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Creating the Orono Bog Boardwalk: A Facility for Education, Research, and Recreation

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Creating the Orono Bog Boardwalk

A Facility for Education, Research,

and Recreation

by

Ronald B. Davis¹

It was a snowy and icy day at the middle of Orono Bog in late November 2002. Two teams of workers were in the final stages of extending the two arms of the boardwalk loop toward each other, one 8-ft (~2.4 m) section at a time. Excitement rose as the teams got closer. Finally, they met, and cheers rang out as the “golden spike” was driven. After nearly four months of labor putting 509 sections in place, we ended the 2002 construction season knowing that after finishing the final work in spring 2003 we would be ready to open the Orono Bog Boardwalk (OBB) to the public.

The OBB is a 4,200 ft (~1,280 m) long² by 4 ft (~1.2 m) wide and slightly raised boardwalk in a gently convex bog typical of central Maine (Figs. 1 and 2).³ At this writing in 2021, nineteen years have passed since the OBB first opened to the public.^{4,5} In this period it has received about 500,000 visits⁶ including many school and university classes, hosted several research projects, and become a major destination in the Bangor region of Maine for outdoor science education and nature-based recreation.

In 1998 I investigated the feasibility of building a bog boardwalk in the Bangor area of Maine. The inquiry indicated that the project would involve a diversity of challenging tasks, some of them requiring knowledge and skills that I had not yet acquired, but I pressed on. By mid-2000, I had

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chosen a site and route of access for the OBB and initiated practical measures for its construction.

Three years later, on the 23rd of June the gate was opened to the public.⁷

I estimate that 250 persons, most from the Bangor–Orono part of Maine, participated in the walkway's construction, mainly as on-site volunteers.⁸ Since the construction was completed, some of these persons and many others have participated as volunteers in boardwalk maintenance, operation, and education. Names of volunteers and donors are listed on one of the kiosks near the entrance to the boardwalk. That long list and this essay reveal that the creation and operation of the OBB has been a community effort (Fig. 3).

The OBB and its programs were created in seven phases, which together provide a framework for this essay. The phases were: (1) inspiration, conception, learning and planning, late 1950s to 2000; (2) pre-construction preparations, including the garnering of community support, establishing an administrative structure, fundraising, and permitting, 2000–2002; (3) major construction, 2002; (4) preparing interpretive materials, and more fundraising and recruitment of workers, winter and early spring 2002–2003; (5) completion of construction, spring 2003; (6) first two boardwalk seasons including establishment of rules, operational practices and programs, 2003 and 2004; and (7) construction of support facilities (cabin and outhouse), 2004. Information that I include here is derived from a weekly journal, from memory, and from documents referenced in the endnotes.

PHASE 1

Inspiration, conception, learning and planning, late 1950s to 2000

The fascination and love of bogs that I wanted to share with others began in a late 1950's summer when I was a seasonal 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. The bog wasn't visible from the road, and no trail led into it,⁹ but Paul knew exactly where to go. We walked through thick woods and shrubbery, finally emerging 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.¹⁰

A second memorable moment of the Big Heath excursion was when Paul bent over 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. I regularly used a kettle-hole bog on the side of an esker as an outdoor laboratory for my students.¹¹ To protect the bog from destruction, and to ensure its ongoing availability for education and research, I 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 Colby College.¹²

After moving to the University of Maine (UM) in 1970, at least once a year for the next 31 years I took my students to Orono Bog for field studies. In the late 1970s I began a 25-year research

program on the ecology of Maine's peatlands (bogs and fens) including Orono Bog. Unfortunately, our repeated visits to Orono Bog damaged the vegetation and the structure of the upper peat on the trail I had created (Fig. 4),¹³ to the extent that parts of the trail would no longer support foot traffic. Occasionally, a student would sink into the degraded peat and have to be pulled out. Over the years, the trail was widened as students and researchers sought firmer footing, increasing the damage. Through this experience, it became clear to me that a boardwalk would provide a better way to repeatedly visit a bog.

The 616-acre (~1 mi² or ~2.6 km²) Orono Bog was a perfect place to construct such a boardwalk because (1) it displayed the main features of a northern peat moss and black spruce bog,³ (2) it had been designated as a National Natural Landmark in 1974 by the National Park Service,¹⁴ (3) it was only a short drive from the UM and the center of the City of Bangor (CB), and (4) much of it was owned by the UM and bordered by other public land.

Preliminary learning and planning

Visiting wetland boardwalks to study design and construction details. Starting in 1998 I scheduled visits to boardwalks that had been built in inland and estuarine wetlands in eastern United States and southeastern Canada¹⁵ and whenever possible met with the builder, manager, or maintainer of the facility.¹⁶ Design and signage varied from one boardwalk to another 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, for example, in Everglades National Park, they

consisted of pilings driven to bedrock supporting 2–4 m wide walkways raised 1-2 meters above the wetland and bounded by strong waist-high railings.

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 that boardwalk admission be free,¹⁷ and anticipated that in addition to the general public, visitors would include clubs and institutional groups of many kinds. I also planned 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. I hoped that the building of an appreciative constituency would help to ensure the protection of these wonderful wetlands.

PHASE 2

Pre-construction preparations, 2000–2002

By fall of 2000, the Orono Bog Boardwalk Project (OBBP) was officially underway.

Building community support and participation. If a project of this kind was to succeed, community support was essential. I expected the project to be dependent on volunteers from nearby communities including Orono, Veazie, Bangor, and the UM to provide labor for construction, and to operate and maintain the boardwalk after it was built. As part of the effort to encourage community involvement and build support I gave slide talks about bogs and the OBBP. The first of these was at an annual meeting of the Orono Land Trust (OLT). OLT later became one of the three organizations

to construct and operate the boardwalk.¹⁸ 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 information tables at two to four area events per year including the annual Orono Festival. We sold T-shirts and other boardwalk memorabilia at such events to raise money for the project.

Not the least significant of these promotional efforts was the annual bird walk each May in the fields and forests surrounding Lee's and my house followed by a buffet brunch for 15 to 25 of our conservationist friends.¹⁹ During the OBBP years there was always some constructive discussion of the project at this event. We held other social events at the house, some of them specifically for boardwalk workers and potential donors. I also drafted promotional brochures and distributed them on many occasions.

An important step for involving the community was the establishment of a Steering Committee, later formalized in a Memorandum of Understanding (MoU; see below). The initial committee had a dozen members including community leaders with track records in conservation, outdoor natural area recreation and education, and natural area management—with representation from Bangor, Orono and the UM. I used the committee as a sounding board and sought members' ideas on a range of issues relating to planning and construction. The committee members would discuss boardwalk issues with their friends, helping to widen community support. An especially helpful and constructive member of the committee was avid conservationist Sally Jacobs (dec.). Because permission and permits would be needed for the project, I lobbied public officials and administrators from the two municipalities and the UM on whose land the OBB would be built.

Providing an institutional foundation: drafting and negotiating a Memorandum of

*Understanding (MoU).*²⁰ It was essential to include commitments in the MoU from organizations representing the boardwalk's main constituent communities to bear ongoing official responsibility for boardwalk construction, operation, maintenance, and fundraising. The MoU also needed 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 consideration by the three sponsoring organizations I had been lobbying for this purpose: the UM,²¹ the CB, and the OLT.²² The CB owned and maintained the City Forest including parking area and access trail to the boardwalk and the first 19 percent of the boardwalk's route (see *Selecting a boardwalk route and surveying it*, below). The 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.²³ The OLT represented the conservation interests of Orono and balanced the more wide-ranging interests of the other two organizations.²⁴ I was the fourth party to the agreement and served as Project Director until the completion of construction. After eight months of negotiations and meetings, and eight drafts of the MoU it was signed by the four parties in October 2001.²⁵

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-motorized²⁶ 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 organized into the pre-construction, construction, and post-construction phases of the project, each part detailing goals and responsibilities of the parties including modest one-time funding by the CB and the UM. An important commitment by the CB was the granting of a license to the UM for access to the boardwalk over city land.²⁷ 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. The CB was also to enlarge the parking area at the Tripp Drive entrance to the City Forest.²⁸

The Project Director position I held during the first two phases was a volunteer position but by early 2002 it occupied most of my time. 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.” The Project Director was to plan, administer, and supervise construction of

the boardwalk. During these two phases, the director would be advised by a Steering Committee and expected to seek its approval for major initiatives. This committee replaced the less formal Steering Committee set up earlier 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. The Boardwalk Director, a volunteer position, would be appointed by the UM.²⁹ 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 building the endowment by fundraising. The MoU specified that after the first two years of operation, meetings of the Management Committee must take place at least twice a year. 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 maintain its relevant parking area(s) and access trail(s) to the boardwalk according to Americans with Disabilities Act (ADA) specifications.

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 point, not only because the land was privately owned but also because the high-speed traffic over Stillwater Avenue would create a hazard for entry and exit to/from a parking lot.

Fortunately, public land bordering and including part of the bog was present nearby in the form of the Bangor City Forest (BCF). Access to BCF was available from Stillwater Avenue along Tripp Drive which dead ended at a parking lot in the BCF. This lot was less than a 5-mile (~8 km) drive from the Bangor, Orono, and UM population centers.

The BCF already contained a well-developed trail system with some trails beginning at the Tripp Drive parking lot. One of these trails, 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 that trail and extended out onto the bog. One of these boundary lines was only a 0.25-mile (~0.4 km) walk from the parking lot. 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) in Orono. That parcel boundary line provided an ideal route for the beginning of the boardwalk.

In early April 2001, a student assistant and I trudged out on snowshoes over the property line and beyond it to survey by tape and compass and mark a 4,100 ft (~1,250 m) boardwalk route. A week later, UM forester Alan Kimball and I resurveyed the route with GPS and re-marked it over 4,200 ft (~1,280 m). Thawing in the intervening week had caused enough meltwater to accumulate in the hollows between the snow-covered hummocks³⁰ of the forested stretches so we needed both hip boots and snowshoes.

Among my many positive interactions with CB officials was a meeting with James “Jim” Ring, 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. 2 and 5), the peat is 17 to 23 ft (~5 to 7 m) deep, and in most of that stretch the upper 3 ft (~0.9 m) of peat is soft and soggy (90–95% water by weight).³¹ 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 be prohibitively expensive and too damaging to install over most of the boardwalk route. The solution was to use dock floats to support the boardwalk and raise it above the wet surface over most unforested stretches and elsewhere where needed.

At the forested half of the OBB's route (Figs. 2 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 sections and keep them above seasonal high water. However, the first 190 ft (~58 m) of the bog's forested stretch, starting at the beginning of the boardwalk, was subject to considerable flooding, mostly in spring. There, we would need to use floats.^{32, 33}

Earlier visits to boardwalks at other locations showed that they could be built from preassembled sections, typically 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 to lengthen the walkway one section at a time.

Vegetation could be maintained under the boardwalk by leaving gaps between the deck boards for light penetration. Additional light would enter under the sides of the raised boardwalk.³⁴ The

lateral flow of water in the upper peat would be unimpeded by the boardwalk by placing dock floats and footings only at the ends of the raised sections.

A major decision regarding the new boardwalk was the type of material to use to build it. We considered strength and rigidity, durability and resistance to decay, workability, weight, appearance, and cost. Several of the other boardwalks I 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. Weight was an important factor because OBB boardwalk sections had to be moved and put in place by hand.³⁵ Moreover, the composite decking available at that time was viewed as incongruous amid the natural beauty of the bog. But the deciding factor that led us to reject composites was their much greater cost than wood and the improbability³⁶ that enough money could be raised to purchase the amount needed to build a 4,200 ft (~1,280 m) long boardwalk.³⁷

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 greater strength. I had calculated that 45,000 board-feet of lumber would be needed to build the boardwalk.³⁸ Hemlock trees ready to cut in the UM Forest would produce about 78 percent of the lumber needed and could be cut and trucked to a

sawmill by UM crews, although we 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, and the estimated cost of other supplies and tools, I projected a total cost of materials and rentals for building the boardwalk at \$150,000.³⁹ Adding paid services and labor raised the estimate to \$200,000. This estimate fell substantially short as the project developed.

