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REPORT

ON THE SUSTAINABLE

RE-USE OF TIMBER

**FROM FELLED URBAN
TREES**

IN THE ACT

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Disclosure: Since undertaking and preparing the initial draft report for the Commissioner for Sustainability and the Environment, Ian McArthur ¹of Farm Forestry Consulting has been approached by a company who have expressed an interest in sourcing woody bio-mass for production of bio-energy and bio-char.

The recommendations were made previous to this approach, and the approach has not altered the recommendations in this report.

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1. Introduction

1.1 Brief for the report. To provide advice to the Commissioner for Sustainability and the Environment for the Investigation into the ACT Government's tree management practices, and the renewal of Canberra's urban forest in relation to the sustainable re-use of timber from felled trees.

1.2 Definition of sustainable timber re-uses. The re-use of timber and other material from felled trees varies considerably across jurisdictions. The ACT is different from other jurisdictions in that the ACT Government has the responsibility for the management of trees on public land in the urban environment, while elsewhere in Australia it is mainly a local government management issue. It is therefore possible for the ACT to develop a good policy for the sustainable re-use of material from urban trees across the entire city compared to other jurisdictions in Australia.

Sustainable re-use of felled urban trees should consider the best possible environmental, economic and social outcomes for the ACT. This includes an examination of what currently occurs in the ACT and other jurisdictions, and possible new usages.

Thus a definition of sustainable re-use of felled trees could be: *“The sustainable re-use of trees is defined as the use of material from those trees which provides the best environmental, economic and social outcomes, including the minimum possible carbon footprint.”*

Following from this, there should be some guiding principles on the re-use of felled trees, which take into account the environmental, economic and social outcomes.

These principles could include:

- Re-use of material from urban trees locally, where possible to minimise handling and transport costs;
- maximise long term use of suitable timber;
- recover some of the financial cost of tree maintenance and management where possible;
- improve ecological condition of the local area;
- minimise carbon footprint; and
- maintain visual amenity when considering the re-use of urban trees.

1.3 Overview of uses, past, current and proposed. From what can be ascertained, there has never been a co-ordinated approach in the ACT to seek the best possible re-use of timber from felled trees. Past approaches have been to try and market some of the more specialised high value trees, and Jim Laity (personnel communication) has indicated that 25 years ago, City Parks set aside some high value desirable trees,

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sealed the ends to prevent splitting and then could not find any interested parties to use them.

During the 1990s, when the Haig Park removals and replanting commenced, some high grade *Pinus radiata* sawlogs were harvested and sent to Penrose Pine Products, a regional pine mill.

In the recent past, some wood chip that has been mulched has been sent to Visy Industries in Tumut for use as boiler fuel in the pulp mill. However, this operation has involved a considerable cost to the ACT, with Visy paying \$20 per tonne at the pulp mill, with the cost of harvesting, chipping and transport being approximately \$120 per tonne. There is still a lot of waste wood transported to Visy Industries from Sydney, mainly to avoid this product going into landfill, which is often incorporated with wood from building demolition.

Other jurisdictions in major Australian cities mainly utilise felled urban trees for mulch, and sometimes still as landfill. The City of Perth has commissioned some high value furniture from suitable felled street trees, but this is a minor use.

Current practice in the ACT is to mulch most of the trees that have been felled, with mulch being spread on beds as close as possible to where the trees have been removed. Some large tree trunks are either blocked and left in situ for a few days, or the trunk left in situ, so that anyone interested in firewood might remove them. At present, tree surgery contractors may also dispose of material as trees are felled, and this is usually through casual enquiries. (Territory and Municipal Services). However, discussions with the Environment Protection Authority suggest that this practice could be in contravention of the EPA Act. If not removed for firewood, they are then mulched.

The use of felled trees for mulch and firewood is current custom and practice, and is not guided by any policy. Also, according to staff from Territories and Municipal Services, this firewood use is at a small scale. The argument that removal for firewood could be in contravention of the EPA Act relates to the proper licensing of firewood merchants who abide by a Firewood Code of Practice, and are required to sell correctly seasoned firewood.

There is some use by wood turners who can access high value species, but this is ad hoc and involves no payment. Some of this high value wood is also donated to charities and schools. Allowing wood turners access to high value wood could have positive social benefits, and is an avenue that should be further explored.

