Review of Mariana Gosnell's *ICE: The Nature, the History, and the Uses of an Astonishing Substance*

Book review for the *Bulletin of the American Meteorological Society*
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Abstract

The book *ICE: The Nature, the History, and the Uses of an Astonishing Substance* by Mariana Gosnell is a well-written, engaging book about all types of ice.

Significant Findings

This is a book review; the one significant finding is that the book reviewed is a comprehensive, informative book about ice, well worth reading.

Popular Summary

ICE: The Nature, the History, and the Uses of an Astonishing Substance is a recently published book by Mariana Gosnell about ice. It covers not just the ice that is readily seen, such as sea ice, lake ice, icebergs, glaciers, ice sheets, and ice cubes, but also ice in the ground, in the atmosphere, inside plants and animals, and in outer space, plus new ice forms being created in scientific laboratories. Gosnell treats the reader to a well-written, easy-going mixture of science, adventure, history, applications, science methods and controversies, and philosophy, all centered in one way or another on ice. The book is 563 pages long and is filled with fascinating anecdotes and details, such as beetles in the Canadian Rockies that can supercool to 60°C below freezing and a lake in Minnesota where each winter typically 65,000 fishing shanties are set up on the lake's ice, many with couches, beds, television sets, and bathrooms. Gosnell also includes many practical suggestions. Among them: When driving on lake ice, keep your windows open, in case your vehicle breaks through the ice and you need to make a rapid exit.

ICE: THE NATURE, THE HISTORY, AND THE USES OF AN ASTONISHING SUBSTANCE

Mariana Gosnell, 2005, 563 pp., $30.00, hardbound, Alfred A. Knopf, New York, ISBN 0-679-42608-6

Ice has garnered considerable scientific and media attention over the past decade because of reductions occurring in land ice and sea ice at many locations around the world and the hypothesized damaging consequences should those reductions continue, as projected by many scientists in view of expected continued global warming. Among the major concerns, massive land ice reductions will raise global sea level, and continued Arctic sea ice reductions will certainly affect the rest of the Arctic climate system and the Arctic ecosystem and could conceivably lead to the extinction of polar bears and other Arctic life forms dependent on the sea ice cover. As a result, many people, scientists and non-scientists alike, have become interested in ice and what is happening to it.

Mariana Gosnell has an interest in ice that includes the climatological connections, but also extends far beyond those topics. Her book *ICE: The Nature, the History, and the Uses of an Astonishing Substance* takes the reader on a wandering and comprehensive journey about the incredibly important and remarkable substance that ice is. Gosnell's fascination with ice is clear throughout, ranging from her description of watching ice cubes, to renting a cabin in New Hampshire for a winter so that she could observe a lake freeze, to journeying to ice in the Arctic and Antarctic, and to conversing at length with people directly affected by ice and with scientists studying ice. As befits a former writer for a major news magazine (*Newsweek*), Gosnell has done extensive research and has written with a highly readable and flowing style.

In a book filled with anecdotes and autobiographical details, Gosnell treats the reader to a well-written, easy-going mixture of science, adventure, history, applications, science methods and controversies, and philosophy, all centered in one way or another on ice. The book is neither a science textbook nor a history, but the attentive reader will learn a good deal about both science and history as well as the substance and importance of ice.

Gosnell divides the book into an Introduction and the following 36 chapters: Lakes, Rivers, Great Lakes (including Asia's Lake Baikal), Loading, Breakup (highlighting the rapid flooding of all of downtown Montpelier, Vermont in 1992, when an ice dam on the Winooski River suddenly broke), Alps, Surging Glaciers (first identified during the 1957-58 International Geophysical Year), West Antarctic Ice Sheet, Coring (including Lonnie Thompson's work at low latitudes, plus the Greenland ice coring projects that yielded startling evidence in the 1990s of extremely rapid past climate changes), On Glaciers (highlighting the 1911-12 Amundsen/Scott race to the South Pole and explorations of Douglas Mawson, Vivian Fuchs, and Edmund Hillary), two chapters on Icebergs, two chapters on Sea Ice, two chapters on Ground Ice (i.e., permafrost and its impacts), Plants (including plant survival tactics in sub-freezing temperatures and human strategies for keeping commercial plants from freezing), four chapters on Animals, two chapters on Human, two chapters on Games (including the standard Olympic ice sports and many others), three chapters on Uses, Other Forms of Ice, three chapters on Atmospheric Ice,