My design for the OBB consisted of four types of structural units. The first and by far the most numerous were 8 ft (~2.4 m) long by 4 ft (~1.2 m) wide standard sections, each with “bump-railings” 4-inches (~10 cm) high at the sides to prevent wheelchairs from rolling off (Fig. 6).⁴⁰

The 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). To provide those spaces, we planned a second structural unit, a 2 ft wide side-section to expand the width of selected standard sections to 6 ft (~1.8 m) (Fig. 7).

The third type of 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). These units were 16 ft (~4.9 m) long and 10 ft (~3.0 m) wide and were expected to accommodate 8-12 persons. Each IS would have a 2 x 3 ft (~0.6 x 0.9 m) interpretive sign on one side (Figs. 8 and 9). Waist-high railings would be needed because without them members of guided groups listening to presentations might fall 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 unit was the insert, variable connector piece, or angle—each shaped like a piece of pie (Fig. 10). The size of the piece 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. Work on those permits began in April 2001 with a pre-application meeting of representatives of the Maine Department of Environmental Protection (DEP), the CB, the UM, and the OBBP Director. The DEP administered the Natural Resources Protection Act and took the lead on wetland permitting in Maine, but the US Army Corps of Engineers (USACE) would also have to approve the permit.⁴¹ Site plan approvals and building permits also were needed from the CB and Town of Orono (TO).

The DEP/USACE application was a substantial effort, occupying much of my professional time in January and February 2002. It required frequent liaison with engineers and administrative officials at the UM and the CB, the organizations on whose behalf I was preparing the application. A wetland delimitation survey in the vicinity of the boardwalk's beginning had to be included.⁴² Technical plan drawings of boardwalk sections and other units would be needed. Claude Junkins of Engineering Services at UM transformed my hand-drawn technical drawings into computer generated graphics (Figs. 6, 8, and 10). The graphics needed an engineer's stamp and signature for the DEP/USACE and site plan applications, so I took them to Habib Dagher⁴³ 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 for without modification after explaining the methods that Alan Kimball and I had used.

In early March 2002 I completed and submitted our application to the DEP/USACE. It contained 80 pages and two large-format drawings. I used much of the same content for the shorter and less complicated site plans for the Bangor and Orono Planning Boards. After addressing a set of questions from DEP/USACE, that application was approved on the 14th of May. Planning board hearings in Bangor and Orono to consider the site plans 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. He alleged that the proposed walkway would be hazardous for walkers, claiming that a horse 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 landowner withdrew his objection. I expected approval in May, but the May meeting was cancelled for lack of a quorum,⁴⁴ and our hearing postponed until the 19th of June.

The 19th of June was precariously close to the scheduled beginning of boardwalk construction by a Maine Conservations Corps (MCC) crew on the 26th of June. If modifications to the site plan were called for on the 19th, and approval further delayed a month or longer, the beginning of construction that summer might not be possible. At a hastily assembled meeting of the OBBP

Steering Committee, we decided to continue all preparations and keep all commitments for construction personnel on the assumption that our application would be approved on the 19th. The situation was further exacerbated by (1) the delay at the UM in approval of the \$8,000 in matching funds required for receipt of \$30,000 from the Maine State Trails Program for employment of the MCC crew and purchase of dock floats, and (2) the delay in completion of an access license agreement which would grant the UM permanent access over CB land to the part of the boardwalk on UM land. These two delays ended with approval and signing, respectively, on or about the 18th. And on the 19th of June the Orono Planning Board approved our site plan. On-site construction of the OBB commenced as planned.

Abandonment, plantings, and monitoring of the old trail. In the permit application to the DEP/USACE, we included the example given earlier in this essay of the damage to the bog by repeated use of the trail entering it from Stillwater Avenue (Fig. 4) and pointed out that permanently closing the trail and allowing it to recover would benefit the environment. We argued that shifting such visitation to a boardwalk would greatly reduce impacts on the bog, and that the minimal adverse effects of a boardwalk would be more than compensated by its educational and recreational benefits. 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).⁴⁵ Because we were required to monitor the recovery of the trail, in October 2002 I established six permanently marked quadrats along it, sampled them photographically

in 2002, 2003, and 2004 and sent an interim report to the DEP, and sampled them a final time in 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 marked the trail in season. This successional growth contrasted with the carpet of peat moss (*Sphagnum* spp.) and low shrub-heath vegetation that grew along the trail's route before it was established. 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 multiple decades or longer than a century for the trail to become indistinguishable from the surrounding bog. It would be enlightening to resume the monitoring of these quadrats.⁴⁶

Fundraising. I carried out solicitations for funding and prepared applications for funding on behalf of the three organizations that administered the boardwalk, all three of which served as grantees. For handling donations by individuals and foundations, in January 2002, we chose the University of Maine Foundation (UMF) as the boardwalk's fiscal agent. From that point until the boardwalk was almost completed, I mailed hundreds of individually addressed and signed fundraising letters, many of them personally annotated, along with colored brochures to potential donors.⁴⁷

Much of my time in 2002 was occupied by fundraising. On March 1st that year we received word that our application for \$30,000 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, 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 were to be 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.⁴⁸ We 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. For soliciting donations of equipment, supplies, and services for construction I used an in-person approach whenever possible. First, I had to convince owners or managers of companies that the boardwalk would enhance the community. For each contact, I had a request specific to the type of business, as in the following examples.

We were going to need two specially designed carts for transporting boardwalk sections from the assembly site to the end of the incomplete boardwalk (Fig. 13). I took my plans to H. E. Sargent Inc. in Stillwater where the manager agreed to make the carts and supply the angle iron. We supplied the plywood. Each cart needed two wheels with tires and these I solicited from Bennett Tire Company in Bangor.

We 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 we had to transport the 8 tons of boards from Biddeford to the assembly site at the BCF. I contacted Carlen Transport of Bangor and they generously offered to pick up and transport the boards free. There wasn't enough room for their 18-wheeler to turn around at the boardwalk assembly site or the Tripp Drive parking lot. Fortunately, American Concrete Industries provided a drop off place and transferred the load the final distance with one of their smaller trucks equipped with a hoist for loading and unloading. That generous company also transported IS units to the assembly site from Eastern Maine Community College where they were fabricated (see **Major construction, 2002**, *Indoor work, early 2002*), and later donated and delivered a concrete vault for the double outhouse we built in 2004 (see **Construction of cabin and outhouse, 2004**, *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 container where boardwalk visitors could deposit cash donations. In spring 2003, I took my plans for a lockable container made of 6-inch diameter iron pipe (Fig. 14) to Lane Systems and Supply in Brewer and they donated its fabrication. The heavy "money pipe" was installed that summer and by the end of the boardwalk season we had collected more than \$2,000.⁴⁹

A major supporter of the boardwalk was Tom Hanson, co-owner of Bangor Hardware. Construction of the boardwalk required several thousands of dollars of hardware including power tools. Thankfully, much of what we acquired at Bangor Hardware was at wholesale prices, and some of it *gratis*. Early in the 2002 construction season, we rented a pickup truck from the UM Motor Pool at considerable expense to transport the many large and/or heavy items we needed. We cancelled that

rental when Tom loaned us a pickup truck that we used until boardwalk construction was complete in 2003, boardwalk funds paying only for fuel and servicing.

After boardwalk construction and during the first 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 we would erect at the information area near the beginning of the boardwalk. In the cabin, we would store tools and supplies for maintenance and cleaning, stocks of memorabilia for sale, first aid supplies and a wheelchair, reference books on peatland flora and fauna, and other items. Also, the cabin would provide shelter for volunteers 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 unattended. In January 2004 I approached Jonathan French, owner of Northeastern Log Homes in Kenduskeag to ask for donation of a small log cabin. He graciously donated a kit for a “Cozy Cabin II” (retail price in 2003: \$7,700) that volunteers would erect in summer 2004.⁵⁰

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. By chance, early in 2004 at the boardwalk I met a visitor named Al Larson who worked at Northern Log Homes⁵¹ and asked if the company would donate a kit for a double-stall outhouse, one side of which would be ADA compliant. Al was quite enthusiastic about the boardwalk and arranged for the company to make the donation.

The nine companies and their owners/managers in the above examples illustrate the important role of the commercial establishment in facilitating the construction of the OBB.

Recruiting construction workers. Early in 2002 I arranged for Maine Conservation Corps (MCC) teams to work for 12 weeks in summer on mass production of boardwalk sections and installation of them in the bog. Additional workers came in the fall from the Charleston Correctional Facility, a minimum-security prison about 25 miles (~40 km) from Orono. The prison provided a group of inmates with carpentry and construction experience.

Additionally, over the summer and fall I recruited numerous volunteers from the greater Bangor area including students from high schools, colleges, and universities. Community interest in the project led to several interviews in the local media where I announced the need for volunteers. During construction, several persons became regular volunteers including Jim Bird, Lee Davis, Jerry Ellis, Jay Johnson (dec.), Jerry Longcore, Joan Martin (dec.), Mara Miller, John Pickering and Wendall Tremblay (dec.), to name the most frequent few.

PHASE 3

Major construction, 2002

We got a head start in winter 2002 by building boardwalk components indoors. Outdoor operations began in May at the assembly site in the BCF, but mass production of boardwalk sections there and their installation in the bog didn't begin until summer after we had acquired permits. From early summer until late November, we produced 495 standard boardwalk sections and, along with the 14 produced in winter placed them along the 4,200 ft (~1,280 m) route in the bog. Through the 2002–2003 winter, work continued off-site, and construction was completed in spring 2003.

Indoor work, early 2002. Work outside the bog didn't require permits, so in February I arranged for 5,000 board-feet of hemlock lumber and hardware to be delivered to Eastern Maine

Community College in Bangor where the shop teacher Lester Stackpole guided his students in the construction of components D, E, and F and railings of the seven ISs (Fig. 8).⁵² When they finished, American Concrete Industries donated a flatbed truck with driver to deliver the components to the boardwalk assembly site.

At Orono High School, the first of two 4 x 8 ft (~1.2 x 2.4 m) jigs were fabricated under shop teacher Lawrence (“Larry”) Berthiaume’s guidance. I had designed the jigs to maintain uniformity and speed construction of the standard boardwalk sections (Figs. 6, 15, and 17). The second jig and seven boardwalk sections were built at United Technology Center under shop teacher David Stevens’ guidance.

Last minute preparations and planning, late spring 2002. In late May we precisely marked with stakes at frequent intervals the boardwalk position along the route we had flagged in 2001. In early June the CB finished enlarging the parking lot at the end of Tripp Drive to accommodate an additional 20 cars of boardwalk visitors, and completed the clearing, leveling and graveling of a 75 x 75 ft (23 x 23 m) boardwalk assembly site. Shortly afterward, we set 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 delivered power equipment including a gasoline-fueled generator, power saws, air compressor and nail guns to the 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 bringing the total to 45,000 bd-ft. Also, we constructed a 9-ft long fiberglass-lined wooden “bathtub” for dipping each of the many thousands of pieces of cut lumber (e.g., ~10,500 deck boards) in wood-preservative (Fig. 16).

Secure storage space was needed for our equipment for periods when we were not at the assembly site. For this purpose, we rented a trailer truck body that could be locked and arranged for it to be set up 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. It was our responsibility to provide a place for them to camp or stay indoors. We rented a large group-campsite at Villa Vaughn Campground on the shore of Pushaw Lake in Orono, providing a great place for a cooling swim after a hot and dirty workday building the boardwalk.⁵³

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.⁵⁴ 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) very important to me, protection of the sensitive bog surface from disturbance outside the 4-ft wide boardwalk footprint, so the bog vegetation adjacent to the boardwalk would appear undisturbed.

