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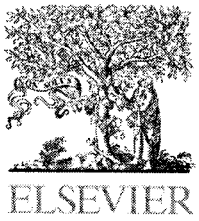

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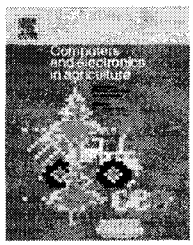

Evaluation of a system to spatially monitor hand planting of pine seedlings

Timothy P. McDonald[a,*], *John P. Fulton*[a], *Matthew J. Darr*[b], *Thomas V. Gallagher*[c]

[a] *Biosystems Engineering Department, Auburn University, 200 Corley Building, Auburn, AL 36849, USA*
[b] *Food, Agricultural, and Biological Engineering Department, The Ohio State University, 212 Agricultural Engineering Building, 590 Woody Hayes Drive, Columbus, OH 43210-1057, USA*
[c] *School of Forestry and Wildlife Sciences, Auburn University, 3301 Forestry and Wildlife Building, Auburn, AL 36849, USA*

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ABSTRACT

A tree-planting dibble was outfitted with an accelerometer, a GPS, and associated data acquisition hardware to form a system to map the locations of seedlings as they were planted. The system was worn by a planter and collected a stream of position and maximum acceleration data at 1-s intervals. An experiment was conducted to test the performance of the data acquisition system in which a planter was videotaped while using the instrumented dibble. The video provided information on timing of the dibble ground impacts that could be synchronized with the output of the dibble data acquisition system. The positions of the planted seedlings (194 total) were also mapped with a real-time kinematic (RTK) GPS survey-grade system. Procedures were developed to process the instrumented dibble output data stream in two stages into a map of positions. The stages were (a) define the level of acceleration corresponding to an impact of the dibble with the ground, and (b) associate groups of impacts with the planting of individual seedlings. Results showed the procedures for detecting and mapping the seedling locations were robust and accurate in counting the number of seedlings and in defining their general location. Absolute accuracy of the seedling positions was, however, less than would be required to identify with certainty any individual seedling at some time in the future. Average deviation between dibble-defined and RTK position was 4.5 m, three times the within-row spacing of the seedlings. The level of accuracy could be improved if a higher quality GPS were used in the data acquisition system. The procedures developed to interpret dibble output data were tested without modification on four other sites using different operators. Estimates of total numbers of tree planted based on the dibble output were found to be accurate to within 7%.

1. Introduction

Natural resource managers typically focus on a specific minimum unit of land area at which to prescribe activities. This 'management resolution' is becoming progressively smaller in forestry as technology to characterize and influence site and stand conditions evolves. It is quite possible with current technology to track stand characteristics at spatial resolutions smaller than the stand itself while also adapting management prescriptions to conditions at the sub-stand level. As

* *Corresponding author*. Tel.: +1 334 844 3545; fax: +1 334 844 3530.
E-mail address: mcdontp@auburn.edu (T.P. McDonald).
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