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Ronald B. Davis

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25 January 2021

An Illustrated Memoir and Historical Account of

The Creation of the Orono Bog Boardwalk

by

Ronald B. Davis

Boardwalk Founder

Introduction

In 1998 I first thought about building a bog boardwalk. By mid-2000 the Orono Bog Boardwalk (OBB) was well formed in my mind, and my aspiration to build it was strong. From that point, it took three years to complete it. On the 23rd of June 2003 the OBB opened to the public.¹ It is a 4,200 ft (1,280 m) long² by 4 ft (1.2 m) wide and slightly raised boardwalk in a wetland, and a damn good one (Figs. 1 and 2), even if I say so myself!

This essay is an historical account of the creation of the OBB. Although it emphasizes the role I played in the process and reads, in part, like a memoir, it would not have been possible to create the OBB by myself. I roughly estimate that 250 persons—most from the Bangor–Orono part of Maine—participated in myriad ways, many of them as on-site volunteers³ in the walkway’s construction. Since construction was completed, some of these persons and others have participated as volunteers in boardwalk maintenance, operation, and education. In this essay I name several of the leading volunteers. Many of the others are listed on the kiosks near the beginning of the boardwalk together with the companies and institutions that contributed to the establishment of the OBB. Even those long lists are incomplete, but they reveal as will this essay that the OBB has been a community effort from the beginning (Fig. 3).

Since its construction, the OBB has been open 17 boardwalk seasons,^{4,5} and has received about 450,000 visits. It has become a premier destination in the Bangor region of Maine for outdoor science education and nature-based recreation.

In this account, I describe how I was inspired to build the OBB, the early planning and complex three-year building process, and the boardwalk's first two years of operation. The most challenging part of the endeavor occurred before actual construction and installation. Much preparation had to be done, including but not limited to (1) marshaling community support, (2) engineering and drawing plans, (3) fundraising and soliciting free building materials and professional services, (4) writing applications for permits from local, state, and federal authorities, (5) choosing and surveying a boardwalk route, (6) engaging groups and individual volunteers to build it, (7) drafting and negotiating an agreement between the three organizations⁶ that I chose to have formal responsibility for constructing and governing it, and (8) setting up an endowment whose earnings would be available for ongoing maintenance and operation.

To put my involvement in context, I'll start by briefly describing my employment circumstances in the 1998–2004 period. In 1998 I began my final five years as a biology professor at the University of Maine (UM). My academic appointment was for half-time teaching in the College of Natural Sciences, Forestry, and Agriculture, and half-time research in the Maine Agricultural and Forest Experiment Station, with a smattering of public service for good measure. One of the three major research emphases in the second half of my career was the ecology of peatlands including bogs, apropos for creating a bog boardwalk. By 1998, I had already had a busy 40-year academic career, but rather than retire “cold turkey” at the age of 67, I decided to enter a phased retirement for the next five years when I might expend some of my remaining energies in a less stressful manner.⁷ Little did I know in 1998 that during the final two

years of phased retirement (mid-2001 to mid-2003) I would be performing virtually full-time public service striving to complete the OBB while attempting to wrap up my research programs. My full retirement from UM in 2003 coincided with the completion of construction of the OBB, a great relief combined with a sense of satisfaction.

This account concludes with a description of the first two seasons of boardwalk operation (2003 and 2004) when I was the first volunteer Boardwalk Director. During this time, I arranged for and helped to construct near the boardwalk's beginning two additional structures, a double-stall outhouse and a small cabin as a base of operation for volunteers and for storage. I also established the OBB's programs of volunteer staffing, maintenance, and education.^{8,9,10}

What inspired me?

I'd like to share some personal recollections that explain how, over a period of four decades, I became motivated to undertake the boardwalk project, and why I chose Orono Bog as its location. The fascination and love of bogs that I wanted to share with the public began in a late 1950's summer when I was a Ranger Naturalist at Acadia National Park in Maine. Paul G. Favour, Jr. (dec.), then Chief Naturalist of the park and a master naturalist took me to Big Heath, a coastal bog in the park north of the road between Bass Harbor Head and Seawall. The bog wasn't visible from the road, and no trail led into it,¹¹ but Paul knew exactly where to go. We walked through the thick woods and shrubbery, moving the branches aside to make our way, taking care not to break them, and finally emerged into a largely unforested expanse carpeted by plush peat mosses and supporting a scattering of dwarfed black spruces. This vista resembling Labrador muskeg was an awesome and memorable sight for a young man from Brooklyn, N.Y. who had never ventured to the far north.¹²

The second most memorable moment of the Big Heath excursion was when Paul bent down by a peat moss hummock on the shore of a bog pool, and with his fingers gently parted the soft moist moss on the side of the hummock to reveal a small cavity containing a tiny, exquisite four-toed salamander (*Hemidactylium scutatum*) curled around its mass of white eggs. This amphibian species is rarely seen because of its cryptic habits. To view one with its egg mass under natural conditions is exceptional. Paul quickly closed the window he had opened, but the joy and curiosity engendered by this experience remains open within me.

My appreciation of bogs further developed when I was a biology professor at Colby College in Waterville, Maine from 1960 to 1970. Several miles from the college in Belgrade I regularly used a kettle-hole bog on the side of an esker as an outdoor laboratory for my students. To protect the bog from destruction, and to ensure its ongoing availability for education and research, I sought and obtained funding from a private donor for its purchase by the Nature Conservancy (TNC) with the intent that it would be transferred by TNC to the college with reverter clause.¹³

After moving to UM in 1970, at least once a year when I wasn't out-of-state on a sabbatical, and until I retired from teaching 31 years later, I took my students to Orono Bog for field studies. In the late 1970s I began a research program on the ecology of Maine's peatlands (bogs and fens) including Orono Bog that was to last 25 years, further adding to my knowledge about and enthusiasm for bogs. Unfortunately, my visits to Orono Bog with UM classes caused the destruction of the vegetation and the structure of the upper peat on the trail I had created (Fig. 4),¹⁴ to the extent that parts of the trail would no longer support foot traffic. Occasionally, students would sink into the degraded peat and have to be pulled out. Over the years, trail usage resulted in trail widening as students sought firmer footing, causing further damage. Through

this experience, it became clear to me that a boardwalk would be a better way to visit the bog. When I entered partial retirement at UM in 1998, I became more interested in sharing my fascination for bogs with educational audiences of all ages. To avoid worsening the damage I had already done, and also because most persons are unprepared to traverse soggy bogs on foot, I simply had to build a boardwalk. The 616 acre (~1 mi² or ~2.6 km²) Orono Bog was a perfect place to do it because (1) it displayed the main features of a northern peat moss and black spruce bog,¹⁵ (2) it had been designated as a National Natural Landmark in 1974 by the National Park Service,¹⁶ (3) it was only a short drive from UM and the center of the City of Bangor (CB), (4) much of it was owned by UM and bordered by other public land, and (5) Orono was where I expected to live for the rest of my life.

Preliminary learning and planning

Visiting wetland boardwalks to study design and construction details. In my various travels for personal and professional reasons in eastern United States and southeastern Canada starting in 1998, I often scheduled visits to boardwalks that had been built in inland and estuarine wetlands. These visits took place in Florida, Georgia, South Carolina, Massachusetts, Maine, New Brunswick and Québec. I tried to arrange a meeting with the builder, manager, or maintainer at each boardwalk.¹⁷ Construction design and signage varied from one boardwalk to another, typically to take account of wetland hydrology, substrate character, depth to supportive sediment or bedrock, purpose of the walkway, and available funds. At their simplest on supportive woody peats, some boardwalks consisted only of boards laid on the surface. At their most elaborate, they consisted of pilings driven to bedrock supporting 2–4 m wide walkways bordered by strong waist-high railings and raised several feet above the wetland.

Envisioning important features of the Orono Bog Boardwalk (OBB). To tell the full story of the bog's ecology and plant life, I envisaged a boardwalk that would traverse the various vegetation types and associated hydro-chemical environments of the concentrically zoned Orono Bog, extending from its forested edge to its open, raised center (Fig. 5). I intended the boardwalk to be free.¹⁸ I anticipated that in addition to the general public, visitors would include clubs and institutional groups of many kinds, including classes at all levels from public and private schools. I also intended that the walkway be safe and friendly for wheelchair users and other physically and mentally challenged persons. The facility would have signage and programs of nature interpretation to instill an appreciation in children and adults of the importance, natural history, ecology, and beauty of bogs. What better way to help ensure the protection of these wonderful wetlands than to build an appreciative constituency?

Preconstruction tasks, 2000–2002

By fall of 2000 I began to take steps toward boardwalk construction: the Orono Bog Boardwalk project (OBBP) was officially underway.

Building community support and participation. From the outset, one of my goals was to make the OBB a “town-gown” community project. I expected that if a project of this kind was to succeed, community support was essential. In the hearings of town and city planning boards and governing councils, where permits to build the boardwalk would be approved or rejected, large turnouts of supportive community members would be extremely helpful. Additionally, I expected the project to be dependent on volunteers from the three communities (Orono, Bangor, UM) to provide labor for construction of the boardwalk, and to operate and maintain it after it was built. As part of my effort to encourage community group involvement and support I gave slide talks about bogs and the OBBP. I began this effort in late 2000 by giving a talk at a

meeting of the Orono Land Trust, which later became one of the three organizations to construct and operate the boardwalk. I averaged five talks per year during 2000–2005, including talks to Kiwanis, Rotary, Audubon, and UM Wildlife Society. Over those years, the Bangor Daily News interviewed me on several occasions and published illustrated articles about the OBBP containing calls for volunteers and donations. In September 2002 with volunteers participating, we started tending an information table at two to four area events per year including the annual Orono Festival. I designed a t-shirt with a stylized representation of the boardwalk on it, and we sold them and other boardwalk mementoes at such events to raise money for the project.

Not the least significant of these promotional efforts each May was the annual bird walk in the fields and forests adjacent to Lee's (my wife) and my house followed by a buffet brunch at the house for 15 to 25 of our conservationist friends.¹⁹ We held other social events at the house, some of them specifically for boardwalk volunteers and potential donors. I also drafted and had printed promotional brochures and distributed them on many occasions.

An additional and important approach for involving the community was to establish a Steering Committee, later formalized in a Memorandum of Understanding (MoU; see below). The initial committee had a dozen members that I hand-picked to include community leaders with track records in conservation, outdoor natural area recreation and education, and natural area management, with representation from Bangor, Orono and UM. I favored persons who I knew I could work with. My objective was to use the committee as a sounding board, and to seek members' ideas on a range of issues relating to planning and construction. On the assumption that committee members would discuss boardwalk issues with their friends and contacts, the committee would help widen support of the project throughout the community. An especially helpful and constructive member of that committee was avid conservationist Sally

Jacobs (dec.). In addition to building community support, I lobbied public officials and administrators of the two municipalities and UM on whose land or in whose domain the OBB would be built, as permissions and permits from respective planning boards, governing bodies, and administrations would be needed.

Having been a teacher and research scientist for the prior ~45 years, never an administrator or politician, all of the above “political” activity was new to me. I learned as I went along. I also began raising funds and donations of equipment and supplies for carrying out the construction. I was more familiar with that type of activity, as I had to raise funds for my research during my academic career.

Drafting and negotiating the Memorandum of Understanding. An essential part of my efforts was to obtain commitments from organizations representing the boardwalk’s main constituent communities to bear ongoing official responsibility for boardwalk construction, operation, maintenance, and fundraising, and to establish an administrative structure within which they could do so. The ongoing success of the boardwalk required that it be run by long-lived organizations independent of individual persons in leadership positions at any particular time. Accordingly, in February 2001 I drafted a MoU for the three sponsoring organizations I had been lobbying for this purpose: UM,²⁰ City of Bangor (CB), and the Orono Land Trust (OLT).²¹ The City of Bangor owned and maintained the City Forest including parking area and access trail for/to the boardwalk and the first 19 percent of the boardwalk’s route (see *Selecting a boardwalk route and surveying it*, below). UM owned and managed the other 81 percent of the route on the Hyland Tract and was the main source of scientific and educational expertise relating to bog management and boardwalk educational programs.²² I chose the OLT as the third party to represent the conservation interests of Orono, and to serve as a check and balance over

the more wide-ranging interests of the other two organizations.²³ I was the fourth party to the agreement and served as Project Director until the completion of construction. It took eight months of negotiations, presentations to a committee of the Bangor City Council and the Council itself, and to the Orono Land Trust, and eight drafts of the MoU until it was signed by the four parties between the 25th and 29th of October 2001.²⁴

The MoU clarified the purposes of the boardwalk, as follows:

“The parties agree that the boardwalk is for the use by the public, for the following purposes, in order of priority.

1. education regarding the ecology, natural history, environmental importance, conservation of wetlands/peatlands, and compatible research;
2. nature study, including watching birds and other wildlife, observations of plant life, photography, and appreciation of natural beauty;
3. outdoor, non-motorized²⁵ recreation consistent with the above purposes; and
4. access to a wetland for persons unable, for reasons of disability, to traverse a wetland on foot.”

The remainder of the MoU was separated into three phases, pre-construction, construction, and post-construction, with each phase detailing goals and responsibilities of the parties including modest one-time funding by the CB and UM. An important commitment by CB was the granting of a license to UM for access to the boardwalk over city land, as most of the boardwalk was to be on UM land but the beginning of it was to be on CB land.²⁶ The city was to clear, level and gravel a boardwalk assembly site in the City Forest along the woods-road near the boardwalk’s beginning, where construction of boardwalk sections and stockpiling of supplies and completed boardwalk sections would take place. After completion of construction, this area

was to become an unloading/loading area for school buses and vehicles transporting persons with limited mobility. CB was also to enlarge the parking area at the Tripp Drive entrance to the City Forest.²⁷

During the first two phases, I served as Project Director, a volunteer position which by early 2002 occupied most of my work time, although I continued to carry out research during my half-time phased retirement at UM. According to the MoU, my responsibilities as Project Director were “....to develop and submit proposals for funding, solicit contributions of boardwalk construction materials, prepare and submit applications for permits from town, state, and federal authorities, represent the project parties at hearings regarding the applications, and raise funds for a Boardwalk Endowment.” Although the MoU wasn’t explicit on the matter (my oversight), it was clear that the Project Director was to plan, administer, and supervise construction of the boardwalk. During these two phases, I was to be advised by a Steering Committee and expected to seek its approval for major initiatives. This committee replaced the less formal Steering Committee I had set up early in the project. The MoU-specified committee membership was: two representatives each from the three administering organizations, three to five members chosen to represent conservation interests in the Bangor-Orono area, and one member from the National Park Service representing the Northeast Region’s National Natural Landmark Program.

The post-construction phase of the MoU set up permanent governance for the boardwalk. A volunteer position of Boardwalk Director would be appointed by UM.²⁸ A Management Committee, consisting of the Director plus one representative from each of the three administering organizations, was expected to make all important decisions regarding the boardwalk, including overseeing repair and maintenance, managing general usage of the

walkway, facilitating educational uses, withdrawing earnings from the Boardwalk Endowment Fund, as needed, and enhancing the endowment by fundraising. The MoU specified at least semiannual meetings of the Management Committee after the first two years of operation. The UM was to manage its property where the boardwalk is located as a natural area, and the CB was to do the same on its property where the boardwalk is located. In addition, the CB was to manage according to ADA specifications its relevant parking area(s) and access trail(s) to the boardwalk.

Selecting a boardwalk route and surveying it. It became evident that the area of the bog's periphery by the old trail into the bog from Stillwater Avenue would be an unsuitable access because the land there was privately owned and would have to be purchased for a parking lot. Furthermore, the high-speed traffic over Stillwater Avenue would likely increase and make entry and exit from such a lot hazardous.

Fortunately, public land bordering and including part of the bog was present nearby in the form of the Bangor City Forest (BCF), a $\sim 1 \text{ mi}^2$ ($\sim 2.6 \text{ km}^2$) forest managed for wood production and recreation. Access to BCF was available from Stillwater Avenue along Tripp Drive, which dead ended at a parking lot within the periphery of the BCF and had very little traffic. This lot was only a ~ 2 mile ($\sim 3.2 \text{ km}$) drive from the Bangor shopping mall and ~ 5 mile ($\sim 8 \text{ km}$) drive from central Bangor making it an easy destination for the largest population concentration and hub for commercial activity and tourist travel in the eastern half of Maine. Furthermore, it was only a 4–5 mile ($\sim 6.5\text{--}8 \text{ km}$) drive from downtown Orono and UM.

The BCF was advantageous as the starting point of the boardwalk. It already contained a well-developed trail system with some of the trails beginning at the Tripp Drive parking lot, one of which, the East West Loop Trail, skirted the southwestern edge of the bog. Cleared boundary

lines between original property parcels that made up parts of the BCF crossed the East West Loop Trail and extended out onto the bog. One of these boundary lines was only a 0.25 mile (0.4 km) distance from the parking lot along that trail. In the bog it extended 800 ft (244 m) to the Bangor-Orono town line and pointed toward the open center of the bog on UM land (i.e., the Hyland Tract) on the Orono side of the town line. That old parcel line seemed ideal for the beginning of the boardwalk.

In early April 2001, a student assistant and I trudged out on snowshoes over the aforementioned property line to use tape and compass to survey and mark a 4,100 ft (1,250 m) boardwalk route. A week later, UM forester Alan Kimball and I resurveyed that route with GPS and re-marked it over a distance of 4,200 ft (1,280 m). On that second visit, enough meltwater had accumulated in the hollows between the snow-covered hummocks²⁹ of the forested stretches that we needed both hip boots and snowshoes.

Among my many interactions with CB officials was a meeting with the City Engineer to request the drafting of a map depicting the boardwalk route superimposed on a map of city properties that I could use for permit applications (see *Permitting*, below), and he assigned a draftsman to prepare it.

Designing the boardwalk. Supporting a boardwalk on Orono Bog's deep, water-saturated peat would present a challenge. Over about half of the OBB's route, where the bog is largely unforested (Figs. 1 and 5), the peat is 17 to 23 ft (5 to 7 m) deep, and on most of that stretch the upper 3 ft (~0.9 m) of peat is soft and soggy (90–95% water by weight).³⁰ Placing a boardwalk directly on that surface would not work. Instead, the walkway would have to be well supported above the surface to be dry and steady enough for use by the public. Pilings driven through the peat and into the firm sediment under it would provide good support but prohibitively expensive

and too damaging to the bog. The solution was to use plastic dock floats to support the boardwalk and raise it above the wet surface over most of the unforested stretches and elsewhere where needed.

