotted at scale of 1:10000.

Output: Diameter frequency table, BA, volume/ha, mortality, hygiene, spacing and slope information. Site Index determined.

Application: Yield regulation, used in contractor logging rate setting, and contractor scheduling.

Status: Pine inventory up to date, Eucalypt inventory just commencing as plantation coming up to age 13.

INVENTORY METHODS: A.N.M.

Address of Organisation: The Manager,
Australian Newsprint Mills Ltd.,
BOYER TAS 7140

Address of Contact: M.G. White,
C/- A.N.M. Ltd.,
BOYER TAS 7140

Summary of Forest Estate: 160,000 ha of forest concession and 10,000 ha of private land includes 9,500 ha Pinus radiata plantation and 20,000 ha eucalypt regrowth.

Sampling Techniques: 1 plot/10 ha randomly located. Plots are normally 0.04 ha. 1 plot in 10 is 0.08 ha and is measured in detail. Plots located at age 10 years in pine, 20 years in eucalypt.

Tree Measurements: 0.04 ha plots, Dbhob and mean dominant height. 0.08 ha plot, as for 0.04 ha plots plus a range of height trees and double bark thickness on heightened trees.

Area Information: Boundaries plotted from aerial photographs at either 1:5,000 or 1:20,000 scale.

Output: Volume and basal area by size classes.

Application: Future planning and yield regulation.

Status: Pine assessment current. Eucalypt assessment still catching up. Currently measuring stands 23-25 years old.

INVENTORY METHODS: A.P.M. FORESTS

Address of Organisation: Manager,
A.P.M. Forests Pty. Ltd.,
Box 37,
MORWELL VIC 3840

Address of Contact: M.J.Mann,
Chief Forester,
A.P.M. Forests Pty. Ltd.,
Box 811,
CAMBERWELL, VIC 3124

Summary of Forest Estate: Gippsland; 42,000 ha of Pinus radiata plantation managed on a 28-30 year rotation with 3-5 thinnings.

Gippsland; 5,800 ha of eucalypt plantation.

Soil Survey: Soil mapping prior to planting. Inventory, silvicultural treatments and growth modelling based on soil type.

Sampling Technique: 0.04 ha inventory plots, one plot per 4-8 ha selected at establishment when tree stocking is measured, at age 1 survival is assessed. Tree measurements commence at age 11.

Subsequent Inventory: Immediately after each thinning, or after 5 years if no thinning. Individual tree identity not maintained.

Tree Measurements: Dbhob all trees, height of 3 largest trees. Electronic field data recorder used.

Growth Plots: Stratified by soil type, measurement before and after thinning, heights of all trees measured or estimated from height/diameter function for that plot.

Area Information: Net areas recorded to 0.1 ha. Areas amended by air photography.

Output: Volumes by log size class.

Application: Base data for planning models, insurance and valuation.

Status: Inventory up to date for Victoria. 14,300 plots held on file.

References: Dargavel, J.B. et.al. (1975) Comm. For. Rev. 54 (1) 27-37.

INVENTORY METHODS: AUSTRALIAN CAPITAL TERRITORY

Address of Organisation: General Manager,
Forest Branch, Department of Territories,
Civic Square, ACT 2608

Address of Contact: A.Davey, D.Johnson,
Forest Branch, Department of Territories,
P.O. Box 1011,
Civic Square, ACT 2608

Summary of Forest Estate: Net area 15,900 ha including 13,715 ha Pinus radiata, 580 ha Pinus ponderosa and 193 ha other species.

Sampling Techniques: Randomly located temporary plots of variable size. Size remains constant for each sampling unit and is selected so that the majority of plots contain 9-12 stems. Sampling intensity 1 plot per ha, optimum number found to be 40. First measurements at age 10-12 subsequently every 5 years or after operation that changes stocking, or other specific reason.

Tree Measurements: Dbhob, height (used to estimate stand top height).

Area Information: Areas determined using photogrammetric techniques, updated by ground survey, compilation from other maps, small format aerial photography.

Output: Basal area, stocking, top height, mean tree diameter, diameter distribution in 2 cm classes, volume assortments in 5 cm classes for each sampling unit.

Application: Output used for long term, short term planning models, valuation and economic analysis of stand strategies.

Status: System fully operational, minor backlog in measurements, 3500 to 4500 plots held on file on Hewlett Packard 1000 system.

References: Anon (1977) Forest Branch Assessment Procedures and Principles. Dept. Capital Territory, Australian Government Publishing Service Canberra. (Internal Working Document).

Johnson, D.A. (1985) Yield regulation in the ACT. Paper presented to Workshop, Modelling Trees, Stands and Forests, University of Melbourne.

Turner, A.J. and Munnings, P. (nd) Forests Branch, Department of Territories, Computer simulation programmes (Unpublished).

INVENTORY METHODS: NEW SOUTH WALES HARDWOODS

Address of Organisation: The Secretary,
Forestry Commission of New South Wales,
G.P.O. Box 2667,
SYDNEY, N.S.W. 2001

Address of Contact: R. Donovan,
Forestry Commission of New South Wales,
G.P.O. Box 2667,
SYDNEY, N.S.W. 2001

Summary of Forest Estate: Over 3,553,000 ha of dedicated State Forest, with 3,179,000 ha of mixed hardwood forest under sustained yield management.

Sampling Techniques: Yield assessment by stratified random temporary plots covering the assessment area. Concentric circular plots 0.04-0.4 ha depending on Dbhob. Growth assessment by stratified random permanent plots covering the forest region, 100 per region.

Tree Measurements: Yield assessment plots Dbhob, species, estimated use, vigour, crown, log length, bole height, damage, tree status code, location (bearing and distance).

Area Information: Compartment areas are stored on 1:25,000 scale map sheets. Total forest area is extracted from the maps, features mapped from Aerial photographs on CMA base maps.

Output: Volume by Dbhob size class, increment by Dbhob size class.

Application: Base data for CUTAN yield scheduling, analysis, growth assessment provides growth increment data for use in modeling future yields.

Status: Yield assessment conducted as need arises, growth assessment continuous with 75% of regions presently involved in a program of plot establishment.

INVENTORY METHODS: NEW SOUTH WALES PLANTATIONS

Address of Organisation: The Secretary,
Forestry Commission of New South Wales,
G.P.O. Box 2667,
SYDNEY, N.S.W. 2001

Address of Contact: C.Brack,
Forestry Commission of New South Wales,
G.P.O. Box 2667,
SYDNEY, N.S.W. 2001

Summary of Forest Estate: Over 160,000 ha of predominately Pinus radiata, managed on a 30-45 year rotation with up to 5 commercial thinnings.

Sampling Techniques: 0.05-0.15 ha temporary circular plots established at a 1:4 ha density in a management unit, subject to a minimum and maximum number of plots. Plots randomly established at age 10 years and immediately prior to any operation.

Tree Measurements: Dbhob (2cm classes), mean dominant height (tallest 40 trees/ha), trees marked for removal or retention where appropriate.

Area Information: Net and gross areas for each compartment are calculated from maps derived from standard aerial photography.

Output: Site class, stand table, volumes removed by size class.

Application: Base data for planning and yield scheduling, monitoring marking prescriptions, monitoring growth predictions.

Status: Inventory is controlled by the field officers via micro computers and the Commission's mainframe computer, and is up to date.

References: None published. See proceedings of RWG2 conference 1986.

INVENTORY METHODS: QUEENSLAND NATIVE FOREST

Address of Organisation: The Conservator,
Queensland Department of Forestry,
G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000

Address of Contact: J.K.Vanclay and B.L.McCormack,
Resources Branch,
Queensland Department of Forestry,
G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000

Summary of Forest Estate: 1,854,000 ha Eucalypt forest, 665,000 ha rain forest and 700,000 ha of Cypress pine forest. (Areas are gross areas).

