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Forestry and Forest Products Research Summary of Changes in Capacity 2008-2011

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Summary

A desk-top analysis has been undertaken of changes in forestry-based scientific research capacity since the last review of research expenditure (2008). The review was undertaken using direct contacts and available information. Not all the organisations contacted previously were contacted this time. The past reviews used the methodologies and definitions established by Quick and Booth in 1987 and we have reviewed those methodologies as to their relevance.

Since 2008, the total of non-University scientists (Commonwealth, State and private companies) have decreased from about 251 to about 132. This may in fact be lower if effective full time equivalents are used rather than staff numbers. Technical staff have declined from 247 to 76 and support staff from 52 to 20. The reductions are primarily due to restructures within organisations, reductions in funding and consequent loss of staff, private companies failing (e.g., MIS companies) and reduced Research and Development expenditure. The impact of these reductions on various fields of expertise has not been evaluated in detail but it is obvious that forest products research has been greatly reduced - one public organization (Queensland) has the major remaining capacity in this area.

Fourteen universities reported undertaking forestry related research in 2008 with a total of 183 people involved and it is estimated that this has declined to about 149 people in 2011. The effective capacity for research in Universities is a difficult area to evaluate as permanent staff may be spending only a small part of their time on research. Most research is undertaken by graduate students. Further, the research may be related to forestry but in an overseas location. There is a significant amount research on forests which has no relevance to commercial management (e.g. ecological studies) and there is also a high annual variation in the undertakings. Research is dependent upon grant money and if that is not available, research will be undertaken elsewhere. Very little university work is in forest products. One issue for any university research is the lack of employment opportunities for post-graduate students when they finalise their studies.

The numbers of researchers are declining to a level where viability of some of some fields of research becomes an issue.

Significant research being reported and used now, was initiated decades ago. There is little initiation of new programs or projects, and this does not bode well for the future of forestry in Australia in terms of risk management or innovation.

➤ **Introduction**

Analyses of research undertakings, expenditure, capacity and outcomes are fundamental components of integrated research planning and implementation. The expenditure on Australian forestry and forest products research over the last 24 years has been analysed and reported using comparable definitions and methodologies (AFC 1985; Quick and Booth 1987; Lambert and Turner 1992; Turner and Lambert 1997; 2005; 2011).

Detailed analysis of research expenditure was initially undertaken by John Quick and Harry Booth (Quick and Booth 1987) at the request of the Standing Committee on Forestry (SCF), formalising a preliminary study by the Australian Forestry Council (AFC) in 1985. A basic premise to this was that scientific research was fundamental to sound forest management and to the optimum utilisation of products from the forest and that forest were a perpetual, renewable resource when managed properly. At that time, the terms of reference were to determine:

- How much was being spent on forestry and forest products research and by whom?
- What areas were being researched and how they were decided? [it may be added that it appears this was part of ongoing political arguments between various States and CSIRO management].
- Were there areas of expertise lacking or limited?

➤ **Early Assessments**

It is of value to consider the background to the earlier assessments as they were used as the basis for later analyses. In the 1985 (AFC) assessment, key issues affecting research direction and investment were listed and these form the basis of much of the research carried out in forestry in the subsequent decade:

- **Restriction of conversion** of State-owned indigenous forest to softwood plantations, necessitating intensive management of the existing plantation resource and the development of agroforestry and private forestry.
- **Public concern for the future of rainforests** reflected in vigorous activity by conservation lobbies and the responses of Government in removing significant areas of such forests and co-occurring hardwood forests from wood production, and requiring plantation establishment of softwood and rainforest species on cleared farmlands (often degraded) in such areas, as well as increased research on the ecology dynamics, non-wood values and sustainable yields of rainforests.
- **Environmental sensitivities to non-wood values**, for example, water supply and wildlife conservation, particularly in intensively utilised hardwood forests.
- **The increasing use of prescribed burning** of forests as a strategy for reducing fire hazard, necessitating consideration of fire control methodologies and the impact of fire on forest ecology.
- **Hydrological aspects of site preparation** for plantation establishment and re-establishment concerned with changes in ground water levels and the development of salinity and water use by forests.
- **The necessity to manage the plantation sector** for sustained yields of raw materials to achieve a higher level of utilisable production per unit area per unit cost in order to increase profitability.