Conversely, at the forested half of the OBB's route (Figs. 1 and 5), where water-saturated but firmer and more supportive woody peat was present, it would be sufficient to support the walkway on composite-board footings laid on the surface. Composite-board shims placed on the footings could be used to raise and level the corners of the sections and keep the boardwalk above seasonal high water. The first ~190 ft (~58 m) of the bog's forested stretch, starting at the beginning of the boardwalk, however, was subject to considerable flooding, mostly in spring.^{31,32} Here, we would need to use floats.

I learned from visits to the Saco Heath Boardwalk in Maine, and to some other 3 to 5 ft (~0.9 to 1.5 m) wide boardwalks in other states and provinces that boardwalks could be built from preassembled sections, each 8 to 12 ft (~2.4 to 3.7 m) long and then connected end to end. Sections could be transported out onto the wetland over those already installed thereby lengthening the walkway one section at a time.

Some light would continue to reach the vegetation under the boardwalk through ~0.5 inch (~1.3 cm) gaps between the decking boards. By raising the boardwalk several inches (largely 10 to 20 cm) above the surface, additional light would penetrate from the sides to support plant growth.³³ By placing dock floats and footings only at the ends of sections, the horizontal flow of water in the upper peat would be unimpeded.

A major decision regarding the new boardwalk was the type of material to use to build it. I considered strength and rigidity, durability and resistance to decay, workability, weight, appearance, and cost. Several of the other boardwalks I had visited were made of wood

including hard southern pine, pressure-treated or not, and others were made of composites. Composites had the advantage of durability and resistance to decay, even better than pressure-treated wood. At some of the boardwalks (e.g., at Everglades National Park), however, the composite decking had sagged (poor rigidity) between supporting beams after only one or two years of use. Moreover, composite beams of sufficient strength and rigidity to support groups of persons crowded together on composite decking would be much heavier than most types of wood. This was an important consideration at Orono Bog because the boardwalk sections had to be moved and put in place by hand.³⁴ Moreover, I viewed the composite decking available at that time as ugly and incongruous amid the natural beauty of the bog. But the deciding factor that led me to reject composites was their much greater cost than wood and the improbability in those years (2000–2002) that enough money could be raised to purchase the needed materials to build the boardwalk. It was improbable then, because the benefits of a bog boardwalk were unknown in the Bangor area, nor could it be envisioned how popular such a facility would become.³⁵

As my employer (UM) was one of the three official sponsors of the project, I had access to logs from the UM Forest. Of the two tree species available, I chose eastern hemlock (*Tsuga canadensis*) over eastern white pine (*Pinus strobus*) because of its much greater strength. I had calculated that 45,000 board-feet of lumber would be needed to build the boardwalk.³⁶ Hemlock trees ready to cut in the UM Forest would produce about 78 percent of the lumber I needed and could be cut and trucked to a sawmill by UM crews, although I had to raise funds for the cost of milling. Given the free supply of most of the hemlock lumber, the relatively low price for purchase of the other ~22 percent of it, and the estimated cost of other supplies and tools, I projected a total cost of materials and rentals for building the boardwalk at \$150,000.³⁷ Adding

paid services and labor raised the estimate to \$200,000. This original estimate fell substantially short, as indicated in this essay's **Summary**.

My design for the OBB consisted of four types of structural units. The first and by far the most numerous were 8 ft (2.44 m) long by 4 ft (1.2 m) wide sections, each with “bump-railings” 4-inches (10-cm) high to prevent wheelchairs from rolling off (Fig. 6). The 509 of these sections that we finally installed on the 4,200 ft (1,280 m) route, if placed end to end in a straight line would total only 4,072 ft (1,241 m) of the walkway's 4,200 ft (1280 m) route. But the route is not straight. The 128 ft (39 m) difference would be accounted for by the numerous inserts and wedge boards (see below) that bridged the angular gaps where adjacent sections changed direction at turns in the boardwalk.

The federal Americans with Disabilities Act (ADA) and Maine law consistent with it specified that public walkways provide a minimum 5 x 5 ft (1.5 x 1.5 m) turnaround space for wheelchairs at least every 200 ft (61 m). Accordingly, I designed a second structural unit by adding a 2-ft wide side-section to some standard 4-ft wide sections to expand them to 6-ft (1.8 m) wide (Fig. 7). Together with the interpretive stations (see below) an ample turnaround space would be available at least every 200 ft along the walkway.

The third major type of boardwalk unit was the interpretive station (IS) (Fig. 8). Seven of these were to be placed along the boardwalk, each to represent a different major biological and environmental condition of the bog (Fig. 5). The center of each would consist of an ordinary 4 ft (~1.2 m) wide boardwalk section without bump-railings. An additional 3 ft (~0.9 m) wide section would be attached on each side for overall dimensions of 10 x 8 ft (~3.0 x 2.4 m). Each IS would have a 2 x 3 ft (~0.6 x 0.9 m) interpretive sign on one side (Fig. 9). Waist-high railings would be needed, as groups of visitors, as on guided nature walks, might be distracted enough to

step off the edge. Extra footings or floats would help to support the weight of such groups. Four small benches were tucked against the diagonal sides of the station (Fig. 8).

The fourth type of boardwalk unit was the insert or variable angle (i.e., shaped like a piece of pie) connector piece (Fig. 10). The angle would depend on how sharply the boardwalk turned and would have to be custom made for each turn. Where a turn was slight ($< \sim 10^\circ$), however, a simple wedge-shaped board could be used to fill the gap.

Permitting. Federal and state permits were required to build the boardwalk because of laws protecting wetlands. I began work on those permits in April 2001 with a pre-application meeting with staff members of the Maine Department of Environmental Protection (DEP). The Bangor City Engineer and a representative from UM joined me for this important meeting. The DEP administered the Natural Resources Protection Act, the state law regulating projects affecting wetlands and other natural resources. Its rules regarding wetlands were consistent with those of the U.S. Army Corps of Engineers (USACE), the federal agency administering the Clean Water Act that regulates waterways. Wetlands were covered by the act because of their close physical and functional association with waterways. Although the DEP took the lead in Maine, both it and USACE would have to approve the permit. I would also apply for site plan and building permits from the City of Bangor and Town of Orono.

The DEP/USACE application was a multifaceted and substantial effort, occupying much of my professional time in January and February 2002. It required frequent liaison with engineers and administrative officials at UM and CB, the joint applicants on whose behalf I was preparing the application. A wetland delimitation survey in the vicinity of the boardwalk's beginning had to be included. Fortunately, I had already completed it with a student assistant in May 2001. Technical plan drawings of boardwalk sections and other units also would be

needed. Claude Junkins of Engineering Services at UM transformed my hand-drawn to-scale drawings into computer generated graphics using a standard, digital drafting program (Figs. 6, 8, and 10). The drawings needed an engineer's stamp and signature for the DEP/USACE and site plan applications to local Planning Boards so I took them to Habib Dagher³⁸ who required one modification before stamping and signing them. Additionally, the Orono Planning Board insisted that our survey map of the boardwalk route be approved by a registered surveyor, which I arranged without modification after explaining the methods that Alan Kimball and I used.

On or about the 1st of March 2002 I completed and submitted to the DEP/USACE our application containing 80 pages and two large-format maps. I used much of the same content for the shorter and less complicated site-review applications to the Bangor and Orono Planning Boards, which I submitted at the end of March. After I received a set of questions from DEP/USACE and replied to them, that application was approved on 14th of May. Planning board hearings in Bangor and Orono took place in April. Our Bangor application was approved at the hearing on the 16th, but the application process in Orono was prolonged and stressful.

At the Orono hearing on the 17th of April, a landowner of part of the northern periphery of the bog (distant from the boardwalk site) raised an objection. This landowner, Perry LaPointe, assisted by his son, Daniel LaPointe, alleged that the proposed walkway would be hazardous for walkers, claiming that one of their family's horses had sunk into the bog, and could not be extricated. The prolonged discussion of this claim and its relevance (or lack thereof) prevented completion of consideration of our application that evening. Continuation of the hearing was scheduled for 15th of May. In the interim, the LaPointes withdrew their objection, so I expected approval in May. This critical period of preparation for construction was further complicated when, on the 2nd of May I re-herniated the same vertebral disc I had herniated two months

earlier, both times while preparing the boardwalk assembly site in the City Forest. The second event fully incapacitated me for nearly two weeks. I showed up on crutches at the 15th of May meeting, only to learn that the meeting was cancelled for lack of a quorum. This cancellation put off a board decision until the 19th of June, precariously close to the scheduled beginning of boardwalk construction work by the Maine Conservations Corps (MCC) on the 26th of June, thereby making it questionable whether we would be able to begin construction that summer.

I quickly called a meeting of the Steering Committee to decide what to do. At the hastily assembled meeting, the committee decided to continue all preparations for construction and keep all commitments for construction personnel on the assumption that our Orono application would be approved at the mid-June Planning Board meeting. Additional uncertainties included (1) slowness of the UM bureaucracy in approving the \$8,000 match required for receipt of \$30,000 from the Maine State Trails Program to cover the employment of the MCC crew and the purchase of dock floats, and (2) completion of an access license agreement which would grant UM access over City of Bangor land to the part of the boardwalk on UM land. Both were completed and signed on or about the 18th of June 2002. At the same time, other preparations (see **2002 construction phase**, *Last minute preparations and planning, late spring 2002*) continued frenetically in anticipation of arrival of the MCC crew on the 26th. Fortunately, at their evening meeting on 19th of June the Orono Planning Board approved our site plan for building the OBB.

Abandonment, plantings, and monitoring of the old trail. In the permit application to DEP/USACE, I used the example I gave earlier in this essay of the severe damage to the bog surface by repeated use by UM classes and other groups and individuals of a trail entering the bog from Stillwater Avenue (Fig. 4). I pointed out that permanently closing that trail and

allowing it to recover would benefit the environment. I argued that shifting such visitation to a boardwalk would greatly reduce effects on the bog, and that the minimal adverse effects of a boardwalk would be more than compensated by the educational and recreational benefits gained by the many people using it. In the permit granted by those agencies, we were required to terminate use of the old trail, hide its entrance with plantings, and carry out ongoing monitoring of the recovery of the bog along the trail.

In June 2002, I planted cuttings of the native shrubs winterberry (*Ilex verticillata*) and red-osier dogwood (*Swida sericea*) at the trail entrance. They would grow and hide the entrance after a few years of growth (Fig. 11). I had collected the cuttings near the same site and brought them to Brad Libby who rooted them under mist in the propagation structure in the Roger Clapp Greenhouses before I planted them at the trailhead. Because we were required to monitor the recovery of the trail, in October 2002 I established six permanently marked quadrats along it, and sampled them photographically in 2002, 2003, and 2004 and sent an interim report to the DEP. I retired as boardwalk Director at the end of 2004 but did a final photographic sampling of the quadrats on 26th August 2007 (Fig. 12). Natural plant colonization of the trail was evident over the five years but was incomplete. It included abundant sedges and in some stretches abundant horned bladderwort (*Utricularia cornuta*) whose yellow flowers in clearly flagged the trail. This successional growth contrasted with the *Sphagnum* and shrub heath lower strata of vegetation that grew naturally beside the trail. The damaged peat profoundly differed structurally and hydrologically from the surrounding normal peat. Clearly, it was going to take many more than five years, possibly decades or longer than a century for the trail to become indistinguishable from the surrounding bog. Such a long timetable might be expected from the time it takes for peat to form. It would be instructive to continue to monitor these quadrats.³⁹

Fundraising. I would not have been able, on my own, to apply for grants for the boardwalk project, nor would I have been able to directly receive and administer funding from funding agencies, private foundations or individuals. Although as Project Director I was the writer of applications for funding and primary solicitor of donations, and the spender of almost all the acquired funds, the applications had to go out under the letterhead and over the signature of an official of one or more of the three administering organizations of the project, as I had set them up in the MoU (see *Drafting and negotiating a memorandum of understanding (MoU)*, above). Acquired funds would be administered and accounts kept by the grantee organization(s). All three of the organizations performed those functions during the project. For handling donations by individuals and foundations, in January 2002 I chose the University of Maine Foundation (UMF) as the boardwalk's fiscal agent. From that point until the boardwalk was almost completed I mailed over 400 individually addressed and personally signed fundraising letters, many of them personally annotated, along with colored brochures to potential donors. The first gifts were deposited in March 2002 into the boardwalk endowment and boardwalk construction accounts at UMF.⁴⁰

Much of my time in 2002 was occupied by fundraising. On March 1st that year I received word that our application for \$30,000 funding from the Maine State Trails Program had been approved. Most of that money was to be used for hiring crews from the MCC for 12 weeks in summer. I used the remainder to purchase almost 300 dock floats to support the boardwalk on the softer/wetter stretches of peat. The required matching funds of \$8000 from UM I used for additional construction materials and tools.

One of the first persons I approached (in November 2000) for funds to produce and purchase interpretive materials was Deborah DiQuinzio, who administered the National Natural

Landmarks program at the National Park Service regional office in Boston. Deb was immediately enthusiastic about having a public boardwalk at the Orono Bog National Natural Landmark and by February 2002 had arranged for NPS to grant us \$22,625 to pay for sign fabrication and display mountings of NPS quality, and for printing costs of a guide booklet.⁴¹ I also acquired a \$20,000 grant for boardwalk construction from the Stephen and Tabitha King Foundation. Many other governmental, institutional, foundational, commercial and individual grantors and donors of funds for OBB construction are listed on a kiosk at the boardwalk information area (Fig. 3).

Soliciting donations of materials, equipment, and services. To solicit donations of equipment, supplies, and services for construction I used an in-person approach whenever possible. In the Bangor area, I visited owners and managers of several companies. First I had to convince that person about how much the boardwalk would enhance the community. To help my case, I provided a brochure that I had designed for the purpose. In each instance, I had a request specific to the type of business, as in the following examples.

I was going to need two specially designed carts for transporting boardwalk sections from the assembly site to the end of the incomplete boardwalk where sections would be placed (Fig. 13). After designing the cart I took the plans to H. E. Sargent Inc. in Stillwater which had a welding shop. The manager agreed to make the carts and supply the angle iron. I supplied the plywood. Each cart needed two wheels with tires; these I solicited from Bennett Tire Company in Bangor.

I needed 4500 linear feet of composite decking board (approximate retail value in 2002: \$11,000) for footings and shims. In early April 2002 I asked for a donation of the boards from Marty Grohman at Correct Building Products in Biddeford, Maine. He agreed to make the

donation, but I had to transport the 8 tons of boards from Biddeford to the assembly site at the BCF. I contacted Carlen Transport of Bangor. It had an open bed 18-wheeler scheduled to return home empty from the Biddeford area and generously offered to pick up and transport the boards free. But there wasn't enough room for the 18-wheeler to turn around at the boardwalk assembly site or the Tripp Drive parking lot. American Concrete Industries, about three-quarters of a mile away from the assembly site, agreed to provide a drop off place and to transfer the load the final distance to the assembly site with one of their smaller but still good-sized trucks equipped with hoist for loading and unloading. That generous company also transported IS units to the assembly site from Eastern Maine Technical College where they were fabricated (see **2002 major construction**, *Indoor work, early 2002*), and later donated and delivered a concrete vault for the double outhouse we built in 2004 (see **2004 construction of cabin and outhouse**, *The outhouse raising*).

Although access to the boardwalk was free, we needed donations to support boardwalk operations and maintenance, and planned to install a secure box where boardwalk visitors could deposit cash donations. I designed a lockable money box made of 6-inch diameter iron pipe (Fig. 14), and in spring 2003 approached Lane Systems and Supply in Brewer to ask them to donate its fabrication. They did so, and we installed the heavy "money pipe" that summer. By the end of that first boardwalk season, we had collected over \$2,000 in it.⁴²

A major supporter of the boardwalk was Tom Hanson, co-owner of Bangor Hardware. Construction of the boardwalk required many thousands of dollars of hardware including power tools. I set up an account at Bangor Hardware, and authorized payment of bills monthly. Thankfully, much of what we acquired was at wholesale prices, and some of it *gratis*. On many days during boardwalk construction it was necessary to run errands to obtain some item needed

for the work, and some of these items were large and bulky. Early in the 2002 construction season, I rented a pickup truck from the UM Motor Pool at considerable expense. But then Tom came to our rescue and loaned us a pickup truck that I was able to keep and use until boardwalk construction was complete in 2003, boardwalk funds paying only for fuel, care and servicing.

After boardwalk construction and during the first partial season of operation in 2003, it became apparent that we needed two small buildings to facilitate boardwalk operations. The first was a small cabin that would be erected at the information area near the beginning of the boardwalk where we could store tools and supplies for maintenance and cleaning, stocks of memorabilia for sale (e.g., boardwalk t-shirts, place mats, and hats), first aid supplies and a wheelchair, reference books on peatland flora and fauna, and other items. Also, it would be a place where volunteers could shelter from rain and biting insects. In 2003 we used a 10 x 13 ft (~3 x 3.4 m) screen tent for some of these purposes but could not leave valuable items in it when we weren't there. In January 2004 I approached Jonathan French, owner of Northeastern Log Homes in Kenduskeag to ask for donation of a small log cabin and he agreed. He donated a kit for a "Cozy Cabin II" (retail price in 2003: \$7,700) that we (i.e., volunteers) would erect in summer 2004.⁴³

The second building was a double-stall outhouse that we would build at the assembly site about 150 yards (~135 m) away from the cabin. The boardwalk greatly increased the numbers of visitors to the BCF but the city provided no toilet facilities. We did not want walkers relieving themselves outdoors along the boardwalk, by the access trail, or at the assembly site. Early in the 2004 boardwalk season I still hadn't determined how I was going to go about building the outhouse. By chance at that time, while I was serving as a docent at the boardwalk, I met and chatted with a boardwalk visitor whose name was Al Larson. I learned that he worked at

Northern Log Homes⁴⁴ and asked if the company would be interested in donating a kit for a double-stall outhouse, one side of which would be ADA compliant for handicapped persons. Al was quite enthusiastic about the boardwalk and conferred with the company owner who agreed to make the donation.

