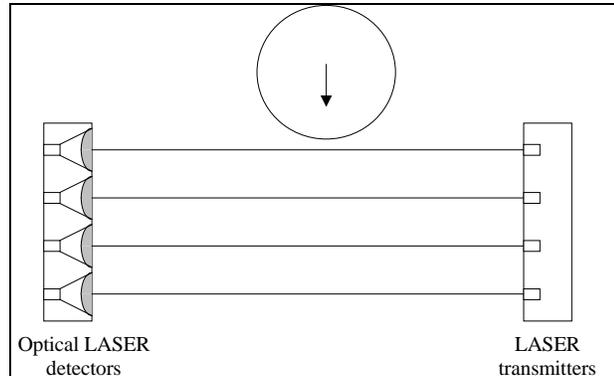


## Tree diameter measurement during cutting with a feller-buncher

**ISSUE:** Precision agriculture is an approach to crop management that seeks to maximize crops yields using yield and other data collected at a very fine spatial scale. It became feasible in the '90s after GPS receivers were coupled with reliable yield monitors. Similarly, to realize the potential of precision forestry a system is needed to spatially measure yield (harvest volume). The intent of this project is to design and develop a sensor for measuring tree size (diameter) as it is being cut, and 'map' yields across a stand. The system must survive extremely harsh conditions, be accurate, non-contact, very rugged, and fast.



**Study description:** A tree diameter sensor was developed using laser light (see top picture). As a tree enters the saw head of a feller-buncher, four laser beams are interrupted. Tree diameter is inferred from measurements of the time between the laser beam interruptions (indicating tree velocity) and the total time the tree blocks a single laser beam. Four laser beams are used in the system to compensate for variations in forward velocity of the felling head as the tree is severed. Four beams provide three velocity measurements, improving the diameter estimate accuracy significantly. The laser light beams have the major advantage that the interrupts are 'clean' (they produce a sharp shadow). The disadvantage is that the beams must be precisely aligned with the receivers. To make the system more robust, the receivers were fitted with lenses that compensate for small lateral variations in the laser beam. The signals from the receivers are fed into a data acquisition computer that calculates a diameter measurement and combines it with a location from a GPS receiver.

**Status:** The study is in progress, the optical sensors are built, and the software is completed. A dedicated field-hardened computer was built for testing purposes (see picture on the left). Field trials will be initiated late 2001 to early 2002.



### Benefits:

- Tree diameter will be known in real time and could be communicated to procurement brokers, allowing for targeted marketing of products rather than purchase of entire stands and in-woods merchandizing.
- Tree size will be mapped across stands. This will document site productivity and provide information to improve the growth environment in future rotations.

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