- **Re-organisation of land-management agencies** (forestry, parks, conservation, lands) in some States to accommodate a wider perspective of the role of individual agencies, including diversion of research efforts from State Forests to National Parks in the areas of fire ecology, flora and fauna and dieback.
- **Adjustments required by the processing industry** from old growth hardwoods to smaller sized regrowth hardwoods and to softwoods, and the substitution of forest hardwoods and other species for rainforest species in special purpose products (for example, industrial plywoods, panelling and furniture stock).
- **Efficient development of products and their marketing** from locally grown plantation softwoods in the face of increasing competition from imports, in a scenario of increasing availability of supply of sawn wood and pulpwood.
- **The reduction in research resource allocation** (manpower and financial) over the last few years to product utilisation research by both CSIRO and the States.

The question of research funding was analysed within the framework of most forest resources being State-owned plantations (particularly coniferous) and being expanded. Technology was improving utilisation of a range of products (for example, through drying and testing); woodchip sales were expanding; States had strong research organisation and supporting technical areas together with the developing forestry in CSIRO and there were at least four strong forest products research centres. Much of the forest products research at a State level was funded through Community Service Obligations (CSO) as part of Public Good and in at least two States, this work was supporting consumer protection legislation (for example, NSW Timber Marketing ACT and its equivalent in Queensland).

Quick and Booth (1987) had a fairly straightforward assessment process contacting States, CSIRO, two Universities and several major companies. A major consideration was what would be considered research into forestry and forest products. This had several aspects. They considered research to be scientific undertakings relating to improved forest and associated land management and into products directly harvested from the forest. The definitions were more exclusive than inclusive so that research had to be obtaining new information and not including routine assessments (for example, inventory) and surveys. Land management was focused on the relationship of forest management to effects on soil and water, and at that time, bio-diversity was not considered a major research issue. Products from the forest were related to wood and included sawn, round and chips, energy (this mainly being related to charcoal) and other forest products (for example, *Eucalyptus* oil, honey). [Carbon accretion, briquetting, liquid fuels were not considered significant at that time]. End use of wood was not considered, for example, furniture making was not included. However, the testing of wood for end purposes was included (for example, machine stress grading (Harry Booths' brainchild) for products such as framing and ladder stiles). Research into suitable material for paper making was included but not mill runs and associated aspects.

In addition, the infrastructure (laboratories, equipment, access to and storage of information) was recognised as important but was not addressed.

Their approach was to:

- (i) Ask administrators what was spent and the sources of the funds (mainly to limit double counting).
- (ii) Review and interview staff to consider what was being done, and determine the expertise and organisational structures. This information was also used by applying some standardised cost estimates (salary bands) to overcome problems of "non-comparability" of organisations, mainly in relation to inclusion/exclusion of overheads.

➤ **Continued Evaluations**

Using these same guidelines, evaluation of research has been undertaken every five years to obtain patterns and trends. There have been emerging problems mainly related to the definitions of research to be included/excluded but it has provided some idea of trends.

Research expenditure on Australian forestry and forest products is being assessed using methodologies similar to previous assessments. In addition to reporting on expenditure, some commentary on changes in the industry need to be made as context. These changes include:

1. General decline in world economy affecting exports.
2. Restructuring of Commonwealth research organisations (CSIRO)
3. Restructuring of State Forestry agencies.
4. Decline or loss of some private companies (specifically MIS companies).
5. Winding down and loss of Cooperative Research Centres.
6. Role and change of funding organisations.
7. Change in role of native forests and their management.
8. Change in relative importance of plantation species with minor changes in coniferous plantings in the last few years and higher rates of hardwood planting and now very limited new plantation establishment.
9. Developments in the tropics (mahogany, sandalwood).
10. New industries specifically related to carbon and energy.

The assessment of the 2007-2008 expenditure indicated \$61 million spent on forestry and \$27 million on forest products research with \$10.5 million on administration and \$7.5 million on wildlife surveys which may or may not be considered research. This amounted to \$5.8 per managed hectare or \$3.9 per cubic metre of timber harvested.