Sampling Techniques: Either, temporary rectangular plot of 0.5 ha for all stems greater than 30 cm Dbhob, subplot of 0.125 ha for stems greater than 20 cm, (10 cm in Cypress pine), or, clusters of point samples using 1, 2, 5 or 10 m²/ha basal area factor optical wedges.

Tree Measurements: Dbhob of all stems, estimated log length of (potentially) merchantable stems.

Area Information: Area subsystem provides area data and other relevant information. Resource stratified into Management Units each comprising relatively homogeneous subunits.

Output: Stocking, basal areas and/or volumes by species, tree size, merchantability and/or visual thinning and by individual plots, selected strata or regional averages.

Application: Source data for yield regulation.

Status: Current.

References: Vanclay, J.K., Henry, N.B., McCormack, B.L., and Preston, R.A. (1987) Report of the Native Forest Task Force. Qld. Dept. For. 103pp.

McCormack, B.L. (1988) Area Information System, Field Procedures Manual. Internal Report Qld. Dept. For. 21pp + Appendices.

McCormack, B.L. (1988) Area Information System, System Operating Manual. Internal Report Qld. Dept. For. 30pp.

INVENTORY METHODS: QUEENSLAND PLANTATIONS

- Address of Organisation: The Conservator,
Queensland Department of Forestry,
G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000
- Address of Contact: W. Bale and M.C. Lofts,
Resources Branch,
Queensland Department of Forestry,
G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000
- Summary of Forest Estate: 165,000 ha of plantation, comprising three main species, Pinus caribea var hondurensis, Pinus elliottii (Slash pine) and Araucaria cunninghamii (Hoop pine). Rotation varies from 35-50 years depending on species, with 1-3 commercial thinnings.
- Sampling Techniques: For inventory a strip assessment at about 1.5% intensity. First assessment is at age 7-10 years with subsequent assessment following thinning.
- For growth plots, 0.1 ha plots established at the time of first inventory assessment, remeasured immediately after each thinning or at five year intervals.
- Tree Measurements: Dbhob, predominant height (tallest 50/ha), stocking, form class (defined as pruned, unpruned or useless), and three classes of relative straightness).
- Area Information: Plantations are surveyed at compartment establishment. Computer based plantation register system keeps track of areas on the basis of species, experiments, write-off, clear fall etc.
- Output: Merchantable volumes, basal areas and stocking by Predominant Height, Site Index or form classes for each compartment unit.
- Application: Provides feedback to District staff on current status, and is used as input to data management system and estate yield prediction modelling systems.
- Status: Inventory is up to date. 5500 growth plots have been established. Computer systems have been established to integrate all inventory systems. Development and refinement are ongoing.
- References: Resources Branch, Plantation Resource Assessment and Management Manual. Internal report of the Queensland Department of Forestry.

Plantation Resource Assessment - History and Rationale. Internal report of the Queensland Department of Forestry.

INVENTORY METHODS: SOUTH AUSTRALIA

Address of Organisation: The Director
Woods and Forests Department
Box 1604
ADELAIDE S.A. 5000

Address of Contact: J.W.Leech and I.B.Millard
Woods and Forests Department
Box 162
MOUNT GAMBIER S.A. 5290

Summary of Forest Estate: 70,000 ha of predominantly Pinus radiata plantation, managed on an approximately 45 year rotation with up to 6 commercial thinnings. The age class distribution is approximately normal.

Site Quality Survey: At age 9.5 all stands are assessed for site quality (total production volume to 10cm diameter underbark) by a strip survey with strips 60m apart, using temporary 0.05ha plots as standards, or yardstick plots.

Subsequent Inventory: One to two years after each commercial thinning operation, or at least every 8 years or so.

Sampling Techniques: 0.1 ha temporary plots are located at random within site quality and/or stocking strata. There are 3-6 plots established for a 20 ha compartment.

Tree Measurements: Dbhob of all trees, selection of trees to be removed in the next thinning. Upper stand height is estimated from yield tables or measured directly.

Area Information: All plantations are surveyed by theodolite and electronic distance measuring equipment. Net effective and total compartment areas are recorded to 0.1 ha. Areas by site quality class within each compartment are recorded. There are 7400 compartment records stored on the Area master file.

Output: Volume and increment estimates by size classes for each plot. The file structure is such that the complete file may be reprocessed to facilitate the use of improved estimation functions, or revised procedures.

Application: This inventory data base is used for all* planning models.

Status: Inventory is up to date, 7700 plots are currently stored on file. Two computer systems process the data on Vax 11/750 computers.

References: Lewis, N.B., Keeves, A. and Leech, J.W. (1976) Yield regulation in South Australian Pinus radiata plantations. Woods and Forests Department Bull. 23, 176pp.

INVENTORY METHODS: TASMANIA NATIVE FOREST

Address of Organisation: The Chief Commissioner,
Forestry Commission,
G.P.O. Box 207B,
HOBART TAS 7001

Address of Contact: S.R.Davis,
Forestry Commission,
G.P.O. Box 207B,
HOBART, TAS 7001

Summary of Forest Estate: Approx. 1.5 million ha of eucalypt forest managed on a sustained yield basis with an estimated rotation for regrowth of 80 years.

Sampling Techniques: Either (a) permanent and temporary 0.4 ha plots at the rate of 1 plot per 250 ha in selected strata. Stratification by height and crown density classes interpreted from aerial photography. The permanent plots are measured every 5 or 10 years.

Alternatively (b) prior to logging a 5% strip-line sample with strips 400m apart with a random starting point.

Tree Measurements: If (a) Dbhob, bark thickness at breast height, bole height, total height of 15-20 trees.

If (b) Dbhob, bole height, sawlog/pulp height, total height from tallest regrowth tree per 0.04 ha.

Area Information: Forest boundaries and strata plotted from aerial photographs. All patches digitized and attributes recorded on computer file. Private Property boundaries surveyed as are roads etc.

Output: Volume and increment by diameter classes.

Application: As a resource inventory and as a base for growth modelling.

Status: Inventory on-going with approx. 2000 permanent plots established (up to 4 measurements per plot).

Reference: Edgley, T.S. (1985) CFI Permanent Plot Manual. Internal Publication Forestry Commission of Tasmania.

INVENTORY METHODS: TASMANIA PLANTATIONS

Address of Organisation: The Chief Commissioner,
Forestry Commission,
G.P.O. Box 207B,
HOBART TAS 7001

Address of Contact: S.R. Davis,
Forestry Commission,
G.P.O. Box 207B,
HOBART, TAS 7001

Summary of Forest Estate: 37,000 ha of Pinus radiata spread over the State covering a range of sites managed on either a 25-30 or 40+ year rotation. Over half the area is pruned and thinned for clear-wood production.

Sampling Techniques: Systematic grid sample at age 10 0.04 or 0.06 ha temporary plots. One plot per 4 ha. Inventory repeated either once or twice in rotation depending on logging operations.

Tree Measurements: Dbhob, total height of tallest tree per 0.02 ha, selection of trees to be thinned or retained, form defect (type and height), pruned height.

Area Information: Plantation surveyed at establishment recorded to nearest 0.1 ha. Thinning and pruning boundaries by aerial photography or rough ground survey.

Output: Volumes by size classes.

Application: Base for planning models.

Status: Inventory not up-to-date on poor sites but else where satisfactory 3,500 plots measured. Data accessed by two computer sub-systems for planning purposes.

Reference: Van Saane L. (1982) Plantation Inventory System Internal Publication Forestry Commission of Tasmania.