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, setting up their campsite and cooking their dinner and 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 the next morning for their first day of work at the boardwalk assembly site.

Each day's work began at 8:00 AM by forming a circle for group exercise, stretching, and meditation followed by questions/answers/discussion. I always joined the circle.⁵⁵ MCC teams worked eight 10-hr days straight, Wednesday through Wednesday, and then had 6 days off, freeing several days for me to work on other aspects of the project including approving invoices and submitting them for payment.⁵⁶ 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. These types of interactions helped to motivate the workers.

Our two major goals were to construct as many as possible of the standard 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.⁵⁷ We also cut composite boards into the thousands of pieces needed for footings and footing-shims.

We supported the two section-jigs on sawhorses at a comfortable height so the outer and central longitudinal joists easily could be placed in the jig. The end joists were attached by driving in spikes with small sledgehammers (Fig. 15). Then, 21 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 bump-railing riser

blocks were nail-gunned atop the ends of the deck boards and a bump-railing nailed atop of them (Figs. 6 and 17).⁵⁸

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. A turnaround was big enough to also accommodate a small bench (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 (~244 m) 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 additional 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 peat moss 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 feet (~1,280 m) of path clearing and leveling and started placing sections in the bog. But we had assembled only 106 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 and other components (e.g., dock floats) at the assembly site (Fig. 18) was running low, so more workers were shifted to installing sections in the bog.

The estimated weight of each completed boardwalk section while the wood was still wet was 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). Each cart had a pair of wheels positioned so the weight of a boardwalk section would balance over them. Lifting the handles and pushing a cart with a boardwalk section on it was easy for one person (Figs. 13 and 19). Upon reaching the end of the incomplete boardwalk, the cart pusher raised the handles 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).

At the end of the incomplete boardwalk, an installation team of two or three workers was ready to receive and attach each new section, having already put footings or dock floats in place (Figs. 19–21).⁵⁹ With two carts we could keep the section installation process moving at a good pace.⁶⁰ 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 were used to spread out each worker's weight on the bog surface.⁶¹

During installation, I often worked several section-lengths ahead of the placement team marking positions of each section's corners⁶² and putting the finishing touches on preparations of the surface for footings or floats. I tried to work my way far enough ahead of the 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.

In follow-up passes along the emplaced boardwalk, workers tied sections to the outer edges of the footings or floats to minimize side-slippage, and leveled them.^{63,64} After the 800 ft (~244 m) straightaway was completed, two installation teams were used to extend 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, and we became 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. The goal was to have all sections built and installed before winter.

The Charleston crew worked for two weeks in mid-October. I established goals and was on hand to answer questions as I worked along with the inmates. 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. 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 enveloped the region, some mornings about 20° F (~ -7° C), two inches (~5 cm) of wet snow fell, collapsing our main tarp, and fingers were getting numb. Despite the cold weather, by the 7th of November we built the final boardwalk section. Weather then warmed to temperatures more typical of mid-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 in 2002 looked grim, but the MCC came to the rescue!

Apparently, the MCC was impressed by the OBB project and the experience it provided to its teams,⁶⁵ and offered to assign its 18 team leaders to work at the boardwalk free for the final week (17th–23rd November) of their 2002 season. Because it was too late in the season for camping, I contacted the CB 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 leaders.⁶⁶

The group split into two teams to simultaneously extend both ends of the incomplete boardwalk loop in the open bog. At the start, the teams peered across a ~400 ft (~122 m) gap at each other. As the week progressed, they slowly approached, section by section, as excitement mounted. Finally, at 2:00 PM on the 22nd of November, a snowy and icy day, the two teams touched hands and a cheer rang out that seemed to warm the frigid air. Only about a 1-ft (~0.3 m) gap was left between the two ends that would be easy to bridge next spring (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 each other's company in a private dining room.

Two more workdays by volunteers wrapped up the operation for the winter. We took down the tarps, collected all remaining equipment, tools, and supplies, transported them to my garage for winter storage,⁶⁷ and cleaned up the assembly site. By Sunday afternoon, the 24th of November, field activities ceased for the winter.

More than 10,500 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. Although most of the construction was complete, much remained to do before the OBB could be opened to the public—but it would have to wait until spring of 2003.

Fiscal condition and cost of boardwalk by the end of 2002. By December, our fiscal situation approached insolvency. At one point we were \$7000 in debt. We had spent about \$175,000 for materials and supplies, power and hand tools, professional services, sawmill fees, truck and porta-potty rentals, and paid labor (MCC only). The true end-of-year cost was higher when the value of donated materials and professional services were included, bringing the total to about \$200,000, and still higher when the value of the large amounts of volunteer and other donated labor (e.g., Charleston Correctional Facility crews) was added,⁶⁸ bringing the estimated end-of-year cost of the OBB to about \$240,000, not counting the monetary value of my time. See phase 7 section for total cost of construction.

PHASE 4

Behind the scenes, winter, and early spring 2002–2003

Three aspects of the project were addressed during this period: (1) fundraising, (2) preparing interpretive materials, and (3) recruiting workers to complete construction.

Fundraising. Fundraising activities included the preparation and chairing of frequent meetings of our Fundraising Subcommittee, giving presentations to local organizations, arranging for tables and their staffing at local events,⁶⁹ granting interviews to magazines and broadcast media,⁷⁰ preparing a new fundraising brochure, soliciting potential donors, and applying for grants. An

example of a successful grant proposal was the one to the Maine Recreational Trails Program to fund a MCC crew for three weeks in spring 2003.

Interpretive signs, guide booklet, website, and brochure. A 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 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 (Fig. 5), and sign content was to reflect those special characteristics. Each of these signs would have a descriptive natural history text and eight illustrations. The 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 at the IS,⁷¹ 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 illustrations, except for seven photos of my own, had been previously published in field guidebooks and other places, so before using them I obtained publisher permissions and the digital files. The credits for these illustrations are in Figure 3.⁷²

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 UM Research Associate Dennis Anderson and I probed the peat and a short distance 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 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) was prepared by me and Alan J. Kimball from vertical and large-scale false-color infrared aerial photos in early 2003. I used scaled-down versions of it 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.

After preparing mockups of the signs, I took them along with digital files of the edited texts⁷³ and final illustrations to my UM colleague, Ann Dieffenbacher-Krall who was skilled at CoreDRAW (CDR), a graphics and layout program, for preparation of the final eight composite files. On 27th of May, I sent the final 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. We purchased high quality display mountings from the same company. When I received the proofs on the 13th of June, I quickly checked them and sent them back, but by then it was certain that we would not have the final signs and display mountings in time for installation prior to the scheduled opening of the boardwalk to the public on 23rd of June.

The National Park Service grant that covered the interpretive signs and mountings also paid for the production and initial printings of a 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. 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/>.

A free informational brochure about the boardwalk that visitors could take with them also was needed. In spring 2003 I wrote one for inexpensive three-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.

PHASE 5

Completion of construction, spring 2003

In spring 2003, we began work on a boardwalk that was already in place. We could easily walk around it, but it wasn't yet ready and safe for the public and needed a lot of work. The Charleston crew started work on the 12th of May and in five days completed all 43 of the benches for the wheelchair turnarounds and ISs. In the next two weeks, community volunteers re-leveled boardwalk sections to ADA standards because many of them had been shifted by frost action. The volunteers also tightened side restraints and chains.^{74,75} When the MCC crew started on the 28th of May, I gave

them a range of assignments.⁷⁶ As in 2002, I worked along with MCC crew members. Lee and I entertained the crew at a barbeque at our home on the 4th of June.

Role of social interactions and events in maintaining esprit de corps. The last-mentioned social event was one of many that Lee and I hosted for boardwalk workers including 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 (see *Five boardwalk programs, 2. Docents, openers, and closers*), 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 materials to build it. The city excavated the holes for the large posts on each side of the kiosk and Jerry Ellis played the 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; on the side facing persons exiting the boardwalk, we displayed the credits poster listing 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 again, but this time at the information area at the beginning of the boardwalk. In spring 2002 the CB transported a ~3 ft (~0.9 m) wide boulder with a relatively flat side to the boardwalk information area and anchored it in the ground so the flat side faced walkers

approaching the boardwalk. Then Ed Guernsey (of Guernsey Monuments) mounted the brass plaque on the boulder where it 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 would occupy too much space in someone's garage. I started searching for a free storage area and learned that space was available in one of the large hangers that was part of the old Dow Airforce Base where Bangor International Airport is now located. We obtained permission from Tony Caruso of the airport authority to use that space.

PHASE 6

Opening, and the first two boardwalk seasons, 2003 and 2004

23rd of June 2003 opening of the OBB. The initial opening of the OBB lacked fanfare, consisting only of unlocking and opening the gate, but the turnout was immediate and in large numbers. Because the interpretive signs were such an important part of the boardwalk, we put off a gala opening until later in summer after the signs had been installed.

Interpretive signs, water level indicator, and gala opening. By early July I had completed a 600-name invitation list to the gala opening but put off printing and mailing 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 scheduled the event for the 2nd of August, and UM printed and mailed the invitations. The signs and mountings arrived on the 24th of July, and we completed installation two days later.

I installed a water level indicator (Fig. 26) at the open bog so visitors could learn how close the water surface was below their feet. Except for a few small transient pools visible from the boardwalk in

spring, the water surface (table) was invisible. 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.⁷⁷ Observations I had made of water levels at lawns and hollows at this part of the bog over 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 to the surface in spring and falling over the summer.⁷⁸

I designed the water level indicator and installed it at the moss lawn adjacent to IS6, as follows. After removing a 5 ft (~1.5 m) deep and 3-inch (~7.6 cm) diameter core of peat I cased the hole with an 8 ft (~2.4 m) length of 3-inch plastic pipe (casing), leaving 3-ft (~0.9 m) of pipe above the surface. The water level in the casing should be the same as in the surrounding peat, but to assure equilibration, before installing the pipe I drilled a series of small holes along the part that was to be under the peat surface. Then I inserted a float-pipe made from an 8 ft (~2.4 m) length of 2-inch (~5 cm) diameter plastic pipe sealed at both ends. When inside the casing, the float-pipe rises and falls along with changes of water level in the peat. We had marked the float-pipe with an easily readable scale in inches (2.54 cm increments), so it would indicate 0-depth when the water level was at the peat surface.⁷⁹ The reading on the float-pipe scale where it intersects the top of the casing pipe indicates the distance in inches to the water surface below the peat surface (Fig. 26). With the educational installations completed we were ready for the gala opening.

Because of an uncertain weather forecast for the 2nd of August, I visited General Rental in Old Town to rent party tents. After I explained what the occasion was, they gave us a big discount on the rental, delivery, and setup of three large and colorful tents plus tables and chairs at the assembly site.

The celebration was attended by about 100 persons. Lots of liquid and solid refreshments, many of them donated by volunteers, were consumed. Short speeches were given, music was performed by a string trio, and a ribbon was cut at the boardwalk gate (Fig. 27). After the ribbon cutting, attendees were guided on tours of the new boardwalk.

Establishing boardwalk rules, season, and hours. The Management Committee established a set of rules that we posted on a sign near the beginning of the boardwalk (Fig. 28). 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 banned⁸⁰ for three reasons. First, some visitors 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 flammable. 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, but small baby carriages/strollers and wheelchairs were

allowed. We provided a trashcan at the beginning of the boardwalk to help minimize littering along the boardwalk.⁸¹

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. 29). Although it has been possible for agile persons to climb around or over the gate, our observations suggest that very few persons do so.⁸² 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.⁸³ That date allowed a final visit to the boardwalk during the traditional family holiday weekend.

