



Techniques for Tracking, Evaluating, and Reporting The Implementation of Nonpoint Source Control Measures

Forestry



**TECHNIQUES FOR TRACKING, EVALUATING,
AND REPORTING THE IMPLEMENTATION
OF NONPOINT SOURCE CONTROL
MEASURES**

II. FORESTRY

**Final
July 1997**

Prepared for

Steve Dressing

Nonpoint Source Pollution Control Branch
United States Environmental Protection Agency

Prepared by

Tetra Tech, Inc.
EPA Contract No. 68-C3-0303
Work Assignment No. 4-51

TABLE OF CONTENTS

Chapter 1 Introduction

1.1	Purpose of Guidance	1-1
1.2	Background	1-1
1.3	Types of Monitoring	1-3
1.4	Quality Assurance and Quality Control	1-5
1.5	Data Management	1-5

Chapter 2 Sampling Design

2.1	Introduction	2-1
2.1.1	Study Objectives	2-1
2.1.2	Probabilistic Sampling	2-2
2.1.3	Measurement and Sampling Errors	2-8
2.1.4	Estimation and Hypothesis Testing	2-10
2.2	Sampling Considerations	2-13
2.2.1	Site Selection	2-13
2.2.2	Data to Support Site Selection	2-14
2.2.3	Example State and Federal Programs	2-14
2.3	Sample Size Considerations	2-17
2.3.1	Simple Random Sampling	2-19
2.3.2	Stratified Random Sampling	2-23
2.3.3	Cluster Sampling	2-26
2.3.4	Systematic Sampling	2-26

Chapter 3 Methods for Evaluating Data

3.1	Introduction	3-1
3.2	Comparing the Means from Two Independent Random Samples	3-2
3.3	Comparing the Proportions from Two Independent Samples	3-3
3.4	Comparing More Than Two Independent Random Samples	3-4
3.5	Comparing Categorical Data	3-4

Chapter 4 Conducting the Evaluation

4.1	Introduction	4-1
4.2	Choice of Variables	4-2
4.3	Expert Evaluations	4-4
4.3.1	Site Evaluations	4-4
4.3.2	Rating Implementation of Management Measures and Best Management Practices	4-9
4.3.3	Rating Terms	4-11
4.3.4	Consistency Issues	4-12
4.3.5	Postevaluations Onsite Activities	4-13

Table of Contents

4.4	Self-Evaluations	4-13
4.4.1	Methods	4-13
4.4.2	Cost	4-14
4.4.3	Questionnaire Design	4-15
4.5	Aerial Photography	4-17
Chapter 5 Presentation of Evaluation Results		
5.1	Introduction	5-1
5.2	Audience Identification	5-2
5.3	Presentation Format	5-2
5.3.1	Written Presentations	5-3
5.3.2	Oral Presentations	5-3
5.4	For Further Information	5-6
References		R-1
Glossary		G-1
Appendix A: Statistical Tables		A-1
Appendix B: Sample Evaluation Forms		B-1
Index		I-1

List of Tables

Table 2-1 Applications of four sampling designs for implementation monitoring	2-3
Table 2-2 Errors in hypothesis testing	2-12
Table 2-3 Definitions used in sample size calculation equations	2-18
Table 2-4 Comparison of sample size as a function of various parameters	2-20
Table 2-5 Common values of ($Z_\alpha + Z_{2\beta}$) for estimating sample size	2-23
Table 2-6 Allocation of Samples	2-25
Table 2-7 Number of harvest sites implementing recommended BMPs	2-27
Table 3-1 Contingency table of implemented BMP and rating of installation and maintenance	3-5
Table 3-2 Contingency table of expected harvest site type and implemented BMP	3-6
Table 3-3 Contingency table of implemented BMP and rating of installation and maintenance	3-7
Table 3-4 Contingency table of implemented BMP and sample year	3-8
Table 4-1 General types of information obtainable with self-evaluations and expert evaluations	4-3
Table 4-2 Examples of variables related to management measure implementation	4-6

List of Figures

Figure 2-1 Simple random sampling from a list and a map	2-4
Figure 2-2 Stratified random sampling from a list and a map	2-6
Figure 2-3 Cluster sampling from a list and a map	2-7
Figure 2-4 Systematic sampling from a list and a map	2-9
Figure 2-5 Graphical presentation of the relationship between bias, precision, and accuracy	2-11
Figure 4-1 Potential variables and examples of implementation standards and specifications	4-5
Figure 5-1 Timberland area by stand size class, East and West	5-4
Figure 5-2 Forest type groups on unreserved forest land in the East	5-5
Figure 5-3 Example written presentation slide	5-5