INVENTORY METHODS: VICTORIA

Address of Organisation: Director General,
Department of Conservation, Forests and Lands,
240/250 Victoria Parade,
EAST MELBOURNE, VICTORIA 3002

Address of Contact: I.W.Wild and W.D.Incoll,
C/- Resource Assessment Branch,
Department of Conservation, Forests and Lands,
Room 102,
2 Treasury Place,
EAST MELBOURNE, VICTORIA 3002

Summary of Forest Estate: Approximately 4.7 million ha of Eucalypt forest of which approximately 1.4 million ha is suitable for the production of sawlogs. Approximately 200,000 ha of softwood plantation, principally Pinus radiata, of which approximately half is state owned.

Sampling Techniques: For Pinus radiata a systematic sample of temporary plots is carried out at age 10-12 years and then after each thinning. For the hardwood resource, both random and systematic sample of plots are used. Some hardwood forest has a C.F.I system. Comprehensive sets of permanent plots in both hardwood and plantation forest to investigate treatment effects and provide data for modelling.

Tree Measurements: For temporary plots, Dbhob of all trees and stand height. For permanent plots, Dbhob of all trees and a sample of tree heights. Taper measurements are made on selected sample trees.

Area Information: Stand boundaries obtained by A.P.I. are transferred to planimetric maps and stored by digital transfer to a Geographic Information System and related systems. Areas mapped to 0.2 ha for plantations, accuracy varies for hardwood forest.

Output: Volumes by size class and/or product classes for defined localities.

Application: Source data for all strategic and tactical planning.

Status: Softwood data up to date with >14,000 active plots. In the hardwood forest it varies with forest type and the intensity of management practices.

Reference: Dept.C.F.and L. Softwood Assessment Manual. Forest Resources Information and Yield Regulation Manual No.3 (FRIYR-3).

INVENTORY METHODS: WESTERN AUSTRALIA NATIVE FOREST

Address of Organisation: The Executive Director,
Department of Conservation and Land Management,
50 Hayman Rd.,
COMO WESTERN AUSTRALIA 6152

Address of Contact: Manager, Inventory Branch,
Conservation and Land Management,
50 Hayman Rd.,
COMO WESTERN AUSTRALIA 6152

Summary of Forest Estate: 1.5 million ha of Jarrah, managed by single tree selection; 153,000 ha of Karri, managed by clearfelling with a 100 year rotation.

Sampling Techniques: Stripline assessment at 2.5% to 5% intensity.
Measured one or two years prior to a planned operation.

Tree measurements: Dbhob and estimates of height to the top of each product section. Volumes calculated by computer based volume tables.

Area Information: Forest blocks mapped from aerial photographs; nett and gross areas calculated. Map scale 1:25,000 and 1:50,000

Output: Volumes by product classes and species for each compartment.

Application: Data for 1-2 year logging plans.

Status: Inventory up to date, field crews are trained to process their data interactively on the computer. A new resource level inventory using large scale photography and ground sampling is being developed.

INVENTORY METHODS: WESTERN AUSTRALIA PLANTATIONS

Address of Organisation: The Executive Director,
Department of Conservation and Land Management,
50 Hayman Rd.,
COMO WESTERN AUSTRALIA 6152

Address of Contact: Manager, Inventory Branch,
Conservation and Land Management,
50 Hayman Rd.,
COMO WESTERN AUSTRALIA 6152

Summary of Forest Estate: 31,000 ha of Pinus radiata, 28,000 ha of Pinus pinaster managed on a 30 year rotation with early heavy thinnings to promote sawlog yields.

Sampling Techniques: Systematically located variable radius plots, 1 plot per 3 ha. (Fixed area plots to be used in the future). Measured at age 10 and after each thinning operation. Sampling unit is a planting year, later stratified by thinning history and terrain.

Tree Measurements: Dbhob and total height of each tree in plot. Volumes calculated by computer based taper tables.

Area Information: Plantations mapped from aerial photos, net and gross areas calculated. Areas mapped by planting year, terrain, thinning history. Map scale 1:12,500.

Output: Volumes by size classes for each stand or operation.

Application: Data for annual logging plans.

Status: Models currently being revised to improve the accuracy of their predictions. Inventory proceeding at a reduced level. Data base up to date.

PLANNING METHODS: A.P.P.M. NATIVE FOREST, LONG TERM

Address of Organisation: Manager,
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LAUNCESTON TAS 7250

Address of Contact: A.J. Warner,
C/- Associated Forest Holdings Pty. Ltd.
P.O. Box 582,
BURNIE TAS, 7320

Summary of Forest Estate: 40,000 ha Eucalypt forest (E. delegatensis and E. obliqua), 17,000 ha Rainforest (predominantly Nothofagus cunninghamii), 7,000 ha mixed Eucalypt and Rainforest.

Objective: Schedule wood supply to Company sawmills, pulpmills, veneer mills, particle board mills and outside mills.

Planning Horizon: 200 years

Package: WOODSHED, the Forest Commission of Tasmania developed optimisation and simulation package for native forest.

Inputs: Forest type classes, yields for classes, areas of classes, desired cutting regime for classes. Constraints on these inputs include yield of sawlog and pulpwood by class by 10 year period.

Method: LP Simulation (LP is based on MINOS).

Computer: Prime 550. To run WOODSHED (the non-linear optimisation) takes 20-40 minutes dependant on constraints. To run GROWER (Simulation program) takes 1-2 minutes.

Status: Current, but under ongoing review and development.

PLANNING METHODS: A.P.P.M. PLANTATIONS, LONG TERM

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LAUNCESTON TAS 7250

Address of Contact: A.J. Warner,
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P.O. Box 582,
BURNIE TAS, 7320

Summary of Forest Estate: 12,000 ha radiata pine and 8,000 ha Eucalypts (E. nitens and E. gloagulus) expanding annually by 3,000 ha.

Objective: Schedule wood supply to Company sawmills, pulpmills, veneer mills, particle board mills and outside mills.

Planning horizon 50 years.

Package: FORMOD and BASMOD.

Inputs: Compartment age, size, indicator of site quality, desired regime, target, limiting volumes for years, starting year.

Outputs: Yield of sawlog and pulpwood by compartment by year.

Method: Simulation models, no optimisation but can easily edit data and rerun.

Computer: IBM PC/AT and XT with 31 Mb and 20 Mb hard discs.
 Status: Current, but under ongoing review and development.

PLANNING METHODS: A.N.M. LONG TERM

Address of Organisation: The Manager,
 Australian Newsprint Mills Ltd.,
 BOYER TAS. 7140

Address of Contact: M.G.White,
 Australian Newsprint Mills Ltd.,
 BOYER TAS. 7140

Summary of Forest Estate: 160,000 ha of Forestry Concession and 10,000 ha of private land includes 9,500 ha Pinus radiata plantation and 20,000 ha eucalypt regrowth.

Objective: Schedule supply of wood for paper mill at Boyer plus supplies to sawmills as required by crown.

Planning Horizon: Up to 80 years.

Inputs: Statement of current forest estate which is grown or using local adoption. STANDSIM grows Pinus radiata using stand tables developed from local plot data.

Outputs: Permissible cuts available.

Computer: VAX 11/785.

Status: Current.

PLANNING METHODS: A.P.M. FORESTS SHORT TERM

Address of Organisation: Manager,
 A.P.M. Forests Pty. Ltd.,
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 Morwell, Vic 3840

Address of Contact: M.J.Mann,
 Chief Forester,
 A.P.M. Forests Pty. Ltd.,
 Box 811,
 Camberwell, Vic 3124

Summary of forest estates: Gippsland; 42,000 ha of Pinus radiata plantation managed on a 28-30 year rotation with 3-5 thinnings.

