Preface

This volume summarizes the results of ecological research on Siberian larch forests that has been conducted jointly by a team of Russian and Japanese scientists in northern Central Siberia during the past decade. In the following pages, we report our findings, including assertions, discoveries, and re-discoveries on the patterns and processes of the larch forests that were so common to Russian ecologists but very remote, inaccessible, and unusual to foreign scientists. Inaccessibility of the Siberian ecosystems stemmed, of course, from the world politics particularly those after the Second World War. The Soviet Union had practically prohibited foreign scientists from conducting any scientific investigation in Siberia. Ecological knowledge from this region had been published nearly exclusively in the Russian language, and was not distributed widely. In the meanwhile, ecological concepts and methods progressed in the western-block countries somewhat independently of the ecological knowledge within the Soviet Union. As a result, some major discrepancies have developed in the ecological knowledge. There were also discrepancies in the methods of analyses in forest soils and ecophysiological measurements. By working together, we have overcome some differences. We have also realized that the larch ecosystems of Siberia are unusually nutrient-limited systems. This fact has led to some discoveries in both forest structure and function, which will be discussed in some depth in the following chapters.

Opportunity for a joint research came rather suddenly. Michael Gorbachev, then the president of the Soviet Union, visited Japan in 1989, and proposed with Prime Minister Toshiki Kaifu to set aside funds for joint scientific investigation of the territory of Siberia. Gorbachev fell from power shortly thereafter, and the Soviet Union has disappeared from the world map – but the promises were kept in both sides. A major research program on atmospheric and terrestrial carbon dynamics in Siberia was organized in 1991 by funds from the Environment Agency (now Ministry of the Environment) of Japan. Japanese ecologists started visiting Siberia, first in Yakutia in 1991, then began to concentrate the efforts near a village of Tura in 1995 at 64°N and 100°E, about 800 km east of the Yenisei River and in the midst of the continuous permafrost zone. Russian Government has also contributed funds through V.N. Sukachev Institute of Forest at Krasnoyarsk.

The purpose of our investigation has been to describe Larix gmelinii (Rupr.) Rupr. (Gmelin larch) ecosystems in northern taiga of Central Siberia and to discern
the potential role those forests may play under the climate that is considered to be warming. A series of study sites and study plots were established near Tura by adding necessary study areas to those already been established by the scientists of V.N. Sukachev Institute of Forest. Stand structure, stand development, forest production, forest floor vegetation, tree ecophysiology, and soils have been examined. Carbon budget study with CO$_2$ flux measurement and nitrogen dynamics study with fertilization experiment have been initiated recently as well. This volume describes mostly the former part of our investigation, but some materials from the latter will also be included.

Readers should be reminded that this book does not provide the whole picture of larch forests in Siberia. It reviews where our knowledge stands, and adds some new information and implications that were obtained through our investigation. We do not pretend that the work has been completed. A series of investigations answered some questions. But this process created further questions. Many of them have not yet been answered. We hope to make a point in this book that the larch ecosystem over continuous permafrost is a distinct and wide-spread biome, and should be recognized as such in ecological disciplines. With this hope, we included discussions comparing larch ecosystems of Siberia to other biomes. Implications of the structure and functioning of the larch forests under global warming are also added toward the end of the book. We hope that these discussions are enlightening and useful to the readers.

The book is composed of five major parts. Part I describes ecological setting of Siberian ecosystems that are dominated by the larch species. Part II is devoted to the description of dynamics and function of the larch forest ecosystems. Part III describes tree ecophysiology and the environment for the larch species in Siberia. Part IV deals with comparisons of our findings to forest ecosystems on the other parts of the globe and implications with respect to responses to the anticipated climate change in the following decades. Finally, Part V synthesizes characteristics of larch species and larch forests in Siberia, including their potential responses to climate change.

Our activities in Siberia owe numerous individuals and organizations. Gen Inoue of Nagoya University (then at National Institute for Environmental Studies) was the key person organizing the initial scientific program with the Japanese Environment Agency during 1991–1992. Without him, there would have been no program. Kunihide Takahashi of Hokkaido University (then a member of Forestry and Forest Products Research Institute of Japan) was instrumental in creating a vital program in forest ecology. Masami Fukuda of University of Alaska, Fairbanks (then at Hokkaido University) supplied us ample insight and suggestions on the field work in Siberia. Ruzhena V. Gordeeva, director of Evenkia Department of Nature Protection at Tura, provided logistical help in our field activities. Viktor M. Borovikov and Sergey Tenishev of Evenkia Department of Forestry helped us in many ways at the field station in Tura. Galina M. Gruncheva and Galina A. Borovikova, among others, worked as cooks at our field station at separate field seasons, to whom we are grateful. Scientific field assistance were provided by many students, including T. Chikhachova, K. Fukuzaki, A. Ishizaki, E. Mizumachi,
O. Rezvykh, Y. Seo, A. Shcherbacheva, A. Shinkareva, V. Shkikunov, Y. Yanagihara, and V. Zyryanov. Following colleagues helped us focus on particular aspects of research activities through many discussions: M. Araki, A. Bondarev, K. Fukuyama, M. Ishizuka, G. Iwahana, S. Kagawa, G. Kofman, K. Kushida, V. Kuzmichov, O. Martinsson, T. Miyaura, K. Noguchi, K. Ono, N. Saigusa, H. Saito, H. Sakai, H. Sawada, T. Sofronova, R. Tabuchi, G. Takao, A. Takenaka, T. Toma, S. Yamamoto, Y. Yamamura, and T. Yokota. We tried to list all persons who contributed to our study greatly; however, if there are any relevant names missing from the above list, it is solely a mistake of the editors.

O. Martinsson, T. Lei, N. Kurachi, and S. Sugita read the manuscript and provided invaluable comments. Parts of the manuscript were also read and commented by students in a graduate course in boreal forest ecosystems at Kyoto University, including T. Agata, K. Fukuzaki, S. Takahashi, M. Takenaka, and M. Togo. We thank particularly E.-D. Schulze who carefully reviewed the entire manuscript, and helped us to improve the quality of the book substantially. Funding for our scientific work came mostly from Ministry of Environment of Japan through projects S-1 and B-053 as noted earlier. However, additional funds were also provided from Science and Technology Agency of Japan; Ministry of Education, Science, Sports, and Technology of Japan; Ryukoku University; Sukachev Institute of Forest, Siberian Branch of Russian Academy of Sciences; Russian Fund of Basic Research; and Forestry and Forest Products Research Institute of Japan. We are thankful to all these donors. Institutional and managerial support for our activities was also provided by E. Petrenko of V.N. Sukachev Institute of Forest, and N. Kanaya of Forestry and Forest Products Research Institute of Japan. We are particularly grateful to A. Onuchin, the director of V.N. Sukachev Institute of Forest, who oversaw our activities and helped us in invaluable ways. Ria Kanters of Springer provided editorial support that made our book much more readable than its original form. Last, but not to the least, we thank our families to have endured various inconveniences while we were away in Siberia for field work over many field seasons: Without their support, this work would have been impossible.

Kyoto, Japan
Krasnoyarsk, Russia
Tsukuba, Japan
Tsukuba, Japan
Edmonton, Canada

Akira Osawa
Olga A. Zyryanova
Yojiro Matsuura
Takuya Kajimoto
Ross W. Wein
Permafrost Ecosystems
Siberian Larch Forests
Osawa, A.; Zyryanova, O.A.; Matsuura, Y.; Kajimoto, T.;
Wein, R.W. (Eds.)
2010, XXVI, 502 p. 10 illus. in color., Hardcover
ISBN: 978-1-4020-9692-1