In undertaking the analyses, four main questions arise, namely:

What is being done?

What does it cost?

What are the numbers, expertise, distribution and structure of those undertaking research?

What is being produced?

Repeated measures of these components allow analyses of trends to be undertaken. The focus has been on costs and capacity and while the fields of research are considered, the actual projects within those fields are not considered. There is no measure of research output and this may be considered a limitation of the analysis.

➤ **Changes in Research Capacity**

A “desk-top” analysis of the major changes that have occurred in research organisations since the 2008 analysis, was undertaken in December 2011. The analyses involved contacting the main research organisations to determine what staff and structural changes had occurred and were in the process of occurring.

The focus should be on research in commercial forests and hence areas of research activity need to be reviewed to exclude those areas not of direct relevance. Areas for consideration are:

- Biodiversity research (fauna and flora) be excluded from research activities. This area has been significantly reduced by some organisations and the actual definition of undertakings has often been difficult in the past. Some organisations included pre-logging assessments of biodiversity as research, primarily because it was often undertaken by research staff (having the expertise).
- Carbon accretion research in non-commercial forests be excluded. Research is being undertaken on amenity or farm plantings for carbon accretion but these have no commercial basis and hence will be excluded.
- Research organisations are funded to undertake overseas research (for example by ACIAR) but the research is of no direct benefit to Australian forestry. On the books, those scientists are part of the research capacity but they have been removed from our analysis as they are not benefitting Australian forestry.
- There is an increase in research into the use of forest materials as an energy source (solid and liquid). Where the research is directly considering use of forest thinnings or sawmill waste, the research is included (it is considered comparable to pulpwood utilisation).
- Research into innovative species, such as sandalwood, are considered forest research even though it may be argued they do not form forests and the outputs are not traditional.
- University research capacity may need to be evaluated differently to other organisations as much of the research is undertaken by graduate students and, hence, may only be on a short term basis. Staff may also be only undertaking research on a part time basis.
- Research on fire behaviour has not been included although this is an area of importance in any long term forest management.
- Non technically scientific areas such as economics and planning were not included in the analyses.

- **Comonwealth Scientific and Industry Research Organisation (CSIRO)**

Prior to major re-organisation and the merging of CSIRO Divisions and the joint venture with NZ Scion, there were six Divisions reporting research into areas of forestry and forest products namely Forestry Research, Forest Products Research, Plant Industry, Entomology, Land and Water, and Wildlife Research. These included centralised research organisations plus regional centres usually working in cooperation with a State organisation or University. It was estimated across all the Divisions in 1985, there were 145 scientists, 132 technicians and 48 support staff. By 2008, this had declined to 75 scientists, 81 technical and 17 support staff. The current position appears to be approximately 40 effective research staff in Sustainable Ecosystems and about 29 staff in Plant Industry and up to 10 in Regional areas working on projects such as tree water use. There is no ongoing research on forest products, but two scientists working on different projects have been retained. This is a total of about 50 scientists, 48 technical staff and 13 support staff - a decline of about 37% since 2008. This may be further reduced if research on carbon in non-commercial forests, and conducted overseas, and contract work on assessments (such as reviews of Codes of Forest Practice) are excluded.

- **State Organisations**

There have been significant reductions in staffing of State research organisations in the period 2008-2011. The actual number of individuals involved in the staffing may be lower than Table 1 suggests due to part time workers, hence the data in Table 1 are best estimates of full time equivalents.

Table 1. *Changes in capacity of State forest research organisations.*

Year	1985	2008	2011
Scientists	180	117	77
Technical Staff	206	109	71
Support	46	21	9
Total	432	247	156

The changes reported in Table 1 are as a result of:

- (i) The State Forest organisation in NSW is initially being split into the Department of Primary Industry (DPI) and the Forests NSW component, resulting in significant reductions in scientific and support staff to support only core commercial research. The remainder of the research organisation was amalgamated within a larger Department and that has subsequently being restructured and reduced with losses in biodiversity and forest health. There is no remaining forest products research capacity.
- (ii) Victoria has had State staff amalgamated within Melbourne University and then, more recently, some staff moved back to their Departments but not necessarily in research roles. Areas such as silviculture and forest health have been affected.
- (iii) Queensland (DEEDI) have had significant restructuring and loss of scientific and technical staff. The demise of MIS companies has impacted on staff involved in tree improvement programs and other areas have also been affected. Nearly half of their strength is in the forest products area, this group being the primary research capacity in forest products remaining in Australia.