Gippsland; 5,800 ha of eucalypt plantation

Objective: Annual cutting plans to schedule supply from Pinus radiata plantations to a pulpmill and sawmill.

Planning Horizon: 6 months - 5 years

Inputs: Age, basal area, height and stocking for each cutting unit, its area and suitability for summer or winter cutting, visual assessment of sawlog quality by cutting units.

Outputs: Schedule of stands to be cut and volume of pulpwood and sawlogs by size class by summer and winter sites.

Methods: Data from Management Information System using inventory data. Includes a stand growth model. Selects stands for cutting by priority rules based on operation due, criteria for thinning, quality of sawlogs and volume requirements.

Computer: IBM 3084 programmed in PL1.

Status: Used routinely for cutting plans and annual budgetting.

References: Dargavel, J.B. and Marshall, P.J. (1976) Annual cutting plans for developing plantations. PROC. IUFRO Working Group S4.02.4 XVI Congress, Oslo.

PLANNING METHODS: A.P.M. FORESTS LONG TERM

Address of Organisation: Manager,
A.P.M. Forests Pty. Ltd.,
Box 37,
Morwell, Vic 3840

Address of Contact: M.J.Mann,
Chief Forester,
A.P.M. Forests Pty. Ltd.,
Box 811,
Camberwell, Vic 3124

Summary of forest estates: Gippsland; 42,000 ha of Pinus radiata plantation managed on a 28-30 year rotation with 3-5 thinnings.

Gippsland; 5,800 ha of eucalypt plantation.

Objective: Plantation simulation; four simple models for development planning for plantations of Pinus radiata, P. elliotti, Eucalyptus regnans and mixed Eucalypt species.

Planning Horizon: 20 to 50 years.

Inputs: Pinus elliotti model allows 4 different sites each with a standard yield table, others assume one average site and yield table. Areas of each age and standard cost are required.

Output: Schedule of areas planted, thinned and clear felled to meet nominated wood demands.

Method: Yield table projections.

Computer: One requires IBM mainframe, others IBM PC.

Status: Used intermittently for land purchase and planting rate decisions.

PLANNING METHODS: A.P.M. FORESTS LONG TERM, OPTIMISATION

Address of Organisation: Manager,
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Box 37,
Morwell, Vic 3840

Address of Contact: M.J.Mann,
Chief Forester,
A.P.M. Forests Pty. Ltd.,
Box 811,
Camberwell, Vic 3124

Summary of forest estates: Gippsland; 42,000 ha of Pinus radiata plantation managed on a 28-30 year rotation with 3-5 thinnings.

Gippsland; 5,800 ha of eucalypt plantation

Title: Gippsland plantation model.

Objective: Optimisation model for long term planning of wood supply to a pulpmill and a sawmill including land purchase, silvicultural options for plantation management and purchase of wood from outside sources.

Planning Horizon: 27 years.

Inputs: An average of 31 alternatives for each of 257 stands showing yields, cash flows and contribution to objectives produced from a stand model. Growth models, treatments, logging season and logging costs by soil types, also modelling of wood quality and pulp yields. Volumes and costs of outside wood purchase options.

Outputs: Extensive reporting of:

1. Silvicultural regime for each stand (fertilising, thinning method and clear felling age).
2. Wood purchase schedule.
3. Planting, thinning and clear felling schedule.
4. Wood production by summer and winter logging sites.
5. Rationing of capital between plantation activities.
6. Forecasts of wood size and pulp yields.
7. Marginal costs.

Method: Linear programming.

Development Task Size: Approximately 6 man years and effort in continual modification and maintenance.

Computer: IBM 3084, programmed in PL1.

Status: Used routinely for examination of options for expansion, determining annual planting rates and for broad consideration of thinning type and fertiliser options.

References: Dargavel, J.B. (1978). A model for planning the development of industrial plantations. Australian Forestry 41 (2) 95-107

Mann, M.J. (1985) A.P.M.'s Gippsland Plantation Model - Recent Developments. Workshop: Modelling Trees, Stands and Forests, University of Melbourne, August, 1985.

PLANNING METHODS: AUSTRALIAN CAPITAL TERRITORY SHORT TERM

Address of Organisation: General Manager,
Forest Branch, Department of Territories,
P.O. Box 1011,
Civic Square, ACT 2608

Address of Contact A.Davey, D.Johnson,
Forest Branch, Department of Territories,
P.O. Box 1011,
Civic Square, ACT 2608

Summary of Forest Estate: Net area 15900 ha including 13715 ha Pinus radiata, 580 ha Pinus ponderosa and 193 ha other species.

Objective: Schedule Pinus radiata stands for cutting to supply sawmills and treatment plant.

Planning Horizon: 2-4 years.

Inputs: Age, basal area, height, diameter distribution, area, wastage factor residual basal area and rainfall.

Outputs: Yield in size classes, total yield, area thinned and area clearfallen for each year in the planning horizon. Output is grouped by contract by year.

Method: Current growth models are incorporated. Stands for inclusion are specified prior to a run. All stands are grown to a base year and then the yields are estimated for each year.

Development Task Size: Programme is written in FORTRAN 77. Most time consuming process is maintaining inventory data base.

Computer: HP 1000 F Series.

Status: System fully operational. Growth functions currently under revision.

References:

Anon (1977) Forest Branch Assessment Procedures and Principles. Department Capital Territory, Australian Government Publishing Service Canberra. (Internal Working Document).

Bary, G.A.V. and Borough, C.J. (1980) Tree volume tables for Pinus radiata in the Australian Capital Territory. CSIRO Division of Forest Research Report No. 11 (Unpublished).

Ferguson, I.S. (1979) Computer based growth model of ACT Forests. Unpublished report. Resource and Environment Consultant Group, Department of Forestry Australian National University.

Johnson, D.A. (1985) Yield Regulation in the ACT. Paper presented to Workshop, Modelling Trees, Stands and Forests, University of Melbourne.

Turner, A.J. and Munnings, P. (nd) Forests Branch, Department of Territories, Computer Simulation Programmes (Unpublished).

PLANNING METHODS: AUSTRALIAN CAPITAL TERRITORY LONG TERM.

Address of Organisation: General Manager,
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Civic Square, ACT 2608

Address of Contact A.Davey, D.Johnson,
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P.O. Box 1011,
Civic Square, ACT 2608

Summary of Forest Estate: Net area 15900 ha, 13715 ha Pinus radiata,
580m ha Pinus ponderosa and 193 ha other species.

Objective: To predict long term yield from the Pinus radiata
plantation resource.

Planning Horizon: 40-50 years.

Inputs: Age, basal area, height, diameter distribution,
areas, residual basal area, planning horizon,
minimum interval between operations, minimum age
of first thinning, maximum age of thinning, volume
production targets, rainfall, priority of thinning
to clearfall, option to fulfill deficits in volume
by extra clearfelling.

Outputs: Yield in 5 cm size classes, total yield, area for
each stand harvested in each year in the planning
horizon. Cash flow, mean log sizes for thinning
and clearfelling, residual growing stock and area
of each age class remaining at the end of each
year.

Method: Targets are specified for total yield and volume
of clearfelling. Current growth functions are
used to update all stands to a base year and to
predict their outturn. Thinning commences with
stands that have the greatest basal area and
clearfall with stands that have the largest mean
tree diameter.

Operations are carried out until targets are
achieved or there is no other stand available for
harvesting. A limited number of strategies can be
evaluated as only one residual basal area can be
specified per run.

The model is deterministic and provides assistance
for yield regulation.

Development Task Size: Programme is written in FORTRAN 77, most time
consuming process is maintaining inventory data
base.

Computer: HP 1000 F Series.

Status: System fully operational, growth functions currently under revision.