1.4 Community Consultation. The sustainable re-use of felled trees in the ACT might have the potential to cause conflict within the community. Canberra has long cherished its street trees, and recent removals have created some anxiety within the

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community. At issue here is a better consultation process identifying the process in which trees are to be removed, along with the reasons for tree removal.

The sustainable re-use of felled trees could in all probability lead to an increase in community anxiety, as many may see this as a commercial use of street and other amenity trees. The community would require re-assurance that the sustainable re-use of felled trees is not for commercial purposes, but in response to safety issues and the fact that some trees are at the end of their life cycle.

If one of the possible re-uses is identified as firewood, and depending on the marketing strategies used, it would be necessary to consider the impacts on existing firewood merchants and EPA requirements.

2. Background

2.1 Background of forest industry. The forest industry in Australia directly employs 77,000 people, and has a turnover over 421 billion, accounting for 0.6% of GDP. Despite this, Australia still has a trade deficit in timber and other wood fibre products of \$2 billion per annum.

2.2 Forest resource, plantations and native forests. As at 2010, Australia has 2 million hectares of plantations, of which 50% are fast growing eucalypts for woodchip production and 50% softwood plantations. Over the past 10 years, the softwood plantation area has remained static, and the hardwood plantation area has expanded. There is an estimated 11 million hectares of native forest managed for timber production.

2.3 Decline of native forest resource. The amount of native forest managed for timber production is in decline, mainly due to conversion to national parks and other reserves. The NSW Government has just created a further 107,000 hectares of national park in a river red gum forest that was managed for timber production.

2.4 Specialty timber from native forests. Virtually all specialty timber for furniture manufacture, feature timber flooring and other similar uses, has come from native forests. Most plantations do not produce the highly coloured and prized specialty timbers.

2.5 Imports and illegal logging. A large quantity of timber, particularly specialty timber, is sourced from illegal logging operations in Indonesia, Malaysia, New Guinea and other south-east Asian countries.

2.6 Wood fibre for bio-energy and bio-char. There is a slow but increasing awareness of the potential for the use of wood fibre for the production of bio-energy, and for the production of bio-char which can be used in horticulture and agriculture. Australia is

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lagging behind some overseas countries, especially Scandinavia, in exploring the potential of this fuel source.

These facts then present some opportunities for felled trees from urban forests, which to date has been a largely ignored resource. However, this will not be without difficulty. The community must be made aware that the urban tree resource is not the same as a plantation resource, and that it is not advocated that the urban forest resource be treated as such.

3. The resource related to Canberra and the ACT

3.1 Nature of the resource. Canberra has 630,000 trees in the urban environment that are managed by Territory and Municipal Services, both as street and park trees. This number does not take into account trees on other land, such as school grounds, and trees in Canberra households. It would be a reasonable estimate that the total number of trees in the urban area would be between 1.2 million and 1.5 million.

There are also tree removals in the nature parks close to the urban edge, mainly for fire prevention but at times for public safety. The nature of planting and the proximity to residences will always ensure that harvesting costs are high.

The often wide spaced planting means that street trees will grow with wide spreading crowns, and often very short main trunks, which has implications for sawlog quality and desirability. Trees are often used to post notices, and nails and other foreign objects will be found in some trees, which could be a factor in determining the most sustainable re-use of felled trees.

3.2 Management objectives. Canberra's urban trees provide a broad range of benefits to the community. These include visual amenity, habitat, shade, particulate capture and woody bio-mass when they reach the end of their life span. Canberra's urban tree landscape creates a special environment for the community, and management objectives reflect this (Territory and Municipal Services).

3.3 Management techniques. The management objective is for a range of benefits, including visual amenity, and this necessitates management techniques to achieve this. The major management technique is tree pruning, which is carried out to maintain a healthy crown.

The method of tree pruning used for street and park trees may mean that the tree form is not sufficiently good for production of high quality logs to produce sawn timber.

3.4 How the urban tree resource differs from traditional forest resource. The urban street and park tree resource differs from a traditional forest resource in a number of ways. Firstly, trees in the urban environment are usually planted on a wide spacing to allow for large wide spreading crown development, whereas trees in both plantation

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forests and native forests have a closer spacing to develop straight trunks and then are thinned out to allow for diameter increase.

