

A Publication of the  
National Wildfire  
Coordinating Group

# National Interagency Incident Management System

## Basic Land Navigation



PMS 475  
NFES 2865

June 2007



# Basic Land Navigation

**JUNE 2007**  
**NFES 2865**

Sponsored for NWCG publication by the NWCG Training Working Team. The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader and does not constitute an endorsement by the National Wildfire Coordinating Group of any product or service to the exclusion of others that may be suitable.

---

Comments regarding the content of this publication should be directed to: National Interagency Fire Center, Fire Training, 3833 S. Development Ave., Boise, Idaho 83705. E-mail: [nwcg\\_standards@nifc.blm.gov](mailto:nwcg_standards@nifc.blm.gov).

---

This publication is available for download at [www.nwcg.gov](http://www.nwcg.gov). It may also be ordered from National Interagency Fire Center, ATTN: Great Basin Cache Supply Office, 3833 S. Development Ave., Boise, Idaho 83705. Order NFES 2865.

## PREFACE

Basic Land Navigation is pre-course work for several courses in the National Wildfire Coordinating Group (NWCG) wildland fire curriculum. It is primarily designed for students to complete in a non-classroom environment; however, it is often used as a student workbook for navigation courses. The 2007 version was developed by an interagency group of experts with direction and guidance from the National Interagency Fire Center (NIFC) Fire Training Group under authority of the NWCG. The primary participants in this development effort were:

U.S.D.A. FOREST SERVICE  
San Bernardino National Forest  
Mary Bogens

U.S. FISH AND WILDLIFE SERVICE  
New Jersey  
Michael Durfee

STATE OF NEW HAMPSHIRE  
Lee Gardner

BUREAU OF INDIAN AFFAIRS  
Oklahoma  
Richard Streeper

NATIONAL INTERAGENCY FIRE CENTER, FIRE TRAINING

NWCG appreciates the efforts of these personnel and all those who have contributed to the development of this training product.



# CONTENTS

<b>Preface</b> .....	i
<b>Introduction</b> .....	v
<b>Chapter 1 – Overview of Maps</b> .....	<b>1.1</b>
Key Points When Working with Maps .....	1.2
General Types of Maps .....	1.3
Incident Specific Maps .....	1.6
Map Legend and Symbols .....	1.12
Map Sources .....	1.15
Checking Your Understanding .....	1.17
<b>Chapter 2 – Reading Topographic Maps and Making Calculations</b> .....	<b>2.1</b>
Reading the Margins .....	2.2
Interpreting Contour Lines .....	2.12
Estimating Slope .....	2.17
Estimating Aspect .....	2.19
Estimating Acreage .....	2.20
Estimating Distances .....	2.27
Estimating Percent Contained .....	2.27
Checking Your Understanding .....	2.29
<b>Chapter 3 – Geographic Location Systems</b> .....	<b>3.1</b>
Latitude and Longitude .....	3.2
Universal Transverse Mercator .....	3.5
U.S. Public Land Survey .....	3.8
Other Geographic Location Systems .....	3.13
Checking Your Understanding .....	3.15
<b>Chapter 4 – Using a Compass and Clinometer</b> .....	<b>4.1</b>
Parts of a Compass .....	4.2
Tips on Getting Accurate Compass Readings .....	4.4
Adjusting a Compass for Magnetic Declination .....	4.5
Orienting a Compass .....	4.7
Taking Bearings (Direct and Back) .....	4.8
Following Bearings .....	4.11
Estimating Slope with a Clinometer .....	4.13
Checking Your Understanding .....	4.15

<b>Chapter 5 – Global Positioning System</b> .....	<b>5.1</b>
How the Global Positioning System Works .....	5.2
Using a GPS Receiver .....	5.7
Checking Your Understanding .....	5.13

<b>Chapter 6 – Navigation and Field Mapping</b> .....	<b>6.1</b>
Orienting Maps .....	6.2
Measuring a Bearing on a Map .....	6.4
Plotting Points on a Map using Latitude/Longitude .....	6.7
Plotting Points on a Map using UTM .....	6.17
Estimating Your Own Position Location .....	6.21
Estimating Unknown Position Locations .....	6.22
Estimating Distance on the Ground .....	6.23
Field Mapping .....	6.25
Taking Notes .....	6.29
Checking Your Understanding .....	6.30

## **Appendixes**

**Appendix A – Glossary**

**Appendix B – Answers to Exercises**

**Appendix C – Tools and Resources**

## INTRODUCTION

Navigating with a compass and map is an essential skill for many incident positions. Even with new technology, such as Global Positioning System (GPS) receivers, map and compass skills are still needed. Confidence with navigation skills comes with practice and proficiency. This confidence level often impacts how a person performs during a crisis – which can result in life or death decisions.

*Basic Land Navigation* is an introduction to land navigation. It begins with a general overview of maps. Then it specifically addresses how to read topographic maps. Next it covers various types of geographic location systems, such as latitude/longitude and Universal Transverse Mercator (UTM). This is followed by basic instructions on using a compass and clinometer. Then a general overview of the Global Positioning System is presented. The last chapter builds on skills learned in the previous chapters and adds new skills for navigation and field mapping. The three appendixes – glossary, answers to exercise, and tools/resources – include additional information as a reference.

Each chapter starts with a bulleted list of what you will learn. This is followed by a general overview of the chapter and how the information can be used. The technical content is then presented with several illustrations to facilitate understanding the concepts. Each chapter ends with the section “Checking Your Understanding,” which consists of several questions. The answers to those questions are in Appendix B. Map scales may have changed during the printing of this publication; this may cause the correct answers to be slightly different than the given answers.

As you read through the chapters it will be helpful to have a U.S. Geological Survey (USGS) color topographic map to use as a reference. To complete the exercises you will need the following materials:

- Compass with adjustment for magnetic declination
- Clinometer
- Calculator
- Engineer’s ruler (see Appendix C)
- Protractor (see Appendix C)
- Dot grid (see Appendix C)
- UTM grid reader (see Appendix C)

