



## Progress towards more uniform assessment and reporting of soil disturbance for operations, research, and sustainability protocols

Michael P. Curran<sup>a,1,\*</sup>, Richard E. Miller<sup>b</sup>, Steven W. Howes<sup>c</sup>,  
Douglas G. Maynard<sup>d</sup>, Thomas A. Terry<sup>e</sup>, Ronald L. Heninger<sup>f</sup>,  
Thomas Niemann<sup>g</sup>, Ken van Rees<sup>h</sup>, Robert F. Powers<sup>i</sup>,  
Stephen H. Schoenholtz<sup>j</sup>

<sup>a</sup> B.C. Ministry of Forests, Forest Sciences Program, Kootenay Lake Forestry Centre, 1907 Ridgewood Road, Nelson, BC, Canada V1L 6K1

<sup>b</sup> Pacific Northwest Research Station, Forestry Sciences Laboratory, 3625, 93rd Avenue S.W., Olympia, WA 98512-9193, USA

<sup>c</sup> USDA Forest Service, Pacific Northwest Region, P.O. Box 3623, Portland, OR 97208-3623, USA

<sup>d</sup> Natural Resources Canada, Canadian Forest Service, 506 West Burnside, Victoria, BC, Canada V8Z 1M5

<sup>e</sup> Weyerhaeuser Company, Box 420, Centralia, WA 98531, USA

<sup>f</sup> Weyerhaeuser Company, P.O. Box 275, Springfield, OR 97478-5781, USA

<sup>g</sup> B.C. Ministry of Forests, Forest Practices Branch, P.O. Box 9513, Stn. Prov. Govt., Victoria, BC, Canada V8W 9C2

<sup>h</sup> Department of Soil Science, 51 Campus Drive, University of Saskatchewan, Saskatoon, Sask., Canada S7N 5A8

<sup>i</sup> USDA Forest Service, Pacific Southwest Research Station, 3644 Avtech Parkway, Redding, CA 96002, USA

<sup>j</sup> Department of Forest Engineering, Oregon State University, 267 Peavy Hall, Corvallis, OR 97331-5706, USA

### Abstract

International protocols, such as those of the Montreal Process (MP), specify desired outcomes without specifying the process and components required to attain those outcomes. We suggest that the process and its components are critical to achieve desired outcomes. We discuss recent progress in northwestern North America, on three topics that will facilitate development of and reporting in sustainability protocols: (1) common terms and comparable guidelines for soil disturbance, (2) cost-effective techniques for monitoring and assessing soil disturbance, and (3) improved methods to rate soils for risk of detrimental soil disturbance. Uniform terms for soil disturbance will facilitate reporting and exchange of information. Reliable monitoring techniques and tracking the consequences of soil disturbance for forest growth and hydrology are paramount for improving understanding and predictions of the practical consequences of forest practices. To track consequences, we urge creation of regional research and operations databases that can be used to: (1) address MP values, (2) define detrimental soil disturbances,

\* Corresponding author. Tel.: +1 250 825 1100.

E-mail address: [mike.curran@gems5.gov.bc.ca](mailto:mike.curran@gems5.gov.bc.ca) (M.P. Curran).

<sup>1</sup> Adjunct Professor, Agroecology, University of B.C., Vancouver, BC, Canada.

(3) develop risk rating systems for operational application, and (4) improve best management practices (BMPs) and ameliorative treatments that avoid or correct detrimental disturbances.

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*Keywords:* Soil compaction; Rutting; Monitoring; Adaptive management; Criteria and indicators; Montreal Process

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## 1. Introduction

Sustainable management of forests requires maintenance of the soil resource including its biological, chemical and physical properties and processes. This dependency is addressed at many levels (scales): at a local and regional level through operational guidelines and standards, and more recently at national and international levels through sustainability protocols (e.g., criteria and indicators of the Montreal Process) and third-party certification.

The Montreal Process (MP) included a Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests ([Montréal Process Working Group, 1997](#)). The MP is supported by 12 non-European countries covering 5 continents and representing 90% of the world's temperate and boreal forests. A major purpose of the Montreal Process, and the similar Pan European (formerly the Helsinki Agreement), is to provide a common framework for describing, assessing, and evaluating each member country's progress towards forest sustainability. Indicators will be used to describe, assess and evaluate progress. Two of the MP indicators for the conservation and maintenance of soil and water resources refer to area and percent of forestland with significantly diminished soil organic matter (indicator 21) or significant compaction (indicator 22) ([Montréal Process Working Group, 1997](#)). Clearly, we need to define what is "significant". Moreover, we need to validate an underlying assumption that we know what amount of organic matter loss or severity of compaction will lower forest productivity, and where and to what extent.

The MP clearly identifies indicators 21 and 22 as "b-type" indicators, which "may require the gathering of new or additional data and/or a new program of systematic sampling or basic research". Yet, some entities (national organizations/agencies), including

some in the USA, are monitoring or sampling compaction before "significant" changes in compaction levels have been reliably defined or validated.

In the USA, the current response to the MP for federal forestland is to utilize the existing systematic grid of forest inventory plots as the sampling matrix, then estimate extent of compaction at these sample locations. Responsibility for responding to the MP and to the larger Forest Health issue has largely been assigned to the USFS Forest Inventory and Assessment Group (FIA). To help guide this large effort, we strongly recommend soil scientists participate in the processes and review results reported to the Montreal Process by Technical Advisory Committees (TACs) and the FIA. Of highest priority, is to quantify the practical consequences of changes in soil physical properties and soil organic matter that are important for sustainable forestry.

One approach to addressing "b-type indicators" is to use locally applicable standards as proxies and then ensure adequate validation occurs to confirm that existing guidelines and standards adequately address the intent of the indicator. This is the process adopted by the Canadian Council of Forest Ministers' in their criteria and indicators for sustainable forest management, which was developed in part to address the MP ([CCFM, 2000, 2003](#)). For soil disturbance, the various Canadian provinces are now reporting out on their level of compliance with locally applicable guidelines, which is a proxy for the related MP indicators. These guidelines address the amount of an operating area that can have specific disturbance types, such as different types of ruts, compacted trails, and displacement. Commensurate with use of guidelines and standards as proxies is the paramount need to test and adapt these guidelines and standards in a reliable continual improvement (adaptive management) framework. This is complicated by the fact that each jurisdiction has different disturbance types that are targeted by their guidelines.

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