Secondly, the management techniques to maintain wide spreading healthy crowns will limit the usefulness of urban trees for high quality timber products, although some trees will certainly be useful for these high quality products.

Thirdly, the large number of different species differ from a forestry resource. A forest plantation is usually a monoculture, and all but a few native forests have a relatively small range of tree species in any limited geographical area. This contrasts to the urban street tree and park plantings, which may contain hundreds of species.

3.5 Wide range of differing species. There are 300 different tree species planted in the streets and parks of Canberra (Territory and Municipal Services advice, and Pryor and Banks, Street Trees of Canberra). While some have the potential to produce high quality timber, many are unsuited to this use, and their value as solid firewood would even be questionable, although this might be a suitable re-use in pellet form. Wood pellets used in higher efficiency wood heaters are an emerging technology with virtually no particulate emissions.

3.6 Trees in decline. Of the 630,000 trees in Canberra's streets and parks, approximately 400,000 are estimated to be in some stage of decline over the next 20 years. ACT Government Territory and Municipal Services staff are unable to place a figure on how many of these trees will be removed during this time frame, but do note the scale of works that may be required when the ANU estimated that two-thirds of Canberra's urban forest will age and decline over the coming 20-30 years. (Territory and Municipal Services,). The level of tree removal will depend on budget constraints, safety issues and what level of expenditure is considered to try and save some trees in decline through tree surgery. These figures have been verified in discussion with consultants undertaking street tree assessments.

The Department of Territory and Municipal Services has removed 30,000 trees over the past six years of which 18,500 were removed using tree surgery contractors, and 2,100 trees have been identified for removal in 2010/2011 (Territory and Municipal services). A further unknown quantity of trees have been removed in nature parks for fire protection and safety management. Any co-ordinated approach to sustainable re-use of felled trees will need to include an assessment of these tree numbers.

Territory and Municipal services staff acknowledge that they will need to plan for the increasing rate of decline estimated in the ANU research.

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4. Measurement and calculation of volume

4.1 How volume is calculated in forestry. Tree volume is calculated by multiplying tree basal area (which is the cross sectional area of the trunk) at 1.3 metre height, times the height of the tree times a taper factor. This gives the volume of the stem (or trunk). For total volume, a further 50% is added for branches, and there is a further volume underground in the roots of the tree.

4.2 Why volume calculation for street trees will vary. Volume calculation for street trees will vary considerably. The form of street trees is significantly different in that the length of trunk is shorter, and there is a far larger crown, which means that the branch to stem ratio in street trees is far higher than forest trees. This lessens the potential high value sawlogs that can be obtained from street and other open grown trees as opposed to trees growing in a commercial forest environment.

4.3 Problems in how to measure and calculate volumes. This also presents a problem in how to estimate volumes of wood available from urban trees. As the form is different, normal forestry volume tables will not be appropriate to calculate volumes. The other problems with volume calculation is the vast number of different tree species. Plantations are usually monocultures, and native forests usually only have a few different species. Contrast this to the ACTs urban trees where there are over 300 tree species present.

A sampling technique to determine the tree material volume would be when trees of certain species are felled, the diameter, length of suitable trunk, height and total weight of tree is measured, then the total wood volume of dry wood can be calculated and entered into a data-base for long term calculations of weight of wood from felled street trees. This Updating estimates through field data will be more accurate than calculation methods, but will be a long and ongoing process, which is desirable so that accurate forecasts of available timber, or potential wood, can be made.

5. Potential products

5.1 Sawlogs. In the forestry industry, sawlogs and veneer logs are the high value product for the grower. However, as a high value product sawlogs come with a high grade specification as regards to species, diameter, length, sweep (which is the deviation of the side of the log from a straight line) and branch size.

Sawn timber from sawlogs is used for structural purposes (house frames and roof trusses), furniture manufacture, flooring and other feature uses. Many of the tree species in the ACT would be unsuitable for sawlogs, and many of the street trees in particular would contain a sawlog that is too short for structural timber. However, some of the species would be desirable for high grade feature timber, especially for specialty uses such as furniture manufacture.

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Among the suitable species would be the durable eucalypts, oaks and most of the conifers. However, due to the potential problems of metal contamination within tree trunks mentioned in 3.1, and the potential of this contamination to cause serious damage to saws and possible injury, then any sawlogs would need to be scanned by metal detectors before sale or the price offered by purchasers would reflect the risk of metal contamination.