Recruiting construction workers. Early in 2002 I made arrangements for Maine Conservation Corps (MCC) teams to work for 12 weeks in summer on mass production of boardwalk sections and their installation in the bog. It didn't seem possible to complete the boardwalk in so short a period, so I sought additional workers to follow the MCC teams. I had heard that the Charleston Correctional Facility, a minimum security prison about 25 miles (~40 km) from Orono had been sending supervised groups of inmates into Bangor area communities to carry out public service projects, and that they had a group with carpentry and construction experience. I made contact with the prison and arranged for their crew to start at the boardwalk in October. Additionally, I recruited numerous volunteers from the greater Bangor area to carry out the many additional tasks that needed to be done. These volunteers included students from several area high schools, colleges, and universities.

The challenge of recruiting volunteers for the boardwalk has continued to the present day. During the construction period, I put the word out when I was interviewed for articles about the OBBP in the local press and on TV, and by word of mouth. I contacted the many persons who had already been involved in the OBBP, and they spread the word further. As construction continued, several persons became frequent and/or regular volunteers including Jim Bird, Lee Davis, Jerry Ellis, Jay Johnson, Jerry Longcore, Joan Martin, Mara Miller, John Pickering and Wendall Tremblay, to name the most frequent few. Many more persons became regular volunteers for operating the boardwalk after its construction was completed. Of the estimated

250 persons who contributed their time and energy to the boardwalk's establishment, roughly half were directly involved in boardwalk construction.

2002 major construction

Construction of boardwalk components outside of the Orono Bog wetland didn't require permits. On the assumption that we would be successful in acquiring all necessary permits we started early in 2002 to get a jump on the season. The effort wouldn't be lost even if we had to wait until 2003 to start work in the bog. We started by building boardwalk components indoors. Field operations began in May at the assembly site in the BCF, but mass production of boardwalk sections and their installation in the bog didn't begin until summer after we had acquired all permits. From early summer until late November, we produced 495 8-ft (~2.4 m) long boardwalk sections and placed them along the 4,200 ft (1,280 m) long route in the bog. Through the 2002–2003 winter, work continued behind the scenes, and construction was completed in spring 2003. During these phases of the project, I made a point of calling meetings of the Steering Committee whenever important decisions needed to be made.

Indoor work, early 2002. Construction of the seven ISs, each consisting of three modules and extra railing for adjacent standard sections (later assembled in place in the bog) began in February at Eastern Maine Technical College (EMTC) in Bangor. I arranged for 5,000 board-feet of hemlock lumber and hardware to be delivered to the college. With our plan drawings, the two shop teachers expertly guided their students through the construction. When they finished, American Concrete Industries donated a flatbed truck with driver to deliver the components to the boardwalk assembly site at the BCF.

Additional components were constructed under shop teacher guidance at Orono High School (OHS) and at United Technology Center (UTC), a regional vocational school in Bangor

for high school grades 11 and 12. The OHS students constructed the first of two 4 x 8 ft jigs according to my specifications to be used to maintain uniformity and speed construction of boardwalk sections,⁴⁵ In early April 2002 I approved their ¼ scale model of the jig and a ¼ scale boardwalk section that they assembled in it, and they constructed a full-scale jig. The other full scale jig and seven boardwalk sections built with it were produced by students at UTC.

Last minute preparations and planning, late spring 2002. In late May we precisely marked the boardwalk position along the route I had flagged with Alan Kimball in 2001. This time, we marked one side of the future boardwalk position at frequent intervals with 5-ft bamboo stakes. In early June the City of Bangor finished enlarging the parking lot at the end of Tripp Drive to accommodate an additional 20 cars of boardwalk visitors (used by construction volunteers, at first), and completed the clearing, leveling and graveling of a 75 x 75 ft (23 x 23 m) boardwalk assembly site in the City Forest near the beginning of the boardwalk route. Shortly afterward, we began setting up two large tarps on posts at the site so the workers producing boardwalk sections could have shade and shelter from rain and power tools would stay dry (Fig. 15). By that time, I had started picking up purchased and donated power equipment including a gasoline-fueled generator, power saws, air compressor and nail guns and delivered them to the assembly site. All the while, large amounts of rough-sawn hemlock lumber were being delivered from the sawmill and by mid-June we received the final 10,000 bd-ft to add to what was already stockpiled at the assembly site, bringing the total to 45,000 bd-ft (some of which had already been used during the prior winter's indoor assembly). Also, we constructed a 9-ft long fiberglass-lined wooden "bathtub" for dipping each of the many thousands of pieces of lumber we were to cut to size (e.g., ~10,500 deck boards) in wood-preserved.

Secure storage space was needed for our equipment, tools, and supplies for periods when we were not at the assembly site. For this purpose, I rented a trailer truck body that could be locked and arranged for it to be delivered to the assembly site.

The MCC teams would need to reside within a short drive of the construction site during their 12 weeks of summer work, and it was my responsibility to provide a place for them to camp or stay indoors. After inspecting a large group-campsite for them at Villa Vaughn Campground on the shore of Pushaw Lake in Orono I rented it for them. The lake was great for a cooling swim after a hot and dirty workday building the boardwalk.⁴⁶

Major construction at Bangor City Forest and Orono Bog, summer & fall 2002. Safety at the assembly site, on the trail, and in the bog was a top priority. Apart from a few minor cuts, scrapes and bruises, no one suffered serious injury during the entire project except for me when I twice ruptured a vertebral disc at the assembly site prior to the major construction period. Three additional priorities were: (1) efficiency, so we would complete construction and open the boardwalk to the public as soon as possible, (2) precision and accuracy in construction and boardwalk installation to maintain uniformity among boardwalk components and the exact boardwalk route described in our permits, and (3) most important to me, protection of the sensitive bog surface from disturbance outside the 4-ft wide boardwalk footprint, so the public could view undisturbed bog vegetation immediately adjacent to the boardwalk.

On the 26th of June 2002, I welcomed the MCC team to Orono and presented the eight team members and two leaders with a brief overview of the boardwalk project and a description of their work assignment. After enduring a long day of preparations and travel, cooking their dinner and setting up their campsite at Villa Vaughn Campground was an added challenge. Severe evening thunder and lightning rainstorms continued well into the night. The intrepid

group of young men and women survived the tempest and showed up in their van on time for work the next day at the boardwalk assembly site.

Each day's work at the assembly site began at 8:00 AM by forming a circle for group exercise, stretching, and meditation followed by questions/answers/discussion. I always joined the group.⁴⁷ MCC teams worked eight 10-hr days straight, Wednesday through Wednesday, and then had 6 days off, allowing me several days to work on other aspects of the project including the approving of invoices for the many purchases of equipment and building materials, and submitting them to UM for payment from the correct accounts.⁴⁸ The first MCC team worked for six weeks and was replaced by a second team for the next six weeks. Lee and I invited each team to our house for a barbeque the evening of their first full workday, and on their last day of work for a potluck. The regular volunteers substantially contributed to the potluck, and it was a good chance for them to chat with MCC team members.

Our two major goals were to construct about 495 8-ft boardwalk sections and to place them in the bog. We started by cutting boards to proper length, dipping them in preservative (Fig. 16), and piling them with spacers to dry. Over the summer and fall, we produced some 20,000 such pieces.⁴⁹ We also cut composite boards into thousands of pieces needed for footings and footing-shims.

We supported the two section-jigs on sawhorses at a comfortable height so the outer 2x8-inch (~5x20 cm) and central 3x8-inch (~7.6x20 cm) by 7-ft 8-inch (~2.34 m) longitudinal joists easily could be placed in the jig. The 2x8-inch by 4-ft (~1.2 m) long end joists were joined by driving in spikes with small sledgehammers (Fig. 15). Then, 21 1x4-inch (~2.5x10 cm) by 4-ft long deck boards were placed in the jig and joined to the longitudinal and end joists with nail guns. Finally, on each side of a section, five 2x2-inch (~5x5 cm) by ~7-inch (~18 cm) long

bump-railing riser blocks were nail-gunned atop the ends of the deck boards and a 2x2-inch by 7-ft 8-inch long railing nailed on top of them (Fig. 17). See Figure 6 for the aforementioned wooden components.

The jigs were also used to construct 15 half-wide sections that were attached by lag bolts to one side of regular sections to produce 6-ft (~1.8 m) wide wheelchair turnarounds. Together with the seven ISs, they provided ample spaces at least every 200 ft (61 m) for wheelchairs to turn around. Because these turnarounds were 8-ft (2.4 m) long, enough room was available to add a one-person, 2-ft (0.6 m) long bench, longitudinally oriented at one end of each side-section. On these benches, a walker could rest and contemplate nature (Fig. 7).

While half the MCC team and volunteers continued to cut and treat lumber and assemble sections, the others worked on clearing and leveling the 4-ft (~1.2 m) wide path (“footprint”) of the boardwalk. Our earlier selection of that path aimed to minimize the need to cut obstructing trees, tall shrubs and peat hummocks. The first 800 ft of the boardwalk as far as the Bangor-Orono town line was through forested peatland. By locating that part of the boardwalk along a cleared property line, we greatly minimized the need for tree cutting. Nevertheless, much chain sawing of woody branches and roots was needed. It was an easy matter to chainsaw roots in the bog because the peat was virtually devoid of mineral solids, so the saw blade could be directly inserted into the wet peat without dulling or damaging it. To level or cut back *Sphagnum* hummocks (typically containing buried branches and roots of ericaceous shrubs) in the open part of the bog, we used a large, sharp bread knife, a perfect tool for the job.

By the 24th of July, we had finished the 4,200 linear feet (1,280 m) of path clearance and leveling but had stockpiled only 106 completed sections with 389 to go! At that point, I renewed my effort to enlist volunteers to work side by side with MCC members to speed the

assembly of sections, and on most days one or more volunteers showed up. After a few weeks, space for stockpiling sections—along with other components (e.g., dock floats)—at the assembly site (Fig. 18) was running into short supply, so I shifted more workers to installing sections in the bog.

I estimated that the weight of each completed boardwalk section while the wood was still wet would be 125–150 lbs. (57–68 kg). The distances from the assembly site to their installation in the bog ranged from about 400 to 2,900 ft (~122 to 884 m). Loading a completed section on one of the aforementioned carts took little time for two to four workers. Transporting the section to the bog was easy for one person (Figs. 13 and 19). Each cart had a pair of wheels positioned so the weight of a boardwalk section would balance over them. The cart handles could be lifted easily by one worker to push the cart along like a wheelbarrow. The cart's wheelbase was designed to fit between the bump-railings at the sides of the boardwalk. When reaching the end of the incomplete boardwalk, the cart pusher raised the handles above waist height to tip the cart forward, causing the section to slide off into the bog, thereby lengthening the boardwalk by one more section (Figs. 20 and 21).

In the bog at the end of the incomplete boardwalk, an installation team of two or three workers was ready to receive the next section, having already put footings or dock floats in place (Figs. 19–21). After receiving the section, they would more precisely position it, level it with shims, and attach it to the prior section. With two carts we could keep the section installation process moving at a good pace. To minimize damage to the bog surface, the installation team stayed within the boardwalk's 4-ft wide footprint as much as possible, avoiding the trampling of adjacent vegetation. When it was necessary to step outside that area, step boards (~0.7 x 2 ft; ~0.2 x 0.6 m) were used to spread out each worker's weight on the bog surface.⁵⁰

During installation, I often worked several section-lengths ahead of the placement team marking positions of each section's corners and putting the finishing touches on surface preparation for the footings or floats. I had improvised a light-weight but strong 4 x 8 ft (1.22 x 2.44 m) L-square made of angle aluminum. With that tool, I could accurately stake positions of section corners. I also carried a 4-ft carpenter's level, chainsaw and a large, sharp bread knife. I tried to work my way far enough ahead of the installation team so from time to time I could take a quick walk to the assembly site to check on the crew there, deal with any problems, and hurry back to the end of the walkway to avoid slowing the installation process.

Until the 800 ft (244 m) straightway (Fig. 5) was completed, the cart pusher would immediately return her/his cart to the assembly site to clear the way for the next section on the other cart. Extra cart trips to the end of the incomplete boardwalk were made to supply the installation team with composite footings, shims, dock floats, and other items. When leveling sections,⁵¹ occasionally a crew would need to do more trimming of woody roots. In follow-up passes along the emplaced boardwalk, MCC members and volunteers tied the boardwalk to the outer edges of the footings or floats to minimize sideways slippage and chained the sections together.⁵² After the 800 ft (244 m) straightaway was completed, I assembled two installation teams to operate simultaneously, as we separately extended the boardwalk along each arm of the 3,400 ft (1,036 m) loop (Fig. 5).

The MCC teams completed their contractual period at the boardwalk in mid-September, but we still had a long way to go. At that point, I was entirely dependent on volunteers for the next month. I stepped up publicity efforts and sent out calls for volunteers to various area organizations. Over the coming few weeks we had volunteers every day, numbering 1 to 10 persons, typically 2–4 per day, with largest turnouts on weekends, an inspiring display of

community enthusiasm and support for the project. In the fall the tarps we had erected provided shelter from the cold rain and enabled us to continue building sections. My goal was to have all sections built and installed before winter.⁵³

The Charleston crew worked for two weeks in mid-October with their own supervisor. I added oversight specific to boardwalk construction and worked along with the crew. They were much more experienced in construction than the young MCC members and most volunteers and were able to accomplish a great deal in a short time. In addition, volunteers from the community kept coming, and by the end of October only about 50 sections remained to be built. However, in the first week of November record low temperatures, some mornings about 20° F (~ -7° C) enveloped the region. Two inches (5 cm) of wet snow fell, collapsing our main tarp, and fingers were numbed. I continued encouraging our regular volunteers and recruited new ones. Despite the bad weather, by the 7th of November we built the final boardwalk section. Weather then warmed to temperatures more typical of early fall, facilitating the installation of about half of the hundred or so sections that remained in our stockpile. But in mid-November the weather worsened again, with snow, sleet and cold rain, and prospects for completing installation of the entire boardwalk looked grim, however, the MCC came to the rescue!

Apparently, the MCC was impressed by the OBB project and the experience it provided its teams.⁵⁴ While I was engaged in the discouraging chore of fixing a broken table saw, I received word that the MCC was offering (unsolicited) a special treat. The 18 MCC team leaders from projects around the state would work at the boardwalk free for the final week (17th–23rd November) of their 2002 season. I enthusiastically accepted the offer. As it was too late in the season for camping by the crew, I contacted The City of Bangor to see if it had any housing available. The city offered, free of charge, the use of a furnished four-bedroom house with extra

beds for sleeping all 18 Corps leaders. A few of these leaders were already experienced on the OBB job, and they helped to train the newcomers. I asked the group to split itself into two teams for simultaneously extending both arms of the incomplete boardwalk loop, and each team further divided itself into section transport and installation squads. As the week progressed, excitement mounted as the teams at each end of the closing loop approached each other in the open bog. At 2:00 PM on the 22nd of November, a snowy and icy day, the two arms met and a cheer went up that seemed to warm the frigid air. Only about a 1-ft (~0.3 m) gap was left between the two arms and it would be easy to bridge later (Fig. 22). That evening was an occasion for celebration. Lee and I took the MCC group to dinner at the Oriental Jade in Bangor where we enjoyed the warmth of each other's company in a private dining room.

Two more workdays by volunteers were needed to adjust, tie down, and chain together the most recently installed sections and dismantle the assembly site. We took down the tarps, collected all remaining equipment, tools, and supplies, transported them to my garage for winter storage,⁵⁵ and cleaned up the assembly site. No problem existed in getting volunteers for this work because there was so much excitement about how much all of us had accomplished. More than 10,000 deck boards, 1,500 supporting joists, 1,000 end joists, 4,000 bump-railing riser blocks, and 1,000 bump-railings had been cut, dipped, piled to dry, and assembled into boardwalk sections that were installed in the bog. By Sunday afternoon, the 24th of November, field activities at the construction site ceased for the winter. Although the major part of construction of the OBB was complete, much remained to be done before it could be opened to the public. The additional fieldwork would have to wait until spring of 2003.

Fiscal condition and cost of boardwalk by the end of 2002. As the pace of expenditure accelerated during construction in 2002, our fiscal situation approached insolvency. At one point

we were \$7000 in debt. By the end of the year, we had spent about \$175,000 for materials and supplies, power and hand tools, professional services, sawmill fees, truck and porta-potty rentals, and labor (MCC only). The true end-of-year cost of the OBB was higher when the value of donated materials and professional services were included, bringing the total to ~\$200,000, and still higher when the large amounts of volunteer and other donated labor (e.g., Charleston Correctional Facility crews) were added, bringing the estimated end-of-year cost of the OBB to about \$235,000, not counting the monetary value of my time. See **Summary** for total cost together with 2003 and 2004 construction.

Winter and early spring 2002–2003, behind the scenes

Although I was able to spend more time on my university-sponsored research in the winter and early spring, the boardwalk continued to demand my attention on an almost-daily basis. Two aspects of the project were most time-consuming: (1) fundraising and (2) preparing interpretive signs and a guide booklet.

Fundraising. Fundraising in that period included the preparation and chairing of frequent meetings of the Fundraising Subcommittee of the Steering Committee. It was my responsibility to solicit funds from the sources selected by the subcommittee. I applied for more grant funds, gave presentations to local organizations about bogs and the OBBP, arranged for tables and staffing at local events, gave interviews on local radio and TV stations always ending with a plea for funds and volunteers, and prepared a new fundraising brochure. An example of a successful grant proposal was one to the Maine Recreational Trails Program to fund a MCC crew for three weeks later in the spring 2003. Examples of annual tabling events included the 2003 the Penobscot County Conservation Association's Eastern Maine Sportsman's Show and the Bangor Flower and Garden Show. Related to fundraising were the interviews I gave to the UM Alumni

Magazine and the Maine Times. The articles about the OBB that appeared in spring 2003 in those publications both mentioned our need for support.

