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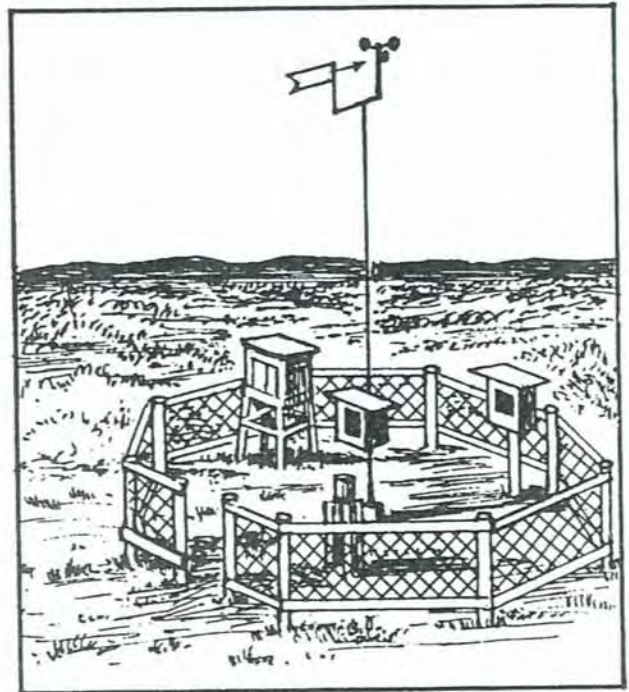
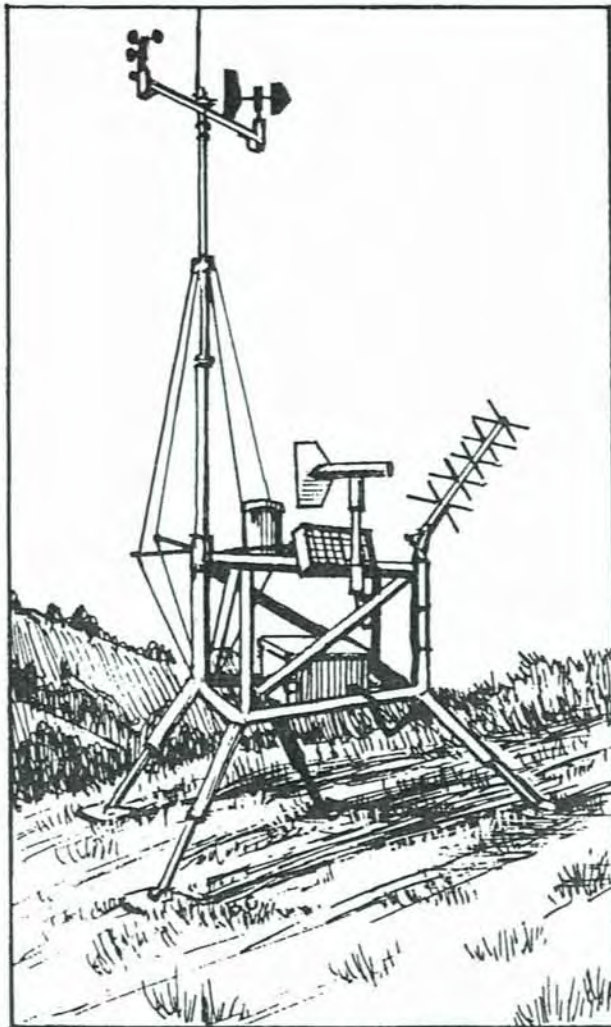