References: Bary, G.A.V. and Borough, C.J. (1980) Tree volume tables for Pinus radiata in the Australian Capital Territory. CSIRO Division of Forest Research Report No. 11 (Unpublished).

Ferguson, I.S. (1979) Computer based growth model of ACT Forests. Unpublished report. Resource and Environment Consultant Group, Department of Forestry Australian National University.

Johnson, D.A. (1985) Yield Regulation in the ACT. Paper presented to Workshop, Modelling Trees, Stands and Forests, University of Melbourne.

Turner, A.J. and Munnings, P. (nd) Forests Branch, Department of Territories, Computer Simulation Programmes (Unpublished).

PLANNING METHODS: NEW SOUTH WALES

Address of Organisation: The Secretary,
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SYDNEY, N.S.W. 2001

Address of Contact: C. Brack,
M.P.D.,
Forestry Commission of N.S.W.
G.P.O. Box 2667
SYDNEY N.S.W. 2001

Summary of Forest Estate: Over 160,000 ha of predominately Pinus radiata, managed on a 30-45 year rotation with up to 5 commercial thinnings.

Objective: To rationalise yield flows through time and to maximise volume/value production while meeting market constraints.

Planning Horizon: Both short term (5 years) and long term (35+ years) horizons are used.

Inputs: Inventory plot data, market constraints, financial details, potential acceptable silvicultural regimes.

Output: Cutting plan applicable to individual areas (cutting units), size and distribution over time of volume production.

Method: Stand simulation using models derived from research and inventory data. Optimisation by linear programming which maximises volume or value while meeting product constraints, by selecting thinning regimes to apply to each cutting unit.

Computer: CSA, Control Data bureau computers. Computer system currently under review.

References: Donovan, R.M. (1982) "The RADHOP system". Forestry Commission of NSW. 37pp.

Wilson, R.V. (1978) "Scheduling to meet requirements - selections from possible regimes". Paper presented at Forestry Commission Pinus Plantation Management Conference, Tumut, April 1978, 13pp.

PLANNING METHODS: QUEENSLAND NATIVE FOREST

Address of Organisation: The Conservator,
Queensland Department of Forestry,
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BRISBANE, QUEENSLAND 4000

Address of Contact: J.K.Vanclay,
Resources Branch,
Queensland Department of Forestry,
G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000

Summary of Forest Estate: 1,854,000 ha Eucalypt forest, 665,000 ha rain forest, and 700,000 ha Cypress pine forest. (Areas are gross areas).

Objective: Sustained yield timber management.

Planning Horizon: Short (5 years), medium (20 years), and long term (50 years).

Inputs: Current stand table, areas from Area sub-system, harvest data from inventory, growth models developed from permanent plot data.

Outputs: Profiles showing projected stand table, total merchantable volume and loggable volumes per hectare over time.

- Method: Projection of individual plots using the "cohort" method (Reed 1980). Sustained yield derived through heuristic simulation.
- Development Task Size: 12 man months.
- Computer: MIPS M1000 running Unix V.
- Status: Undergoing further development.
- References:
- Preston, R.A. and Vanclay, J.K. (1987) Calculation of timber yields from north Queensland rainforests. Qld. Dept. For. Tech. Paper No. 47, 24pp.
- Reed, K.L. (1980) An ecological approach to modelling the growth of forest trees. For. Sci. 26 (1) p33-50.
- Vanclay, J.K. (1983) Techniques for modelling timber yield from indigenous forest with special reference to Queensland. M.Sc. Thesis, Oxford, 194pp.
- Vanclay, J.K. (1985) Yield Regulation in Native Forests. Workshop: Modelling Trees, Stands and Forests, University of Melbourne, August 1985, 5pp.
- Vanclay, J.K. (1985) A stand growth model for Cypress Pine. Workshop: Modelling Trees, Stands and Forests, University of Melbourne, August 1985, 16pp.
- Vanclay, J.K., Henry, N.B., McCormack, B.L., and Preston, R.A. (1987) Report of the Native Forest Resources Task Force. Qld. Dept. For. 103pp.
- Vanclay, J.K. (1987) A stand growth model for yield regulation in north Queensland rainforests. Pp 928-35 in Ek, A.R., Shifley, S.R. and Burk, T.E. (eds.) Forest Growth Modelling and Prediction. Proc. IUFRO Conference, Aug 23-7 1987, Minneapolis Minnesota. USDA Forest Service Gen. Tech. Report NC-120, 1149 pp.
- Vanclay, J.K. and Henry, N.B. (1988) Assessing site productivity of indigenous cypress pine forest in southern Queensland. Comm. For. Review 67(1), p53-64.
- Vanclay, J.K. (1988) Site productivity assessment in rainforests: an objective approach using indicator species. Paper presented at IUFRO Growth and Yield in Tropical Mixed/Moist Forests Conference, Kuala Lumpur, Malaysia, June 20-4, 1988, 14pp.

PLANNING METHODS: QUEENSLAND PLANTATIONS

Address of Organisation: The Conservator,
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Address of Contact: E.Keady and J.K.Vanclay,
 Resources Branch,
 Queensland Department of Forestry,
 G.P.O. Box 944,
 BRISBANE, QUEENSLAND 4000

Summary of Forest Estate: 165,000 ha of plantation, comprising three main species, Pinus caribea var Hondurensis, Pinus elliottii (Slash pine) and Araucaria cunninghamii (Hoop pine). Rotation varies from 35-50 years depending on species, with 1-3 commercial thinnings.

Objective: Calculation of short and long term yields, cash flows and standing volumes and values when required, for any time interval into the future, under various management regimes.

Planning Horizon: Short term up to 10 years, long term up to 50 years.

Inputs: Inventory strip assessment data comprising basic diameter, height, stocking and form class information from existing computer system, and area control information from plantation register system are combined to effect estate level prediction.

Outputs: Wide range of stand parameters; volumes, values, size assortments, discounted values and worths for thinnings, clear falls and residuals. User defined reporting facilities are very flexible and wide ranging.

Method: Basal area increment and height growth models developed from growth plot and experimental plot data are used to forecast growth of individual cohorts (spacing independent). At any stage the list of cohorts making up a stand can be recombined to form a traditional stand table or diameter distribution for simulation of thinnings. Optimisation of management strategies handled by strategy generators, prediction systems and linear programming, all forming an integrated system.

Development Task Size: Big.

Computer: MIPS M1000 running Unix V.

Status: Operational, to be enhanced to include log processing simulation.

References: Beck, R.D. (1983) Plantation final crop harvest scheduling using optimisation modelling. Unpublished report, 137pp.

Beck, R.D. (1985) Platipus physiology. Workshop: Modelling Trees, Stands and Forests, University of Melbourne, August 1985, 11pp.

Keady, E.J. (1987) PLYSIM User manual. Internal report of the Qld. Dept. For.

Keady, E.J. (1987) Site Index curves, all main species. Internal report of the Qld. Dept. For. 20pp.

PLANNING METHODS: SOUTH AUSTRALIA SHORT TERM

Address of Organisation: The Director
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ADELAIDE S.A. 5000

Address of Contact: J.W. Leech and I.B. Millard
Woods and Forests Department
Box 162
MOUNT GAMBIER S.A. 5290

Summary of Forest Estate: 70,000 ha of predominantly Pinus radiata plantation, managed on an approximately 45 year rotation with up to 6 commercial thinnings. The age class distribution is approximately normal.

Objective: Preparation of short term (5 year) plans directing where logging should proceed.

Planning Horizon: 5 years, but revised every 2-3 years.

Inputs: The inventory of the forest (area and plot data for each compartment). The definition of each logging unit (group of relatively homogeneous compartments). Any overriding information.

