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Timber Harvesting in the 1980's

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Mechanized harvesting will be an important aspect of the total forestry approach to meet the increased demands for forest products. This paper presents some of the critical equipment needs that we see necessary to supply wood in the 1980's.

by Warren T. Doolittle and John R. Erickson

INTRODUCTION

Each of the past three decades has provided significant improvements in the equipment and methods used to harvest timber. We expect that the trend in mechanized timber harvesting will continue to increase to new levels in the 1980's. Some reasons for this projection and a few examples of new harvesting concepts will be described here. Before discussing these future needs, it is appropriate to review briefly the state-of-the-art of forestry mechanization.

IN THE PAST

A notable advancement of the 1950's was the beginning of improvements in chain saws. This process has continued to date. Improved small gasoline engines, light-weight metal and plastic molded frame components, improved cutter design, vibration isolators, and superior metallurgy for chains provided a large array of light, dependable chain saws for the industry.

Development work was also started on rubber-tired skidders during the 1950's. These rubber-tired skidders came of age after the introduction of the articulated frame steered models in the early 1960's. several small and a few large manufacturers began to market and improve the design features of rubber-tired skidders. They evolved into the major means of moving logs of gentle terrain. Their significance to the logging industry was their ability to travel about twice as fast as crawler tractors. This effectively decreased the density of logging roads, thus reducing the cost of access to timber stands and some of the adverse environmental impacts that occur with some road building activities. Other important developments in the 1960's were tree shears, mechanical limbing devices, hydraulic loads, and whole-tree harvesters.

The 1970's provided considerable sophistication of whole-tree harvesters. Several companies now manufacture machines that will convert the standing tree to either tree-length or short-length logs at the stump or at the landing. The most significant advance in shears was the development of accumulating arms that permit the cutting of several small stems prior to the carrier depositing them to form skidding bunches. In addition, whole-tree chipping at the woods landing became a commercial reality, and helicopter logging became a feasible alternative in many inaccessible timber stands.

These and other new technologies contributed to widespread international trade for logging equipment. In addition, mechanization improved forest land management, as well as working conditions and pay for forest workers, and has had a favorable stabilizing effect on the cost of forest products.

FACTORS AFFECTING CHANGE

The rapidly growing and changing demands for wood-based products will result in even greater mechanization in the 1980's. These demands will pressure forest managers and the industry to utilize more of each tree cut and to intensify the management of forest lands to increase growth. Mechanization will provide the means to both meet the increased demands and to improve forest management.

On the demand side, several factors will influence timber harvesting methods. These are:

- —increased demand for lumber and veneer products
- —increased demand for residential and industrial fuelwood
- —increased demand for reconstituted wood products that will substitute for lumber and plywood products
- —increased demand for pulpwood

These last three items will create competing market demands for several types of materials. Excluding fuel wood, the demand projections for wood-based products indicate that twice as much wood must be harvested by the year 2000. Part of this increased demand will be met by harvesting wood currently left unused. Examples of this unused forest resource are:

- —logging residues
- —thinning from softwoods
- —excess growth of hardwoods
- —insect- and disease-killed timber stands
- —residual small and rough trees left after harvesting that must be disposed of prior to regeneration
- —cull trees
- —short-rotation plantations developed from intensive culture

Excluding the unknown potential from short-rotation plantations, an estimated 485 million dry tons of unused forest resources could be made available annually.

NEW TECHNOLOGIES

The recovery of all these classes of unused material will require innovative approaches that will include cost and energy effcient equipment. Existing harvesting equipment and systems which evolved during the past few decades were designed primarily to harvest relatively straight and uniform logs. These recent developments permitted the harvesting of small sized trees, but are not economical for most of the harvesting situations that include the unused material described above. The economical harvest and utilization of those classes of material previously mentioned will

present formidable challenges to researchers, equipment developers, and manufacturers.

These challenges will vary by geographic region, species, and terrain. However, based on the best prodictions of where future wood supplies will come from and the need to manage forest stands more intensively, the following technical advances are expected in the 1980's:

- —a new generation of small, long-reach cable yarders with intermediate supports
- —systems to prebunch small timber on steep slopes to maximize the production of the cable yarders
- —mechanized felling and bunching of trees on steep slopes
- —whole-tree yarding on steep slopes
- —swath-cut harvesters for gentle or flat terrain and intensive culture plantations
- —systems for harvesting and transporting whole trees to the mill
- —chipping at the stump
- —mechanized felling and yarding of high quality timber from swamp lands

All of these technologies are focused on utilizing the timber or residues that cannot be harvested economically with current equipment and market situations. For the most part, they are aimed at recovering materials that will meet the growing demands for pulpwood, reconstituted wood products, and energy. The major exceptions to this rule are the new cable yarders and the mechanized felling of high quality timber from swamp lands where the major objective is to recover logs for solid wood products. Secondarily, these technologies will supply residues for other uses, particularly cable yarders.

The rationale for proposing the technological advancements in mechanization needed for the 1980's can best be described in three separate discusisons. These deal with the problems existing on (1) steep terrain, (2) gentle terrain, and (3) swamps.