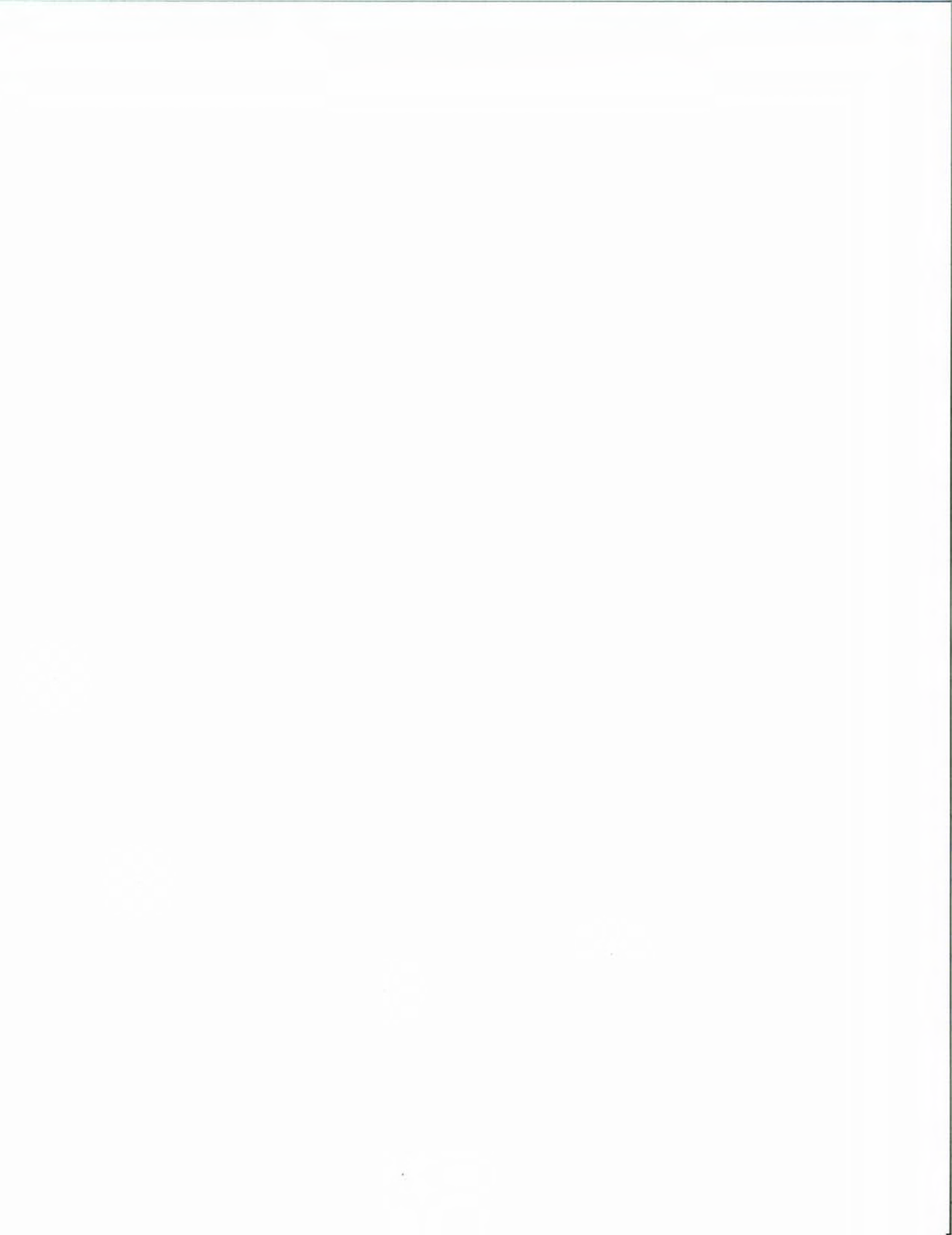
# Weather Station Handbook—an Interagency Guide for Wildland Managers

Arnold I. Finklin  
William C. Fischer

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## INTRODUCTION

### Background

The U.S. Department of Agriculture (USDA), Forest Service (FS), the U.S. Department of the Interior (USDI), Bureau of Land Management (BLM), and the USDI National Park Service (NPS) share common objectives in the management of natural resources. Likewise, they are often faced with the same need for accurate and timely weather data. These data are vital to many operational and program decisions. Most of the required data must come from the agencies' own weather stations. The total number of these stations is rather large. As of 1988, the FS operated approximately 1,000 manual and 265 automatic-type stations; the BLM, more than 165 automatic stations. The NPS maintains a skeleton network of manual and automatic stations. The USDI Bureau of Indian Affairs (BIA) and various State and private agencies or organizations also require weather data and operate weather stations.

The data collected from these stations are used for a variety of purposes. The primary use has been for National Fire Danger Rating System (NFDRS) calculations. But resource management now commands a major share of use in some areas, particularly where automatic stations are operated year-round (for example, in the Siskiyou National Forest in Oregon). Weather records have a key role in fire planning efforts, and the NFDRS outputs (indexes) are sensitive to inaccuracies in the acquired weather data. Thus, if the historical or current fire weather data contain errors (or values from poorly sited or exposed instruments), fire management plans and operational guidance derived from such data can be seriously affected.

Although each agency has its own network of weather stations, these networks are often maintained through cooperative interagency efforts. The data gathered by the different agency networks are also shared among the agencies through a common data base and communications medium.

Currently, the Administrative Forest Fire Information Retrieval and Management System (AFFIRMS) is the common medium for forestry weather data management. AFFIRMS was designed in the 1970's to address primarily fire weather data requirements identified at that time. Additional weather data needs have subsequently been identified. Many of these are not fire related and are not being addressed by AFFIRMS. A comprehensive Weather Information Management System (WIMS) is therefore being developed to meet current needs. WIMS is expected to be available for initial testing in 1990 and to become operational in January 1992.

