The North-American Long-Term Soil Productivity Study: Concepts and Literature

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Abstract—The resiliency of forest sites after a pulse disturbance is one of the key questions mandated by the National Forest Management Act (NFMA) of 1976. This Act mandated that we maintain the productive capacity of federally managed stands. The original USDA Forest Service soil quality standards were based largely on professional judgment. The North American Long-Term Soil Productivity (LTSP) study was founded to provide a scientific basis for validating or proposing changes to the current standards. Research on the 100 field installations centers around how two key properties, site organic matter and soil porosity, affect a forest's long-term productivity capacity. Results from these installations are listed in a bibliography.

Introduction

The Long-Term Soil Productivity (LTSP) program began in 1989 as a "grass roots" effort that quickly grew to a national program within the USDA Forest Service (Powers 2006). LTSP was founded to examine the long-term consequences of soil disturbance on fundamental forest productivity. Today more than 100 installations and affiliated sites comprise the world's largest coordinated research network.

Background

The National Forest Management Act (NFMA) of 1976 specified that the "Secretary of Agriculture shall limit the sale of timber from each National Forest to a quantity equal to or less than the quantity which can be removed from such forest annually in perpetuity on a sustained-yield basis." This landmark land-ethics statement mandated that the USDA Forest Service conduct research, monitoring, and assessments to evaluate management effects and to manage for sustained-yield in perpetuity in a manner that protects all resources and values. NFMA led to the development, by National Forest Systems, of their soil quality standards. The standards that evolved were based on professional judgment and were meant to act as an early warning rather than absolute limits (Cline and others 2006). Forest managers expressed a desire for simplicity and nationally consistent metrics, although many authorities have since pointed out that single parameters, values, or measurement methods are not appropriate in all cases (Page-Dumroese and others 2006). Therefore, the LTSP study is critical to development of more site-specific soil quality standards, guidelines, or prescriptions.

Development of useful indicators of soil quality will continue to be tied to the intensive investigations by the LTSP program and its many collaborators. Results from this research can lead to the development of indicators of best management practices. These indicators of sustainable forestry should be (1) scientifically sound, (2) operationally practical, (3) socially responsible and credible, (4) standard methodology for measurement, (5) easily interpretable, (6) integrated, (7) linked to silvicultural prescriptions, (8) easily measured and cost effective.

There are five key findings from the LTSP installations that have direct impact on forest management and soil quality: (1) soil organic matter is the link between most management systems and sustainable site productivity (*e.g.*, maintain the forest floor during management activities), (2) nutrient deficiencies can be corrected, (3) soil texture

is the key variable affecting soil organic matter and site productivity, (4) return of crop residues enhances soil organic matter and site productivity, and (5) productive cropping systems have environmental benefits (Cline and others 2006).

All the collaborators with the LTSP study share a commitment to practice ethical stewardship and sustainable forest management. All collaborators agree that achieving sustainable forest operations is an iterative process and that altering existing soil quality standards is one step in developing best management practices and the indicators for monitoring.

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The content of this paper reflects the views of the authors, who are responsible for the facts and accuracy of the information presented herein.