- (iv) Western Australia (WA) has had major restructuring in the Forest Products Commission (FPC) and there have been impacts on Department of Environment and Conservation (DEC). Staff in DEC have been involved in biodiversity research and this will affect the reported capacity. Essentially, one person is remaining in the area of forest products research.
- (v) There have been some adjustments in South Australia (SA) but their staffing appears to be reasonably stable.
- (vi) Tasmania has undergone major restructuring and staff losses. This will be ongoing for some time as the CRC Forestry winds down in June 2012.

The reduction in capacity of about 42% over three years is actually larger when the staff in biodiversity and non-commercial forest carbon research are removed. The actual capacity of State organisations is probably nearer to 130 effective research staff.

- **Private Companies**

Private Companies both undertake and support research in a number of areas. Private company research after the year 2000 was largely related to plantation expansion. There was significant interest in plantation silviculture, genetic improvement and wood properties, although this latter area tended to be contracted out. One feature of private research has been that of individuals working alone or in small groups.

In 1985, it was estimated there was 10 staff involved in private forestry research (Table 2), which increased to 130 in 2002 and probably has an upper level of 69 at present. Not all companies were contacted and there may have been greater reductions.

The most recent changes are a result of cessation or reduction of research by AFRC (W.A.), Carter Holt Harvey (CHH), Great Southern, ITC, WAPRIS, Timbercorp and Willmott Forests. Organisations such as HVP are maintaining activity, however, there are questions on levels of activity in forest research by Gunns. In the forest products area, Norske Skog and Visy reported significant research capacity in the past (a total of 32 research staff) and this level needs further validation but essentially represents half of research capacity. There are a number of small, private specialist research providers not included in the estimate such as Jamie Haig who has established a small company working on aspects of wood deterioration and protection. Forsci Pty Ltd and Timberlands work in productivity and nutrition, and Forest Values works on productivity capacity and silviculture.

Table 2. *Changes in capacity of private forest research organisations.*

Year	1985	2008	2011
Scientists	6	59	30
Technical Staff	3	57	32
Support	1	14	7
Total	10	130	69

- **Universities**

The research capacity of Universities is difficult to determine and varies greatly over time, basically dependent upon the post graduate research being undertaken. The CRCs increased this number of research students but this number will decline after June 2012.

In 1985, three Universities reported undertaking forestry or forest products research (Australian National University, Tasmania and Melbourne) with a total of 11 Scientists (permanent staff), 10 researchers (post-graduate students) and 6 support staff resulting in a total of 27 people involved in research. In 2008, 14 Universities reported forest research activity with a total of 90 staff (technical and support) involved and 46 post graduate students. In 2011, those 14 Universities still report activity with 73 researchers, 40 technical support and 39 post graduate students. That means there is a total change from 182 in 2008 to 149 in 2011. The main changes have been staff transfers or losses from Melbourne University and declines at the University of the Sunshine Coast. There have been increases in staff at Sydney University.

It is proposed that in the analysis of overall capacity, the Universities be kept separate. The analysis needs to determine the actual time of permanent staff (scientists and technical) involved in research within a field. Post graduate inputs need to be considered on a project basis.

- **Analysis and Conclusions**

The data for the research organisations listed above was compiled but the University research has been listed separately. Table 3 contains the capacity in 2011 but also an adjusted capacity removing researchers in some areas as outlined earlier such as biodiversity or carbon accounting in non commercial forests. Essentially, the non-university research capacity has declined by half, the forest products component has a functioning unit (Queensland) and several individuals in different organisations.

The other aspects to be considered are the areas of expertise and the distribution of researchers, age class distribution and consideration of critical mass for research to progress. Infrastructure, facilities and data maintenance are separate issues to be addressed in maintenance of long term research capacity.