In an effort to standardize and improve data acquisition practices, and ultimately promote high data quality, an interagency committee representing the BLM, FS, and NPS was formed to oversee the joint publication of an interagency weather station handbook. The committee first met in Boise, ID, in July 1987, with the following members present: Buddy Adams (BLM), John Bowdler (NPS), William C. Fischer (FS), Russell A. Gripp (FS), Donald A. Haines (FS), Phillip F. Sielaff (BLM), Roger A.

Tucker (FS), and John R. Warren (FS). The members developed plans and guidelines that have led to the present handbook. Although weather station requirements may vary between agencies or within a given region, forest, park, or district, certain basic requirements are common to all jurisdictions.

### Objective

The overall purpose of this handbook is to aid personnel of the Bureau of Land Management, Forest Service, and National Park Service—and other Federal, State, and private wildland resource agencies—in obtaining needed, reliable weather data. Such data must be accurate, complete, representative, and comparable between stations. Toward this, the handbook offers certain standards and procedures designed to minimize sources of error and other problems affecting weather data. Specific attention is given to instrumental equipment—and its siting, installation, and maintenance—and operating (observational) practices.

Concurrently, this handbook also has the purpose of providing a reference that meets the requirements of each agency, thereby avoiding duplication of publication efforts among the agencies.

### Basis of Handbook

This handbook is largely a revised, updated version of the Fire-Weather Observers' Handbook by Fischer and Hardy (1976), with expanded content including unmanned, automated ("automatic") weather stations. Details concerning remote automatic weather stations are in large part based on a BLM manual (USDI BLM, RAWS Support Facility 1987). The BLM manual, revised by Robert McCormick and Buddy Adams, was written mainly by Phillip F. Sielaff in 1984. The content of the present handbook provides for a broad range of applications. The standards and procedures presented here are consistent with well-established practices of meteorological organizations, hydrological services, and fire control agencies. Publications by the U.S. Department of Commerce (1972) and the World Meteorological Organization (1983) were among the primary contributing sources.

In addition to the material obtained from publications, updated information was furnished by several individuals. These contributors, all affiliated with the Forest Service, include: Russell A. Gripp, Siskiyou National Forest, Donald A. Haines, North Central Forest Experiment Station, and John R. Warren, Fire and Aviation Management, at Boise, ID. Bonnie Mason, Watershed and Air Management, Washington, DC, contributed to the Introduction. Catalogs or literature from various companies provided information describing weather-station equipment.

**Figure Credits**—Unless otherwise credited in the captions, photographs and other figures in this handbook are from the USDA Forest Service. Most of the Forest Service photos and drawings are derived from Fischer and Hardy (1976); citations are given in the case of other Forest Service publications.

## Scope of Handbook

This handbook is meant to be a comprehensive reference, although it cannot be all-inclusive—particularly on details concerning technically complex or specialized equipment and systems. The discussions of station siting, instruments, and related standards pertain to manual and automatic weather stations operated for a variety of resource management, monitoring, and research purposes. This should be understood despite the predominant reference to fire-weather stations.

The observational equipment discussed is that currently in use, or available for use, at weather stations operated by United States government agencies. Much of the manual, direct-reading equipment is the standard National Weather Service or Forest Service type; but suitable, less expensive or more convenient alternative types or models are included for consideration. These alternatives include newer instruments incorporating electronic features and digital readout. Conversely, some of the models discussed here, particularly for windspeed measurement, may no longer be manufactured but are still in use. Such models, if included in the handbook by Fischer and Hardy (1976), are retained in the present handbook.

Because of the nature and variety of manual instruments, which can be operated and maintained by nonspecialists after relatively simple instruction, their coverage in this handbook is much lengthier than that of the automatic equipment. Corresponding instructions pertaining to automatic equipment are, largely, left to operating and service manuals provided by the manufacturers.

## Handbook Organization

This handbook is organized into three main parts, each containing chapters whose numbering sequence continues from one part to another.

Part 1 discusses basic considerations that apply to both manual and automatic weather stations. The topics include station networks, site selection standards, equipment requirements, and data management. Part 2 pertains to manual stations, with four subdivisions (A, B, C, and D, respectively) describing the various weather instruments, their installation, observational procedures, and maintenance. This separation, used by Fischer and Hardy 1976, was adopted as a convenient and logical way of presenting the large amount of material to users. In many cases, separate individuals are involved in the installation, observing, and maintenance tasks. Numerous figures (mostly photographs) are included for illustration and easy reference. Part 3 discusses automatic stations, with details focused mainly on remote automatic weather stations (RAWS).

The handbook contains several appendices. These include an abridged set of observational instructions for manual stations, psychrometric tables, a fire-weather station maintenance checklist, user instructions for retrieving RAWS data via computer terminal, and a list of equipment manufacturers or suppliers. An index of subject matter is also included.

## Units

With a few customary exceptions (as in chapter 10), the measurement units given here are those in the English system. English units remain in predominant use for surface weather observations in the United States. Metric equivalents can be obtained from conversion formulas in appendix 8.