Up to the present time, the majority of the timber on steep terrain in the West has been yarded with large highlead and slackline cable yarders. This is due to the large volumes of old growth timber being harvested. In the East where the size and value of timber on steep terrain are somewhat less than in the West, most timber has been harvested by building roads at close intervals (200 to 300 feet apart) along the slopes. Logs were then cable winched to the roads for skidding.

The need to change these practices is quite evident. In the West, there will be a continued but declining use of the large cable yarder as the old growth timber contnues to be depleted. In the East, the adverse environmental impacts of high density road building are forcing a concentrated effort to find improved harvesting systems. The technical advances previously mentioned have applicability in both the East and the West. In the West, entry to vast acreages of second-growth stands will be needed to supply our timber needs and to provide improved growth on crop trees which will be harvested at intervals through partial cuts. In the East, we must find more economical ways of thinning stands, which have a preponderance of lower valued trees, with fewer roads. A first step to solve these problems is to develop an array of smaller and highly efficient cable yarders which can be moved and set up quickly. They must have relatively low capital investment costs and decreased crew size to provide economic yarding. Several small new yarding systems are now under development. One example is the "Peewee Yarder" developed by the Forest Service in the Pacific Northwest, but much work remains to be accomplished.

Concurrent with the development of these new cable yarders, there is a need for other euqipment and systems. The first is a suitable means for prebunching logs or trees on steep slopes. Currently, there are some efforts to build portable cable winch units that can be moved up and down the slope to laterally skid logs or trees to a cable road. These prebunching systems will permit optimum loading on the cable yarders and thus decrease yarding costs significantly. Efforts to date have been only partially successful, but they will become a reality in this decade. Another piece of equipment which will permit bunching is a carrier that can negotiate steep terrain and shear trees. This device would eliminate the man with a chain saw and could increase both timber cutting and yarding production. A prototype of this machine is in early testing phases by the Forest Service.

These improvements are also important for the harvesting residues on steep terrain. Small, more mobile, yarders can reduce the cost of moving residues; prebunchers can maximize loads; and mechanized whole-tree felling on steep terrain can lead to systems where the entire tree is brought to the landing, thus eliminating logging slash. Concepts for handling whole trees on roads or landings on steep terrain are now under study. All of these advanced methods for steep terrain logging should become a reality in the 1980's.

An important advance in technology that is needed on gentle terrain is the devleopment of a "swath-cutter" concept. This concept can be broadly described as a machine traveling at a constant or near constant speed, collecting all woody material in its path. The wood is then converted to bunches of trees, chips, or other suitable packages ready for transport to the mill. This concept differs from present mechanized harvesting where the machine intermittently approaches a tree, cuts it, and then moves to the next tree. The advantage of "swath-cutting" is that the production cost of wood is dependent on volume per acre rather than volume per stem. With swath-cutting, it would be theoretically possible to harvest a stand of 4-inch diameter trees for the same cost as 10-inch diameter trees if the volumes per acre were the same. This concept would permit management of stands (such as sites that must be prepared for planting) at a profit rather than at

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an expense. Some initial attempts have been made to develop this concept. Commercial units should be available within the next 5 years. These same machines could be used for intensive culture, short-rotation plantations which silviculturists now have in experimental stages of development.

Whole-tree chipping at the landing has been in use for several years. Well over 500 whole-tree chippers have been sold. A possible advancement in the 1980's will be highly mobile chippers that will produce chips at the stump. The major impediment which may delay the adoption of this concept is the materials handling required to economically collect chips at the stump for delivery to the mill.

One of the major problems in the South is the harvesting of timber in swamp areas. There are thousands of acres of swamps containing high quality trees in areas that should be harvested while preparing the sites for regeneration. The two major problems are (1) how to best cut these trees, and (2) how to yard them to roads where they can be converted to logs for transport to the mill. Rubber-tired or tracked skidders are unsuitable. A new type of vehicle which can operate in deep water is needed to fell these trees mechanically, and inexpensive cable yarding systems must be devleoped to yard. A concentrated effort on new concepts to address this problem is expected in the early 1980's.

CONCLUSIONS

Undoubtedly, there will be several advances made in the mechanization of timber harvesting in the 1980's that are not included here. The concepts presented here are those on which some research or devleopmental activities are already underway. The 1980's will present some difficult challenges in timber harvesting as the demand for all wood products, including fuelwood, increases. The opportunities to improve forest management are great with this increased market demand which can be supplied from wood we currently leave unused. The challenge will be to develop the necessary equipment and systems to do the job economically. ■

The Ghosts on my Tree Farm

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planting, roadside improvement, timberstand improvement, for which the government will pay half the cost, I could do many things but go broke from no return, or at least no return in my life time.

In the last five years I have traveled 80,000 miles in these United States and have seen many millions of acres of junk timber. Sooner or later this country will have to come to grips with this huge problem. A start to a solution is to only tax an acre of forest on what it will produce regardless of how pretty it might be. If we didn't use any more judgement or science in agriculture than we do in Forestry, the Texas longhorn would have had still bigger horns by now and smaller T-bones.

The ghosts have watched the land be denuded and the timber build houses out on the prairie. But even of more interest they watched it recover. I am most happy to give it a helping hand. The same animals are here, the same trees are here as they were 150 years ago. The main difference is that the people who use it all are different. The land will always be here, will always produce for mankind, if we just remember to tread softly when we enter the world of nature. ■