

Ferns and Lycophytes of Minnesota: The Complete Guide to Species Identification. Welby R. Smith; photography by Richard W. Haug. 2023. University of Minnesota Press, Minneapolis, Minnesota, USA. 323 pages. \$39.95 (paper). ISBN: 978-1-5179-1466-0.

Ferns and Lycophytes of Minnesota by Welby Smith is based upon knowledge obtained from field surveys across Minnesota, by past and present botanists, examination of herbarium specimens, and molecular biology. Herbarium specimens were examined and verified by recognized experts with their annotations on herbarium sheets.

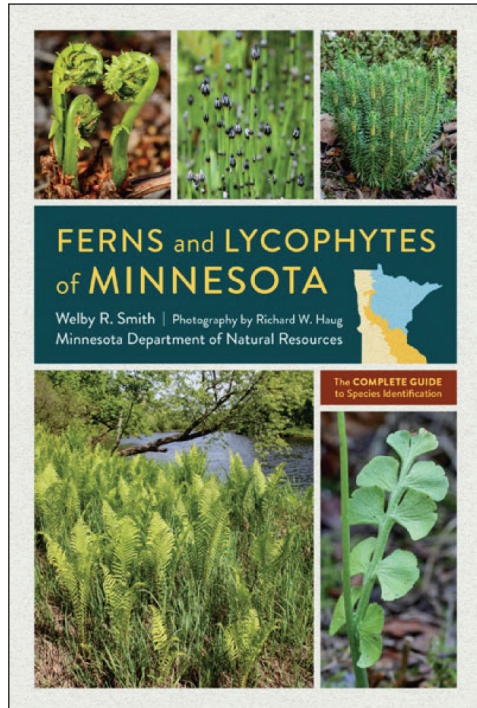
This guide is easy to use at all skill levels. Technical terms are necessary for identification, but non-technical terms also are used, making it much easier for non-botanists to understand the descriptions of plant structures. There is a useful glossary in the back of the book with specialized terms and their meanings. The heart of the book is the treatment of each species. Two facing pages are dedicated for each species. One of the two pages includes the Latin name, common name, authority, synonyms, description of the species, identification discussion, natural history, and a dot map of known occurrences in Minnesota. The facing page has up to five photographs with details necessary for identification to the species level.

The photography by Richard Haug is extraordinary, with very sharp details necessary for identification. It appears that Haug used a technique known as focus stacking. Focus stacking combines multiple images which are taken at different depths of field. Together, all of the images are layered upon one another to create one image where all areas of an object are in focus. The technique helps in the visual identification of the plants.

The taxonomic keys for plant identification in *Ferns and Lycophytes of Minnesota* are very easy to use. I find the keys are much easier to use than the keys in Lellinger (1985) and Tryon (1980). The key to plant orders is especially helpful. This is a good place to begin keying an unknown specimen. Both technical terms and non-technical terms are used in the key to orders. Further keying to genus and species is more technical. If one is not familiar with the technical terms in a taxonomic key, then one may refer to the glossary in the book.

I tested the keys in *Ferns and Lycophytes of Minnesota* on some pressed plant specimens that I had collected, beginning with the key to the orders into which the Minnesota taxa fall. I was quickly directed to order Polypodiales, a difficult order of plants according to the author. The author's key to order Polypodiales is based upon easily seen characteristics. Leaf structure is emphasized in the key. My sterile plant specimen was easily keyed to *Dryopteris intermedia* (Muhl. ex Willd.) Gray (Evergreen Wood Fern), with the rachis sparsely covered with the very small, clear, stalked glands, which I could see with a microscope. Because *Dryopteris intermedia* may be easily confused with *Dryopteris carthusiana* (Vill.) H.P.

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Fuchs (Spinulose Wood Fern), I compared the descriptions of both species, and examined the lower-most and inner-most pinnule. The photographs confirmed my identification. This identification did not take very long. I will be taking *Ferns and Lycophytes of Minnesota* in the field with me in the future.

Book Reviewer: Deborah L. Pomroy, Assistant Scientist (retired), Olga Lakela Herbarium, Department of Biology, University of Minnesota, Duluth, Minnesota 55812, USA. dpomroy@d.umn.edu.

Literature Cited

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- Tryon, R. 1980. Ferns of Minnesota. University of Minnesota Press, Minneapolis, Minnesota, USA. 184 pp.