Interpretive signs, guide booklet, website, and brochure. Although I started planning OBB's eight interpretive signs early in 2002, most of the creative work occurred in winter 2002–2003 and the following spring. This essential educational component of the OBB occupied much of my time in that winter and spring. A large (3 x 4 ft; ~0.9 x 1.2 m) introductory sign was to be displayed in a kiosk at the beginning of the boardwalk, and a 2 x 3 ft (~0.6 x 0.9 m) interpretive sign to be displayed at each of the seven ISs. Each IS was situated in a different part of the bog with more or less different vegetation, animals, and hydro-chemical characteristics than the others, and sign content was to reflect those special characteristics. Each of the seven IS signs would have a descriptive natural history text and eight illustrations. These illustrations would include a “you are here” map, a profile of the peat and vegetation at the IS, an indication of the pH and conductance of water in the upper peat,⁵⁶ and five paintings, drawings or photos of vascular plants, mosses, vertebrate animals, or other features specific to the IS (e.g., Fig. 23). The vertebrates would include birds, mammals, or amphibians as appropriate. The paintings and drawings all (except seven of my own) had been previously published in field guidebooks and other places, so first I had to obtain publisher permissions and digital files of them to use on the signs. See sign credits in Figure 3.⁵⁷

For the large introductory sign (Fig. 24), I decided to include an above- and below-ground profile of the bog, that is, a profile showing altitudes, peat depths and the structure of the vegetation. The profile would be along a straight line starting at the upland adjacent to the boardwalk's beginning, entering the bog and approximately following the boardwalk until IS5, then continuing to the opposite edge of the bog, and ending about 300 ft (~90 m) up the hill, a

total distance of 5,400 ft (1,646 m) (Fig. 5). To obtain peat depths, in summer 2002 my laboratory associate Dennis Anderson and I probed the peat and a short distance below it into the underlying mineral deposit with a Davis peat sampler every 100 ft (~30m) along the line. At the same time, one of my graduate students, Anne Small, sketched a profile of the vegetation strata. To determine tree heights, Anne and I returned in winter 2002–2003 with an Abney Level and measuring tape. Those sketches and data provided her with the information she needed to paint the vegetation profile. For clarity, the above- and below-ground profiles exaggerate the vertical relative to horizontal scale (Fig. 24).

The map on the introductory sign (Fig. 24; updated terminology in Fig. 5) was prepared by me and Alan J. Kimball from vertical and large-scale false-color infrared aerial photos in early 2003. In winter 2002–2003 to verify accuracy in mapping the final boardwalk position we snowshoed the boardwalk and replaced our 2001 GIS survey of the boardwalk route with one of the boardwalk itself. At the same time, we “ground-truthed” the vegetation along the walkway to the extent possible. A scaled-down versions of this map were used for the “you are here” map on each of the seven IS signs (e.g., Fig. 23), the maps in the guide booklet, and on the website.

Sign development was a long, multistep process. I made an additional visit to the boardwalk in mid-April 2003 to obtain moss and skunk cabbage photographs. With these added to my digital files, I had all 56 illustrations for the first printing of the eight signs. Before the composite file of each sign was complete, I wrote a text⁵⁸ and edited each illustration to balance brightness and to crop it to proper shape and size. Then I took completed mockups of all the signs along with the digital files of their components to my colleague, Ann Dieffenbacher-Krall who was skilled at CorelDRAW (CDR), a graphics and layout program, for preparation of the eight final composite digital sign files. On 27th of May, I sent the files to the sign fabricator, GS

Images at Hagerstown, MD. That fabricator had been used by the National Park Service for production of resin-impregnated weather-proof and lightfast signs. I also purchased high quality display mountings from GS Images. It wasn't until the 13th of June that I received proofs. Although I quickly proofed them and sent them back to the fabricator, by then it was certain that we would not receive the signs and display mountings in time for installation prior to the scheduled opening of the boardwalk to the public on 23rd June.

The National Park Service grant that covered the interpretive signs and mountings also covered the production and initial printings of the guide booklet for boardwalk visitors. In winter 2002–2003 I wrote the 16-page glossy booklet, and Ginny Whitaker of Orono did the design. It contains a centerfold of color photos of common bog plant species. The booklet is still in print and available at the boardwalk.

In winter 2002–2003 Ginny and I incorporated information useful to OBB visitors into the first OBB website, www.oronobogwalk.org. This website underwent a series of upgrades until 2014 when it was replaced by a better one, <https://umaine.edu/oronobogwalk/>. That University of Maine webpage is a good source of information for readers who may have questions about the OBB not answered by this essay.

A free informational brochure about the boardwalk that visitors could take with them also was needed. In spring 2003 I wrote one for inexpensive two-fold black-and-white production and took it to Stillwater Design for final layout and production. In recent years, the brochure has been partly revised, updated, and is still in print. Many thousands have been distributed.

Obtaining workers for upcoming construction season. In late winter I initiated arrangements for a week's work by the Charleston Correctional Facility carpentry crew, and three weeks by a MCC crew. As the construction season got closer, I sent out notices to last

season's volunteers asking for help with the final stages of boardwalk construction and received many positive replies.

Spring 2003 construction activities

Finishing the boardwalk. In spring 2003, we began work on a boardwalk that was already in place and traversing 4,200 ft (1,280 m) of the bog. We could easily walk around it, but it wasn't yet ready and safe for the public and needed work of many kinds and in many places. To get started, volunteers transported the power tools and heavy supplies, which we had stored overwinter in my garage, and we organized the assembly site including erection of our large tarps. The Charleston crew started work on the 12th of May and completed all 43 of the 2.5 ft (0.76 m) benches for the wheelchair turnarounds and ISs. The MCC crew started on the 28th of May, but for the 11 days between those groups, I relied on volunteers. Many sections still hadn't been properly tied down and chained together, and many needed leveling; the volunteers performed most of this work.^{59,60,61} The MCC had a wide range of assignments including the attachment of side modules at wheelchair turnarounds and ISs, installation of benches, attachment of railings and supporting braces at ISs, and the filling of gaps remaining between sections with inserts and wedge boards. As in 2002, I worked along with MCC members and did my best to maintain good working relationships. Lee and I entertained the MCC crew at a barbeque at our home on 4th of June.

Role of social interactions and events in maintaining esprit de corps. Lee and I hosted many social get-togethers for volunteers at our house during 2000–2004. I learned that by building close relationships with volunteers and fostering friendships among them, a team spirit and loyalty to the boardwalk developed that made it easier to maintain a large corps of volunteers, including docents, and to schedule them for work when they were needed.

Kiosk. To house the aluminum-framed, plexiglass display case for the 3 x 4 ft (~0.9 x 1.2 m) introductory sign I designed a kiosk and ordered pressure-treated lumber and cedar roof-shingles to build it. The City excavated the holes for the large posts on each side of the kiosk. Jerry Ellis played a lead role in assembling the structure. The kiosk was oriented so persons approaching the boardwalk would see the introductory sign (Figs. 14 and 24). The lockable display case was two-sided. For the side facing persons exiting the boardwalk, we produced a boardwalk credits poster that listed those who contributed their time, talents, supplies and money to help make the boardwalk a reality (Fig. 3).

National Natural Landmark plaque. The brass plaque given to UM by the National Park Service in 1974 when Orono Bog was designated as a National Natural Landmark had been on display for many years and then put in storage in Nutting Hall on the UM campus. I suggested that the plaque be put on display at the information area at the beginning of the boardwalk, and it was transferred to me for that purpose. In spring 2002 I asked the City of Bangor to transport a ~3 ft (~0.9 m) wide boulder with a relatively flat side to the boardwalk information area and to anchor it in the ground so the flat side faced walkers approaching the boardwalk. Then, I visited Guernsey Monuments to ask Ed Guernsey to mount the brass plaque on the boulder, which he graciously did, and it still remains on display at the boardwalk trailhead (Figs. 14 and 25).

Storage space. After major 2002–2003 construction was complete, we had several extra boardwalk sections, two section jigs, and two carts to store for possible future needs, but they were too large to store in someone's garage. I started searching for a free storage area and learned that space was available in one of the large buildings that was part of the old WWII, Dow Airforce Base at Bangor International Airport. We obtained permission from the airport authority to use that space.

2003 and 2004 boardwalk seasons

23rd of June 2003 opening of the OBB. The initial opening of the OBB to the public lacked fanfare, consisting only of unlocking and opening the gate. I had informed the various media about the opening, including announcements of boardwalk hours. The response by the public was immediate. Because the interpretive signs were such an important part of the boardwalk, however, I put off a gala opening until later in summer after the signs had been installed. An additional display I planned to have in place for the gala opening was a water level indicator.

Interpretive signs, water level indicator, and gala opening. After returning the proofs to the sign fabricator on 13th of June, I started work on an invitation list for an opening celebration. The final list contained names of 600 individuals. Although addressed envelopes were ready by early July, we couldn't print the invitations until we had a date for the event. When the signs and mountings were shipped to us on the 17th of July we were assured they would arrive within a week. As all preparations for installing the signs were in place and knowing that installation would take very few days, we scheduled the event for 2 August, and UM printed and mailed the invitations. The signs and mountings arrived on 24 July, and we completed installation two days later.

Another educational display, to be installed at the open bog, was a water level indicator. I wished to make visitors aware of the extreme watery condition of the environment they were walking over, and how close the water level was below their feet. Except for a few small transient pools visible from the boardwalk in spring at the open bog, the water surface (table) was invisible below the bog surface. To minimize the cutting of trees and peat hummocks, we had located the boardwalk mostly on moss lawns and hollows where the water level was closer

to the surface than at hummocks.⁶² Previous observations I had made of water levels at lawns and hollows at the open part of Orono Bog during the prior 33 years indicated that the water surface typically ranged from 1 to 8 inches (~3–20 cm) below the peat surface and varied by season—closest in spring, and falling over the summer.⁶³ To illustrate this relationship, I designed a water level indicator and selected a moss lawn adjacent to IS6 to install it. After removing a 5 ft (~1.5 m) deep and 3-inch (~7.6 cm) diameter core of peat I cased the hole with 3-inch plastic pipe (casing) that also extended ~3 ft (~0.9 m) above the surface. The water level in the casing should be the same as in the surrounding peat, but to be sure I had drilled a series of 0.5-inch diameter holes along the part of the casing that was to be under the peat surface. Then I made a float-pipe from 8 ft (~2.4 m) of 2-inch (~5 cm) diameter plastic pipe by sealing a cap on each end. When inside the casing, the float-pipe would rise and fall along with changes of water level in the peat. We marked the float-pipe with an easily readable scale in inches (~2.54 cm increments),⁶⁴ so it would indicate 0-depth when the water level was at the peat surface. The water level was read on the float-pipe scale where it intersected the top of the casing pipe. Readings above the zero mark on the scale represented distance in inches to the water (table) surface below the peat surface (Fig. 26).

With the educational installations completed we were ready for the gala opening on the 2nd of August. Because of uncertain weather for the 2nd, I approached General Rental in Old Town and explained what the occasion was all about and asked them to supply colorful party tents. They gave us a big discount on the rental, delivery, and setup of a 15 x 15 ft, 20 x 20 ft, and 20 x 30 ft tent plus tables and chairs. The celebration at the assembly site was attended by about 100 persons. Lots of liquid and solid refreshments, many of them donated by volunteers, were consumed. Short speeches were given, and music was performed by a string trio, then a

ribbon was cut at the boardwalk gate. The ribbon cutters were Nikki Farnham, then Mayor of Bangor, Robert Kennedy, then Provost and Vice-President of the University of Maine, Jay Johnson, then President of the Orono Land Trust, Deb DeQuinzio, National Park Service, then Northeast Regional Coordinator of the National Natural Landmarks Program, and Ron Davis (author of this essay), then Boardwalk Director. Attendees were then guided on a tour of the new boardwalk.

Establishing boardwalk rules, season, and hours. Working with the Management Committee, I established a set of rules that we posted on a sign near the beginning of the boardwalk (Fig. 27). The rules were designed to protect the pristine, natural character of the bog, the boardwalk itself, the safety of visitors, and to maintain an atmosphere conducive to the quiet enjoyment of nature. Walkers were asked not to step off the boardwalk, a request repeated on the interpretive signs (e.g., Fig. 23), as we wished to avoid damage to the sensitive bog surface and vegetation. Collection of whole plants and plant parts (e.g., flowers) was prohibited. Such collection threatened to deplete some plant populations along the walkway, especially plants of special interest like pitcher plants and orchids. Pets on the walkway were banned⁶⁵ for three reasons. First, some persons are afraid of animals, especially dogs, and would feel threatened along such a narrow walkway. Second, the bog is managed as a nature reserve and some uncontrolled pets may chase, disturb or kill wildlife and third, some pets may defecate on the boardwalk or immediately adjacent to it. Smoking on the boardwalk also was forbidden because clear, clean air along the boardwalk was a part of the walker's "get out into nature" experience, the peat of bogs above water level readily burns, especially during dry periods, and the wooden boardwalk, itself, is inflammable. Also, we prohibited running, as the pounding on the wooden deck boards would increase breakage, and runners could collide with walkers on the narrow

walkway. Some wheeled vehicles were banned, including bicycles and skateboards, which were unsafe and incompatible with walkers on the narrow walkway. Small baby carriages/strollers and wheelchairs, however, were allowed. Interference with walkers by these conveyances was minimized by the passing space provided by the frequent wheelchair turnarounds and ISs. We provided a trashcan at the beginning of the boardwalk to help minimize littering along the boardwalk.⁶⁶

We decided to limit the boardwalk season and hours to protect it and the surrounding bog from damage. These limits have been enforced with a lockable gate (Fig. 28) at the beginning of the boardwalk. Although it has been possible for agile persons to climb around or over the gate, our observations suggest that few persons do so.⁶⁷ Regarding season of operation, the 1st of May seemed like the best annual opening date, as mid- to late-April typically was when the frost completed melting in the upper peat and the boardwalk settled down to its summer position, leaving at least a few days before the 1st of May to perform maintenance and ensure that the walkway was level and safe for walkers and wheelchairs. We chose the first Sunday after Thanksgiving as the final day of the boardwalk season, weather permitting.⁶⁸ That date allowed a final visit to the boardwalk during the traditional family holiday weekend.⁴

Our decision to close the boardwalk for the winter was based on the desire to protect it. As skiing was a major activity along BCF trails including the East West Loop Trail that passed the beginning of the boardwalk, we were concerned that the boardwalk would become a popular ski track. The steel tips of ski poles, as they are slammed onto the decking and into the gaps between the boards would damage the decking. Ski pole tips catching between the boards and ski tips of ski skaters catching under the bump-railing were potential hazards for skiers who become injured and need rescuing. Furthermore, the boardwalk provided easy access to the open

bog where skiers may wander off the boardwalk. Skiers could badly damage the bog's low vegetation when snow depths were insufficient to cover and protect the plants. Monitoring this public use in winter would exceed the capacity of our volunteer programs. Finally, the ski trail system in the BCF was already an excellent recreational resource that was lightly used; thus, the boardwalk did not need to be part of that system.

We decided to open the boardwalk daily in season, although from the start in 2003 occasional closures ranging from hours to days were needed, for example, during electrical storms and when repairing damage. Nighttime access to the boardwalk has not been legally possible as the BCF is closed after dark.⁶⁹ Even without that stricture, however, we would not have kept the boardwalk open at night for reasons of security and safety. Visiting hours have been 7:00 AM to 6:30 PM from 1st of May to the end of August, and then shortened by 1–2 hours at about monthly intervals as the daylight period waned in the fall.

Registration by visitors. For purposes of publicity, fundraising, and management purposes we began to build a database on boardwalk visitation. During the 2004 season, I used registration cards for this purpose. A notice was posted on the kiosk requesting each person or party of multiple individuals to fill out a card before entering the boardwalk. A large majority of parties filled out cards, some parties only after the urging of docents. Compliance was probably lower when docents were absent, which was about 25 percent of the time. We collected about 5,500 cards over the seven months. In early December, six volunteers spent most of two days at my house entering the information into a computer database. The total number of persons tallied from the cards in 2004 was ~21,000 but this total was a low estimate of the actual number of person-visits. A conservative better estimate would be 25,000 person-visits. These data indicated that the middle of the day and afternoon—largely when docents were present—were

the most popular periods to visit. Most visitors lived within 25 miles (~40 km) of the boardwalk, but many came from other parts of Maine. Additionally, in 2004 visitors that season came from 44 other states and 18 other countries. Parties of families or friends, some a mixture of both, ranged in size from 2 to 15, with the most in the 2-to-5-person range. Registrations also included 99 groups from schools at all levels and other institutions (e.g., senior housing, homes for the disabled, rehabilitation centers, boy and girl scout troops, garden and nature clubs, etc.). These groups ranged from 3 to 62 persons and averaged about 20 persons.

Five boardwalk programs. Starting with the boardwalk's first season (2003), we put five programs into operation: (1) maintenance, (2) docents, (3) student summer intern, (4) guided tours, and (5) specialized nature walks. These programs have continued since I retired as Boardwalk Director at the end of 2004. The programs have been run by volunteers, except that the summer student interns have been paid. As these programs progressed, it became clear that the director could not operate all of them, thus, volunteer leaders were recruited to schedule maintenance personnel, docents, and tours including the scheduling of tour guides.

1. Maintenance. Phil Locke, a retired math professor at UM, and an avid amateur carpenter, soon became our most regular maintenance person (Fig. 29). He recruited loyal helpers and led the maintenance effort for many years. Numerous repairs were needed, some of them urgent for maintaining the safety of the walkway, including replacement of broken deck boards, inserts, and bump railings. Restoring boardwalk sections to level where shims slipped out of place was a frequent chore. Rarely were repairs delayed for more than a day. Phil checked the condition of the boardwalk every few days and often repaired it, and always responded to calls from docents (see below) and others who discovered places in need of repair.

Needed materials (e.g., nails, deck boards) were purchased with monies donated onsite and deposited in our operations account at UMF.