5.2 Posts. There is a market for posts in the rural sector, and posts are a valuable commodity. There are very few species that can be utilised for this market without treatment by creosote or copper chrome arsenate, these being *eucalyptus melliodora* (yellow box), *Eucalyptus polyanthemos* (red box), *Eucalyptus blakelyi* (Blakely's red gum) and *Eucalyptus sideroxylon* (red ironbark).

5.3 Specialty products. This includes wood for turning and craft manufacture. However the market for these products would be very minor. From time to time, there may be some markets available from the demise of iconic trees that could have some interest. An example of this was the marketing of products from the Lone Pine (*Pinus halepensis*) at the Australian War Memorial when a large branch broke off. The iconic value of this tree was such that the products were in high demand.

5.4 Firewood. There is a very large market for firewood in the Canberra region. A firewood forum conducted by the Institute of Foresters of Australia in 1983 identified Canberra's firewood usage at between 80,000 and 100,000 tonnes per annum. A subsequent Masters degree study by Alison Treweek in 1992 further confirmed this figure. Although usage may have declined recently, it would still be reasonable to assume that firewood usage in Canberra would exceed 60,000 tonnes per annum (Terry Scorgie, firewood merchant).

Discussions with firewood merchants report that approximately 80% to 90% of the firewood consumed in Canberra is trucked from distances of up to 400 kilometres, and is sourced from dead standing paddock trees. There are three problems with this. Firstly, the firewood is being cut from a non renewable resource, as the dead paddock trees are not being replaced. Secondly, these dead standing paddock trees are an extremely valuable habitat resource, and yet they are not protected in any way, although in NSW this may change in the near future (NSW Department of Environment, Climate Change and Water), and thirdly, for each tonne of firewood delivered 400 kilometres to Canberra, approximately 9 litres of diesel fuel is used. These three factors clearly indicate that the current firewood use in Canberra is not sustainable.

The other problem with the firewood market in Canberra is that the market is very fussy, demanding boxes, red gum and ironbark, although these species could also be the main types locally available. There is a mis-conception that slow combustion heaters require this class of wood, and that the use of pine, for example, generates

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high levels of resins which clogs up chimneys. This is false, and the New Zealand firewood market relies almost exclusively on Monterey Pine (*Pinus radiata*). Retailers of slow combustion heaters the early 1980s in fact used to state that using pine would void the warranty on the heater (personal experience).

All wood generates almost the same calorific value per kilograms of wood burnt. The problem arises because of the differing wood densities. Red Ironbark (*Eucalyptus sideroxylon*) has a density of 1,100 kilograms per cubic metre, while Monterey Pine has a density of 450 kilograms per cubic metre. Thus 2.4 times the volume of Monterey Pine would be required to achieve the same thermal output as Red Ironbark.

In the late 1990s, Woodstock Firewood (a local Canberra company) used to purchase rejected pine logs from the local sawmills, and mix these 50% with box, and market this as “Eco-wood”. This was a reasonably successful strategy and they were building up a steady clientele until the fires of 2003.

Some wood species will not burn satisfactorily. Among these are Apple Box (*Eucalyptus bridgesiana*) and many of the poplars and willows. Firewood currently retails for \$180 to \$220 per tonne in the ACT, so the industry is worth over \$10 million per annum.

Firewood from renewable sources has a very low carbon foot print. Electricity emits 1.0 kgs of carbon dioxide per kilowatt hour, natural gas 0.31 kgs of carbon dioxide per kilowatt hour, and wood 0.11 to -0.17 kgs of carbon dioxide per kilowatt hour, depending on the initial source (Paul et al, 2003)

Wood can also be pelletised for both domestic heating and power generation. This process, combined with specialist heaters to use pellets, allows a higher thermal efficiency, hence uses a lower volume of wood (Australian Agroforestry, summer 2010)

5.5 Bio-energy. Bio-energy is a potential high-volume use of low grade wood. The Australian Government is yet to grasp the benefits of bio-energy, and this form of energy generation does not appear to rate highly in future renewable energy plans (c. 2005). At one stage ActewAGL were investigating entering into a joint venture arrangement with the Integrated Forest Products sawmill at Hume to establish a bio-energy plant utilising sawmill waste, but this fell through when the sawmill went into receivership (Peter Davies, Director, Real Power Systems).

