

CHARLES (CHUCK) HENRY RACINE (1940–2014)

In the summer of 1972, Chuck Racine, a young plant ecologist from Duke University, came to Alaska and found his calling studying the Arctic tundra. The discovery of oil at Prudhoe Bay, Alaska, in 1968, and the signing into law of the Alaska Native Claim Settlement Act (ANCSA) in 1971, cleared the way for one of the greatest acts of land conservation in history: the Alaska National Interest Lands Conservation Act (ANILCA). As part of the run-up to this conservation legislation, federal agencies began inventorying and assessing almost 100 million acres of Arctic and sub-Arctic lands in 1972, anticipating the creation of new national parks, wildlife refuges, and designated wild and scenic rivers. During that first summer, Chuck was recruited to serve on a 10-person team that evaluated lands on the Seward Peninsula for potential inclusion in the National Park system. Their evaluation study led to the creation of the Bering Land Bridge National Preserve. For the following four summers, Chuck continued in the same type of work, producing vegetation and floristic inventories of some of the most iconic lands in Alaska. During those years, he spent each summer in the field and each winter in the Lower 48 (mostly Vermont) writing up his results. Between 1972 and 1979 he authored nearly a dozen internal reports that contributed directly to the creation or expansion of the Bering Land Bridge National Preserve, Kobuk Valley National Park, Lake Clark and Katmai National Parks and Preserves, and Yukon-Charley National Preserve. A careful and meticulous observer, Chuck also began to notice and record the impact of fire and human disturbance on tundra during these long summer seasons. This was how he became a pioneer in this branch of ecology, and it became the focus of four decades of research. In the end, he published 65 widely recognized papers, six of which appeared in this journal, and he helped set the pattern for how this type of research should be conducted.

Chuck was born on 22 May 1940 and grew up in Hinsdale, Illinois. He attended Lake Forest Academy in Illinois, then Dartmouth College, where his interest in plant ecology began. But it was during his graduate education at Duke University that he first became aware of the possibilities of the Arctic. His PhD began under the direction of H.J. Oosting, but when Oosting passed away, W.D. Billings took Chuck on as a student. Billings has been called the “father of Arctic plant ecology” and before long Chuck was headed north. In 1969, he completed his dissertation on the community dynamics of the oak forests of the southern Blue Ridge Escarpment. He spent the next two field seasons in the Galapagos Islands studying plant-animal interactions, but as fate would have it, in 1972 his opportunity arrived, and from then until his death in 2014, his passion was the tundra. During those years, he held academic positions at Ohio State University, Notre Dame, North Carolina State University (where he met his wife Marilyn), and the Center for Northern Studies in Vermont, before becoming a research ecologist in 1987 at the U.S. Army Cold Regions



Chuck Racine at Imuruk Lake, 2009 (NPS photo, J. Barnes).

Research and Engineering Laboratory (CRREL) in New Hampshire. Even in his later years, when his health slowed him down, he continued to go north to do fieldwork, his ailment in no way diminishing his enthusiasm for being out on the tundra.

Chuck's studies of tundra fire were both serendipitous and prescient. They initially came about because in 1977 large tundra fires in northwestern Alaska burned some of the areas that he had surveyed four years earlier. His detailed field notes (in this pre-GPS era) allowed him to return to plots he had measured prior to the fire and document the primary and secondary stages of the vegetation recovery and thaw depth response. For example, on the Seward Peninsula, Chuck was able to resample his plots four times over a 30-year period, making this record one of the longest and most comprehensive series in existence. Key effects, like increased shrub growth, in some cases emerged only after two decades of monitoring. In subsequent years, he expanded his Seward studies to include burns along the Noatak and Kokolik Rivers on the North Slope. Making intensive use of early Landsat images and Alaska fire records, he was able to develop one of the first

basin-wide estimates of fire return intervals for tundra. His work provides an essential baseline for all Alaskan tundra fires, including the headline-making 2007 Anaktuvuk tundra fire, which burned more than 1000 km².

But fire wasn't the only disturbance that interested Chuck. Over the years, he examined the impact of oil exploration on the tundra of the Seward Peninsula, the response of mosses and lichens to intentional oil spills, the effects of all-terrain vehicles near Anaktuvuk Pass and in the Wrangell-St. Elias Mountains, and even the impact of airboat use on the fens of the Tanana Flats near Fairbanks. Despite being trained as a "pure" plant ecologist, he had a practical and applied focus that drew him to projects where his work would have real and immediate consequences. Perhaps the best example of this was the project he initiated in 1990 at Eagle River Flats on Ft. Richardson (U.S. Army) near Anchorage, where a decade of waterfowl mortality had baffled the Army and curtailed use of a key firing range. Chuck formed a team of scientists that was able to establish that ingestion of white phosphorus contamination (from flares) by the waterfowl was causing the problem. This discovery led to the design and implementation of successful remediation programs that continue today.

It was his finding that disturbances produced an increase in shrub size and abundance that led to our collaboration and friendship. I had obtained a big pile of air photos from northern Alaska taken in the 1940s, and I figured they could be used to determine whether shrubs were encroaching on the tundra ... but I barely knew the difference between a willow and an alder. Chuck and I were already working together on a snow ecology study, and he was headed to our field area near Ivotuk, about 320 km south of Barrow, Alaska. I asked him if he wanted to work with me on the shrub photos, and when he enthusiastically agreed, I handed him a dozen photos and said, "See if you can repeat these." And repeat them he did! When he got back, it took the two of us less than a minute to realize we had superb and incontrovertible evidence for the greening of the Arctic. It was an electric moment. With our third colleague, Ken Tape, we went on to re-photograph hundreds of square kilometers of northern Alaska, finding that an expansion of shrubs was underway nearly everywhere. These photo-based studies remain some of the most compelling evidence for environmental change in the tundra regions of the Arctic.

But there was much more to Chuck than just his science. With his wife Marilyn, he shared a deep-seated attachment to farming and a great respect for all those who made a living off the land. Over the years, he and Marilyn built a log cabin in Vermont and operated one farm after another, usually with the focus on sheep. I recall a visit to the last farm they owned in Vermont, a farm that dated back to the 1700s and a rambling farmhouse built 150 years ago perched halfway up a steep field on the side of mountain. On that visit, Chuck had a cast on his arm; a big ram had recently knocked him down hard. Another ram they had borrowed for breeding had some sort of hoof disease. The price of wool was low. One would think this would have been enough to dampen the ardor of any would-be farmer, yet Chuck laughed, showed me the fields and the beautiful trees, the sheep, and the garden. He and Marilyn clearly relished the good hard work of farming. Perhaps it was this part of his life that had produced in him a buoyant optimism, a great sense of humor, and the real humility that defined him. The memory of mine that captures Chuck's personality best is a canoe trip down the Chandler River in 2002 to examine expanding shrub patches on the ground. He was in the bow of my canoe, and he had a paddle, but most of the time it lay across his lap, unused. The wild Arctic scenery we were descending through held only a secondary interest for him, while the tundra passing by on the bank of the river was to him endlessly fascinating. Then with a start he would remember he was supposed to be paddling, and with great energy and utter disregard for steering or stability, he would start paddling on whatever side of the boat caught his fancy, laughing and thoroughly enjoying yet another Alaskan field campaign. For those of us who knew the pleasure of his company, who have become better observers under his tutelage, and on whom a little of his humility has rubbed off, the world is a little smaller place now that he is gone. A memorial fund has been established at the University of Alaska Fairbanks to support student research on topics Chuck would have found exciting and worthwhile.

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