2. *Docents.* My objective was to place volunteers (or an intern, see below) at the boardwalk for as many hours a day as possible, especially at the busiest times of day.⁷⁰ I called these volunteers “docents.” Definitions of the term include “college lecturer” or person (typically a volunteer) who “guides groups in a museum or art gallery.” These definitions reflect my educational intent, but I must admit that I stretched the meaning of the term. The first docent of the day, typically starting around mid-forenoon, unlocked the cabin and put on display the various handouts and items for sale. Docents sold items and kept a sales inventory. Depending on their personality some docents felt comfortable in offering a friendly welcome to visitors, and freely chatting with them. The docent’s primary job, however, was to answer questions about the facility and the bog. Questions were most frequently asked when visitors exited the boardwalk. The introductory sign and guide booklet could be used by docents as “visual aids” for this purpose. The last docent of the day returned the display materials to the cabin, emptied the money pipe of donations, locked moneys in the cabin lock box, and locked the cabin. That docent also closed the boardwalk gate, walked the boardwalk to confirm that all visitors had exited, and locked the gate. Some docents (and other volunteers) did the morning unlocking/opening of the boardwalk gate and walked the boardwalk to identify any structural or safety issues, which she/he would report to the director or the maintenance leader.

Docents performed a range of additional duties as the need arose. Some visitors with limited physical ability underestimated the length of the walk, or unexpectedly developed a painful leg. Sometimes, a docent would loan the wheelchair we stored in the cabin if a “pusher” was present in the party to facilitate the safe return of the visitor to her/his car. An important

function of docents was to explain the rules to unruly visitors, but only in a pleasant manner given the docent's vulnerability at the isolated boardwalk.⁷¹ Docents also had mundane chores like picking up trash, emptying the trash can, sorting out returnable containers, and maintaining a supply of toilet paper and hand sanitizer in the outhouse.

I trained docents on how to perform their tasks and to answer a range of questions about the boardwalk and the bog. Boardwalk questions covered boardwalk dimensions, design, methods of construction, and history. Bog questions covered land ownership and management, dimensions including peat depths, identifications of plants and animals, and the nature of peatland environments. The reference collection of books on peatland natural history in the cabin was helpful. During my tenure as director, I held training sessions at the boardwalk for docents on two or three occasions per season and gave a peatland PowerPoint presentation about the bog and boardwalk as part of a social gathering of boardwalk volunteers at my home. Whenever possible, I would touch base with individual docents during their sessions to answer any questions they might have.

In 2003 and 2004 we maintained a roster of about 35 docents, some with regular weekly duties and others serving on an irregular basis or as substitutes. Supervising the program, including the effort to schedule docents for most of the boardwalk's open hours was difficult and time consuming. In 2004 I was happy and relieved to welcome Donne Sinderson as co-leader of the program to share the scheduling efforts with me.

3. *Student summer intern.* Each summer we hired a University of Maine student as an intern on a half-time work-study basis for 9–12 weeks. An intern's responsibilities were the same as those of docents. Additionally, depending on the particular intern's skills and interests,

they guided walks (see *Guided tours*, below), participated in maintenance, and performed other tasks. The 2003 intern was Melinda Mooney and the 2004 intern was David McLaughlin.⁷²

4. *Guided tours*. In summer 2003 we began receiving requests for guided tours of the bog on the boardwalk. Inquiries were received from schools at various levels, senior citizen organizations, clubs (e.g., garden) and other groups. I questioned volunteers to determine who would like to become a trained guide and received positive replies from several persons, mostly docents. All had an interest in field natural history but their prior training and depth of knowledge specific to peatlands varied widely. I began training sessions for guides and we started supplying guides for tours. Emphasis was on natural history of the bog, but coverage and presentation techniques varied depending on the type of group (e.g., a 2nd grade class versus a university biology class). Tour guides dealt with a number of questions, starting with the deceptively simple one, “What is a bog?” Other obvious questions included, “How did the bog form, and when did it get started?” And “What accounts for the change we see in the bog as we move from its edge to its center?” On a typical tour, the most common plants of each part of the bog were identified and discussed, and when animals were seen they, too, were discussed. The guided tours program was extremely popular from the outset (Figs. 30 and 31).

We limited the size of guided groups and specialized nature walks (see below), typically to 10–12 persons per guide or leader, however, we always made an effort to accommodate larger groups by separating them into sub-groups, each with a separate guide. We did this because it wasn’t possible on the narrow boardwalk for a guide to gather a larger group closely around her/him to point out something. Also, most tours and nature walks took place during regular boardwalk hours and large groups made it difficult for other visitors to pass.

5. *Specialized nature walks.* We were fortunate to be associated with UM where expertise was available on several facets of bog ecosystems and other aspects of the natural world. Many additional experts with knowledge relevant to bogs lived and practiced their professions in east-central and nearby coastal Maine. With this expertise at hand, beginning in 2003 we were able to start offering nature walks on the boardwalk on specialized topics led by experts. We advertised these on our website, on posters at the boardwalk, and in the media. As space was limited (see prior paragraph), advance registration was required. Among the many topics we started covering in the 2003 and 2004 seasons were: plant adaptations to the bog environment, bog hydrology, bog origins/peat accumulation/postglacial development, and major ecological factors in bogs. We also scheduled walks that focused on groups of organisms of the bog, including fungi, vascular plants, breeding birds, mosses and liverworts, lichens, and insects. Our nighttime astronomy walk was also popular. During the 2003–4 winter, we held two special nature walks (on snowshoes) on winter ecology of the bog. Judy Markowsky worked with me as co-leader of this program

Boardwalk yard sale. The first annual boardwalk yard sale occurred on the first weekend of June 2004. It was conceived by Jerry Longcore and Jim and Mary Bird, and has been held at Jim and Mary's home on Main Street in Orono each year until 2018. These sales were big undertakings, and many volunteers helped to run them (Fig. 32). Yearly earnings have varied from \$2,000 to \$7,000.

2004 construction of cabin and outhouse

The cabin raising. I asked Jerry Ellis, who had a range of construction experience, to be construction crew foreman for the volunteer crew we recruited. We started with a meeting at my house during the last week of June. The Northeastern Log Homes “Cozy Cabin II” log cabin kit

had arrived at the assembly site a few days earlier.⁴³ The cabin was 13 ft (~4 m) wide by 21 ft (~6.4 m) long including a 6-ft (~1.8 m) deep roof-covered porch. I had asked for modification of the porch so we could screen it in. The kit contained essentially everything we needed except tools, concrete footing pads, long 6x6-inch (15 x 15 cm) pressure-treated foundation beams, entry steps, screens and screen door for the porch, and hardwood flooring.

I decided to use round concrete pads to support long beams that would extend the length and width of the cabin to provide the foundation for the log walls.⁷³ First, the CB built up and leveled a well-drained gravel base for us. We placed heavy duty, 5-ft-wide rubber dam sheets under the gravel along the future roof drip line and sloped it away from the cabin to conduct water away to keep the gravel dry, thereby minimizing ground frost and the movement it causes. By early July we did a final leveling of the gravel by shovel, hoe, and rake, placement of the pads, and put the beams in place. Wall construction began shortly afterwards. The word had gotten around, and the initial crew was occasionally joined by several other volunteers. Like the boardwalk, itself, the raising of the log cabin was a community project (Fig. 33). A group from the Orono Unitarian Universalist church, including family members and friends of the builders brought food and drink (Fig. 34) so we could keep working with little interruption.

We built porch steps before finishing the walls to make it easier to get up and down to/from the raised floor. By 8th of August, we had the roof up and were installing the roof vent. In the next month, we installed the soffits, doors and windows, and we shingled the roof. I purchased custom made screens and a screened door for the porch, and we installed them (Fig. 35). I purchased hardwood flooring, and Phil Locke, Jim Bird, and I installed it. To prevent winter ice formation from condensation on the floor I crawled under the floor in October to insulate it. As the porch would be the place a docent would spend much time when on duty, and

as the porch floor consisted of decking with gaps between the boards, I installed screening under the decking to exclude biting insects. Then I built a workbench and installed wood and metal vices on it and put a peg board on the wall behind it for tools. Much of the time in season and during all of the winter and early spring the cabin with its contents of tools and supplies would be unattended and easy to break into. So, I measured the windows for custom-made steel window grills and bolted them in place, including over the main door lite to add security. We added several additional finishing touches that fall including a cabinet and shelves for storage of supplies, a bolt lock for the door, and a large, green, lockable steel tool chest for secure storage including money from the donation pipe and from sales. I bolted that large, heavy chest through the thick log wall behind it to make it even more difficult to steal.

At the boardwalk information area, the cabin porch was the place where docents would sit while watching for visitors arriving from the East West Loop Trail. Docents needed a shelf under the screened window to use for reading material and for writing in the docent logbook where a record of happenings on each docent shift was kept. Phil stepped forward, again, to apply his carpentry skills.⁷⁴ We kept adding finishing touches to the cabin until the boardwalk closed for the year on 28th of November 2004.

The outhouse raising. We didn't start constructing the double (two-stalled/two-doored) outhouse until September when the main structural components of the cabin had been completed. I sketched a floor plan and tentative elevations and included a skylight for each stall (this is a deluxe outhouse!). Northern Log home's drafting department took over at that point. Al Larson shepherded the kit to make sure that everything was correctly planned, sized and included. The CB excavated the hole for the concrete vault. American Concrete Industries donated it, trucked it in, lowered it into the hole and leveled it. When the outhouse kit arrived, I organized a small

group of volunteers to put it together. Some of them had worked on the cabin, including Jerry Ellis who shingled the outhouse roof. Mara Miller helped me construct the doors. We installed the stainless-steel toilet risers and toilet seats in mid-November. The outhouse wasn't fully functional until the final weeks of the 2004 boardwalk season (Figs. 36 and 37).⁷⁵

Throughout construction of the boardwalk, cabin, and outhouse, and during my tenure as Boardwalk Director, Rolland Perry (dec.), Bangor City Forester, was highly supportive. Rolland was the primary manager of the BCF where the OBB begins. He improved the access trail to the boardwalk, graded/leveled and improved drainage of the boardwalk information area and placed crushed rock on it, and took every opportunity to promote the OBBP within Bangor City government. After his retirement in 2006, the name of the Bangor City Forest was changed to the Rolland F. Perry City Forest.

Final tasks and retirement of director

At the end of each boardwalk season, we mothballed the boardwalk facilities for the winter. That included the covering of our interpretive signs to protect them from damage by humans and the elements, including exposure to UV light. Jerry Ellis made well-fitting plywood protective covers which we have continued to use each winter.

In summer 2004 I indicated to the Management Committee that I would be retiring as volunteer Boardwalk Director at the end of the year, and the committee started discussing who to ask to be the new director. The position is a demanding and time-consuming responsibility without salary, so the new director would have to be highly dedicated to the boardwalk and its programs. We decided to ask John Daigle, Leader of the Parks, Recreation, and Tourism Program at the School of Forest Resources at UM. He agreed to do it only after I offered to help him and mobilize the volunteers that would be needed.

Summary

This essay has focused on the five years 2000 to 2004 when the OBB was conceived, built, and its programs established. The essay is a memoir of my leadership role and an historical account of the OBB's creation. It also demonstrates the essential parts played by the many persons from the greater Orono-Bangor community who volunteered their time and skills to the project.

To explain why I undertook this major project, I began the story with reminiscences of experiences I had in the 1950s and 60s as a man in his 20s and 30s. These experiences led to an interest in bogs and resulted much later in life in the creation of the OBB. The story gains momentum in 1998 when I first thought about establishing an educational bog boardwalk and during that year and the next when I started investigating how and where to build it. By far the largest part of the story takes place in the ensuing five years when I was easing into the senior citizen category and celebrating my 69th to 73rd birthdays and when the OBB was created.

Also, on the personal side, early in the essay I pointed out that 1998 to 2003 were the five years of my phased retirement from the Biology and Climate Change Institute faculties of the University of Maine. Bringing my responsibilities as a teacher and researcher to a conclusion while simultaneously leading the boardwalk project resulted in an extremely busy life consumed by a wide range of activities. The phased retirement was completed in summer 2003 coincident with completion of construction of the boardwalk and its opening to the public. After the boardwalk's second season of operation in 2004, I retired from my lead role there, but have continued as an active boardwalk volunteer.

In the fall of 2000, I reached the "point of no return" and took the first concrete steps toward OBB's establishment. The project took place in several phases or steps: (1)

preconstruction tasks, 2000–2002, (2) 2002 major construction, (3) winter and early spring 2002–2003 behind the scenes, (4) spring 2003 construction, (5) program establishment during the 2003 and 2004 boardwalk seasons, and (6) 2004 construction of cabin and outhouse.

The preconstruction phase was the most challenging, as it involved activities with which I had little or no prior experience. These activities included a great deal of public relations work including the building of community support for the project, preparing permit applications and meeting with permitting agencies, forming a boardwalk administration consisting of three organizations and drafting and negotiating an MoU between them that defined their responsibilities and boardwalk governance in general, soliciting free construction materials, equipment and services, and engaging volunteer and paid construction workers. I also carrying out tasks for which I had prior relevant experience, like selecting a boardwalk route and surveying it, designing the boardwalk, and fund-raising including applications for grants.

In 2002 construction started in winter with indoor assembly of boardwalk components as part of carpentry shop education programs at three local schools. Major assembly work by community volunteers and MCC crews began in late spring and early summer, respectively, at a specially prepared assembly site in the Bangor City Forest near the boardwalk's beginning. After a final survey and marking of the boardwalk track in the bog, the track was prepared/leveled, and by midsummer installation of the 509 8-ft (~2.4 m) long boardwalk sections began. The bulk of boardwalk assembly and installation during summer was accomplished by MCC crews, but when they finished in September about a quarter of the assembly and installation remained to be done. At that point, volunteers took over, joined for two weeks by a crew from Charleston Correction Facility, and by the first week of November we had completed all 509 boardwalk sections along with a few extras. About 10,500 deck boards,

1500 supporting joists, 1000 end joists, 4000 bump-railing riser blocks, and 1000 bump-railings had been cut, dipped in preservative, piled to dry, and assembled into boardwalk sections. However, by mid-November about 50 sections remained to be placed in the bog. At that point, despite bad weather, the MCC returned for a week on a *gratis* basis and on the 22nd they placed the final section in the bog. However, much remained to be done before the OBB could be opened to the public.

Over the 2002–2003 winter and early spring I did more fund raising and carried out the substantial job of preparing graphics and text, design and layout of the eight interpretive signs that were to be a major educational component of the OBB. Fieldwork resumed in early May with community volunteers, a Charleston crew, and an additional MCC crew. We completed the wheelchair turnarounds including benches, added side-sections and railings to the interpretive stations, build a kiosk, installed a National Natural landmark plaque on a boulder, and completed a great number of small but necessary final adjustments to the walkway. We opened the boardwalk to the public on the 23rd of June. It wasn't until a month later, however, that we were able to install the all-important interpretive signs and also a water-level indicator. On the 2nd of August we hosted a gala opening celebration and ribbon cutting.

The final cost of boardwalk construction counting interpretive components, both the purchase costs and the value of donated materials and services, and including paid labor was about \$250,000. Adding the value of volunteer labor at \$15/person-hour brings the total to about \$300,000, and that does not include the monetary value of my time.

In the months before the 2003 boardwalk opening, I proposed to the Boardwalk Management Committee: (1) the season and hours of operation, (2) rules for visitors, and (3) five boardwalk programs or working groups. With modifications we agreed to put all of them into

operation. All have been successful, and with minor changes remain in effect today. The boardwalk was to be closed in the winter and early spring, open seven days a week in season, and closed at night. The rules were designed to protect the natural character of the bog, the boardwalk, the safety of visitors, and to maintain an atmosphere conducive to the quiet enjoyment of nature; details given earlier in the essay.

The maintenance group was to keep track of boardwalk condition, receive notification from other volunteers or the director of places in need of repair, and carry out repairs. Docents were to be in attendance at the boardwalk for as many hours of operation as possible. They were to unlock/open the gate in the morning, greet/welcome visitors and provide them with information and answer questions, inform visitors of the rules, as needed, display and sell boardwalk memorabilia, carry out a number of housekeeping tasks, and close/lock the boardwalk gate at the end of the day. A paid student intern each summer would have the same duties as docents but be encouraged to take on additional responsibilities like maintenance and guiding school groups. The guided tour program was designed to provide visiting groups with trained guides and has done so for many groups each season. During periods of overlap between the boardwalk season and the school year, most of the groups have come from schools. Specialized nature walks are given by experts in their fields and are announced in advance so participants can sign up for them.

All of the above efforts have created a popular educational and nature-based recreational facility, free to the public as well as to institutional groups including schools and universities, and with programs that further understanding of bogs, other wetlands and the natural world in general. Through the 2019 season it has served approximately 450,000 visitors. For many visitors, a walk on the OBB is like a short trip to the muskeg of Labrador, similar to the exciting

experience I had in the late 1950s when Paul Favour guided me into the Big Heath. It is my hope that the experience ignites a spark that kindles an interest in nature, especially among young visitors, and helps to build support for the conservation of natural areas, and that the OBB continues to serve the public in its many ways long into the future.

I thank Jerry Longcore, Jim Bird, and Lee Davis for reviewing the manuscript and for their editorial and substantive suggestions, most of which are incorporated in the essay. Sarah McPartland-Good of the University of Maine Foundation checked the boardwalk account records to confirm some of the facts contained here. I am deeply grateful to my wife, Lee, for her loving support throughout the boardwalk project, and to the enthusiastic MCC workers and numerous volunteers without whom the boardwalk would not have come into being.