Most of the alternative renewable energy strategies developed to date are not reliable and capable of providing base load electricity. Wind and solar power rely on the elements (wind and sun), yet wood fired generators are capable of providing a reliable source of base power. Wood can substitute for coal in existing power stations, or can be used in small regional power generators.

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With current technology, 1½ tonnes of dry wood are required to generate 1 megawatt hour of electricity. Thus a 1 megawatt bio-energy generator operating 12 hours per day every day of the year will require 6,800 tonnes of wood. Some European countries use bio-energy on a large scale, and Sweden obtains 40% of energy production from burning woody bio-mass. Bio-energy can also use waste wood from building demolition, and is also capable of burning other organic waste for energy production.

Current prices for bio-energy are \$50 to \$80 per megawatt hour, which is less than offered for wind generated power (\$110) or the home purchase of solar power (up to \$600). Despite this, there are bio-energy plants operating at Narrogin in WA, and one being set up at Marysville in Victoria to utilise burnt and dead forest from the Black Saturday fires of 2009.

The other advantage of small wood fired bio-energy plants is that they are transportable, and so can be moved to the wood supply to lessen transport costs. The Southern Tablelands Farm Forestry Network is currently working with a company developing gasifier plants for bio-energy production to identify regional resources suitable for bio-energy plants.

Providing that felled trees are replaced, then the use of these felled trees is either carbon neutral, or very close to carbon neutral. This is because the felled tree, is not sequestering carbon, while its replacement tree will be actively sequestering carbon.

5.6 Bio-char. Any new protocol for greenhouse gas reduction and carbon trading will include soil carbon. The most likely source of soil carbon will be bio-char, which is produced by burning wood in the presence of a limited air supply (similar to charcoal production).

Bio-char can be produced as a by product of burning woody bio-mass to produce bio-energy (in the same manner that coke was produced as a by product of burning coal in a limited air supply to produce coal gas).

By restricting air flow to woody bio-mass being burnt to produce bio-energy, approximately one tonne of bio-char can be produced for every three tonnes of wood burnt. Thus the 1 megawatt power station using 6,800 tonnes of wood could produce 2,270 tonnes of bio-char which on current markets could be worth between \$200 and \$1,000 per tonne.

5.7 Mulch. Mulch is the chipping of timber and material from urban trees. Due to a lack of alternate uses this is what most of the felled trees in Canberra are turned into at present. While there is value in reducing evaporation from garden beds with the mulch, thus reducing water usage, as the mulch breaks down it is releasing carbon

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dioxide into the atmosphere, and so is not of benefit in any carbon pollution reduction scheme, whereas bio-energy and bio-char are of benefit in any carbon pollution reduction scheme.

5.8 Seed. This is a potentially valuable commodity, depending on species and demand for specific seed. Seed catalogues indicate that most Eucalyptus seed is worth between \$500 and \$2,000 per kilogram depending on scarcity, and many of the exotic street trees would have desirable seed.

As a word of caution, seed should only be collected from superior specimens, as seed from a poor quality tree will only exhibit poor quality genetics in the off spring. Despite this, should the opportunity arise and there is a demand, the collection of seed from good quality trees should not be overlooked.

5.9 Ecological habitat and restoration. In a native forest managed for production purposes, some over mature trees are deliberately left for their habitat value. As they become aged and senescent, branches break off and hollows are left, providing habitat for birds, possums, gliders and other animals.

However, in the urban environment, to leave trees of this age could be dangerous to the public, hence they might have to be removed before the chance of shedding limbs becomes a problem. Trees which are felled and removed may still be able to provide ecological habitat, by being relocated to areas within nature parks or urban parks, where they could still provide habitat for a number of years. Opportunities for the retention of standing habitat trees are not discussed in this paper.

6. Opportunities and constraints

6.1 Non uniformity of the resource. The biggest problem for marketing of the felled trees for sawlogs will be the non uniformity of the resource and that when many urban trees are removed they are structurally unsound and contain areas of decay. The non-uniformity arises from a number of factors. Firstly, as there are approximately 300 tree species in Canberra, the first problem will be that there will be relatively small volumes of different species. While some species may be highly desirable, such as oaks, ashes, elms, most of the conifers and many eucalypts, there will be many species of no interest to sawmillers for saw logs.