Outputs: Underbark volume yields by size class for the next operation, for each logging unit, also summarised for each year for each forest area. Clear fellings and thinnings are totalled separately.

Method: The Inventory data include details of expected year of treatment, but these can be modified easily. Because most of the forest estate has been thinned to a consistent thinning regime for about 20 years it is relatively simple to schedule the operations to meet required levels of cut.

Development Task Size: This subsystem of the Yield Regulation system was first implemented on computer in 1969, rewritten in 1974, and again rewritten in 1982-3. It has about 10,000 lines of FORTRAN.

Computer: Vax 11/750.

Status: Fully operational, under continual review and revision to incorporate new requirements as they emerge.

References: Lewis, N.B., Keeves, A. and Leech, J.W. (1976) Yield regulation in South Australian Pinus radiata plantations. Woods and Forests Department Bull. 23, 176pp.

PLANNING METHODS: SOUTH AUSTRALIA LONG TERM

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Address of Contact: J.W. Leech and I.B. Millard
Woods and Forests Department
Box 162
MOUNT GAMBIER S.A. 5290

Summary of Forest Estate: 70,000 ha of predominantly Pinus radiata plantation, managed on an approximately 45 year rotation with up to 6 commercial thinnings. The age class distribution is approximately normal.

Objective: Preparation of long term (70 year) plans that are used to determine the level of Permissible Cut.

Planning Horizon: 70 years, plans being revised at 5-10 year intervals or as required.

Inputs: The inventory of the forest, (area and plot data for each compartment). The definition of each logging unit. Fertiliser history and any overriding information. Prescriptions for any logging unit which cannot be treated according to the wide range of programmed options.

Outputs: Underbark volume yields to various top diameter limits from successive operations during the planning horizon for the whole of the forest estate.

Method: A simulation model where a silvicultural strategy for each stand is first defined, and then the stand is treated according to that strategy. Multiple runs allow sensitivity analyses to be carried out.

Development Task Size: This subsystem of the Yield Regulation system has about 15,000 lines of FORTRAN. The complete system took about 12 years to develop and implement to the present stage.

Computer: Vax 11/750.

Status: Operational, under continual review and revision as better models become available and needs change.

References: Lewis, N.B., Keeves, A. and Leech, J.W. (1976) Yield regulation in South Australian Pinus radiata plantations. Woods and Forests Department Bull. 23, 176pp.

Leech, J.W. (1985) A management planning model for a large plantation forest. Mathematics and Computers in Simulation, 27, p199-206.

Leech, J.W. (1985) Analyses using the South Australian long Term Planning Model. Workshop "Modelling trees, Stands and Forests". Melbourne, August 1985, 11pp.

PLANNING METHODS: TASMANIA NATIVE FOREST

Address of Organisation: Chief Commissioner,
Forestry Commission,
G.P.O. Box 207B,
HOBART TAS 7001

Address of Contact: R.L.Gordon,
Forestry Commission,
G.P.O. Box 207B,
HOBART TAS 7001

Summary of Forest Estate: Approximately 1.5 million ha of eucalypt forest managed on a sustained yield basis with an estimated rotation for regrowth of 80 years.

Objective: To calculate sustained yield from eucalypt forest taking into account areas of State Forest unavailable for logging, fire frequency, and recovered versus assessed volumes.

Planning Horizon: 200 years (or 20 periods).

Inputs: Areas by Forest Class, annual area lost by fire, time between logging and regeneration, areas understocked, yields by forest class, "couping-up effect".

Output: Volume of wood by forest class per period for 20 periods.

Method: Either a simulation program where user dictates solution (this allows easy sensitivity analysis), or a non linear optimization using the MINOS package. There are two objective functions; maximum volume, and smoothed volume. User constraints are allowed. There can also be non-linear constraints.

Computer: Prime 550. To run WOODSHED (the non-linear optimisation) takes 20-40 minutes dependant on constraints. To run GROWER (Simulation program) takes 1-2 minutes.

Status: Both programs running.

References: Osborn, T.E. (1986) WOODSHED, an overview. Internal Publication, Forestry Commission, Tasmania.

PLANNING METHODS: TASMANIA PLANTATIONS

Address of Organisation: Chief Commissioner,
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HOBART TAS 7001

Address of Contact: R.L.Gordon,
Forestry Commission,
G.P.O. Box 207B,
HOBART TAS 7001

Summary of Forest Estate: 37,000 ha of Pinus radiata spread over the State covering a range of sites managed on either a 25-30 or 40+ year rotation. Over half the area is pruned and thinned for clearwood production.

Objective: To calculate long-term yields by product type operation type and geographic location.

Planning Horizon: 40 years (1 year intervals).

Inputs: Expected MAI or inventory plots to use for growth base, sawlog/pulp percentage, logging conditions, logging unit description.

Outputs: Volume of wood by product-type, operation type and stand location by year. Area of treatment by year and operation type.

Method: A simulation program. A homogeneous stand is manually scheduled for an operation in a specified year. It is automatically grown to that age and cut. Smoothing is done by iterative processing.

Computer: Prime 550. A suite of programs with the growth model taking 20 minutes to run for an average run of 1500 stands.

Status: About to be updated to include automatic area update from other sources.

PLANNING METHODS: VICTORIA

Address of Organisation: Director General,
Department of Conservation, Forests and Lands,
240/250 Victoria Parade,
EAST MELBOURNE, VICTORIA 3002

Address of Contact: I.W.Wild and W.D.Incoll,
C/- Resource Assessment Branch,
Department of Conservation, Forests and Lands,
Room 102,
2 Treasury Place,
EAST MELBOURNE, VICTORIA 3002

Summary of Forest Estate: Approximately 4.7 million ha of Eucalypt forest of which approximately 1.4 million ha is suitable for the production of sawlogs. Approximately 200,000 ha of softwood plantation, principally Pinus radiata, of which approximately half is state owned.

Objective: To provide information to managers to enable the creation of a wide range of management alternatives, to evaluate the consequences of each alternative in terms of product and cash flows and thus determine the most appropriate solution consistent with Government policies.

Planning Horizon: 50 years.

Inputs: Base inventory plot data giving diameter distribution and stand height, costs, management constraints, industry commitments.

Outputs: Product volumes and cash flows for specified localities.

Method: For softwood plantations see the FRIYR Report (see references). For hardwoods the method varies by forest type; for major production forest types the same approach as FRIYR is used, but the simulation models STANDSIM and MESSIM are used. For macro-planning of the hardwood resource the hardwood resource information system, HARIS, is used.

Development Task Size: FRIYR has taken approximately 10 man years. The hardwood systems have been developed piecemeal over the last 18 years.

Computer: Prime 9955-II using FORTRAN77 and SIR Data Base Management System.

Status: The FRIYR system is in production mode. The hardwood planning systems are being reviewed.

Reference: Wild, I.W. (1986) Progress report of FRIYR: a fully integrated Management Information System and Decision Support System package for the forest manager. Proc. Research Working Group No. 2 Perth.

PLANNING METHODS: WESTERN AUSTRALIA NATIVE FOREST

Address of Organisation: The Executive Director,
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COMO, WESTERN AUSTRALIA 6152

Address of Contact: Manager, Inventory Branch,
Department of Conservation and Land Management,
50 Hayman Road,
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Summary of Forest Estate: 1.5 million ha of Jarrah, 153,000 ha of Karri.

Objective: To develop 5 year logging plans.

Planning Horizon: 5 years.

Inputs: Volumes of products by compartments from management level inventory.

Outputs: For each year of the planning period, the areas to be cut and volumes by products produced.

Method: FMIS (a grid based Geographic Information System) is used to derive available areas based on land use management plans, cutting history, burning buffers and other constraints. Areas to be cut are selected to meet all commitments from integrated operations.