Figures

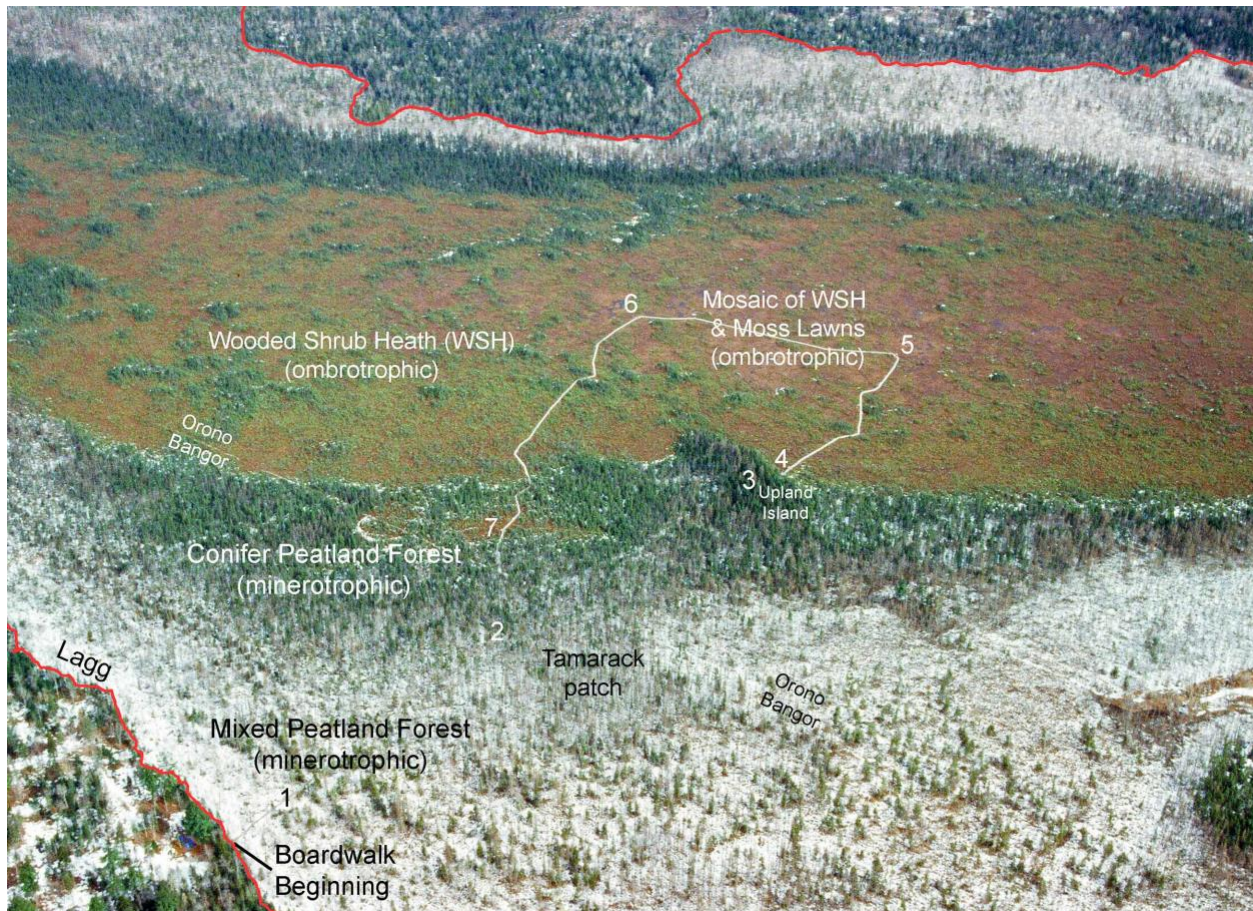


Fig. 1. Aerial photo looking north over the central part of Orono Bog showing the Orono Bog Boardwalk. The red line indicates the limit of the bog (wetland boundary). Vegetation types are labeled using terminology superseding that used on boardwalk interpretive signs (compare to Figs. 23 and 24). The boardwalk appears as a white line over the darker vegetation types, but as an inconspicuous fine gray line at the largely white mixed forest area. To find it in the latter area, zoom in on this page and look at the lower left part of the photo at the tip of the pointer from the label, “Boardwalk Beginning.” The scale decreases with distance due to oblique nature of aerial photo (compare to Figure 5). When this page is viewed at 8.5 inches (21.6 cm) width, the approximate left-right scale at center photo is 1 inch = 0.15 mi or 1 cm = 0.10 km. Ronald B. Davis photo.



Fig. 2. The Orono Bog Boardwalk at the open bog. The view is back toward Interpretive Station 4 where the walkway emerges from the conifer peatland forest. Ronald B. Davis photo.

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ILLUSTRATIONS:
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bog rosemary
(*Andromeda polifolia* var. *glaucofolia*)

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northern leopard frog
(*Rana pipiens*)



Lincoln's sparrow
(*Melospiza lincolni*)

Fig. 3. A draft copy of the 2006 credits poster with imperfect graphics. Zoom in to read.
Prepared by Ronald B. Davis and others.



Fig. 4. Damaged old trail in October 2002 in wooded shrub heath vegetation, looking easterly toward forested peatland and Stillwater Ave, showing marked plot 4 (see Fig. 12). Ronald B. Davis photo.

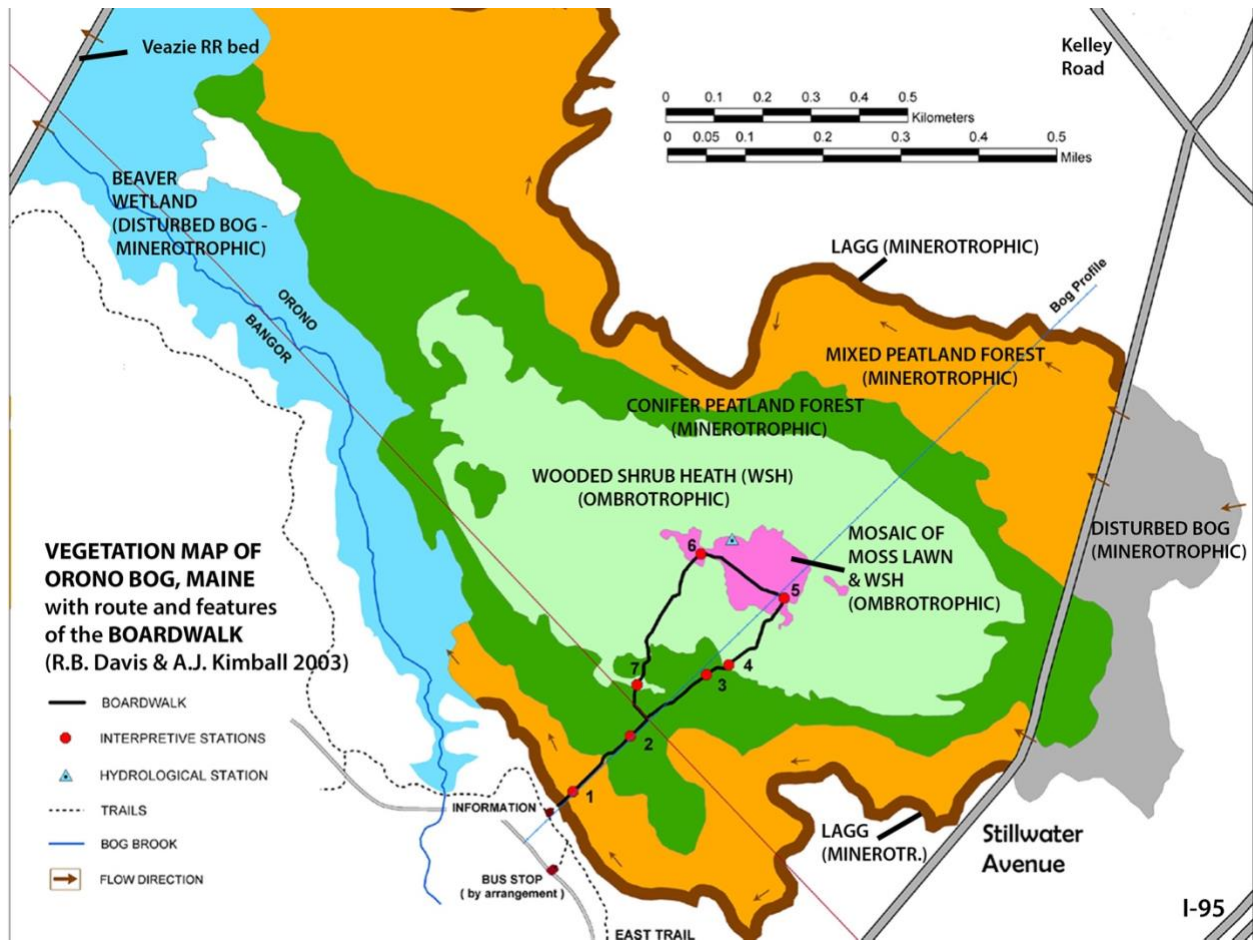


Fig. 5. Vegetation map of Orono Bog with terminology superseding that used on boardwalk interpretive signs (e.g.s, Figs. 23 and 24) and showing the Orono Bog Boardwalk and position of the bog profile that appears in Figure 24. Mapped from vertical large-scale false-color infrared aerial photos by Ronald B. Davis and Alan J. Kimball in early 2003. The constant width of the lagg is a rough average, as its width variation could not be distinguished on the photos. Compare this map to the oblique aerial color photo in Figure 1.

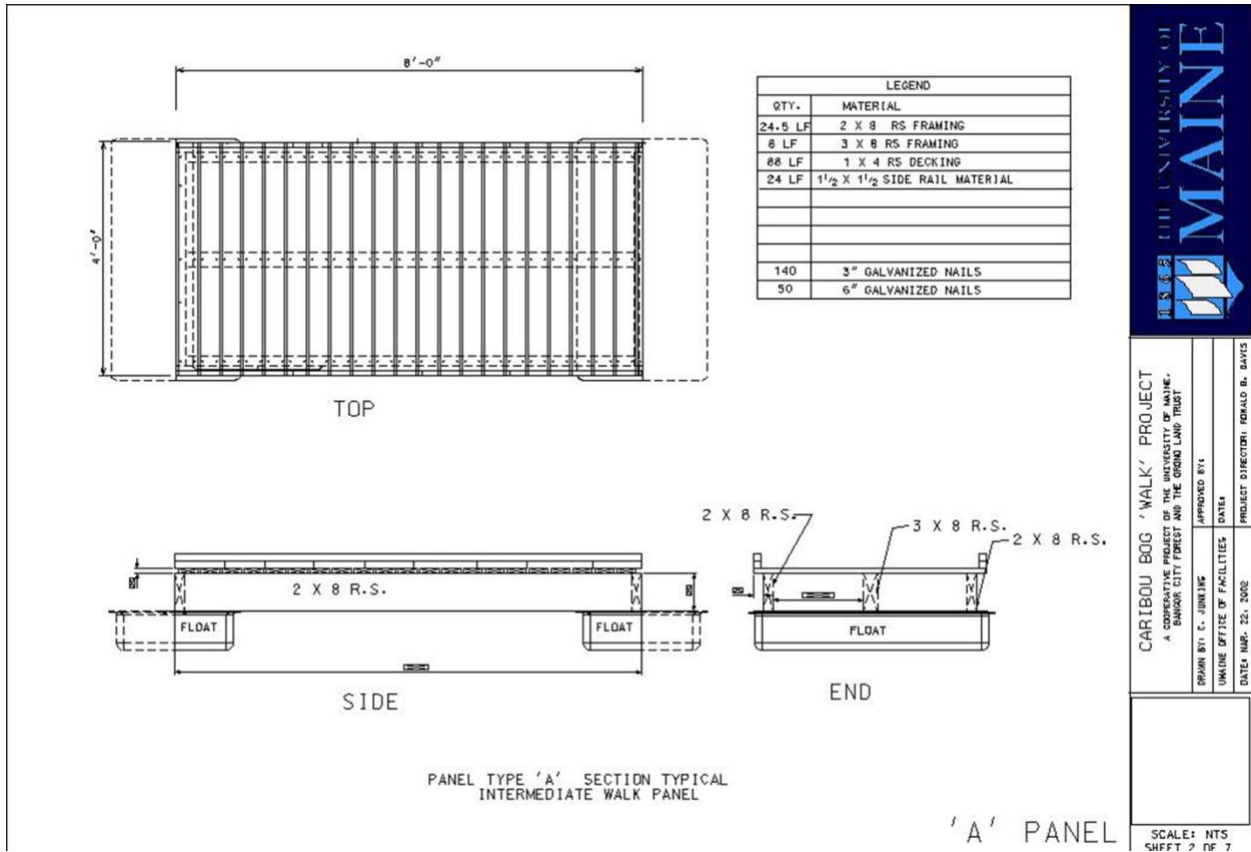


Fig. 6. Digital technical plan drawing of a standard OBB section on floats by Claude A. Junkins of UM Engineering Support Services based on a by-hand technical plan drawing by Ronald B. Davis. When standard sections on floats abut each other each occupies only half a float.



Fig. 7. Jeremy Libby is turning his wheelchair at a boardwalk turnaround section. Jeremy worked as an Independent Living Specialist at Alpha One. These turnarounds also provided places to sit for rest, quiet contemplation, or birding. Ronald B. Davis photo.

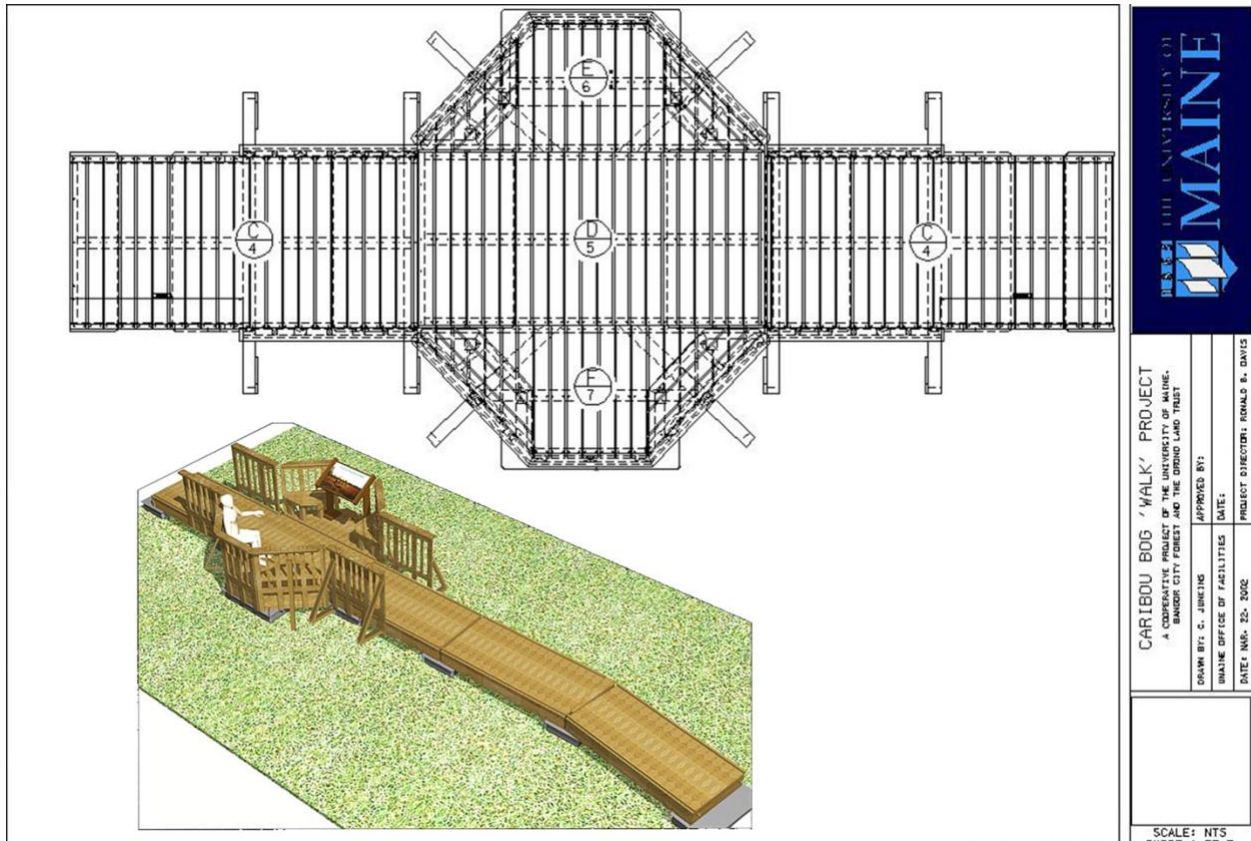


Fig. 8. Components C to F, fully comprising an interpretive station. The interpretation station, proper, consists of three modules (D and 2 x F). It is flanked by two regular boardwalk sections (C) to which have been added 4 ft lengths of railings as an extra precaution for situations when a large group of persons is present. The 12 boards that project out are props for the angular braces that support the railings. Benches are present along the insides of the four diagonal railings. In the schematic drawing, below, a person sits on one of these benches. That drawing also shows an interpretive sign at one side. Digital drawings by Claude A. Junkins of UM Engineering Support Services based on by-hand plan drawings by Ronald B. Davis.



Fig. 9. Family viewing the interpretive sign and birding at IS5. UM photo.