two chapters on ice in outer Space (including a presumed ice crust 100s of miles thick on Neptune's moon Triton), the Ice Ages, and the Lake of the Woods. Throughout, there are telling details (some trivial, some decidedly nontrivial), mixed smoothly with scientific and historical information. The following list gives a short sampling of what's included in this wide-ranging book:

-- In the chapter on Loading, the topic of what the ice can bear is illustrated with fascinating details such as the network of over 2000 seasonal ice roads that is constructed in Manitoba each winter and the fact that each winter typically 65,000 fishing shanties are set up on the lake ice of a single lake, Mille Lacs in Minnesota, many with couches, beds, television sets, and bathrooms. Among the practical suggestions: When driving on lake ice, keep your windows open, in case your vehicle breaks through the ice and you need to make a rapid exit.

-- In the chapter on the Alps, details on glacier flow and moraines are enhanced by discussion of the early glacier studies of Louis Agassiz, John Tyndall, and others in the nineteenth century. The emerging understanding of glacier flow was well confirmed in 1861 when parts of the bodies of three guides who had fallen into a crevasse in 1820 appeared at the foot of the glacier, as predicted well in advance by the English geologist J. D. Forbes, who was only one year off in his estimate that it would take 35-40 years for the corpses to make the journey.

-- In the chapter on the West Antarctic Ice Sheet, Gosnell reviews the recent research and thinking regarding the stability of the ice sheet, the flow of the ice streams within it, and the buttressing provided by its ice shelves. She captures well the shifting level of concern over the past three decades about the possibility of a collapse of this ice sheet and the attendant sea level rise, the concern fluctuating in line with the accumulating evidence of whether individual ice streams have been speeding up or slowing down.

-- In the chapters on Animals, in addition to the well-known large and medium-sized polar animals, Gosnell discusses creatures living within the ice, fish with antifreezes, wood frogs and painted turtles that survive being frozen, and insects with strategies for avoiding and/or tolerating freezing, including beetles in the Canadian Rockies that can supercool to -60°C.

-- The two Human chapters cover frostbite, ice forming on beards and eyelashes, the use of clothing to prevent frostbite, medical freezing away of freckles and warts, the use of ice to preserve body parts temporarily, e.g., for organ donation, and human bodies preserved in glaciers, such as the famed Iceman of the Alps.

-- The set of chapters on Uses begins with William Scoresby making optical lenses out of ice to focus the sun's rays during a whaling trip to Greenland in 1822 and the Mesopotamians 4000 years ago using ice to chill drinks and food. Many additional uses are then described, making fully understandable why the harvesting of ice became such an important commercial activity prior to the inventions leading to manufactured ice. Also receiving attention in these chapters are air-conditioning, ice cream, the commercial

importance of ice for preserving fish on fishing boats, frozen foods and the processing involved, and ice carvings, including igloos, ice palaces, and a 60-foot ship made of ice and tested on a Canadian lake in 1943 for possible military use, with its advantage of not being able to be sunk.

-- The chapter on Other Forms of Ice describes ices artificially created by subjecting water or ice to particularly high pressures and low temperatures. Some of these ices don't float in water, and some could be common elsewhere in the universe, where environmental conditions are far different than those on Earth.

As is probably unavoidable in a book of this length covering such a wide range of topics, some small factual errors are present, despite the author's obvious care in researching the topic and in providing 31 pages of notes and bibliography. The book is not a textbook and does not present systematic, comprehensive analyses of the various topics. However, it includes a large amount of information, covering a vast array of ice-related topics, and addresses current controversies regarding ice and climate, all presented in a non-adversarial, readable, conversational tone. I recommend it to anyone, general public and scientists alike, wanting to know more about ice.

-- Claire L. Parkinson

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