UTILIZING URBAN TREE DEBRIS--TODAY AND IN THE FUTURE

James R. Geiger
California Department of Forestry
Sacramento, California

ABSTRACT

We are a long way from maximizing potential to utilize urban tree debris. As new technologies are developed and networking of existing information is improved, cities will capitalize on the opportunity to utilize more tree debris. Communities will benefit by having more products available in the form of manufactured wood products, soil amendments, landscape material, and energy. The majority of tree debris, however, will still require disposal. To achieve total utilization of urban tree debris, a new way of thinking will be needed. The urban tree debris problem must be recognized by politicians, and it must be considered as part of the total waste stream. Only then can new ideas like fiber management be implemented to begin making dramatic advances in urban tree debris utilization.

INTRODUCTION

For years now we have struggled with the problem of what to do with urban tree debris. During the height of Dutch elm disease, the debris problem reached epidemic proportions. Frantic attempts were made to turn the debris into traditional wood products, but most failed miserably. When the country was stricken with an energy crisis, new hope was felt as people and industry turned to this "new resource"--wood. But this, too, has become only an extremely limited use of urban tree debris.

What is the solution? Is there a solution? These are the questions that I want to discuss. I will discuss the potential and limitation of a number of different forest products, as well as management potential for producing these products in conjunction with managing for amenity purposes. The discussion will be limited to street, park, and private trees, since these are of immediate concern to urban and community foresters. However, urban trees are part of the total urban waste stream that should be of concern to all of us, and will be discussed later in the paper.

QUANTITY OF URBAN TREE DEBRIS

According to 1978 estimates (Carr and McGovern 1978), urban waste wood (trees, demolition lumber, and dunnage) totals 16.4 million tons and urban waste paper about 44.5 million tons--a total of 61 million tons of reuseable resources.

Tree debris constitutes a small (5 percent) but very significant portion of this urban wood and fiber waste--about 2.8 million tons annually. However, 85 percent (2.38 million tons) is disposed of in landfills or incinerators. Only 10 percent (280,000 tons) is used for energy and 5 percent (140,000 tons) is used for fiber or other traditional forest products.

This is not a satisfactory level of performance, knowing that our disposal sites and options are rapidly disappearing. We must do better. But in defense of the people who have

worked extremely hard trying to utilize the tree debris, there are some very good reasons why we are currently only utilizing 15 percent. Does it have to remain at this level? I don't think so. We are on the edge of some new frontiers in waste utilization, the potential being 100 percent utilization of urban tree debris.

RAW MATERIAL

Even though tree material is often referred to as a resource, it is first and foremost a waste or debris. It is a result of an activitiy that must occur anyway--thinning, pruning, or removal--and the quantity produced does not easily respond to changes in demand.

Tree debris comes in several different forms: leaves, twigs, and small branches under 6 inches, large branches over 6 inches, and logs of varying shape, sizes, and conditions. Most cities and private tree companies have the ability to chip everything under 6 inches on the street, with small portable chippers. Processing of the large material into a useable product depends on the quality of the material, its soundness, and lack of or presence of foreign material. Processing large material requires more sophisticated and expensive equipment.

PRODUCTS FROM THE URBAN FOREST

Because of the ingenuity and perseverance of many individuals that have viewed this waste material as a resource, quite a number of wood products have been produced from urban tree debris (Association of Bay Area Governments 1981). With recent innovations in the energy and solid waste industries, many additional products are now possible. Following is a list of possible end uses of urban tree debris.

WOOD PRODUCTS--MANUFACTURED

Lumber production involves an operation as simple as a chainsaw mill to a very sophisticated circle saw or band saw operation. It requires relatively straight, crotch, and stub free logs that are not contaminated with tramp metal, concrete, or other foreign material.

Composite wood includes such products as chipboard, particleboard, fiberboard, insulation board, and soundproofing tile. These industries use waste wood in large quantities and are usually located near sawmills and other primary wood operations. They generally need chipped wood that is of one species or a controlled species mix, and free of contaminants.

Paper products include low grade paper for craft and roofing felt. Restrictions on contaminants and percent bark in the chips could be stricter than for composite wood.

Presto-logs are usually made from sawdust and small chips and mixed with a binder or subjected to heat and pressure to produce a small fireplace log. Often located near an operation that produces a steady stream of material.

Craft and Specialty items are often produced for unique purposes such as large statue carvings, totem poles, carving trees, park furniture, and playground equipment. Requires debarked logs, in most cases, and either a weather-resistant or treated wood.

ENERGY

Firewood can be produced from almost any portion of the tree. Processing involves a lot of sorting and handling and is labor intensive. Demand is seasonal, allowing time for stock piling if space is available.

Live Steam. Direct combustion involves combustion of wood in water-walled boilers to produce live steam for processing or space heat. Some systems can accommodate whole logs; other systems require chipped or hogged material. Efficiency and reliability are reduced by high fuel moisture, contaminants, or variability.