The other variable is the diameter, length and form of many of the potential sawlogs. Sawmillers like long length, small taper and uniform diameter sawlogs (Kim Hayter, sawmiller, personal communication). The urban tree resource will mainly produce short, highly tapered and large diameter logs which are difficult for sawmills to process.

Portable sawmillers would certainly be interested in some of the logs. They do not operate at the same capacity as a sawmill, and can take their time and are set up to cut

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short, large diameter logs. The major problem for a portable sawmiller will be contamination of logs from nails and other material that may have been hammered into trees.

Any material used in this manner retains all of the embodied carbon in the sawn product.

6.2 Sale of raw product versus value adding. This relates to value adding, or vertical integration. The question becomes whether the ACT Government wants to become involved in undertaking processing of certain products to add further value, or if it is worthwhile to do so.

Two examples are that a plantation owner who grows Monterey Pine (*Pinus radiata*) for a period of 30 years and receives a return of \$20 to \$50 per cubic metre, depending on quality and distance to market. The sawmiller, with a capital investment of millions of dollars, recovers approximately 40% of the sawlog as sawn product, and receives a return of \$300 to \$500, depending on product. The big winner is the retailer, who purchases from the sawmiller at \$500 per cubic metre, and with little capital investment, retails the product for \$900 per cubic metre.

The second example is firewood. The owner of dead paddock trees might receive \$10 per tonne from a firewood cutter, who will then cut and deliver firewood for between \$160 and \$200 per tonne.

If the ACT Government did decide to undertake value adding on certain products, such as firewood, this would probably create angst for business, and a debate on use of government resources to compete against the private sector.

6.3 Spot, or ad hoc, sales. If a continuity of supply for sawlogs cannot be guaranteed, then the ACT Government could have a number of portable sawmillers who could be offered desirable felled trees when they become available. This would be on the understanding that there would be no guarantee of volumes or continuity of supply.

6.4 Market to selected outlets. This would be similar to 6.3, the only difference being that there would be a contract in place with agreed prices rather than ad hoc sales.

6.5 Tender. Portable sawmillers could be asked to tender for sawlogs. However this would require a detailed assessment of the trees that would be felled over a period of time, including species and volumes that would be available. The tender process could also be used for use of woody bio-mass for bio-energy and bio-char, and for sale of firewood.

The use of the tender process for woody bio-mass for bio-energy and bio-char would not require a detailed assessment of species and tree size, just a reasonable estimation

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of the volume that would be available on an annual basis. The use of the tender process for firewood would require a better assessment of tree species for reasons explained in section 5.4.

6.6 Web sites. There are a number of web sites now offering plantations and wood for sale. The web site e-bay has had some listings for plantations, including a 160 hectare Monterey Pine plantation near Braidwood.

Australian Forest Growers have developed a web site MarkeTree for sale of plantations and forest timber products - (www.afg.asn.au). If products such as sawlogs were to be offered for sale, this could be an appropriate selling site.

6.7 Case studies. In Australia, there are few known instances of the sale of felled street and park trees other than for low grade uses such as mulch, or to an outlet such as Visy Industries for their use as boiler fuel.

One known successful case was in Mount Macedon in Victoria. Following the devastating Ash Wednesday fires in 1983 which burnt through Mount Macedon, a small enterprise with a portable sawmill commenced and salvaged dead trees of high sawn timber value from some of the old established gardens in the town. This enterprise then marketed the sawn timber to selected timber merchants in Melbourne, and the sawn timber was of highly desirable species and grades, and attracted a premium price.

In New Zealand in the early 1990s, when the export of Monterey Pine to Japan and Korea was in a boom situation, local sawmills had difficulty in sourcing sawn timber for the domestic market. Desperate sawmillers purchased farm trees of varying quality in an attempt to try and meet local demand. However, since those unprecedented export market prices, the market has not come anywhere close to those levels. Indeed, and sadly, prices offered in 2010 are less than in the early to mid 1990s, even without taking inflation into account.

7. Forest Certification

7.1 Advantages of certification. Forest certification assures buyers of wood products that the products they obtain originate from legally and sustainably managed forests. Certification schemes also ensure that forests are managed in accordance with codes of practice and/or environmental management systems. This process ensures correct management procedures with regard to various management practices, and a chain of custody process. To obtain certification, all herbicide and pesticide usage has to be recorded, and compliant with the appropriate standard, and environmental standards have to be met.