Computer: Perkin Elmer and Cyber.

Status: Enhanced version of FMIS for implementation on a VAX computer is almost completed.

PLANNING METHODS: WESTERN AUSTRALIA PLANTATIONS, SHORT TERM

Address of Organisation: The Executive Director,
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50 Hayman Road,
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Address of Contact: Manager, Inventory Branch,
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Summary of Forest Estate: 31,000 ha Pinus radiata 28,000 ha P. pinaster.

Objective: To develop 1 year logging plans.

Planning Horizon: Generally one year.

Inputs: Inventory plot data, compartment areas, harvest prescriptions.

Outputs: Volumes of products by areas to be treated within each year of the planning period.

Method: Simulation of growth. Interactive modelling of thinning operations and log specifications to give yield predictions. Selection of stands to be cut based on silviculture and minimum supply to sawmills.

Computer: Perkin Elmer.

Status: Being used at a reduced level as models are being updated.

PLANNING METHODS: WESTERN AUSTRALIA PLANTATIONS, LONG TERM

Address of Organisation: The Executive Director,
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COMO, WESTERN AUSTRALIA 6152

Address of Contact: Manager, Inventory Branch,
Department of Conservation and Land Management,
50 Hayman Road,
COMO, WESTERN AUSTRALIA 6152

Summary of Forest Estate: 31,000 ha Pinus radiata 28,000 ha P. pinaster.

Objective: Optimise strategies to meet supply commitments,
plan the development of forest based industries.

Planning Horizon: 45 years.

Inputs: Yields of products from 2 year age classes under
various optional treatments, costs, revenues.

Outputs: Volumes of products produced during each year of
the planning horizon by the optimum strategy.

Method: Goal programming formalisation in which production
targets are introduced as goals. The LP solution
maximises long term profits and minimises
deviations from production targets.

Computer: Olivetti M24 for matrix generation, Cyber for LP
package.

Status: More comprehensive model is required and further
development is planned.

YIELD CONTROL METHODS: A.P.P.M.

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LAUNCESTON TAS 7250

Address of Contact: A.J. Warner,
C/- Associated Forest Holdings Pty. Ltd.,
P.O. Box 582,
BURNIE TAS, 7320

Summary of Forest Estate: 40,000 ha Eucalypt forest (E. delegatensis and E. obliqua), 17,000 ha Rainforest (predominantly Nothofagus cunninghamii), 7,000 ha mixed Eucalypt and Rainforest. 12,000 ha radiata pine and 8,000 ha Eucalypts (E. nitens and E. globulus) expanding annually by 3,000 ha.

Outturn Used for Control: Weight in tonnes used for all contractor payment and royalty.

Measurement Methods: Certified weighbridges at major processing plants, otherwise by truck scales (electronic read out).

Method of Calculation: Weight used in all wood procurement rates eg falling paid at \$x/tonne.

Method of Control: Use weight and operation numbers on log loads and weighbridge stamped weight for plantation and native forest operations. Some sawlogs are still measured also by volume, length and centre girth.

Status: Current.

YIELD CONTROL METHODS: A.N.M.

Address of Organisation: The Manager,
Australian Newsprint Mills Ltd.,
BOYER, TASMANIA 7140

Address of Contact: M.G.White,
A.N.M. Ltd.,
BOYER TASMANIA 7140

Summary of Forest Estate: 160,000 ha of Forest Concession 10,000 ha of private property.

Outturn Used for Control: All measurement by weight.

Measurement Methods: Weighbridge.

Method of Calculations: Volumes converted to weight by conversion factors.

Method of Control: All output by weight followed by residual assessment.

Status: Current.

YIELD CONTROL METHODS: A.P.M. FORESTS

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MORWELL, VIC 3840

Address of Contact: M.J.Mann,
Chief Forester,
A.P.M. Forests Pty. Ltd.,
Box 811,
CAMBERWELL, VIC 3124

Summary of Forest Estate: Gippsland; 42,000 ha of Pinus radiata plantation
managed on a 28-30 year rotation with 3-5
thinnings.

Gippsland; 5,800 ha of eucalypt plantation.

Outturn Used for Control: Volume.

Measurement Methods: Pulpwood weighed. Sawlogs weighed, also log
length (scanned) and mid diameter measured by
calipers.

Method of Control: Intermittent reconciliation for selected areas of
calculated versus actual yields. Post harvest
inventory of plantation thinnings.

Status: Current.

YIELD CONTROL METHODS: AUSTRALIAN CAPITAL TERRITORY

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Address of Contact: A.Davey, D.Johnson,
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Civic Square, ACT 2608

Summary of Forest Estate: Net area 15,900 ha including 13,175 ha Pinus
radiata, 580 ha Pinus ponderosa and 193 ha other
species.

Outturn Used for Control: Volume for sawlog, peelers and treatment mat-
erial.

Measurement Methods: Weighbridge used to obtain weight of all loads.

Method of Calculation: A sample of 10% of trucks loads is measured to obtain an estimate of volume and assortments. Dub is measured at both ends, log length is measured. Volume of any defect is recorded.

Weight/volume conversion factor is determined on a compartment basis and the factors are used to estimate the removals from each compartment.

Method of Control: The yield from each compartment is compared with the predicted outturn. Post harvest inventory and waste assessment are used as required.

Status: The system is fully operational. The use of a log scanner to provide 100% measurement of sawlog for one customer is being investigated.

YIELD CONTROL METHODS: NEW SOUTH WALES

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Address of Contact: P.Casimir,
E. & D.S.,
Forestry Commission of N.S.W.,
G.P.O. Box 2667
SYDNEY N.S.W. 2001

Summary of Forest Estate: Over 160,000 ha of predominately Pinus radiata, managed on a 30-45 year rotation with up to 5 commercial thinnings.

Outturn Used for Control: Volume under bark by length and diameter class. Weight is also used.

Measurement Methods: Various; 100% tally (caliper mid-diameter, length), sample measures (count total, measure random loads), electronic log scanners, weighbridge.

Method of calculation: Computerised marketing system LOGSAL calculates volumes (and sample errors where appropriate) from the tally, sample and log scanner data. Pulpwood is sold by weight, and converted to volume only for management monitoring, at present by a simple overall conversion ratio.

Method of control: Sawlog; count and sample, 100% tally, electronic scanner. Pulpwood; weight.

Status: Up to date: LOGSAL currently being implimented on microcomputers, mainframe version due to become operational in 1987.

YIELD CONTROL METHODS: QUEENSLAND NATIVE FOREST

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G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000

Summary of Forest Estate: 1,854,000 ha Eucalypt forest, 665,000 ha Rainforest and 700,000 ha of Cypress pine forest. (Areas are gross areas).

Outturn Used for Control: Volume for mill logs, lineal metres for round timber, individual measurement or counts for most miscellaneous forest products, and tonnes for hardwood pulpwood.

Measurement Methods: Individual log measurment (length and centre diameter, usually overbark) for mill logs, weight from weighbridge is converted to volume for some cypress mill logs, hardwood pulp sold by weighbridge weight, individual measurements or counts for miscellaneous forest products.

Method of Calculation: Individual log volumes by Huber's formula after applying bark thickness conversion. Weight is converted to volume by means of a conversion factor derived from randomly chosen loads.

Method of Control: Hardwood pulp by weight, mill logs by volume, other products by length or number of pieces.

Status: No change is anticipated in the next few years.