Considering here are about 22 locations where research is being undertaken by non-University researchers, there are an average of 6 scientists per location, in fact ranging from 1 to 20. In Universities, there is an average of 3 scientists per location but again this has a wide range. In the analyses of Australian forestry and forest products theses (Lambert and Turner 2010), 18 subject areas were identified. These have been reduced in number by eliminating areas not in the current analysis (ecology, wildlife, botany, policy) and combining several others. There remains:

- Forest hydrology
- Fuel and fire dynamics
- Genetics and tree improvement
- Land use management
- Management and mensuration (including growth modelling)
- Pests and diseases
- Remote sensing/GIS
- Silviculture
- Soils and nutrition
- Timber utilisation
- Tree physiology
- Wood science and chemistry

These research areas need to be considered in terms of location and/or forest type. They could be native forests of different types or locations (W,A., Tasmania, S.E. Australia, sub-tropical and tropical Australia) and plantations again divided into species, structure or location (e.g., short term hardwood, longer term hardwood and coniferous, high value or specialty products). Such categories can be used to develop a matrix and values applied to the individual cells, and however this is undertaken, it is apparent there is only a small, and possibly non-viable, number of researchers in any of the fields.

Significant levels of research are still being reported, however, the projects that this is derived from, were often commenced 10 to 20 years ago. There is little evidence of new research being developed and the amount of information we can mine from the past will become depleted.

Table 3. Estimates of research capacity for forestry and forest products in Australia. The adjusted estimate is based on limitations for research discussed above and is a subjective modification.

Year	1985	2008	2011	2011 adjusted
CSIRO				
Scientists	145	75	38	29
Technical Staff	132	81	39	30
Support	48	17	4	4
<i>Total</i>	<i>325</i>	<i>173</i>	<i>81</i>	<i>63</i>
States				
Scientists	180	117	77	70
Technical Staff	206	109	71	66
Support	46	21	9	7
<i>Total</i>	<i>432</i>	<i>247</i>	<i>156</i>	<i>143</i>
Private Companies				
Scientists	6	59	30	28
Technical Staff	3	57	30	30
Support	1	14	7	7
<i>Total</i>	<i>10</i>	<i>129</i>	<i>65</i>	<i>65</i>
Grand Total (non-University)				
Scientists	331	251	132	127
Technical Staff	341	247	76	126
Support	95	52	20	18
<i>Total</i>	<i>467</i>	<i>549</i>	<i>287</i>	<i>271</i>
Universities				
Scientists	11	90	72	40
Technical Staff	10	47	39	30
Post Graduate students	6	46	39	20
<i>Total</i>	<i>27</i>	<i>183</i>	<i>149</i>	<i>90</i>

➤ ***Future Analysis and Methodology***

Future analyses of resources and capacity in forestry and forest products should involve several components.

The past analyses should firstly be taken into account and while areas of research may be re-defined, the assessments should provide some comparability with the past in order to evaluate trends.

Secondly, research should be more tightly defined so that only people undertaking research are included (remove assessments, evaluations, etc). Probably, the administrative and research management costs should be included as one index of efficiency. The elements of new information, longer term time horizons and elements of risk, should be included.

Thirdly, current and potential fields of research directly relevant to management of commercial forests, should be more carefully defined. One criterion for inclusion is the potential value to improve the long term commerciality of the forest project concerned.

Fourthly, all organisations or companies undertaking research should be directly contacted and asked to provide standardised information. This would include

- Expenditure on research in research categories and whether research is undertaken by the organisation or spent externally.
- Source of research funds.
- Research program areas.
- Number of scientists, technicians, field staff, support staff and contractors.
- Fields of research.
- Listing of individuals, fields of work, proportion of time on research and experience in the field (years).
- Facilities and infrastructure.
- Research outputs.
- Comments on future of research and issues.

One approach is to send a simple electronic questionnaire to relevant organisations to provide basic information. This would then be followed up with personal contact with key organisations for more detailed information.

Information on the source of funding and application of the funds is critical as it forms a basis for restructuring the future of forest research in Australia.

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