Our decision to close the boardwalk for the winter was based on the desire to protect it and the bog. Because skiing was a major activity along BCF trails including the one 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 could damage the decking. Furthermore, the boardwalk provided easy access to the open bog where skiers might wander off the boardwalk and damage the bog's low vegetation when snow depths were insufficient to protect the plants. Finally, monitoring public use of the boardwalk in winter would exceed the capacity of our volunteer programs.⁸⁴

We decided to open the boardwalk daily in season, although from the start in 2003 occasional closures ranging from hours (e.g., during electrical storms) to days (e.g., when repairing damage) were

needed. 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 to fit into the waning daylight period over the fall. Nighttime access has not been legally permissible as the BCF is closed after dark.⁸⁵ Even without that stricture, however, we would not have kept the boardwalk open at night for reasons of security and safety.

Registration by visitors. For publicity, fundraising, and management purposes, we began to build a database on boardwalk visitation. During the 2004 season, we used registration cards to collect data. I posted a notice on the kiosk requesting each person or party to fill out a card before entering the boardwalk. A large majority of persons and parties filled out cards, some only after the urging of docents (see below, *Five boardwalk programs, 2. Docents, openers, and closers*). 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 entering the information into a computer database. The total number of persons-visits tallied from the cards was ~21,000 but this total was lower than the actual number. A more realistic estimate would be 25,000 person-visits. The 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, there were visitors 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 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, openers, and closers; (3) student summer interns; (4) guided tours; and (5) specialized nature walks.⁸⁶ The programs have been run by volunteers, other than summer student interns who have been paid. As these programs continued, it became clear that it was too much of a workload for the director to supervise 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. 30). He recruited loyal helpers and led the maintenance program 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 responded to calls from docents (see below) and others who discovered places in need of repair.

2. Docents, openers, and closers. My objective was to place a volunteer (or student intern, see below) at the boardwalk for as many hours a day as possible, especially at the busiest times of day. I called these volunteers "docents."⁸⁷ 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 term’s meaning.

An important docent responsibility was to answer questions about the facility and the bog. Questions were most frequently asked by visitors exiting the boardwalk. The introductory sign and guide booklet could be used as “visual aids” for this purpose. Visitor 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.

The first docent in attendance, typically starting around mid-forenoon, unlocked the cabin and put on display the various handouts and items for sale. 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 carried our boardwalk closing procedure: close the gate, walk the boardwalk to confirm that all visitors have exited, and lock the gate.

Docents performed a range of additional duties. Depending on their personality some docents felt comfortable in offering a friendly welcome to visitors, and freely chatting with them. Docents also explained the rules to unruly visitors, but only in a gentle manner given the docent’s vulnerability at the isolated boardwalk.⁸⁸ Docents sold memorabilia and kept a sales inventory. When visitors with limited physical ability underestimated the length of the walk, or walking became too painful, a docent might loan the folding wheelchair we stored in the cabin if a “pusher” was available to transport the ailing visitor to her/his car and return the wheelchair.

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.

Some volunteers did the early morning unlocking and 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. These volunteers were called “openers.” When the last docent slot of the day could not be filled, a volunteer was recruited to carry out the boardwalk closing procedure. Such volunteers were called “closers.”

During my two seasons as director, I held training sessions at the boardwalk for docents on two 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. Supervising the program, including the scheduling of docents was challenging and time consuming. In 2004 I was happy to welcome Donne Sinderson to share the leadership of this program.

3. Student summer intern. Each summer we hired a UM 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.⁸⁹

4. Guided tours. In summer 2003 we began receiving requests for guided tours on the boardwalk. Inquiries were received from schools at various levels, senior citizen organizations, clubs (e.g., garden) and other groups. I canvassed our volunteers for interest in becoming guides and

received positive replies from several of them, mostly docents. All had an interest in field natural history but their prior training and depth of knowledge specific to peatlands varied widely. I held training sessions for guides, and we started supplying guides for groups requesting 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 many 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 identified and discussed. The guided tours program was extremely popular from the outset (Figs. 31 and 32).

We limited the size of guided groups and specialized nature walks (see below), typically to 10–12 persons per guide, however, we always tried to accommodate larger groups by splitting them into guided sub-groups. We limited group size because it wasn’t possible on the narrow boardwalk for a guide to gather a larger group closely around her/him so everyone could see what was being discussed. Also, almost all 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 have been 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 started offering nature

walks on specialized topics led by experts. We advertised these on our website, on posters at the boardwalk, and in the media. Because space was limited, advance registration was required. Among the many topics we covered in 2003 and 2004 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 in the bog, including fungi, vascular plants, breeding birds, mosses and liverworts, lichens, and insects. Our nighttime astronomy walk was also popular.⁸⁵ During the 2003–4 winter, we held two special nature walks (on snowshoes) on winter ecology of the bog. Judy Markowsky, founding director of the Fields Pond Audubon Center co-led the specialized nature walks 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. 33). Yearly earnings have ranged from \$2,000 to \$7,000.

PHASE 7

Construction of cabin and outhouse, 2004

The cabin raising. I asked Jerry Ellis, Director of the UM Onward Program, who had a range of construction experience, to be construction crew foreman for the volunteer crew we recruited. The Northeastern Log Homes (NELH) "Cozy Cabin II" log cabin kit had arrived at the assembly site in mid-June 2004.⁵⁰ 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 asked NELH for modification of the porch so we could screen it in. The kit contained essentially everything we needed except tools, concrete footing pads, long 6 x 6-inch (15

x 15 cm) pressure-treated foundation beams, entry steps, screens and screen door for the porch, and hardwood flooring.

Prior to assembly of the cabin, the CB built up a well-drained gravel base for it. This base was level under the cabin but sloped away from it along roof drip lines. Under the sloping gravel, we placed heavy duty, 5-ft-wide sheets of rubber dam to conduct water away and keep the gravel dry under and alongside the cabin, thereby minimizing ground frost and associated movement of the cabin. Next, we positioned the round footing pads and placed the foundation beams on them. The beams extended the length and width of the cabin to provide a foundation for the heavy log walls.⁹⁰ By mid-July, we had installed the floor joists, plywood (cabin) and decking (porch) floors and had begun log wall construction. The word had gotten around, and the initial volunteer crew was joined by others. Like the boardwalk, itself, the raising of the log cabin was a community effort (Fig. 34). A group from the Orono Church of Universal Fellowship including family members and friends of the builders brought food and drink for us (Fig. 35) so we could keep building with little interruption.

We installed 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 shingled the roof. We purchased and installed custom-made screens and a screened door for the porch (Fig. 36), then we purchased and installed hardwood flooring.

To prevent winter ice formation from condensation on the floor, in October I crawled under the floor to insulate it. Because the porch would be the place a docent would spend much time when on duty, and because 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, installed wood and metal vices on it, and mounted 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, we ordered custom-made steel grills for the windows and door lite and bolted them in place to add security. We added 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 of valuables including money from the donation pipe and sales. I bolted the large, heavy chest through the thick log wall to make it difficult to steal.

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 Locke stepped forward, again, to apply his carpentry skills. In addition to the reading/writing shelf, he installed railing for the porch steps, constructed overhead shelves in the cabin to increase storage space, and built a partition separating the two sides of the outhouse.

The outhouse raising. We didn't start constructing the double (two-stalled/two-doored) outhouse until September 2004 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 that American Concrete Industries donated, trucked in,

lowered into the hole, and leveled. When the kit arrived, a small group of volunteers put it together, some of whom had worked on the cabin, including Jerry Ellis who shingled the outhouse roof, and Mara Miller who 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 two weeks of the 2004 boardwalk season (Figs. 37 and 38).⁹¹

Total cost of establishment of boardwalk and ancillary structures

The final cost of boardwalk construction including interpretive components, purchase costs and market value of donated materials and services, and paid labor was about \$250,000. Adding the value of volunteer labor at \$18/person-hour brings the total to about \$310,000.⁹²

Final tasks, retirement of director, and new 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 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 Boardwalk Director at the end of the year, and the committee decided to ask John Daigle, Leader of the Parks, Recreation, and Tourism Program at the School of Forest Resources at UM to be the new director. The position is demanding, time-consuming, and without salary, and John agreed to do it after I offered to help him mobilize the volunteers that he would need.

SUMMARY

This essay indicates that many individuals as well as businesses and other organizations contributed ideas, time, labor, skills, funding, and materials to the creation of the Orono Bog Boardwalk. The OBB continues today as a collaborative effort of the University of Maine, the City of Bangor, the Orono Land Trust, and many volunteers— truly a community effort.

The most challenging part of this seven-phase endeavor was phase 2 before construction. Much needed to be done, including but not limited to (1) marshaling community support; (2) engaging the three organizations that would have formal responsibility for constructing and administering the boardwalk, and drafting and negotiating an agreement between them; (3) engineering and drafting plans; (4) writing applications for permits from local, state, and federal authorities; (5) fundraising and soliciting free building materials and professional services; (6) choosing and surveying the boardwalk route; (7) engaging groups and individual volunteers to build the facility; and (8) setting up an endowment whose earnings would be available for ongoing maintenance and operation.

The boardwalk was built from 10,500 deck boards, 1500 supporting joists, 1000 end joists, 4000 bump-railing riser blocks, and 1000 bump-railings. These components were cut from rough-sawn hemlock lumber, treated with preservative, and assembled into 509 8-ft (2.44 m) long boardwalk sections, seven interpretive stations, 15 wheelchair turnarounds, and numerous angle inserts for boardwalk turns. The assembled units were placed in the bog along a pre-surveyed and marked route that had been cleared of woody plants, while care was taken not to disturb the bog outside the boardwalk's footprint.

Educational signage was designed and installed at the interpretive stations and boardwalk's beginning. Rules were established to protect the natural character of the bog, the boardwalk, and the safety of visitors, as well as to maintain an atmosphere conducive to the quiet contemplation of nature. Five programs were established: (1) maintenance, (2) docent attendance, (3) student summer intern, (4) guided tours, and (5) specialized nature walks. At this writing in 2021, these programs have been in operation for nearly two decades.

From the beginning, this effort was much more than what I cover in this summary. In leading this largely volunteer undertaking, I learned that in addition to organizing and executing logistics, my most important role was to motivate participants and contributors. When hosting social and educational gatherings and during many hours of working side-by-side with volunteers, MCC members, and prison inmates I never contained my enthusiasm. Apparently, it was contagious.

This story has been about the creation of a popular educational and nature-based recreational facility. It is free to the public as well as to institutional groups including schools and universities, and it offers programs that further the understanding of bogs, other wetlands, and the natural world in general. For many first-time visitors, a walk on the OBB is like the exciting experience I had in the late 1950s when Paul Favour guided me into the Big Heath, when I felt I had entered a wondrous new universe. It is my hope that the experience of visiting the OBB sparks an interest in nature, especially among young visitors, and builds support for the conservation of natural areas. May the OBB continue to serve the public in its many ways long into the future.

ACKNOWLEDGEMENTS

I am deeply appreciative of the many individuals and organizations that played important roles in the creation of the OBB and its programs, many of whom are named in this essay. Numerous additional persons volunteered their time, talents, and financial support to the undertaking. The approximately 500,000 visitors who have so far enjoyed the boardwalk and its programs free of charge owe their gratitude to those generous persons and organizations.

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.

I thank Jerry Longcore, Jim Bird, Bob Klose, Lee Davis, Coralynn Davis and the four anonymous MAFES referees for reviewing parts or all of the manuscript and for their editorial and substantive suggestions, most of which are incorporated in the essay. I regret that we were unable to locate Joni Dunn for permission to use her photograph (Fig. 27). Sarah McPartland-Good of the University of Maine Foundation checked the boardwalk account records to confirm some of the facts contained here. I am profoundly grateful to my wife, Lee, for her loving support throughout the boardwalk project.

