

Slope Preparation and Grooming

A Handbook for Practitioners

Fabian Wolfsperger, Hansueli Rhyner, Martin Schneebeil



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Dr. Martin Schneebeli , Head of Snow and Permafrost Research Unit at
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Other authors:

Daniela Limacher-Lehner (Section 1.6: Machine-Made Snow)

Thomas Grünewald (Section 7.6: Climate Change and Snow Reliability)

Mathieu Fauve (2002 edition)

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Foreword

Snow sports remain very popular. As well as classic skiing on slopes in traditional winter sports destinations like the Alps, new and often fun alternatives are now available in snow parks. Meanwhile, populous countries in Asia are discovering the potential of skiing as a recreational sport. All these developments are imposing increasingly stringent requirements on snow preparation. At the same time, climate change is presenting additional challenges for managers of slopes and cross-country ski trails.

This new edition of *Slope Preparation and Grooming: A Handbook for Practitioners* takes account of the rapid developments in snow sports from both a scientific and practical point of view. The book starts with an in-depth summary of the relevant scientific principles, written in readily understandable language so that readers can learn all about the processes taking place in snow. Subsequent more detailed chapters and sections deal with specific topics, including snowmaking, snow farming, measurement technology, and climate change. The book not only provides information for professionals in slope preparation and snow and ski management to consult, but is also a straightforward and highly readable guide for interested non-specialists that can be used for training and teaching purposes.

The text, drawn up in close collaboration between scientists and practitioners, was designed to be of practical use. At the same time, it is meant to help reconcile ecological standards and economic constraints. The efficient use of energy and other resources is crucial in a world where resources are limited and waste is no longer acceptable. Dealing efficiently with snow as a resource is not just economically beneficial for ski resorts: it can also help to make snow sports safer and can play a vital role in protecting the environment.

So I would like to offer profuse thanks to all the authors and other, unnamed contributors who selflessly allowed their material, know-how, and experience to be used for this book. Many employees at the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), and in particular at the WSL Institute for Snow and Avalanche Research (SLF), and numerous snow sports enthusiasts in Switzerland and abroad deserve credit for this updated edition of the handbook. Applying the latest scientific findings in this handbook for practitioners is a prime example of the work done by SLF Davos.

Michael Lehning
Former Head of the Snow and Permafrost
Research Unit

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Introduction

The book *Preparation and Maintenance of Pistes* was first published in 2002. Shortly afterwards, it was translated into various languages, and since then has been used in many institutions and associations worldwide as a textbook and basic training manual on slope preparation and grooming.

Our prime reason for completely reworking the first edition was the rapid practical progress made for example in snowmaking, the construction of increasingly diverse snow parks, or the use of satellite snow-depth measurements during slope preparation. In addition, more and more research in recent years has been devoted to topics relevant to skiing facilities. Examples include the physics of snow farming, the preparation of race tracks, and the issue of water loss in snowmaking.

Last, but not least, increasingly strict quality requirements and the expanding range of snow sports on offer have created a need for sound, up-to-date sources of information, particularly since climatic conditions are becoming increasingly unfavorable for snow sports and making snow an increasingly expensive resource in ski resorts. This is making it more and more important to handle snow the right way as a building material. The book focuses on the sustainable management of snow as a resource while presenting international state-of-the-art knowledge on the subject.

This new edition contains a completely new introductory chapter on snow as a material, making snow's physical processes and resulting properties understandable even to non-specialist readers. For the first time, current snowmaking technologies are contrasted and new knowledge with practical applications is summarized in a readily comprehensible way. The core chapter *Ski Slope Preparation and Grooming* has been restructured to make it clearer, and some interesting data have been added. During the 2017 Alpine World Ski Championships, race track preparation as a whole and the watering of ski slopes in particular were analyzed. The results are described in the chapter *Race Track Preparation and Grooming*. The chapter *Snow Park Construction, Maintenance, and Management* has been updated with help from experts with practical experience. A new chapter, *Snow Management*, covers methods of managing snow, research results on future snow reliability in the Alps, and practical information on conducting snow farming projects. The book then ends with the chapter *Measure-*

ment Methods and Tools, which describes both established and new tools for practitioners who work with snow every day.

We hope readers enjoy the book and wish them every success in their daily work with the captivating medium that snow is.

The team of authors