Electricity. Cogeneration implies the production of steam, heat, and electricity using a wood-fueled boiler system. A reliable fuel supply is absolutely important and often systems are designed to accept other fuels. High fuel moisture and contaminants will reduce efficiency.

Combustible Gases, Oils and Char. Pyrolysis/Gasification/Hydrogeneration are new technologies that convert wood waste to combustible gases, oils, and char. They accept any type of wood waste. Generally it must be chipped or hogged and free of contaminants.

Methane Gas. Anerobic digestion is the biochemical decomposition of wood cellulose into methane gas, and a liquid fertilizer by anerobic bacteria. Wood debris must be chipped to increase surface area and must be free of non-organic contaminants.

Ethyl Alcohol. Fermentation is the destruction of wood cellulose into carbohydrates by the use of acids. Yeasts are added to produce ethyl alcohol and sludge. Wood debris must be chipped to increase surface area and must also be free of non-organic contaminants.

SOIL AMENDMENTS AND LANDSCAPE MATERIAL

Mulch and Compost result when wood chips are mixed with soil or spread on top to enhance soil conditions and promote healthy growth. Different species of wood have different pH's, and some may even have a toxic effect on the soil.

Sewage Sludge Compost is sludge from sewage treatment plants mixed (1:2) with tree debris in chipped form. The wood chips are used to aerate the sludge as it is composted. Approximately 50-75 percent of the chips can be reused in this process.

Animal Bedding requires waste either in the form of sawdust or fine shavings. Both must be clean and free of contaminants.

Landscape Material includes tree debris in the form of bark, log and branches, chips, or hogged wood. The material can be used as a decorator mulch, delineators for paths or parking lots, or for pathways.

POTENTIAL

The list of products does not suggest that one of these end uses is better than another for utilizing urban tree debris. All of the products have been successfully produced. Some with more success than others.

What is becoming very apparent across the U.S. is that there is not just one outlet for all tree debris. At least not yet. Neither private enterprise nor government is prepared to make that commitment. Diversification seems to have enjoyed the most success recently. The material is just too variable and unpredictable to make it economically viable to produce just one product.

A more popular method employs a number of different combinations of utilization options. There are numerous combinations possible. Some the possibilities are: leaves and twigs--usually composted and sold or given away; small branches--cut for firewood or chipped and composted with leaves or used as mulch or landscape material for pathways and playgrounds; and large limbs and logs--bucked and split for firewood, sold as sawlogs, chipped for fiber or fuel, used as is in the landscape, or left for the public to take.

For some cities these options have resulted in almost complete utilization of their debris. For others they are at least a partial solution to their disposal problem.

Selection of some options requires sophisticated equipment like a sawmill or chipmill which, in many cases, is beyond the capability of a local government. A nearby business or industry is often better able to handle the debris. If one is not available, the equipment that is selected should be as unsophisticated as possible, e.g., a chainsaw-mill, small dimension mill, brush chipper, or splitter. Beyond equipment requirements, a lot of additional problems will be encountered.

The choice of options will depend on each unique set of circumstances. Each city has a different political climate, different resources, and a different set of problems. Listed below are a few areas communities need to consider before selecting their options:

Cost or economic feasibility
Amount of debris
Kind of debris
Community resources or ability to fund chosen option
Type of local users or markets
Knowledge
Experience
Available space

LIMITATIONS

As noted earlier, the utilization options that cities have employed are currently using only 15 percent of the tree debris for some productive end use. A few cities have achieved complete utilization. The majority of cities are still disposing of over half of their tree debris in landfills or incinerators. It's not that this is the choice of these tree managers, but presently it is the most efficient and economical method available. In order for tree debris to join the market place, it will have to compete with the various reuse options which obtain more economical sources of wood and fiber.

Many attempts have been made to utilize tree debris but have subsequently failed. Reasons for failure can be categorized as either economic or political:

ECONOMIC

Debris is highly variable and consists of a mixture of logs, branches, twigs and leaves; logs and branches may have imbedded cabling, bracing and cement; butt logs may

have nails, screws, bolts, etc., and these may be short logs; rotted logs; and logs with excessive sweeps, croaks, crotches, and limb studs.

Additional equipment and personnel are required to sort useable material.

A separate operation must be sustained to dispose of debris with metal, debris that is of inappropriate size or shape, or debris that is unsound.

Excessive downtime for repair to equipment that strikes foreign objects during processing results in lost time.

Year round quantity of debris is not constant and does not lend itself to reliable predictions.

Debris is often composed of many different species.

Some utilization operations are very labor intensive, e.g., that for firewood.

Land to store debris or processed product often does not exist or is very costly.

User demand is often seasonal.

Debris usually has a high moisture content.

Some users require a low percentage of bark.

POLITICAL

Public resistance may be encountered to installation and/or operation of a utilization facility in a particular neighborhood.

The utilization facility, storage operation, or transfer facility may create excessive noise or air pollution.

Transportation of Dutch elm diseased logs may be prohibited across political boundaries.

Incumbents may not want controversial changes to occur during their term in office.

Tree ownership may not be properly established for street trees, i.e., homeowner or city ownership.