Figures



Fig. 1. 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.

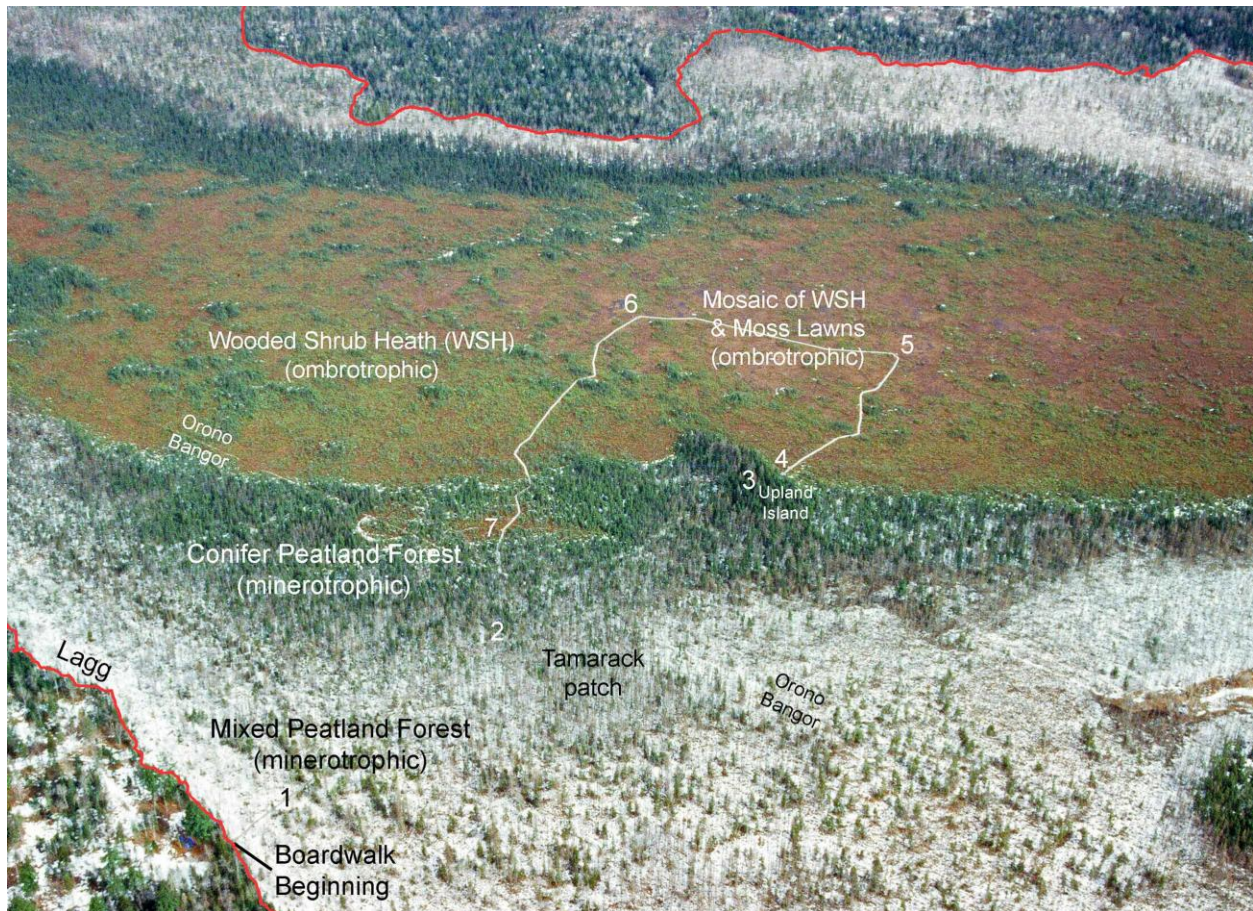


Fig. 2. Aerial photo looking north over the central part of Orono Bog showing the Orono Bog Boardwalk. The red line indicates the limit of the bog (wetland boundary). Vegetation types are labeled using terminology superseding those used on boardwalk interpretive signs (compare to Figs. 23 and 24). The boardwalk appears as a white line over the darker vegetation types, but as an inconspicuous fine gray line at the largely white (snow) 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 the oblique nature of this 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.

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Italic numerals indicate boardwalk sections sponsored

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Bird Paintings: H. Douglas Pratt, except for sparrow (Diane Pierce) and northern horner (Kent Fredrickson), National Geographic Society
Frog Paintings: Leland Hunt Covert, Houghton Mifflin Company
Mammal Paintings: Nancy Holliday (squirrel above, Ross Kluge; snowshoe hare and meadow jumping mouse, Todd Zelenak; southern red-backed vole and meadow vole, Princeton University Press)

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Ronald Davis

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Bill Glanz	Ginny Whitaker, Westminster
Mike Greenwood	Gail White
Tom Hanson	Jim White



bog rosemary
(*Andromeda polifolia* var. *glaucophylla*)

ADMINISTRATION

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John J. Dagle

MANAGEMENT COMMITTEE
Dana Washbush, City of Bangor
Jerry Longcore, Orono Land Trust
Jim Bird, University of Maine
John J. Dagle, Director

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(management, maintenance, operation, education and fundraising)

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Ronald Davis	Judy Markowsky
Joel Davis	Maia Miller
Phil Locke	Wendell Tremblay

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Anker Curt (A) - 2004
Collette Ineson (I) - 2006
David McLaughlin (I) - 2004
Emily Michael (I) - 2005
Melinda Moseley (I) - 2003
Rachel Poman (I) - 2005



northern leopard frog
(*Rana pipiens*)



Lincoln's sparrow
(*Melospiza lincolni*)

Fig. 3. A draft copy of the 2006 credits poster with graphics that hadn't yet been completed. Zoom in to read. Poster prepared by Ronald B. Davis, Jerry R. Longcore, and others.



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

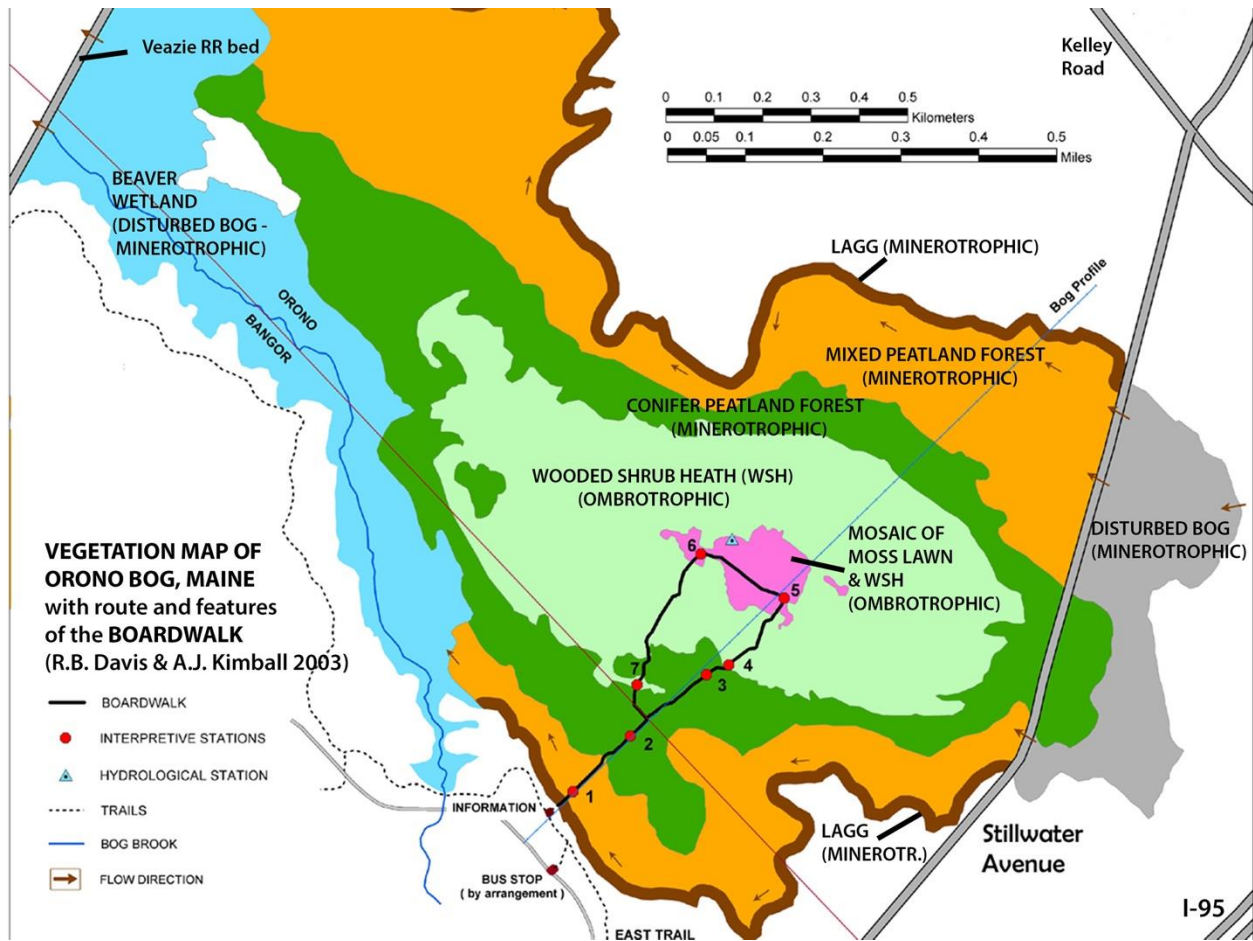


Fig. 5. Vegetation map of Orono Bog with vegetation terminology superseding that used on boardwalk interpretive signs (e.g., Figs. 23 and 24) and showing the Orono Bog Boardwalk and position of the bog profile that appears in Figure 24. The numbered red dots along the boardwalk indicate the interpretive stations. The constant width of the lagg is a rough average, as its width variation could not be distinguished on aerial photos. Compare this map to the oblique aerial color photo in Figure 2. Map prepared from vertical large-scale false-color infrared aerial photos by Ronald B. Davis and Alan J. Kimball in early 2003.