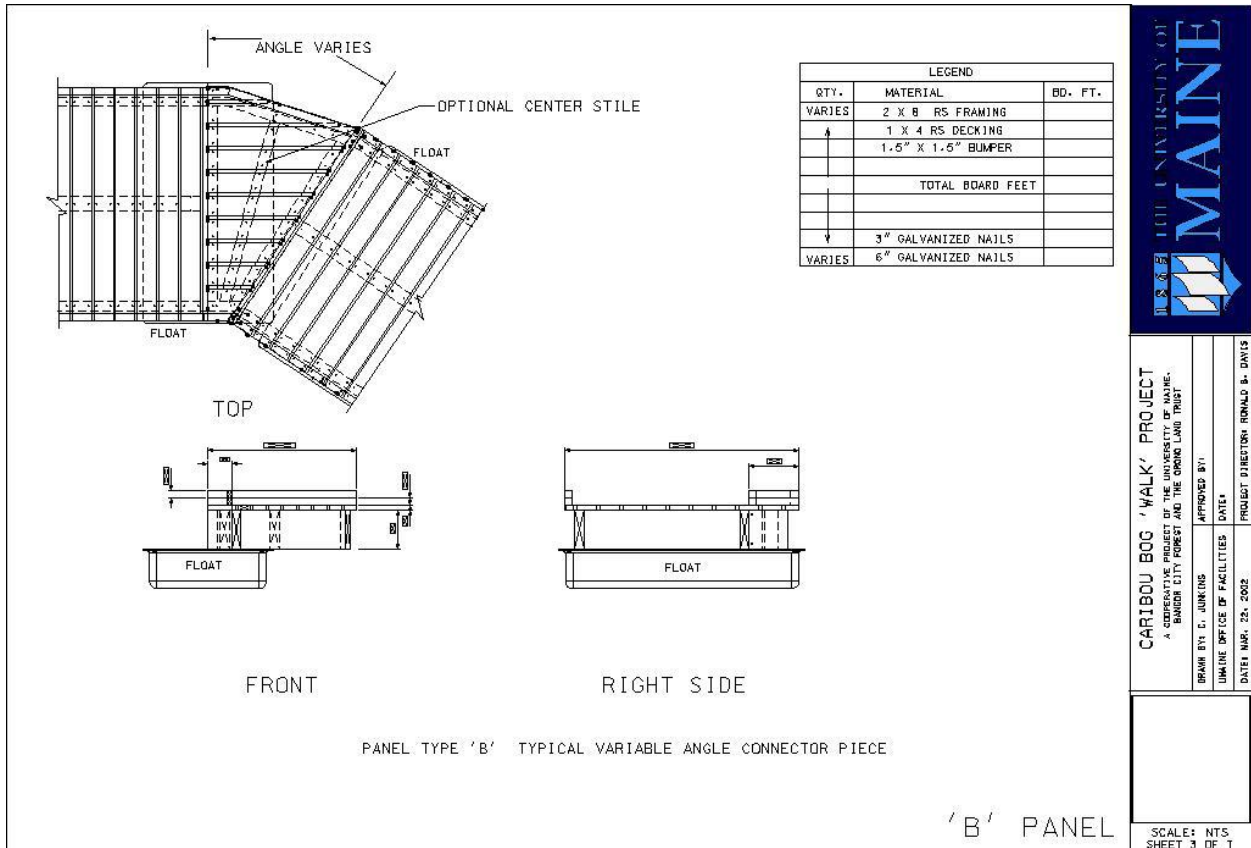


Fig. 10. Variable angle connector piece. Digital drawings by Claude A. Junkins of UM Engineering Support Services based on by-hand plan drawings by Ronald B. Davis.

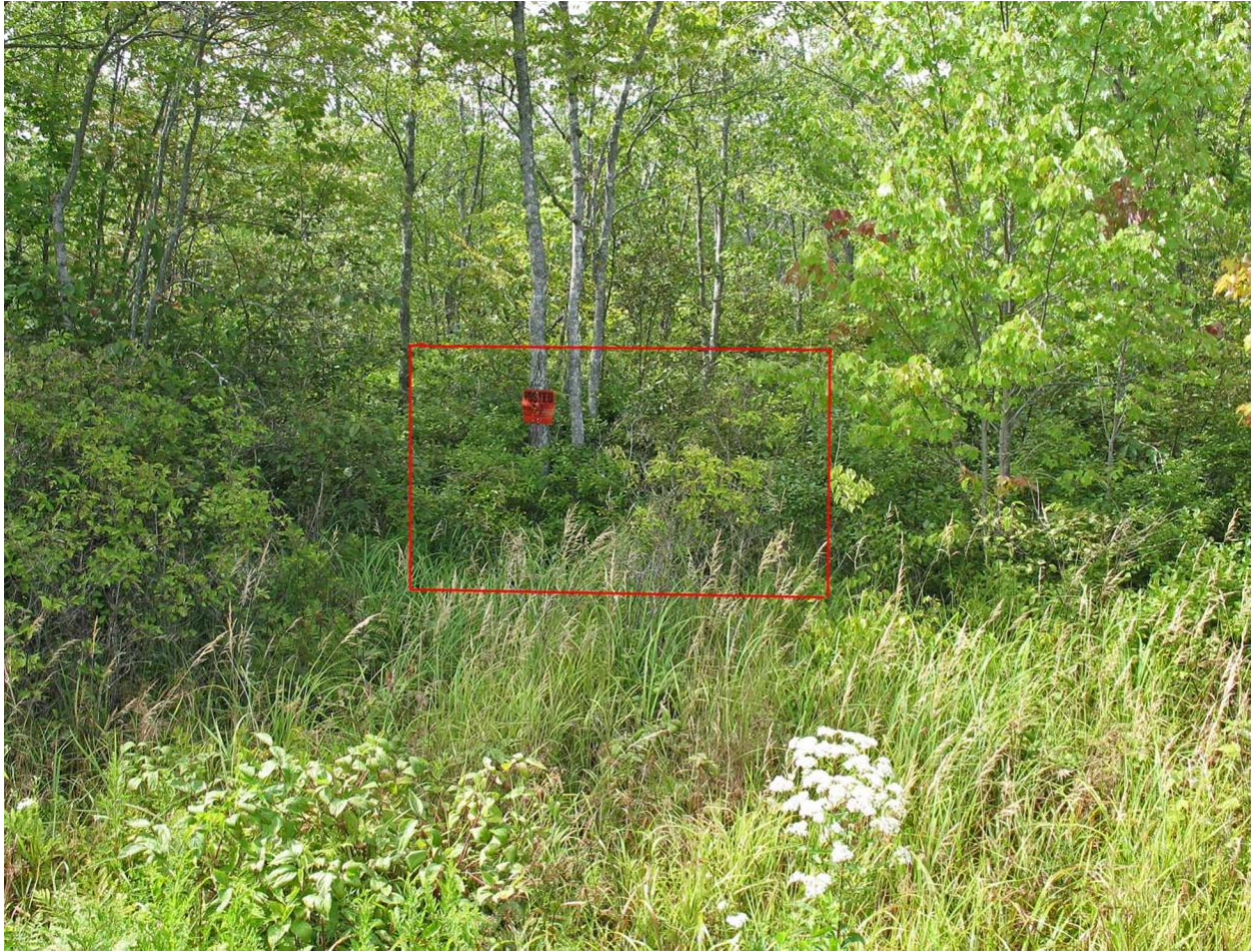


Fig. 11. Old trail entrance into Orono Bog, 26 August 2007, located beside Stillwater Avenue, Orono, screened by new growth since June 2002 (see text). Trail entered forest near center of red rectangle. Landowner's red no trespassing sign appears along old trail. Ronald B. Davis photo.



Fig. 12. Quadrat 4 in wooded shrub heath vegetation (Fig. 4), (A) October 2002 and (B) August 2007. (A) Oblique photo with corners marked, (B) vertical photo with corners marked. Ronald B. Davis photos.



Fig. 13. Transporting a boardwalk section on a special cart along the trail from the assembly site to the incomplete boardwalk. Ronald B. Davis photo.



Fig. 14. Information area in November 2004. Facilities from left to right and references to more detailed illustrations: (1) cabin (Fig. 35), (2) kiosk (Fig. 27) with introductory sign (Fig. 24) and visitor registration box, trash container, display table, and event announcement signs, (3) money pipe (for donations), (4) rules sign, (5) picnic table, (6) bike rack, and (7) boulder with National Natural Landmark plaque (Fig. 25). Only the beginning of the short path to the boardwalk entrance can be seen (left of the boulder). The path runs from left to right and downslope behind the boulder. Ronald B. Davis photo.



Fig. 15. Maine Conservation Corp crew members at assembly site in summer 2002. Member in central foreground is spiking an end joist on a boardwalk section (see Fig. 6) using a small sledgehammer (zoom in). The incomplete section rests in a jig supported on sawhorses.⁴⁵ An incomplete section in another jig is at far left. Its middle joist is in place. The heads of three spikes can be seen on the end joist (zoom in). A pile of bump railings is on the right. Stockpiled components of interpretive stations including railings (see Fig. 8) occupy right background, and a pile large dimension lumber rests in far left background. Ronald B. Davis photo.



Fig. 16. Dipping section joists in wood-preservative in fiberglass-lined wooden “bathtub.” Components of interpretive stations (Fig. 8) appear in background along with full and empty 5-gallon buckets of wood preservative. Tom Hanson’s truck is in left background. Ronald B. Davis photo.



Fig. 17. Final stage of assembling a boardwalk section in the jig in the foreground.⁴⁵ An MCC member is nail-gunning a bump railing atop riser blocks at the ends of the deck boards. On the closest face of jig, the insertions of the half-inch diameter pegs used to space apart the deck boards can be seen. The jig in the background contains a section's longitudinal joists with end joist attached on the right, with the left end joist leaning against the jig. Ronald B. Davis photo.



Fig. 18. Floats and sections stockpiled at assembly site. Floats are 4 x 2 x 0.67 ft (~1.2 x 0.6 x 0.2 m). Ronald B. Davis photo.



Fig. 19. Arriving with a section at end of incomplete boardwalk. The pair of MCC members in the bog have prepared footings for supporting the arrived section. Ron Lisnet UM photo.



Fig. 20. MCC member tipping/sliding section off cart at end of incomplete boardwalk onto composite footings. Ron Lisnet UM photo.



Fig. 21. Receiving section from cart at end of incomplete boardwalk and positioning it onto floats in mid-summer 2002. This location has standing water in spring. Ronald B Davis photo.



Fig. 22. Adjusting the final or 509th placed section shortly after the two arms of the boardwalk loop were joined by it at the middle of the open bog at 2 PM on 22 November 2002. It was a cold, wet and dreary day, but we still were all warmed by the glow of the “drive the golden spike” occasion moments before. The remaining gap of about a 1 ft (~0.3 m) would be easy to bridge when work resumed in spring 2003. Author Ron Davis in green hat observes the four MCC leaders. Photographer unknown.



Fig. 23. Copy of 2 x 3 ft (~0.6 x 0.9 m) sign at IS5. Signs with the same format but different illustrations and text appear at each of the seven interpretive stations, as appropriate for each IS.

Zoom in to read.

ORONO BOG BOARDWALK

Welcome to Orono Bog! In 1974 the National Park Service designated the Orono Bog as a National Natural Landmark – an outstanding example of a northern peat bog. The boardwalk was planned, built, and is jointly managed by the University of Maine, City of Bangor, and Orono Land Trust. It starts in the Bangor City Forest, and crosses the town line to University property in Orono.

FAY HYLAND TRACT

The University owned part of the bog is named in honor of a beloved botany professor who frequented the bog with his students.

WETLANDS, PEATLANDS, AND BOGS

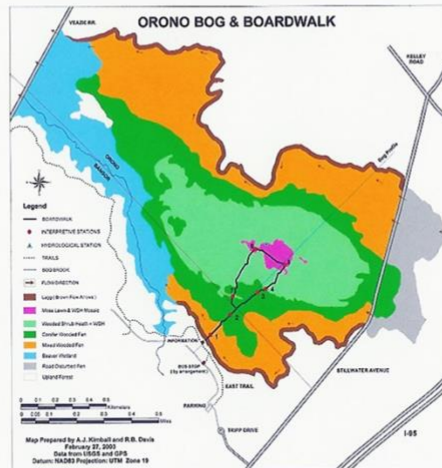
The 616 acre Orono Bog is a wetland. Wetlands have soils that are water saturated, and plants that can tolerate wet soil. Orono Bog is a special kind of wetland called a peatland because of its deep layer of peat. A bog is a peatland with acidic and infertile soil, and with abundant peat moss and other acid tolerant plants. The central half of Orono Bog has been raised by peat accumulation to a higher level than the edge, so it is called a raised bog. The raised surface, combined with the great thickness of the peat and the remoteness of the central area from the mineral soil of the upland, results in extreme infertility and dwarfed plant growth.

PEAT

Peat consists of the undecomposed remains of plants, including mosses, leaves, seeds, branches, and even the trunks of trees. During the early stages of decay, oxygen is used up faster than it can travel through the water saturated soil. Further decay is greatly slowed by absence of oxygen. If plant remains are added to the soil faster than they can decay, peat accumulates.

For additional information, including a list of supporters of this project, visit our web site

WWW.ORNOBOWALK.ORG



The map shows that beavers have modified a major part of the peatland (blue area), and that humans have done the same (grey area). The fine blue line, part of which runs along the boardwalk, shows the position of the profile that appears below.

HISTORY OF THE ORONO BOG BASIN

About 15,900 years ago, the glacier melted away and the area was invaded by the sea. A layer of silt and clay was deposited on the bottom of the sea. After several hundred years, the land rose out of the sea. Small lakes formed in some low parts of the basin see Station 2 on the profile. Other parts of the basin supported non-wetland vegetation for about 4,000 years. Around 11,200 years ago, the climate became wetter, and the poorly drained silt-clay soils of the basin became waterlogged. This condition allowed wetland plants to spread over the entire basin. Since then, the basin has remained wet, and thousands of generations of wetland plants have added their remains to a deepening layer of peat now as deep as 25 feet in some parts of the bog.

INTERPRETIVE STATIONS

Station locations are indicated on the map and profile. Each station has an explanatory sign. Two terms are used to describe the water in the upper peat. The first is "pH," a value of 7 being the neutral point between acidic (less than 7) and basic or alkaline (greater than 7). All of the pH's in Orono Bog are less than 7 the lower the number, the more acidic. The other term is "conductance," indicating the concentration of dissolved, electrically charged particles. The higher the pH and conductance, the greater the input to the upper peat of water from mineral soil and, typically, the greater the fertility.

The National Natural Landmarks Program recognizes outstanding examples of our nation's natural heritage and honors the voluntary preservation commitment by landowners. The program's primary goal is to forge partnerships to promote conservation, education, and research.

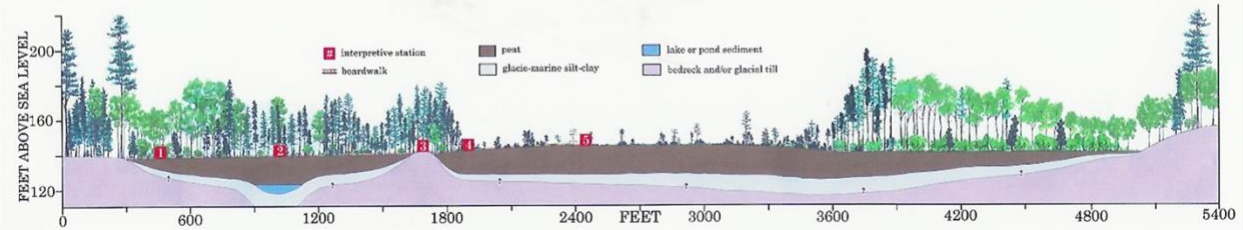


Fig. 24. Copy of 3 x 4 ft (~0.9 x 1.2 m) introductory sign housed in a kiosk at information area by beginning of boardwalk (see Fig. 25). Zoom in to read.



Fig. 25. National Natural Landmark plaque on boulder by entrance to OBB. Jerry R. Longcore photo.

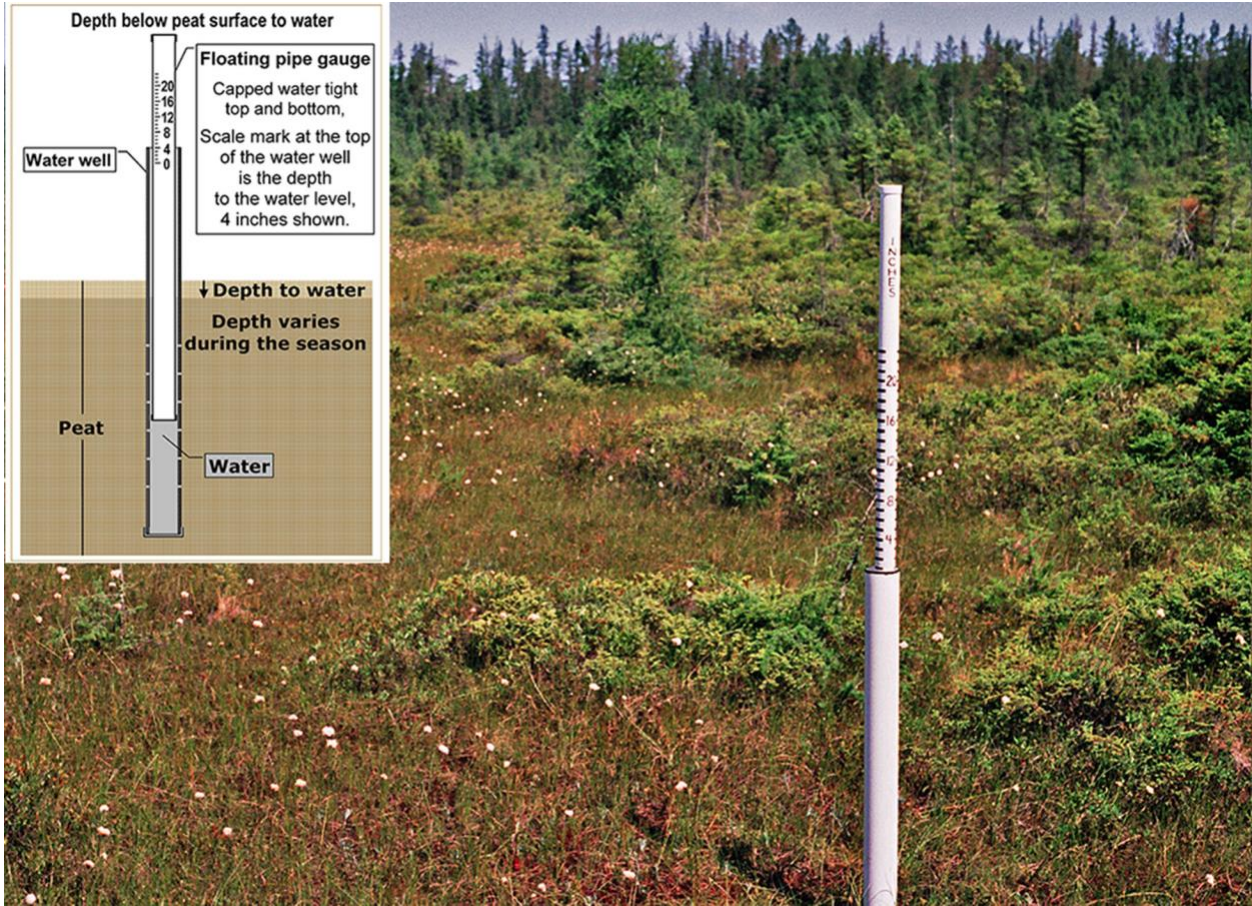


Fig. 26. Water level indicator at IS6. Jerry R. Longcore photo. The explanatory graphic by Justin H. Poland is currently on display at the water level indicator.



