

Kates, R. W. 2011. Gilbert F. White, 1911-2006, A Biographical
Memoir. Washington, DC: National Academy of Sciences.

NATIONAL ACADEMY OF SCIENCES

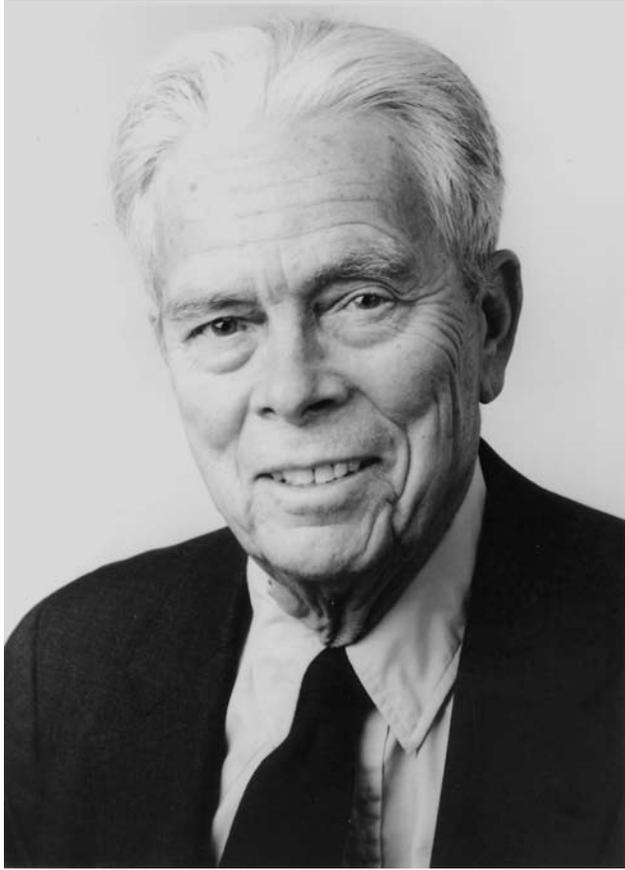
GILBERT F. WHITE
1911-2006

A Biographical Memoir by
ROBERT W. KATES

*Any opinions expressed in this memoir are those of the author
and do not necessarily reflect the views of the
National Academy of Sciences.*

Biographical Memoir

COPYRIGHT 2011
NATIONAL ACADEMY OF SCIENCES
WASHINGTON, D.C.



Robert White

GILBERT F. WHITE

November 26, 1911–October 5, 2006

BY ROBERT W. KATES

GILBERT F. WHITE LIVED through almost a century of accelerated world change: two world wars and continuing conflicts, the completion of the industrialization of the United States, the Great Depression, the collapse of colonial empires, the rise of a multitude of new nations, and the globalization of economies, governance, and concerns for peace, freedom, development, and environment.

Early decades stand out in his biography, introduced in his own words—

Each of us looks at the world around us from a unique background. As a boy living in the neighborhood of the University of Chicago and working summers on a Wyoming ranch along the Tongue River, my mental images were a mix of Gothic academic campus, raw city streets, lakeshore, semi-arid mesa, mountain forest, and tumbling river. The world beyond was successively war-torn, booming, and then depressed. It had a special natural character for me because of the vision and tribulations of a neighbor who had fought to establish the National Park Service. As I attended the high school founded by John Dewey and went on to the University of Chicago, where in parochial fashion, I received three geography degrees, there was a lively interest in a field called “ecology.” I took university courses in plant ecology, urban ecology, and in a discipline—geography—that my mentor, as president of the Association of American Geographers, defined as “human ecology” (Barrows, 1923). Geographic field work in the early 1930s exposed me to Wisconsin fisheries, Ontario forests degraded by smelter-fumes, decaying

British estuarysides, a celebration of colonialism in Paris, well-tended Alpine meadows, and Berlin students debating the merits of Hitler versus Hindenburg...These were among the images contributing to the view of the world that I brought to Washington DC in 1934 to work in the New Deal. I soon identified with others who saw themselves as devoted to getting the country back on track. (White 1994, p. 2)

Thus Gilbert's¹ professional history² began at age 23 in Washington, D.C., as a geographer with the Mississippi Valley Committee, National Resources Committee, National Resources Planning Board, and the Bureau of the Budget (1934-1942). His career was interrupted by the Second World War, which also caused Gilbert a long separation from Anne Underwood—his life-partner-to-be.

As a conscientious objector to military service, he served with the American Friends Service Committee's relief efforts in southern France (1942-1943), and was interned by the Germans (1943-1944) along with American embassy personnel and newsmen in relatively plush quarters at a spa in Baden-Baden. Looking back at that period, Gilbert would often talk about the organization in the camp as Badheim U, with the 69 internees providing 168 courses of study for one another (Hinshaw, 2006, pp. 64-65). Gilbert taught geography both to the children and adults and took part in an economic seminar on the German wartime economy, which to his pacifist chagrin he later learned also served U.S. intelligence as a source of wartime information. He studied four languages, including Russian, as well as accounting, both of which would serve him well in the future.