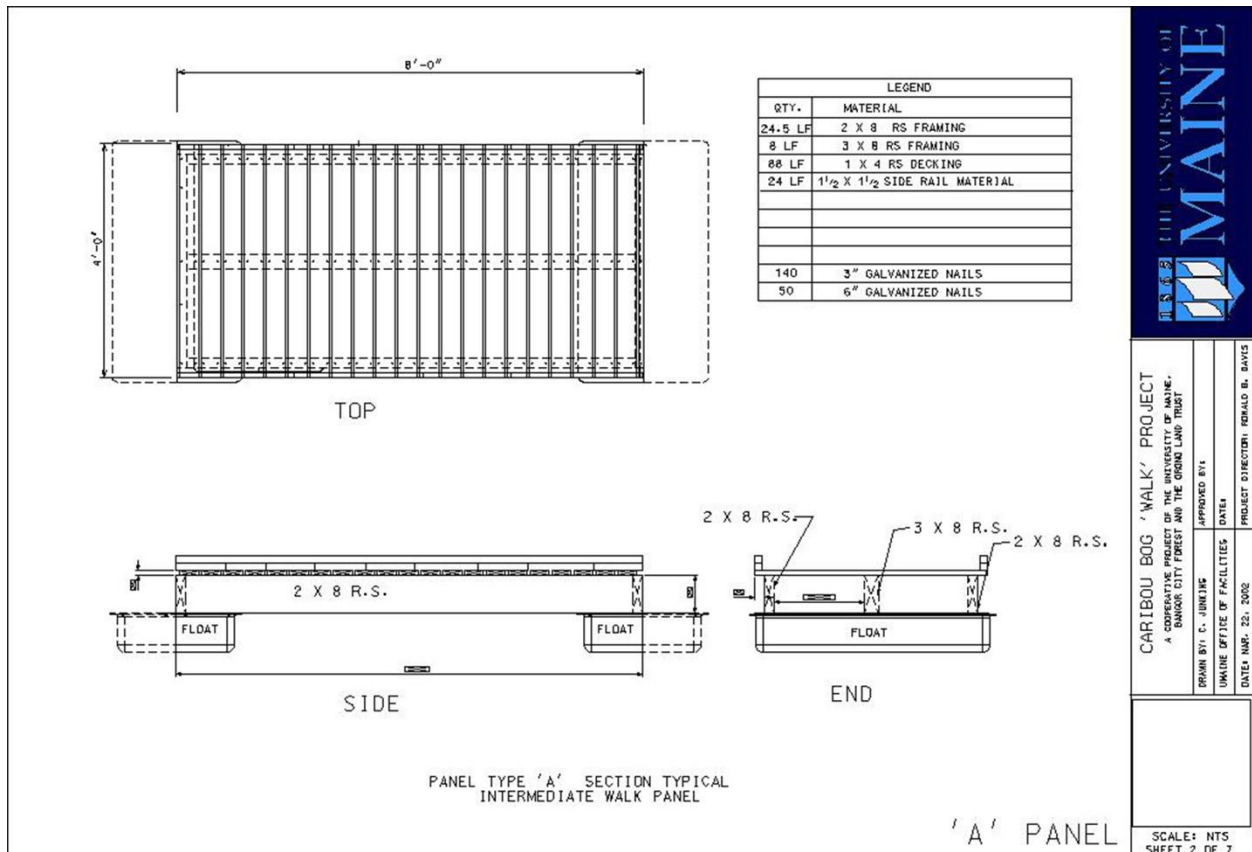


Fig. 6. Digital technical plan drawings of a standard, 8 ft (2.44 m) long OBB section on floats by Claude A. Junkins of UM Engineering Support Services, based on by-hand technical plan drawings by Ronald B. Davis. When standard sections on floats abut one another, each section occupies only half a float.



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.

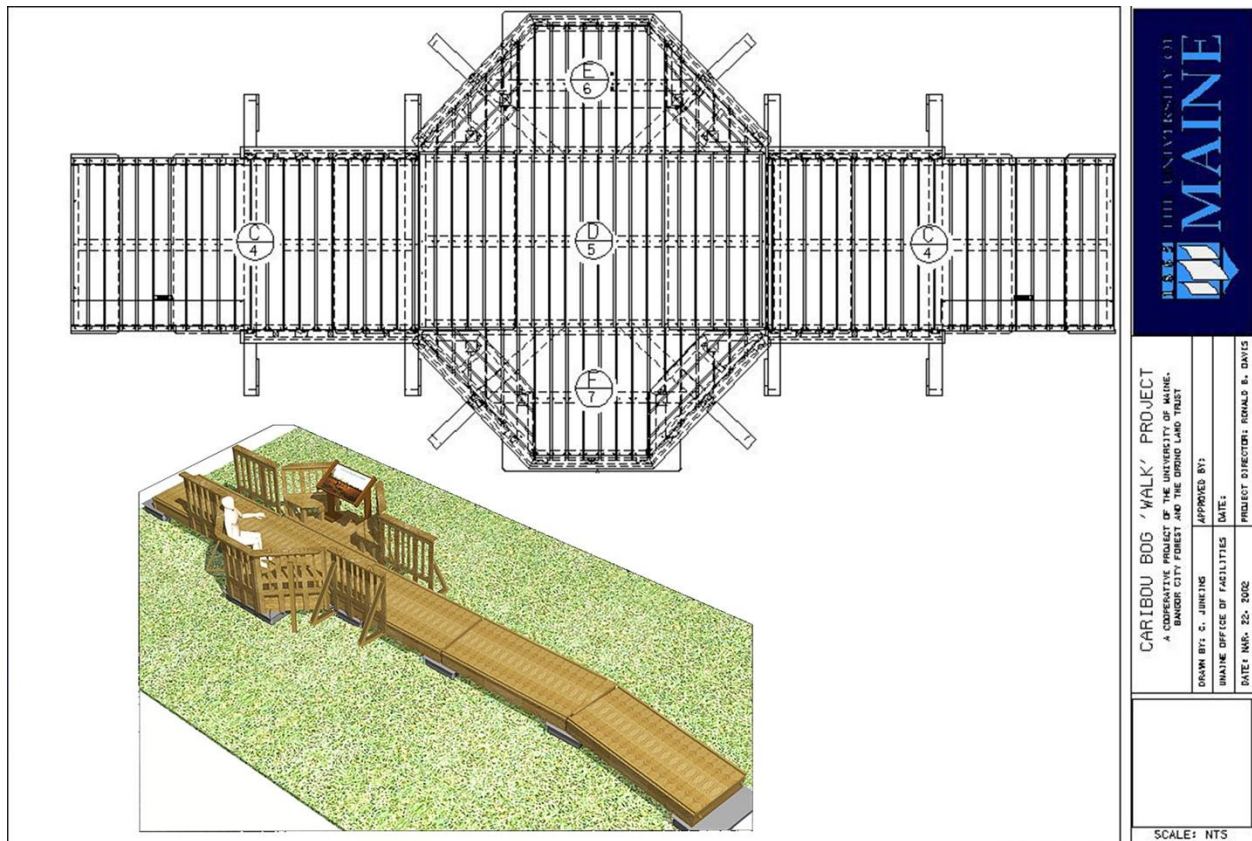


Fig. 8. Components D to F plus half of two standard sections (C's) comprise a 16 ft (~4.9 m) long interpretive station. The central part (D to F) is 10 ft (~3 m) wide. The 12 boards that project out are props for the angular braces that support the railings. Benches are present along the insides of the four diagonal railings. In the colored schematic drawing, a person sits on one of these benches. That drawing also shows an interpretive sign at one side. These digital drawings are by Claude A. Junkins of UM Engineering Support Services, based on by-hand technical plan drawings by Ronald B. Davis.



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

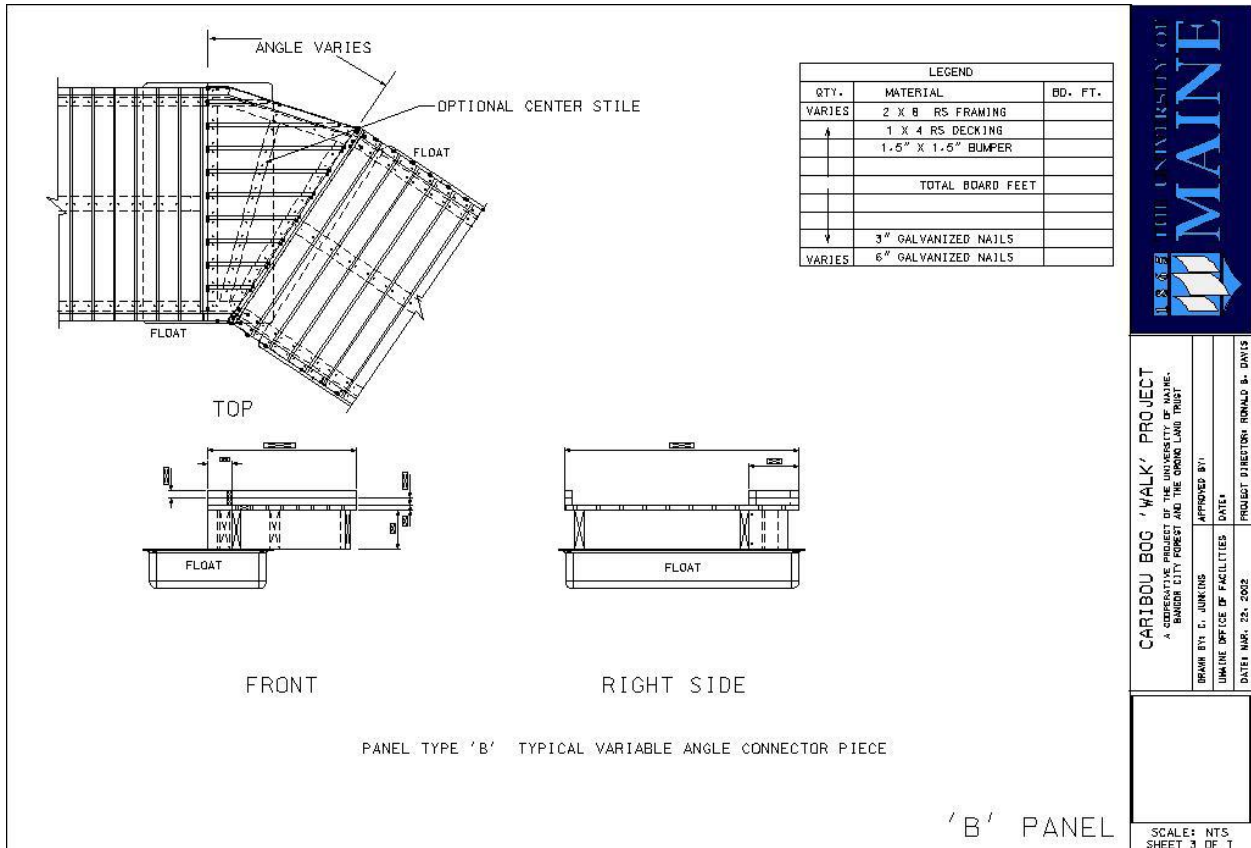


Fig. 10. Variable angle connector piece. These digital drawings are by Claude A. Junkins of UM Engineering Support Services, based on by-hand technical plan drawings by Ronald B. Davis.