Public support for the utilization project may be poor because adequate public education is lacking.

The use of a new utilization option has not been properly "sold" to the administration.

The timing may not be right to compel political forces in the public and private sector to unite and initiate, or lobby for, a new utilization option.

Users do not feel responsible for society's problems and will be reluctant to accept tree debris unless it is profitable.

The issue of public liability regarding access to city property has not been properly addressed, e.g., firewood cutting.

MANAGING FOR END USES--THE REALITY

Beyond both the economic and political limitations of utilization is the real issue that is facing our profession today--is urban tree material a waste or a raw material resulting from production management? I contend that it is debris--waste material that is a result of activities that must occur anyway.

As urban and community foresters, our objective is to manage the urban forest for the greatest number of amenities and resultant benefits of urban trees. The products or end uses are just a result of that management. They are not our primary objectives, as in forest management.

It is unlikely that there are many urban forest situations (large metropolitan parks or open space) that will allow us to manage on a rotational basis. Most cities are faced with street trees and neighborhood parks. Can you imagine selectively cutting street trees or a grove of park trees because they have reached financial maturity? You'd have a lot of outraged citizens, to say the least. Citizens are not ready for that kind of progressive urban forest management.

Instead, we should be asking ourselves, how can we best manage the flow of debris? It is important to know:

How much debris you have now.

How much debris you'll have in the future.

Where the debris is now.

Where the debris will be in the future.

How to retrieve it.

Some of this information may already be on hand or can be satisfactorily predicted. Or an inventory may be needed. The inventory should include some factor that will help predict the approximate date of prunings, thinnings, and removals. Some sort of hazard rating or estimate of condition may also be needed.

This kind of information will facilitate better planning for planting, thinning, and removal activity and achieve a more homogenous uneven-aged forest. The flow of debris will then be fairly constant from all areas of the city and fairly uniform through the year. This will go a long way towards improving the efficiency and effectiveness of operations such as improving personnel scheduling procedures and reducing transportation costs.

By using this procedure, we have not lost sight of our objective (managing the urban forest to maximize the amenities and benefits of trees) without scheduling removal of trees prior to the end of their useful life. What we have done instead is smoothed out the flow of debris and made it more predictable. This in turn will create a more "competitive edge" in terms of marketing tree debris as political and economic problems are overcome and more utilization options become available.

FUTURE PROSPECTS

There are still some major problems ahead in terms of utilization of a greater percentage of the urban tree debris:

Profitability is still marginal, if not questionable.

Politicians do not view the urban tree debris situation as a problem.

Solid waste administrators do not view urban tree debris as part of the total waste stream.

We have a lot of "divided camps," and until we all (individual families, garbage collectors, mayors) start working together, we are not going to make much progress.

As a nation, we are in for some serious solid waste disposal problems in the future. Landfills are filling up rapidly, and new sites are scarce. We need to "get off the dime," and the name of that game is recycling. And I mean everything; but we have to think and act together. We need the expertise of the solid waste and cogeneration industries, and they need our expertise. It is beginning to happen, but until we all begin to think recycle--beginning at the neighborhood level--we are not going to see much progress.

What can happen? With fairly accurate debris flow predictions, we can begin talking about urban trees' debris as part of the total waste stream. As mentioned previously, we are on the edge of some new frontiers in the energy and solid waste industries. This may be the "spark" that is needed to compel the political forces to unite. New technologies would appear, and some of the nation's solid waste problems, at least, will be solved.

In the interim we will see several things occur:

A slight increase in urban tree utilization will occur. More options will be explored, and more options will be put to use. But a dramatic increase in utilization is not likely.

Wood will become more profitable for use as a fuel. Industry will convert to cogeneration facilities and accept clean chips or hogged material. Some may even process material at their site, combining your disposal with their utilization. A dramatic increase in utilization will not occur.

Landfill site production will increase. Landfill operators or other private contractors will produce all types of wood products from urban tree debris, manufactured wood products, energy, or soil amendments, and landscape material--or they will sell the material to appropriate primary producers. The type of material they produce will depend on local market conditions. The incentive in this case is that they are being paid to accept the material at the landfill. There operators will disappear as landfills are closed.

In the future, disposal options for solid waste will diminish, unity among political forces will occur, and public acceptance of new technology will be achieved. We will then be ready to attempt new ideas:

Fiber Management. The entire waste stream of wood and fiber will be managed by a new recycling technique called fiber management. Sorting will begin at the household or demolition site. The incentive will be either law or profit, profit being most desirable. The various utilization techniques that will be employed will depend on each city's unique set of circumstances but could range from lumber to energy to sewage sludge composting.

Satellite Utilization Facilities. These facilities will most likely be operated in conjunction with fiber management. They will be neighborhood facilities to produce steam or electricity for nearby industry or institutions. The facilities will be designed to have minimum impact on the neighborhood. They will accept the remainder of the waste, following separation from all recycled material. By locating satellite facilities throughout the city, transportation costs are reduced dramatically.

REFERENCES

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