YIELD CONTROL METHODS: QUEENSLAND PLANTATIONS

Address of Organisation: The Conservator,
Queensland Department of Forestry,
G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000

Address of Contact: J.K.Vanclay and P.Francis,
Resources Branch,
Queensland Department of Forestry,
G.P.O. Box 944,
BRISBANE, QUEENSLAND 4000

Summary of Forest Estate: 165,000 ha of plantation, comprising three main species, Pinus caribea var Hondurensis, Pinus elliottii (Slash pine) and Araucaria cunninghamii (Hoop pine). Rotation varies from 35-50 years depending on species, with 1-3 commercial thinnings.

Outturn Used for Control: Primarily volume, with weight scaling and sample selling in certain operations.

Measurement Methods: Dbhob, predominant height (tallest 50/ha).

Method of Calculation: Volumes are estimated from a volume equation (the Australian equation $V=f(BA,Ht)$), weights are converted to volumes using conversion factors.

Method of Control: Generally tree marking and assessment, with some weight scaling conversion to volume in thinnings and some sample selling in clearfall.

Status: Development of computer system and assessment methods is continuing.

Reference: Vanclay, J.K. and Shepherd, P.J. (1983) Compendium of volume equations for plantation species used in Queensland. Qld. Dept. For. Tech. Paper No36, 21pp.

YIELD CONTROL METHODS: SOUTH AUSTRALIA

Address of Organisation: The Director
Woods and Forests Department
Box 1604
ADELAIDE S.A. 5000

Address of Contact: J.W.Leech and I.B.Millard
Woods and Forests Department
Box 162
MOUNT GAMBIER S.A. 5290

Summary of Forest Estate: 70,000 ha of predominantly Pinus radiata plantation, managed on an approximately 45 year rotation with up to 6 commercial thinnings. The age class distribution is approximately normal.

Outturn Used for Control: Volume to various top diameter limits.

Measurement Methods: All loads of larger sawlog are either measured directly or weighed. If weighed, a sample of loads is also measured to enable volume to be corrected at the end of each 6-month period. Sawlogs are measured for nominal length and both end diameters, volume is estimated assuming that each end diameter holds for half the log length. All loads of pulpwood and small sawlog are weighed and an arbitrary conversion to volume is used. Preservation material may be measured or may be counted by product and converted to volume for small diameter products.

Logging Residue Assessment: A procedure using line transect sampling has been developed for residue assessment but has only been used to a limited degree.

Comments: The planning models estimate volumes to the same measurement method as sawlog measurements, although all models are based on a base of 3m sectional measurements.

YIELD CONTROL METHODS: TASMANIA NATIVE FOREST

Address of Organisation: Chief Commissioner,
Forestry Commission,
G.P.O. Box 207B,
HOBART TASMANIA 7001

Address of Contact: R.L.Gordon,
Forestry Commission,
G.P.O. Box 207B,
HOBART TASMANIA 7001

Summary of Forest Estate: Approximately 1.5 million ha of eucalypt forest managed on a sustained yield basis with an estimated rotation for regrowth of 80 years.

Outturn Used for Control: Volume (cubic metres), or agreed percentage of defect and size for sawlog. Weight for pulp.

Measurement Method: Sawlog measured by tape or weighbridge. Pulp weighed.

Method of Calculation: Sawlog volume from local volume tables. Pulp volume by conversion approximately 1.06 tonnes/cubic metre.

Method of Control: Logging residue assessment, sawlog measurement checks, log scaling checks.

Status: Current.

YIELD CONTROL METHODS: TASMANIA PLANTATIONS

Address of Organisation: Chief Commissioner,
Forestry Commission,
G.P.O. Box 207B,
HOBART TASMANIA 7001

Address of Contact: R.L.Gordon,
Forestry Commission,
G.P.O. Box 207B,
HOBART TASMANIA 7001

Summary of Forest Estate: 37,000 ha of Pinus radiata spread over the State covering a range of sites managed on either a 25-30 or 40+ year rotation. Over half the area is pruned and thinned for clearwood production.

Outturn for Control: Volume or weight, depending on region.

Measurement Method: Volume by standing assessed volume. Weight by weighbridge.

Method of Calculation: One way log volume table. Pulpwood sold by weight, converted to volume at 0.94 tonnes/cubic metre.

Method of Control: Logging residue and damage assessments, log scaling check.

Status: Current but local volume tables being phased out.

YIELD CONTROL METHODS: VICTORIA

Address of Organisation: Director General,
Department of Conservation, Forests and Lands,
240/250 Victoria Parade,
EAST MELBOURNE, VICTORIA 3002

Address of Contact: I.W.Wild and W.D.Incoll,
C/- Resource Assessment Branch,
Department of Conservation, Forests and Lands,
Room 102,
2 Treasury Place,
EAST MELBOURNE, VICTORIA 3002

Summary of Forest Estate: Approximately 4.7 million ha of Eucalypt forest of which approximately 1.4 million ha is suitable for the production of sawlogs. Approximately 200,000 ha of softwood plantation, principally Pinus radiata, of which approximately half is state owned.

Outturn Used for Control: Volumes by size classes and products by specified areas and/or customer.

Measurement Methods: Varies, but is generally centre diameter underbark and log length (reduced to nearest 0.3 m). In some areas a system of weighing all loads and measuring a sample of these loads is used.

Methods of Control: Comparison of predicted versus actual volumes on a unit area basis are made using FRIYR.

Status: Operational, but fully automatic interfaces between FRIYR and the accounting package LOGSALES are being developed.

YIELD CONTROL METHODS: WESTERN AUSTRALIA JARRAH

Address of Organisation: The Executive Director,
Department Conservation and Land Management,
50 Hayman Road,
COMO W.A. 6152

Address of Contact: Manager, Inventory Branch,
Department Conservation and Land Management,
50 Hayman Road,
COMO W.A. 6152

Summary of Forest Estate: 1.5 million ha jarrah.

Outturn Used for Control: Volume.

Measurement Methods: Measurement of mid diameter and length at the sawmill (sawlogs) or on the bush landing (salvage logs).

Method of Calculation: Log volume tables.

Method of Control: Volume intake to the mills controlled through computerized hardwood logging system. Aerial photography is used to map cutting boundaries every 6 months, areas entered to hardwood operations control system (HOCS).

YIELD CONTROL METHODS: WESTERN AUSTRALIA KARRI

Address of Organisation: The Executive Director,
Department Conservation and Land Management,
50 Hayman Road,
COMO W.A. 6152

Address of Contact: Manager, Inventory Branch,
Department Conservation and Land Management,
50 Hayman Road,
COMO W.A. 6152

Summary of Forest Estate: 153,000 ha Karri.

Outturn Used for Control: Volume

Measurement Methods: Weighbridge for woodchips and one sawmill. Direct
measurement for other sawlogs, midlog girth and
length.

Method of Calculation: Conversion factor from weight to volume for chip
and one sawmill. Log volume tables for other
sawlogs.

Method of Control: Volume intake to the mills controlled through
computerized hardwood logging sSystem. Aerial
photography is used to map cutting boundaries
every 6 months, areas entered to hardwood
operations control system (HOCS).

YIELD CONTROL METHODS: WESTERN AUSTRALIA PLANTATIONS

Address of Organisation: The Executive Director,
Department Conservation and Land Management,
50 Hayman Road,
COMO W.A. 6152

Address of Contact: Manager, Inventory Branch,
Department Conservation and Land Management,
50 Hayman Road,
COMO W.A. 6152

Summary of Forest Estate: 31,000 ha of Pinus radiata, 28,000 ha of
P. pinaster.

Outturn Used for Control: Volume by product and length class.

Measurement Methods: The height of each bin on the truck is measured.
Each bin has uniform log length.

Method of Calculation: Conversion factor for each product and log length class to convert bin measure to volume.

Method of Control: Volumes of all products delivered to the mills. Aerial photography is used to map cutting boundaries every 6 months, areas entered onto plantation operation control system.