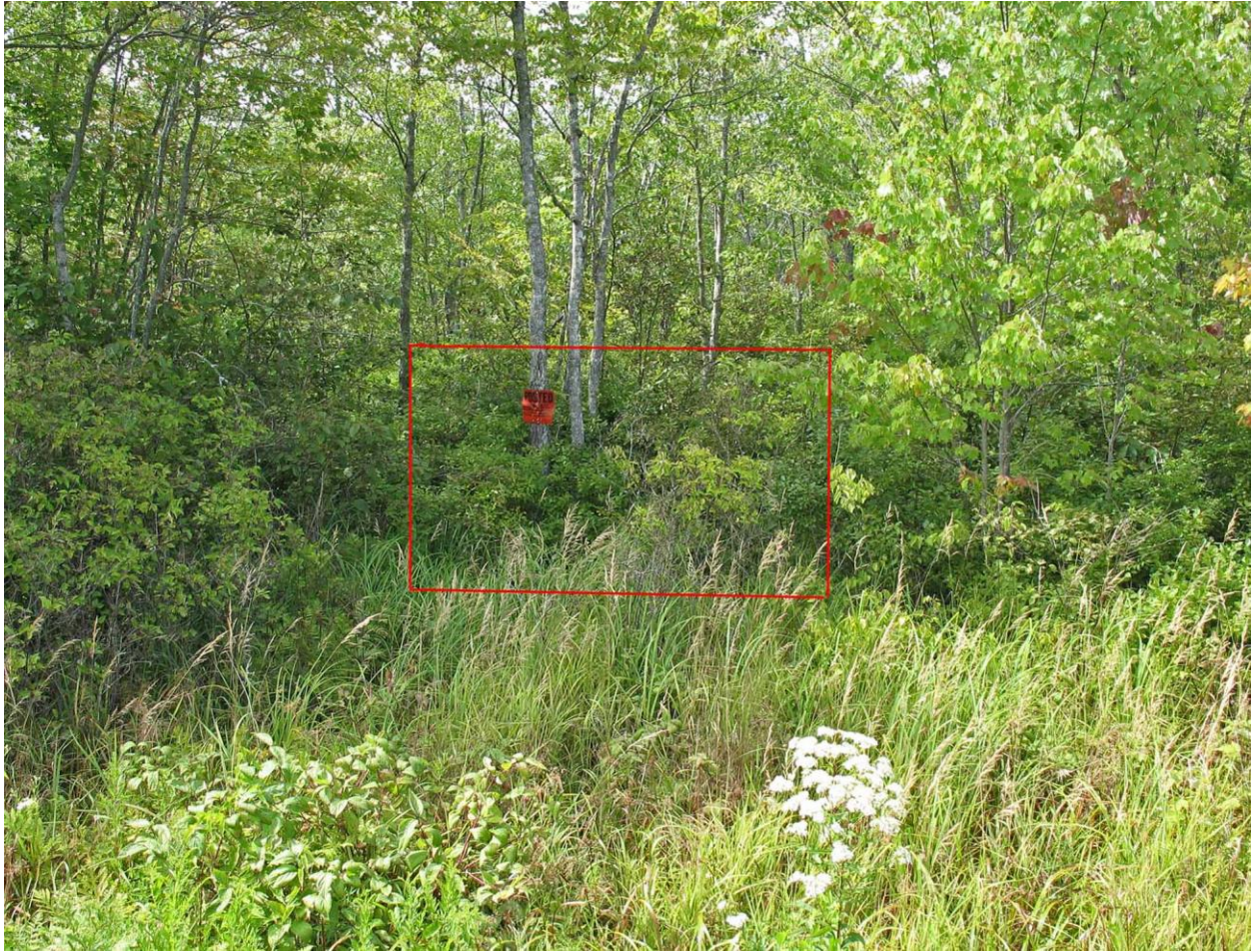


Fig. 11. Old trail entrance into Orono Bog, 26 August 2007, located beside Stillwater Avenue, Orono, screened by new growth since June 2002 (see text). Trail entered forest near center of red rectangle. Landowner's red no-trespassing sign appears on tree along old trail. Ronald B. Davis photo.



Fig. 12. Quadrat 4 in wooded shrub heath vegetation (Fig. 5), (A) October 2002 and (B) August 2007. (A) Oblique photo with corners marked, (B) vertical photo with corners marked. Permanent marker is in the center of the compass-oriented quadrat. 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. 36), (2) kiosk (Fig. 28) 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 (Fig. 28), (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. 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 of 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 assembly of a boardwalk section in the jig in the foreground. 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. Remaining members of the MCC-leader teams adjusting the last-emplaced of 509 boardwalk sections while Ron Davis (green hat) looks on.⁹³ The photo was taken shortly after the two arms of the boardwalk loop were joined at the middle of the open bog at 2 PM on 22 November 2002. Despite being a cold, wet and dreary day, our hearts were warmed by the “drive the golden spike” occasion. 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. The 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.

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

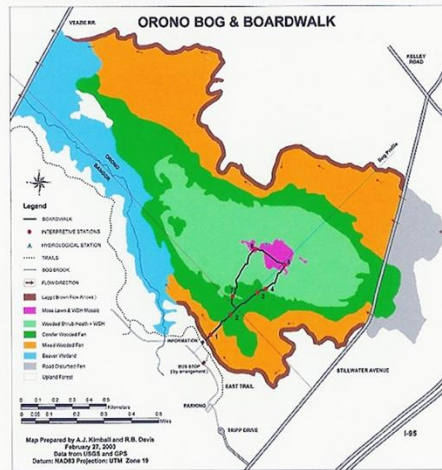
The 616 acre Orono Bog is a wetland. Wetlands have soils that are water saturated, and plants that can tolerate wet soil. Orono Bog is a special kind of wetland called a peatland because of its deep layer of peat. A bog is a peatland with acidic and infertile soil, and with abundant peat moss and other 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.

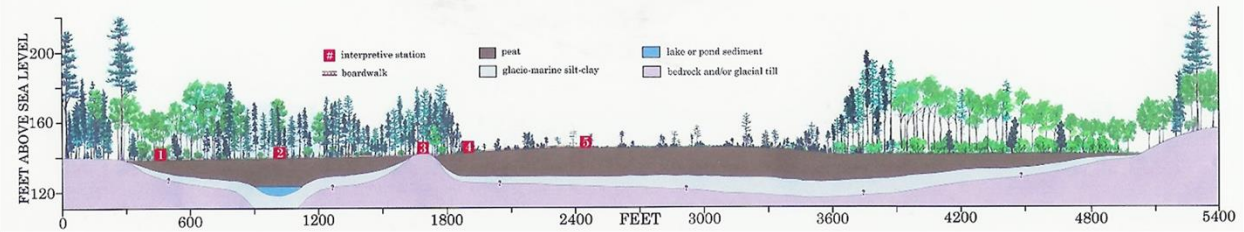


Fig. 24. The 3 x 4 ft (~0.9 x 1.2 m) introductory sign housed in a kiosk at information area by beginning of boardwalk (see Fig. 28). Zoom in to read small print.



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

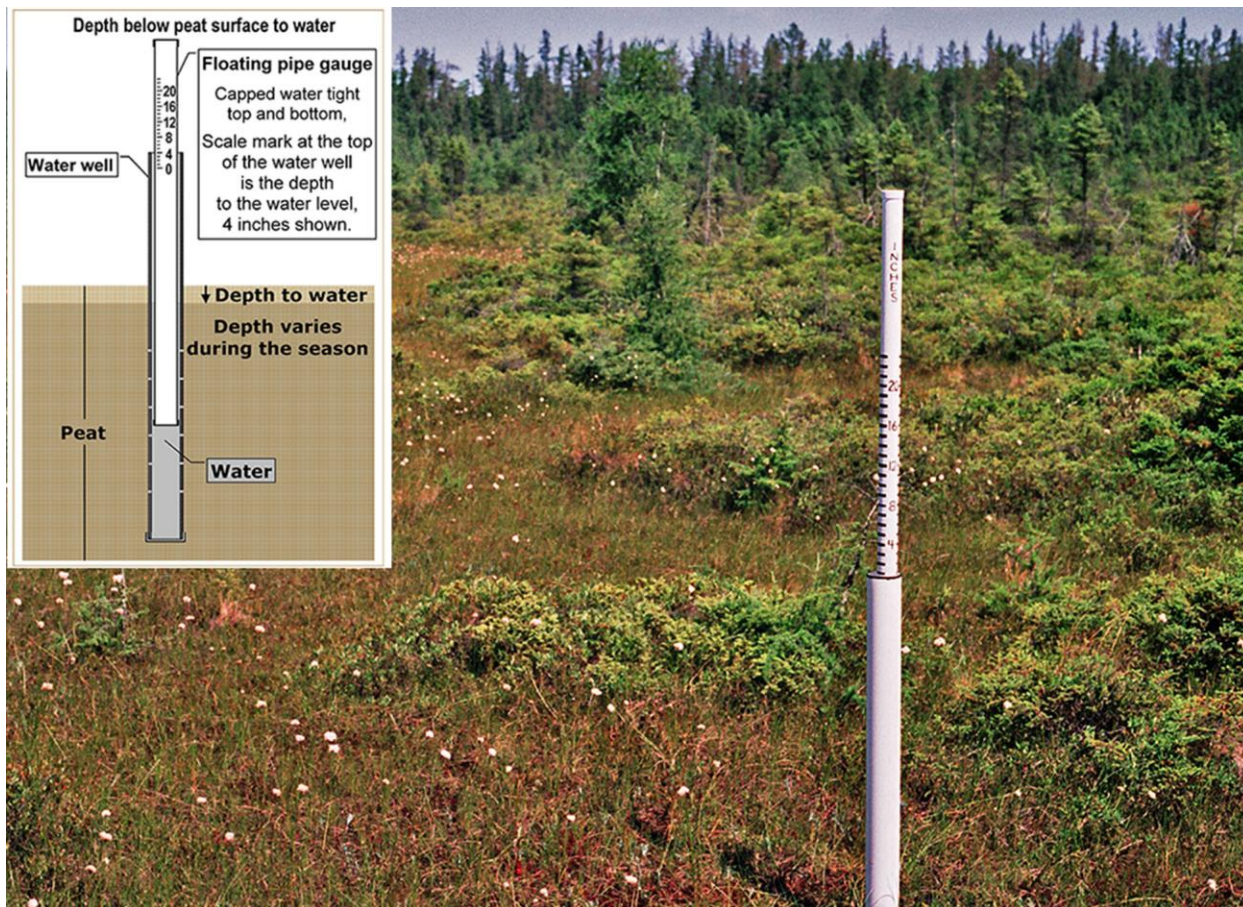


Fig. 26. Water level indicator at IS6. The explanatory diagram by Justin H. Poland⁹⁴ at upper left has been mounted as a small sign on the casing pipe since this photo was taken. The water level on the diagram is 4-inches below the peat surface, but the water level shown by the photo is a bit less than 1-inch below the peat surface. Jerry R. Longcore photo.



Fig. 27. Cutting the ribbon at the formal opening of the new boardwalk, 2 August 2003. The ribbon cutters were, left to right: Nikki Farnham, then Mayor of Bangor; Deb DeQuinzio, National Park Service, then Northeast Regional Coordinator of the National Natural Landmarks Program; Ron Davis (author of this essay), then Boardwalk Director; Robert Kennedy, then Provost and Vice-President of UM; and Jay Johnson (dec.), then President of OLT. Joni Dunn photo.



Fig. 28. Rules sign and visitors reading introductory sign at kiosk in August 2004. See Figure 24 to read introductory sign. Zoom in to read rules sign. Shortening of hours in the fall have subsequently been in approximately monthly increments ending with 3:30 closure in November. Jerry R. Longcore photo.



Fig. 29. 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 2006.³² Ronald B. Davis photo.



Fig. 30. Phil Locke replacing a broken deck board at IS1 on 13 August 2012. Ronald B. Davis photo.



Fig. 31. 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 (seen in distance), 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. 32. 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. 33. Boardwalk annual yard sale 2016. Sharon Fitzgerald photo.



Fig. 34. 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. 35. 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 (orange shirt); seated: Ron Davis (white hat), Mara Miller, and Arthur Benson (blue hat); and standing: Jerry Longcore. Photographer unknown.



Fig. 36. Finished cabin exterior, November 2004. Eventually, entire cabin exterior was stained brown.
Ronald B. Davis photo.



Fig. 37. Outhouse exterior, November 2004. The left side is accessible by wheelchair. Ronald B. Davis photo.



Fig. 38. Outhouse interior, right side, November 2004. Ronald B. Davis photo.

