**6- Integrated Use.**

Some harvesting operations are conducted for only one kind of product, such as saw logs, pulpwood, or poles. When this is the case, the type of operation planned need be based only on consideration of the problems involved in cutting and removing that product. Other operations involve cutting and removing two or more kinds of products, such as saw logs, veener bolts, and poles, and consideration must be given to handling all of them.

The type of harvesting operation that can be planned for given forest, therefore, depends considerably on the number of products to be removed. When the operation is to be integrated, plans for handling a wide variety of products must be made. When only one product is to be cut, only that one need be considered.

**7-Facilities Already Available.**

The way in which a harvesting operation can be most efficiently conducted is often influenced by existing installations, improvements, or equipment owned by the operator or available to him. A change from railroad logging to tractor and truck logging or from team logging to trucks and tractors means that the equipment and supplies already on hand must be sold or discarded. When this involves too much loss, it is usually advisable to use the already available equipment and adapt it to the job if this can be done without excessive costs per unit of production.

**8-Legal Limiting**

In some localities, legal limitations prevent the use of certain harvesting methods. Water-control measures by hydro-generating stations on many drivable rivers forced some companies in Eastern Canada to resort to truck haul. State highway regulations usually specify load limits, and where logs are very big and large load must be trucked, it may be illegal to transport them over state highways. In such cases private roads or railroads must be built, if this is possible, or smaller loads must be hauled.

Stream driving may not allow in navigable stream, as it would obstruct and menace navigation and waterway developments. Therefore, it is not always possible to drive logs even though waterways are present.

A number of states and several provinces require disposal of slash after harvesting, and during periods of serious fire hazard the state foresters or other appropriate officials can shut down woods operations and even exclude the general public from forest areas. Also, safety codes and regulations in provincial forest fire prevention acts specify the kind of protective devices that must be used to give personal protection as well as to reduce fire hazard from cable friction and locomotive and tractor sparks.

Harvesting timber on public lands, of course, must be done in conformance with administrative regulations which have the force of the law.

**9- Policy of Owner.**

Harvesting in forests under management for continuous production of timber crops must be done by methods compatible with such objectives. in a forest where regeneration is already established, where seed trees are to be left, or where partial or selective cutting is to be done, some methods of harvesting would be unsuitable.

Cable skidding, for example, is generally destructive to residual to residual trees on the harvest area and therefore is not compatible with seed tree silviculture or partial cutting. However, cable skidding is fully compatible with harvesting forest types requiring clear-cutting for reproduction by either natural means or artificial means. The shade-in-tolerant Douglas fir forests are a good example of the silvicultural compatibility of clear-cutting with the engineering requirements of economical logging on rough ground. The logging settings are either staggered or interspersed with reserved areas of seed-bearing timber to provides natural seeding, or the clear-cut areas are planted or seeded.

On some crown management areas in Ontario where red pine poles are harvested by partial cutting from even-aged stands, no mechanical skidding equipment is permitted owing to the damage that would be done to the residual stand. Only horses are allowed for skidding.

Intensive forestry in southern Pine areas often requires the complete removal of all timber and brush so that the area can be prepared for planting by heavy disking. When such forest practices are in effect, the more the skidding disturbs the surface, the better.

Cable yarding in the Douglas fire region creates the best seedbed conditions for natural reforestation and on slops of more than 30 to 35% generally causes less soil movement. Cable skidding by beating down the slash brings it more in contact with the ground than other skidding methods. This aids more rapid deterioration and reduces the fire hazard, although for the first year the slash area may be more hazardous in some forest types.

**Stand improvement**

Any cutting of merchantable trees in stands during their growth and development must, of course, be so conducted that the residual trees are not damaged or destroyed. Such cutting is commonly done to thin densely stocked stands or to remove insect-infested or diseased trees.

All cutting of this kind, even for merchantable products, is subordinate to the more important objective of growing a full stand of timber for harvest at maturity hence the choice of harvesting methods must be compatible with the forest management plans in effect.

Balancing the Phases of Harvesting

The most economical harvesting operation is that when get profit from all labor and equipment is used to optimum capacity.

Each stage of harvesting therefore must be in balance with other stages. in an operation where the products being cut is not stored between one stage and another as occurs in some instance, cutting must be no faster than bunching, and bunching must be no faster than skidding, and skidding must be kept geared to loading. Also, hauling must be at a rate sufficient to keep the mill in logs, pulpwood, or other products, as the case may be, and to keep landings where yarding and loading are progressing simultaneously from getting plugged. Likewise, receipt of wood at a manufacturing establishment, cannot exceed production except for short periods to accumulate a supply against bad weather and interrupted harvesting. Careful selection of harvesting method and type of equipment, therefore, is necessary for a well-conducted operation.

Loading is one of the key operations in harvesting, and the type of loading equipment used frequently determines what equipment or methods will be best adapted for other operations.

Loading is the link between skidding and transportation, and particular attention must be given to this aspect to avoid an unbalanced operation. Thus, if a certain type of loading equipment can, with the size of timber and kind of roads found on a given operation, load out 10 truckloads of saw logs or pulpwood per day, it would be uneconomical to use it on an operation otherwise limited to 6 truckloads a day.

Similarly, if the requirement were 14 truckloads a day, it would be inefficient use of loading equipment and men to operate two such loaders.