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Certification for the ACT urban tree resource would be a first in Australia. Territory and Municipal Services staff probably already undertake most of the requirements for certification.

7.2 Difficulties of certification. Certification is a long process, with a large amount of paperwork, and a requirement for external approval. There would probably be 4 to 6 months work by one official involved in gathering and providing all relevant documents and data, and collating the material.

7.3 Auditing. Once certification has been obtained, there is a requirement for ongoing auditing. The schemes provide for a degree of self auditing and reporting, but an external auditor has to be used at some stage. The cost of this varies on the scale of the operation, but may be \$15,000 to \$20,000 (Francis Clarke, a private forest owner who undertook the process, personal communication).

7.4 Certification in Australia. There are currently two schemes operating in Australia. The Australian Forestry Standard is aligned with the Programme for Endorsement of Forest Certification, and the other scheme is the Forest Stewardship Council. Both schemes are equally acceptable, and both issue chain of custody certificates.

If the ACT Government were to obtain certification, then this would be a first for the certification of an urban forest. However, it would be very desirable if long term sale and supply arrangements were to be entered into.

8. Conclusions and recommendations.

The conclusions and recommendations are based on the guiding principles in the introduction, which are;

- Re-use of material from trees locally, where possible, to minimise handling and transport costs;
- Maximise long term use of suitable timber;
- Recover some of the financial cost of tree maintenance and management where possible;
- Improve ecological condition of the local area;
- Minimise carbon footprint; and
- Maintain visual amenity when considering re-use of urban trees.

Of the potential products mentioned in section 5, sawlogs, firewood, bio-energy (including bio-char), mulch and ecological habitat and restoration appear to be the most likely uses. Of these five, the use of the felled trees for mulch is an activity that is not greenhouse gas neutral, or at least close to being neutral, but provides benefits to the local area where the trees are mulched which is consistent with the guiding principle of re-use of material from trees locally. The use of felled trees for sawlogs,

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firewood and bio-energy and bio-char are close to being greenhouse gas neutral in their application.

The use of felled trees for habitat is also consistent with guiding principles in that the trees are used locally and improve the ecological condition of the local area. The use of felled trees for firewood by local residents needs to be carefully considered, as there is the possibility that residents will not properly season firewood, thus potentially creating smoke particulate emissions. This is an area that the ACT Government will have to consider a policy, as the advantage of re-use locally and the minimising of the carbon foot print might be outweighed by particulate pollution.

If the felled tree becomes a sawlog, then the sawn timber produced will retain the carbon that has been sequestered in the final product, eg flooring, or furniture. If firewood is the use, and the average household consumption is four tonnes per annum for heating (Bernie Smillie, firewood merchant sales), then the equivalent use of natural gas would equate to 900 kilograms of greenhouse gas emissions, and for electricity, 3.6 tonnes of greenhouse gas emissions. The greenhouse gas emissions from sustainably sourced firewood are 60 to 120 kilograms. Similar figures would apply to the use of woody bio-mass for power generation, but with the added bonus that 20-33% of the wood burnt could be returned to the soil as bio-char.

This is on the presumption that for every tree that is cut down, at least another tree will be planted. It is assumed that this will happen to maintain or improve the visual amenity of Canberra.

It is difficult to ascertain the rate of tree felling in Canberra over the next 20 years. The current rate of tree felling is approximately 2,000 trees per annum, and TAMS note they will need to plan for the increasing rate of decline estimated in the ANU research (Territory and Municipal Services). There are also an unknown number of trees felled from suburban blocks and from adjacent nature reserves which are felled for fire protection. The number of trees which are felled from these different areas could range from a low of 5,000 trees per annum to a high of 20,000 trees per annum, and there needs to be detailed planning to calculate these numbers.

Detailed estimation of volume or weight is difficult without undertaking a reasonably intensive inventory measurement (see also point 4.3). It would be reasonable to assume every tree would contain approximately 1½ tonnes of woody material in the trunk and branches. Some will have substantially more wood, some less. Based on this, there will be 1,500 tonnes of woody biomass per 1,000 trees felled available for use. A small proportion might be sold to higher-value uses such as sawlogs from desirable species, but most of the resource would be of lower quality.