Endnotes

- ¹ Emeritus Professor and Boardwalk Founder, School of Biology and Ecology, Climate Change Institute, and Maine Agriculture and Forestry Experiment Station, University of Maine, Orono, Maine. 04469.
- 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. the remainder of the OBB is a 3400 ft (~1036 m) loop that is walked only in one direction.
- ³ A “gently convex bog” and other Maine peatland types are defined in Davis, R.B., and D.S. Anderson. 2001. Classification and distribution of freshwater peatlands in Maine. *Northeastern Naturalist* 8:1–50. More description is given by Davis, R.B. 2016. *Bogs and Fens, a Guide to the Peatland Plants of the Northeastern United States and Adjacent Canada*. University Press of New England, Hanover, N.H and London, U.K. 296 pp.
- ⁴ After its late start in the initial (2003) season, the standard boardwalk season has been from 1st of May through the Sunday after Thanksgiving, nearly seven months per year. However, from 2013 to 2019 seasons were shortened by about one month per year 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 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 2020 season.
- ⁶ In the first two seasons we used registration cards to count and collect information on visitors. Subsequently, we used hidden counting devices at the boardwalk entrance.
- ⁷ Near-coincident with my full retirement from UM.
- ⁸ The only paid workers on boardwalk construction were 28 members of the Maine Conservation Corps.
- ⁹ When I last visited that part of Acadia National Park in summer 2021, 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 essay I explain how a boardwalk can minimize such damage while also providing public access and education.
- ¹⁰ I was born 6 August 1931 and spent all but two years of the first 22 years of my life in Brooklyn, N.Y.
- ¹¹ This bog is in Belgrade, several miles from the college.
- ¹² This property, called the Colby-Marston Preserve bears the name of Dorothea Marston, the person who provided the funds for its purchase by TNC. The document transferring the property from TNC to Colby College contained a reverter clause specifying that ownership would revert to TNC 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 4 December 2021).
- ¹³ I established this trail westward into the bog from Stillwater Avenue with permission of the private 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.
- ¹⁴ <https://www.nps.gov/places/orono-bog.htm>, accessed 22 December 2020.
- ¹⁵ These visits to boardwalks took place in Florida, Georgia, South Carolina, Massachusetts, Maine, New Brunswick and Québec. Several of these boardwalks are named and briefly described in Davis, R.B. 2016. *Bogs and Fens, a Guide to the Peatland Plants of the Northeastern United States and Adjacent Canada*. University Press of New England, Hanover, N.H and London, U.K. 296 pp.
- ¹⁶ A meeting with the engineer who had designed some of the boardwalks at Everglades National Park was especially informative.
- ¹⁷ 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.
- ¹⁸ I averaged five talks per year during 2000–2005, including to Kiwanis, Rotary, Audubon, and the UM Wildlife Society.

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 Orono Land Trust, College of Natural Sciences, Forestry & Agriculture of University of Maine, City of Bangor, Maine, and Ronald B. Davis. 2001. Memorandum of Understanding, Orono Bog Boardwalk Project. 7 pp. A copy is available at Special Collections, Fogler Library, University of Maine, Orono, Maine 04469.

²¹ At UM, matters pertaining to the OBB are administered by the Dean of the College of Natural Sciences, Forestry, and Agriculture (CNSFA), including appointment of the OBB Director and the UM representative to the OBB Management Committee.

²² 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.

²³ 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.

²⁴ Except for issuing a building permit for construction of the Orono part of the OBB, the Town of Orono had not been directly involved in boardwalk construction.

²⁵ 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.

²⁶ Motorized wheelchairs are allowed on the boardwalk.

²⁷ The access license agreement was granted by the City of Bangor to UM on or about the 18th of June 2002.

²⁸ 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.

²⁹ I was appointed Boardwalk Director by the Dean of the UM CNSFA to take effect upon termination of the Project Director position when construction was complete and the boardwalk opened to the public on 23 June 2003. I held the Director 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 2021).

³⁰ 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 2 to 20 ft (~0.6 to 6 m).

³¹ As its solid component consists largely of *Sphagnum* spp. (peat moss) remains, this common type of bog peat is called Sphagnum- or peat-moss peat.

³² 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 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 and it was feasible (with considerable effort) to use a custom-made hand-operated pile driver to successfully drive the pilings.

³³ The lagg is the peripheral and lowest part of the raised Orono Bog (Fig. 5) and most other raised bogs. 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.).

³⁴ Despite the increased shade under the boardwalk for 20 years, vegetational cover has been maintained, albeit with changes in species composition and relative abundances.

³⁵ Two all-composite boardwalk sections were installed among the 507 wooden sections, one in a shaded, forested area, and the other at the open part of the bog. They were built by and were an experiment of the Advanced Structures & Composites Center of UM 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 to install—along with additional impact on the bog.

³⁶ Raising the funds for composite decking in 2000-2002 was improbable 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. However, see next footnote.

³⁷ By 2011, the boardwalk had begun to show serious signs of wood rot, most severely where it traversed the forest—the shaded and most humid part of the bog. To keep the walkway safe was requiring maintenance with increasing frequency. The boardwalk needed to be entirely replaced over the next several years, starting with its most degraded stretches. By 2012, composite decking had improved considerably, both in its physical properties and appearance, and boardwalk leadership decided that the expense of replacing the wooden boardwalk with longer lasting and maintenance-free composites was justified by the boardwalk's great popularity. A successful nine-year campaign, and incremental boardwalk 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. Great Northern Docks (GND) of Naples, Maine built each new boardwalk section with a strong but light-weight aluminum frame covered by composite decking. Improvements in design increased boardwalk stability, but boardwalk dimensions, overall appearance, and the boardwalk route remained the same as the original wooden structure. Replacement was completed in 2019 at a total cost of 1.058 million dollars.

³⁸ I used Parker Lumber in Bradford, Maine 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 we used were unplanned (rough sawn). Initial loads of milled lumber were applied to indoor construction of boardwalk components starting in February 2002 (see **Major construction, 2002, Indoor work, early 2002**).

³⁹ Using composite instead of hemlock lumber would have more than doubled the \$150,000 figure.

⁴⁰ The 509 standard sections that we 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 (~1,280 m) length. But the route is not straight. The 128 ft (~39 m) difference is accounted for by the numerous inserts and wedge boards that bridged the angular gaps where adjacent sections changed direction at turns in the boardwalk.

⁴¹ The Natural Resources Protection Act is the State of Maine law regulating projects affecting wetlands and other natural resources. Its rules regarding wetlands are consistent with those of the Clean Water Act that regulates waterways including wetlands nationally and is administered by the U.S. Army Corps of Engineers (USACE).

⁴² Fortunately, I had already completed the wetland delimitation survey with a student assistant in May 2001.

⁴³ Dr. Habib Dagher is founding Executive Director of the Advanced Structures & Composites Center at UM.

⁴⁴ This critical period of preparations 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 of the Orono Planning Board, only to learn that the meeting had just been cancelled for lack of a quorum.

⁴⁵ I had collected the cuttings near the same site and brought them to Brad Libby, horticulturalist at UM, who rooted them under mist in the propagation structure in the Roger Clapp Greenhouses before I planted them at the trailhead.

⁴⁶ 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.

⁴⁷ In March 2002, the first gifts were deposited into the boardwalk endowment and construction accounts at UMF. Upon completion of construction in June 2003, the construction account was changed to an operations account.

⁴⁸ 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.

⁴⁹ The money pipe was destroyed by a thief with heavy duty tools and the contents stolen a few years later.

⁵⁰ 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.

⁵¹ Northern Log Homes was a different company from Northeastern Log Homes.

⁵² Component D of the ISs (Fig. 8) was identical to a standard boardwalk section (Fig. 6) except it lacked bump railings. The seven D-components counted toward the 509 sections that make up the OBB. The IS components including railings were later assembled and installed in the bog by other volunteers.

⁵³ The MCC team that worked on the boardwalk in November was provided with free short-term public housing by the City of Bangor.

⁵⁴ Except for the prior-mentioned vertebral disc that I ruptured at the assembly site before the major construction period.

⁵⁵ 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.

⁵⁶ I didn't receive frequent reports of account balances from UM or OLT. To keep pace with the flurries of purchases, I maintained my own ledger to avoid overspending.

⁵⁷ We used 50 5-gallon drums of preservative to complete the process.

⁵⁸ Dimensions of structural elements of a standard boardwalk section were: side joists 2x8-inch (~5x20 cm) by 7-ft 8-inch (~2.34 m), central joist 3x8-inch (~7.6x20 cm) by 7-ft 8-inch (~2.34 m), end joists 2x8-inch by 4-ft (~1.2 m), deck boards 1x4-inch (~2.5x10 cm) by 4-ft (~1.2 m), bump-railing riser blocks 2x2-inch (~5x5 cm) by ~7-inch (~18 cm), and bump-railing 2x2-inch by 7-ft 8-inch (~2.34 m).

⁵⁹ After receiving the section, the team would more precisely position it, level it with shims, and attach it to the prior section with a chain on each side.

⁶⁰ 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 other cart with the next section. 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.

⁶¹ Step boards continued to be used after boardwalk completion whenever stepping off the boardwalk to perform maintenance.

⁶² 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 and quickly stake the corner positions of the rectangular sections.

⁶³ 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.

⁶⁴ 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.

⁶⁵ I had been invited to give the "graduation address" to the 2002 statewide "class" of MCC workers earlier in the fall.

⁶⁶ A few of these leaders were already experienced on the OBB job, and they helped to train the newcomers.

⁶⁷ For budgetary reasons, I didn't retain the rental truck body for winter storage.

⁶⁸ This calculation is based on the value of \$16.27/hr for volunteer labor in 2002 according to <https://blog.candid.org/post/value-of-volunteer-time-increases-to-27-20-per-hour/>. Accessed 15 December 2021.

⁶⁹ Examples of annual tabling events include the 2003 Penobscot County Conservation Association's Eastern Maine Sportsman's Show and the Bangor Flower and Garden Show.

⁷⁰ Interviews given to the UM Alumni Magazine and the Maine Times resulted in articles later that spring. These articles as well as broadcast interviews always mentioned the boardwalk's need for financial support.

⁷¹ pH is a measure of the water's acidity based on the activity/concentration of hydrogen ions in it. The lower the pH, the more of these ions and the more acidic. Northern peat moss/black spruce bogs are characteristically acidic (low pH). The conductance of the water is an index 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. 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 center.

⁷² For a new printing of these signs in 2011, we made substitutions for some illustrations including additions of three more of my photos.

⁷³ Edited by Jerry R. Longcore.

⁷⁴ In 2002 I assumed 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. Although frost movements occurred and necessitated the releveling of many sections each spring prior to boardwalk opening, frost action was never 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.

⁷⁵ 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 the boardwalk season began.

⁷⁶ The MCC crew completed the attachment of side modules at wheelchair turnarounds and ISs, installed the benches, attached railings and supporting braces at ISs, and filled the remaining gaps between sections with inserts and wedge boards.

⁷⁷ 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 30 re. hummocks and hollows.

⁷⁸ The depth of the water level (table) under hummocks would be deeper, depending on the height of the hummock.

⁷⁹ Due to my tremor, I asked Lee (my wife, and frequent boardwalk volunteer) to paint the scale on the float-pipe with her steady hand.

⁸⁰ Except for service dogs required by some visitors for medical reasons.

⁸¹ I am not aware that major littering along the boardwalk has ever occurred. Only occasionally have volunteers found single pieces of trash beside the boardwalk. Many conscientious visitors pick trash and deposit it in our trash bin.

⁸² 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.

⁸³ In some years, we closed earlier due to snow.

⁸⁴ The ski trail system in the BCF was already an excellent and ample recreational resource that was lightly used; the boardwalk was not needed for enhancement of the ski trail system.

⁸⁵ Nighttime astronomy nature walks occasionally have been conducted on the boardwalk by special arrangement with the City of Bangor for after-dark access to the City Forest.

⁸⁶ These programs have continued since I retired as Boardwalk Director at the end of 2004.

⁸⁷ During the 2003 and 2004 seasons, I assembled a corps of about 35 docents, about 15 of whom were “regulars,” and scheduled docents for most docent slots (each typically 2 or 3 hours) 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.

⁸⁸ 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 are illegal in the Bangor City Forest. Docents were warned to avoid interaction with such persons. Prior to near-universal ownership of cell phones, we kept a charged cell phone in the cabin for emergency use.

⁸⁹ Summer interns were hired in all but three summers since the boardwalk’s founding (plus 2020 when the boardwalk was closed due to the Covid-19 pandemic).

⁹⁰ The porch needed less support.

⁹¹ The BCF stays open all year including December through April when the boardwalk is closed. Although we built the outhouse because of the need by the large number of boardwalk visitors, it is available all year to all users of the BCF. The Bangor Parks and Recreation Department agreed in 2004 to service it during months when the boardwalk is closed, and in 2021 agreed to service it year-round.

⁹² The \$310,000 total cost of OBB and ancillary structure construction does not include the monetary value of my time.

⁹³ Most members had completed their work and had left the site.

⁹⁴ Associate Professor of Mechanical Engineering, UM.