Fig. 27. Rules sign and visitors reading introductory sign at kiosk in August 2004. See Fig. 24 to read introductory sign. Zoom in to this photo to read rules sign. Shortening of hours in the fall have subsequently been in monthly increments ending with 3:30 closure in November. Jerry R. Longcore photo.



Fig. 28. Boardwalk gate chained in open position in early October 2012. Note that the first ~120 ft (~37 m) of the walkway to IS1 (red railing and bench barely visible) is supported by pilings. The original floats were replaced by pilings in April 2006.³¹ Ronald B. Davis photo.



Fig. 29. Phil Locke replacing a broken deck board at IS1 on 13 August 2012. Ronald B. Davis photo.



Fig. 30. Deer Isle/Stonington, Maine kindergarten class beginning a guided boardwalk tour in fall 2014. Two boardwalk guides with ID tags and two teachers in black jacket/vest appear in the photo. Prior to starting on boardwalk, the large class (some pupils out of picture) will be split into groups of 10–12 pupils, each with its own guide. Donna Dwyer photo.



Fig. 31. A guided tour for a biology class from UM starting at the boardwalk information area in fall 2016. Boardwalk guide and author of this essay (blue shirt on right) is presenting an introduction to the tour for the entire class. The class subsequently was split into groups of 10–12 students, each with its own guide for touring the boardwalk. Donna Dwyer photo.



Fig. 32. Boardwalk annual yard sale 2016. Sharon Fitzgerald photo.



Fig. 33. Cabin raising. Recognizable standing on porch floor: Bill Glanz (dec.); on cabin floor: Gail White; on ladder: Jim Bird; and on scaffolding: Jerry Ellis. Ronald B. Davis photo.



Fig. 34. Lunch for cabin construction crew. Sue Owen, of a group from the Church of Universal Fellowship in Orono, serves food to Jerry Ellis, foreman of the crew. Jim Bird walks by wondering what he is going to eat next. In background, from left to right are standing: Travis Ellis, seated: Ron Davis, Mara Miller, and Arthur Benson; and standing: Jerry Longcore. Photographer unknown.



Fig. 35. Finished cabin exterior, November 2004. Eventually, entire cabin exterior was painted.

Ronald B. Davis photo.



Fig. 36. Outhouse exterior, November 2004. Ronald B. Davis photo.



Fig. 37. Outhouse interior, right side, November 2004. Ronald B. Davis photo.

Endnotes

¹ Near-coincident with my full retirement from the University of Maine.

² A walk on the OBB is 5000 ft (1524 m) or nearly a mile long, because it starts and ends over an 800 ft (244 m) straightaway that must be walked in both directions, whereas the remainder of the OBB is a 3400 ft (1036 m) loop that is walked only in one direction.

³ The only paid workers on boardwalk construction were 28 members of the Maine Conservation Corps.

⁴ After its late start in the initial (2003) season, the standard boardwalk season from 1 May through the Sunday after Thanksgiving, nearly seven months per year, has been followed. However, seasons were shortened by about one month per year from 2013 to 2019 to allow for installation of new boardwalk sections. Although the 1st of May opening has allowed time after melting of ground frost for boardwalk leveling prior to opening, patchy ground frost at the open bog area has lasted into early June in some years (e.g., 2004).

⁵ Due to the COVID-19 pandemic, the OBB did not open for its 18th or 2020 season.

⁶ University of Maine, City of Bangor, and Orono Land Trust.

⁷ For those five years, my teaching commitment was cut in half for the first two years and eliminated entirely for the final three years when I retained only a half-time research appointment.

⁸ These programs have largely continued under subsequent boardwalk administrations and are described later in this essay.

⁹ I retired as Boardwalk Director at the end of 2004. Since 2004, my wife Lee and I have continued to regularly volunteer as boardwalk docents and guides a few hours per week during boardwalk season each year.

¹⁰ I have a written record of most of the tasks that had to be accomplished to create the boardwalk and its programs. This record is contained in the files of weekly newsletters that my wife, Lee and I have written to family and friends over our 63-year marriage.

¹¹ When I last visited that part of Acadia National Park in 2019, there still was no trail into Big Heath. I assume the park didn't build one because repeated foot travel on the bog surface would damage it. Later in this chapter I explain how a boardwalk can minimize such damage while also providing public access and education.

¹² I was born 6 August 1931 and spent all but two years of the first 22 years of my life in Brooklyn, N.Y.

¹³ The reverter clause specified that ownership would revert to the Nature Conservancy if the property was not properly conserved by the college. This peatland is still actively used by Colby College as an outdoor laboratory for teaching and research (<http://www.colby.edu/environmentalstudies/about/>, accessed 24 April 2020).

¹⁴ I established this trail running west into the bog from Stillwater Avenue with permission of the owner of that peripheral part of the bog. Parking our vehicles along the heavily traveled Stillwater Avenue was always a problem, and when I decided to build a boardwalk in Orono Bog I knew I had to find another starting point for it.

¹⁵ Davis, R.B., and D.S. Anderson. 2001. Classification and distribution of freshwater peatlands in Maine. *Northeastern Naturalist* 8:1–50.

¹⁶ <https://www.nps.gov/subjects/nlandmarks/site.htm?Site=ORBO-ME>, accessed 5 May 2020.

¹⁷ A meeting with the engineer who designed some of the boardwalks at Everglades National Park was especially informative.

¹⁸ Free entry has continued to the present day. A money collection box (originally a “money pipe”) is present at the information area by the boardwalk's beginning. Boardwalk t-shirts, relevant books and other printed material, and other items are sold at this area. Collected funds supplement endowment earnings for purchases of maintenance supplies and other operating expenses.

¹⁹ Lee and I began hosting this event in the 1980s. During the formative boardwalk years, many of these friends became boardwalk promoters, and during construction and early years of boardwalk operation several of them volunteered their time and talents for the boardwalk.

²⁰ On matters pertaining to the OBB, UM is represented by the Dean of the College of Natural Sciences, Forestry, and Agriculture (CNSFA).

²¹ I had already obtained resolutions of support from the Bangor City Council and Orono Town Council and had convinced the Dean of CNSFA where I worked at UM to support the project.

²² A conservation easement was established on the UM part of the Orono Bog (“Hyland Tract”) in 2010 adding further protection for it. The easement holder is the Orono Land Trust.

²³ Except for issuing a building permit for construction of the OBB in the town, the Town of Orono has not been directly involved in boardwalk construction and operation.

²⁴ Although the MoU had been signed, its full implementation was conditional on receipt of permits for construction from federal, state, and municipal authorities, and on the acquisition of sufficient funds for construction.

²⁵ Motorized wheelchairs are allowed on the boardwalk.

²⁶ The access license agreement was granted by the City of Bangor to UM ~18th June 2002.

²⁷ I helped the City prepare its application to the Land and Water Conservation Fund (LWCF) for a grant to enlarge the parking lot and build the boardwalk assembly site and guided the LWCF fund administrator on a site visit.

²⁸ I was appointed Boardwalk Director by the Dean of the UM CNSFA upon termination of the Project Director position when construction was completed on 23 June 2003. I held the position for the first two years of boardwalk operation before resigning at the end of 2004. I was replaced as director by John Daigle who served through March 2008 when James “Jim” Bird was appointed. Jim continues as Boardwalk Director to the date of this writing (December 2020).

²⁹ The surface of many peatlands is characterized by a “microtopography” consisting of hummocks and hollows. The vertical relief varies among peatlands but generally is in the range of 3 to 20 inches (~0.15–0.5 m), with the hummocks and hollows arranged in a mosaic on a scale of 3 to 16 ft (~1 to 5 m).

³⁰ As its solid component consists largely of *Sphagnum* (peat moss) remains, this common type of bog peat is called Sphagnum- or peat-moss peat.

³¹ Over its first ~120 ft (~37 m) the boardwalk crosses the lagg (see next endnote) where flowing and standing surface water is present most of the year. During the first three boardwalk seasons, we had considerable difficulty maintaining the floating boardwalk in place over this stretch. In April 2006, while the lagg was still frozen, we replaced the floats with pilings that we drove into the compacted glaciomarine silt-clay under the peat. The peat deepened only to 6 ft (~1.8 m) over this stretch, so it was feasible (with considerable effort) to use a custom-made hand-operated pile driver to successfully drive the pilings.

³² The lagg is the peripheral and lowest part of the raised Orono Bog (Fig. 5). It acts like a roof rain gutter or shallow moat but receives runoff (excess water) from two directions: the bog’s raised center and the adjacent upland. The Orono Bog lagg carries water in a generally northwesterly direction toward the rest of the multiple-unit Caribou Bog, of which Orono Bog is the southeasternmost unit (Davis, R.B., and D.S. Anderson. 1999. A numerical method and supporting database for evaluation of Maine peatlands as candidate natural areas. Maine Agricultural and Forestry Experiment Station, Orono. Technical Bulletin 175.166 pp.).

³³ Despite the increased shade under the boardwalk for 17 years, vegetational cover has been maintained, albeit with changes in species composition and relative abundances.

³⁴ Two all-composite boardwalk sections were installed among the total of 507 wooden sections, one in a shaded, forested area, and the other at the open part of the bog. They were an experiment of the Advanced Structures & Composites Center of the University of Maine to learn how composites performed under the year-round wet and acidic conditions of a Maine bog. These sections were 2–3 times heavier than the newly-produced hemlock wood sections and required additional personnel (and impact on the bog surface) to install.

³⁵ By 2011, the boardwalk had begun to show serious signs of wood rot, most severely where it traversed the forest-shaded and most humid part of the bog. To keep the walkway safe in some stretches was requiring maintenance with increasing frequency. It was clear that the boardwalk needed to be entirely replaced over the next several years, starting with replacement of its most degraded stretches. By 2011, composite decking had improved considerably, both in its physical properties and appearance. By 2012, boardwalk leadership decided that the expense of replacing the wooden boardwalk with longer lasting and more maintenance free composites was justified by the boardwalk’s great popularity and mounted a fund-raising campaign to do it. A successful nine-year campaign, and incremental replacement over seven years took place, led by Wendell Trembley for its first two years and then by Boardwalk Director Jim Bird and volunteer Jerry Longcore. The new boardwalk sections were professionally fabricated, each consisting of a strong but light-weight aluminum frame covered by composite decking. Improvements in design increased boardwalk stability, but boardwalk dimensions, overall appearance, and boardwalk route remained the same as the original wooden boardwalk. Replacement was completed in 2019 at a total cost of 1.058 million dollars.

³⁶ I used Parker Lumber in Bradford for milling the ~35,000 board-feet (equivalent) of hemlock logs from the UM Forest, and for purchase of the additional ~10,000 board-feet of hemlock lumber needed for construction. All the boards I used were unplanned (rough sawn). By early spring 2002 we had to rush to get the remaining logs out of the UM Forest before the soil unfroze, as the lumber was needed shortly afterwards. Initial loads of milled lumber were applied to indoor construction of boardwalk components starting in February 2002 (see **2002 major construction, Indoor work, early 2002**).

³⁷ I figured that using composite instead of hemlock lumber would have more than doubled the \$150,000 figure.

³⁸ Dr. Habib Dagher is founding Executive Director of the Advanced Structural & Composites Center at UM.

³⁹ Since 2007, I have not attempted to find the plots' permanent central markers (Fig. 12). I would guide a search for them if requested to do so, health and physical ability permitting.

⁴⁰ Upon completion of construction in June 2003, the construction account was changed to an operations account.

⁴¹ I wrote this booklet in 2002. It is still in print and distributed at the boardwalk. Only the last page has been changed to provide updated contact information.

⁴² The money pipe was destroyed by a thief with heavy duty tools and the contents stolen a few years later.

⁴³ Northeastern Log Homes. 2020. The Cozy Cabin I and II. <https://www.northeasternlog.com/plan/the-cozy-cabin-i-and-ii/>. Accessed 17 November 2020.

⁴⁴ Northern Log Homes was a different company from Northeastern Log Homes.

⁴⁵ These jigs greatly simplified, speeded, and maintained uniformity of the construction of 495 boardwalk sections at the boardwalk assembly site in the City Forest. We raised the jigs on sawhorses to ease their use. There were places to set the three precut longitudinal joists and the two precut end joists where they could be fastened together with spikes, and other places for subsequent placement and uniform spacing of the deck boards for nailing with nail guns atop the joists.

⁴⁶ The MCC team that worked on the boardwalk in November was provided with free short-term public housing by the City of Bangor.

⁴⁷ Although the MCC team had its own leaders who worked with them, I also worked with them as it was necessary to maintain quality control, keep up supply levels, answer questions, and deal with unanticipated problems.

⁴⁸ I didn't receive frequent reports of account balances from UM or OLT. To keep pace with the many flurries of purchases I kept my own account ledger to avoid overspending.

⁴⁹ We used 50 5-gallon drums of preservative to complete the process.

⁵⁰ Step boards continued to be used after boardwalk completion whenever stepping off the boardwalk to perform maintenance.

⁵¹ Leveling was fine-tuned later on multiple occasions in an effort to maintain the boardwalk within Americans for Disability Act and related state legislative and administrative standards, for example, within a 1% slope from side to side.

⁵² Over years of operation of the wooden boardwalk, these methods for leveling, controlling side-slip, and attaching sections to each other proved problematic. By 2012, when the composite and aluminum boardwalk to replace the deteriorating wooden one was being designed, we made changes that led to a great reduction of these problems.

⁵³ My 7-day work week became even more demanding instructing and supervising individual volunteers, many of whom had no prior experience carrying out the construction work I needed them to do, while in evenings keeping my peatland research program going at UM.

⁵⁴ I had been invited to give the "graduation address" to the 2002 statewide "class" of MCC workers which I did earlier in the fall.

⁵⁵ For budgetary reasons, I didn't retain the rental truck body for winter storage.

⁵⁶ pH is a measure of the water's acidity based on the activity/concentration of protons (hydrogen) in it. The lower the pH, the more protons and the more acidic. Northern peat moss/black spruce bogs are characteristically acidic (low pH). The conductance of the water is a measure of total ion activity/concentration based on its electrical conductance. The conductance of near-surface water in northern peat moss/black spruce bogs is characteristically very low because the water has very low amounts of dissolved, charged particles like ions of calcium, magnesium and potassium in it. However, close the bog's edge where some of the near-surface water comes from mineral soils of the adjacent upland, and from mineral deposits under the shallow peat, both the pH and conductance are higher than at the bog's central area.

⁵⁷ For a new printing of these signs in 2011, I made substitutions for some illustrations and added three more of my own photos.

⁵⁸ Edited by Jerry R. Longcore.

⁵⁹ I thought in 2002 that freezing/expansion of the peat in winter might break boardwalk sections if they were rigidly attached to each other and opted for loose connections between adjacent sections in the form of a chain on each side. This arrangement allowed a limited range of independent movement of each section along with ice formation/expansion and melting/contraction. The downside of this approach was greater instability of individual sections. Although frost movements occurred and necessitated the releveling of many sections each spring prior to boardwalk opening, frost action never seemed severe enough to cause breakage. Accordingly, in 2012 when replacement of wooden sections with composite/aluminum ones was being planned, we opted for the greater boardwalk stability of rigidly connected sections.

⁶⁰ Expansion of upper peat upon freezing in late fall, and contraction upon melting in spring moved many boardwalk sections off level. Each spring after melting, volunteers have leveled sections before boardwalk season began.

⁶¹ For the new boardwalk sections installed in 2013–2019, leveling is facilitated by an adjustable leg at the corner of each section.

⁶² In bogs, a lawn is a large (~> 5 m), near-flat hollow characterized by a carpet of peat moss and sparse growth dwarfed shrubs and sedges. See endnote 29 re. hummocks and hollows.

⁶³ The depth of the water level (table) under hummocks would be deeper, depending on the height of the hummock.

⁶⁴ Lee (my wife, and a frequent boardwalk volunteer) painted the scale on the float-pipe with her steady hand.

⁶⁵ Except for service dogs required by some visitors for medical reasons.

⁶⁶ I am not aware that major littering along the boardwalk has ever occurred; only occasionally did volunteers have to pick up single pieces of trash beside the boardwalk. Visitors also would pick up pieces of trash and deposit them in our trash bin.

⁶⁷ A few years after I retired as director, and after several instances of after-hours vandalism that damaged the boardwalk, we installed a trail camera that operated day and night to identify after-hours trespassers. In one case that I know of, Bangor Police were able to trace and bring the vandals to justice. Vandalism has decreased greatly since that occasion.

⁶⁸ In some years, we have closed earlier due to early heavy snow.

⁶⁹ Nighttime astronomy nature walks occasionally have been conducted on the boardwalk by special arrangement with the City of Bangor.

⁷⁰ During the 2003 and 2004 seasons, I assembled a corps of about 35 docents, about 15 of whom were “regulars,” and scheduled one’s attendance during the large majority of docent slots (typically 2 or 3 hours, each) between 9AM and closing time every day. This only would have been possible by building an esprit de corps in the group, as explained in the essay.

⁷¹ Only rarely did potentially dangerous situations arise as, for example, when a visitor attempted to openly carry a handgun onto the boardwalk. Firearms of any kind were illegal in the City Forest. Docents were warned to avoid interaction with such persons. For docents who did not carry their own mobile phones, as was common in the early boardwalk years, one was available at the cabin for use in emergencies.

⁷² Summer interns, half-time summer work-study students at University of Maine have been used for a variety of boardwalk operational tasks all but one summer since the boardwalk’s founding.

⁷³ These beams were under the main walls. The porch needed less support

⁷⁴ Phil Locke later built a railing on the cabin steps, constructed overhead shelves to increase storage space in the cabin, and built a partition separating the two sides of the outhouse.

⁷⁵ The BCF stayed open all year including the period of December through April when the boardwalk was closed. Although we built the outhouse because of the need created by the large number of visitors to the boardwalk, it was available all year for users of the BCF. However, it wasn’t possible for boardwalk volunteers to maintain it during the five months when the boardwalk was closed. Rather than lock it for the winter, as we did for the boardwalk, I negotiated an agreement with the Director of the Bangor Director of Parks and Recreation in which he agreed that his department would clean it and keep it supplied with toilet paper and hand sanitizer during the part of the year when the boardwalk was closed.