Based on the figures in points 5.5 and 5.6, every 1,000 trees utilised as woody bio-mass to produce electricity would run a 200 kilowatt power station, and create a

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supply of 450 tonnes of bio-char per annum. A 200 kilowatt power station can supply enough electricity for 160 suburban houses. As this would be a direct substitute for coal, this would represent 140 tonnes less coal usage, for a saving of 540 tonnes of greenhouse gas emissions. In addition, a further 450 tonnes of carbon would be sequestered in soils as bio-char.

This is a feasible use for the woody bio-mass that is produced from the felling of urban trees, as there are power plants now in the market place with a capacity as low as 250Kv (quarter of a megawatt). These plants are currently being manufactured by Real Power Systems, and the first is being commissioned near Geelong (Peter Davies, Real Power Systems).

There is also a significant resource within a radius of 100 kilometres from Canberra that could also be used for bio-energy. However, it must be noted that current Australian Government policy does not allow the use of woody bio-mass from any native forest (public or private) to qualify under the Renewable Energy Certificate scheme. This is vastly different to the situation in Scandinavian countries, where sustainable harvesting of native forests is an important part in their overall energy production.

Even if all possible felled trees were to be utilised for the highest possible value end usage, the money (or royalty) received will not cover all the costs of harvesting. In a forestry operation, harvesting has a high level of mechanisation that allows high levels of efficiency. This is not possible in the harvesting of urban street and park trees, and high costs of removal will be a fact of life. At best, the sustainable re-use of felled trees will only be able to partly offset some of the financial costs.

Recommendation 1: That the ACT Government give consideration to calling for tenders or expressions of interest to operate a power station fired by woody bio-mass. The size of the power station will depend on the number of trees to be felled, but 200 kilowatts of electricity can be generated per 1,000 trees felled. The document should specify that the woody bio-mass is to be burnt in such a manner as to produce the maximum quantity of bio-char.

In conjunction with this recommendation, ACT No Waste could investigate the integration of organic household waste with the woody bio-mass as a means of lessening the amount of this material that currently goes into landfill.

Recommendation 2: That the ACT Government forms a list of interested portable sawmillers who would be interested in taking small quantities of high value sawlogs from selected felled trees. The portable sawmillers would require an assurance that all logs be scanned to ensure no metal is present. If this is too expensive, then all material that would have gone to the portable sawmillers should be used as woody bio-mass for power generation.

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Recommendation 3: That the ACT Government enters discussions with suitable seed merchants for the sale of seed from selected trees and tree species. Although a minor use, there are some social benefits through employment and the rejuvenation of selected street tree planting. The ACT Government owned Yarralumla Nursery could be user of seed sourced from this recommendation.

Recommendation 4: That the ACT Government consider some minor changes in future tree management, such as pruning techniques to remove lower branches on selected species, that may increase the value of future felled trees without detracting from the visual amenity of the urban forest.

Recommendation 5: That the ACT Government give consideration to obtaining certification for the urban forest. Certification will then provide a guarantee that the urban forest is being managed in a sustainable manner.

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9. References

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Personal Communication with:

- Chris Ware, Manager ACT No Waste.
- Fleur Flanery, Manager, Urban Tree Renewal Programme, Territory and Municipal Services.
- Michael Brice, Manager, Urban Tree Management Unit, Territory and Municipal Services
- Cedric Bryant, Horticulturist, panel member Tree Selection Working Group.
- Tony Fearnside, Chairman, Friends of ACT Arboreta.
- Steve Thomas, Committee Member Friends of ACT Arboreta and Southern Tablelands Farm Forestry Network.
- Terry Scorgie, firewood merchant.
- Jim Laity, Botanist, panel member Tree Selection Working Group.
- Kim Hayter, Managing Director, L&M Hayter Sawmills.
- Peter Davies, Managing Director, Real Power Systems.
- Ian Booth, Director, Carbon Innovations.
- George Dashwood, Owner, Yass Nursery.
- Bernie Smillie, Managing Director of Firewood Baron.
- Dennis Pollack, sawmiller and firewood merchant.
- Neil Cooper, Manager, ACT Fire Management Programme.
- James Gray, National Association of Forest Industries.
- Charlie Bell, Senior Forestry Officer, NSW Department of Environment, Climate Change and Water.
- Daniel Walters, Environment Protection Authority