Gilbert returned to the United States 30 pounds lighter and with a painful shipboard injury that led to his lifelong upright posture as a means of coping with the pain. In 1946 at age 35 he became the president of Haverford College (1946-1955) and during those years his three children—Will, Mary, and Frances—were born. In 1956 he began his life-

time calling of research and teaching in geography at the University of Chicago (1956-1969) and then the University of Colorado (1970-2006).

It was in Washington between 1934 and 1942 that he formed and nurtured the five themes that were at the core of his scientific work, organizational leadership, and moral concerns. In Washington he published his first article, in 1935 (on public water supplies), began his lifelong analysis of natural hazards, became a Quaker committed to peace making, discovered the rudiments of sustainable development in natural resource management, and learned that public policy needed to be informed by scientific knowledge. These themes also serve to organize this memoir.

PUBLIC WATER SUPPLIES

In his first article, "Shortage of Public Water Supplies in the United States During 1934," four major aspects of Gilbert's research emerged: (1) it addressed a policy issue; (2) it was contrarian in findings; (3) it was written in collaboration with practitioners; and (4) publication was designed as part of the research. The policy issue was whether there was a need for a major effort to assist communities with public water supplies that were affected by the great drought of 1934. Contrary to local expression he found that most public water supplies in areas affected by drought proved to be adequate. Where they failed it was mainly not due to the drought. He conducted the national survey with the collaboration of professional organization members and state sanitary engineers and published the results in the *Journal of the American Water Works Association* (White, 1935).

When putting together with Ian Burton a collection of Gilbert's writings (Kates and Burton, 1986), I asked him about publication. *Question*: "How did you come at age 24, in the

New Deal, not in an academic institution, to quickly publish your very first assignment? There surely was no ‘publish or perish’ syndrome.” *Answer*: “I don’t know. We were all doing it. Everybody in Washington was publishing—Galbraith, Milton Friedman, everybody.”

While Gilbert studied and wrote on many aspects of water supply, use, management, and development, it was domestic water supply that most fascinated him and his wife, Anne. Thus along with the London-based epidemiologist David Bradley, they pursued the issue among the people of East Africa. As they described it,

We went into about 35 different sites and inquired about how people decide to use water...We did something which is rudimentary but nobody had done before. We found out where they got their water, how much they used, and what it cost them to use it in terms of time, energy, and health...In almost all cases people have alternative sources from which they can draw water. Thus, they make two decisions everyday: how much water they draw, and where they will go to get it, which involves who will go to get it, generally “she.” (Reuss, 1993, p. 72)

In their published study *Drawers of Water* White, Bradley, and White (1972) again had contrarian findings beginning with a typology of water-related diseases based on modes of transmission rather than the prevailing one based on particular pathogens. Focusing on means of transmission identified new sources of useful interventions. They showed that it was water in quantity, not necessarily cleaner water, that was needed for health when it came to washing people, clothes, utensils, and food. Surprisingly, they found that providing water closer to households did not necessarily increase consumption. They advocated flexibility in management, diversity in sources, and the use of more community and individual initiatives, especially increasing the use of single-taps and standpipes. Today best practices incorporate many of these findings.

The original field research was done meticulously and another team of researchers found it possible to return to the same villages some 30 years later and locate the original randomly selected households (Thompson et al., 2002). They found a population three times larger, with more access to piped water supplies but supplies that were also failing more often due to heavy use and lack of maintenance. Thus, overall per capita consumption had declined by 30 percent in 30 years. In contrast, in rural areas lacking piped supplies and with water that had to be carried, use had nearly doubled and this provided additional health benefits.

Following the publication of *Drawers of Water* Gilbert argued for a basic minimum water supply as a human right, not as an economic good—

In a period of twenty-five years [by 1998] would it be practicable to improve the water supply for those populations now inadequately served...to 95% of the human family?...If we extrapolate the trends of the past decade [1960-1970s] for ninety developing countries the answer is “no”; over [the next] three decades at least half the rural population, or more than 1.5 billion people, still would not enjoy the benefits of improvement...unless there is a world wide marshalling of technical knowledge, administrative wisdom, and political enthusiasm, based on the simple principle of a healthy environment as a human right, the end of the century may see few advances in the lot of the poor on farms and in urban shantytowns in terms of water for domestic well being. (White in Kates and Burton, 1986, pp. 372-374)

White’s “worldwide marshalling” evolved into a 1980 United Nations Decade for Drinking Water Supply and Sanitation with a goal of “water and sanitation for all by 1990.” The decade failed and at the turn of the millennium, the United Nations adopted the more modest goal of cutting by half the number of people without access to safe water by 2015. It seems that this halfway goal will be reached in most regions (except sub-Saharan Africa and the Arab states). In

these two regions it will be 2040 before the “halfway there” goal is reached at current rates of improvement.

NATURAL HAZARD REDUCTION

Gilbert’s dissertation *Human Adjustment to Floods: A Geographical Approach to the Flood Problem in the United States* (White, 1945), completed in 1942 just before White set off to Europe, but published in 1945, is widely recognized as the most influential geography dissertation in the United States. As with the drought study it addressed a policy issue, was contrarian in findings, written with practitioners in collaboration, and publication was designed as part of the research. The policy issue was the “flood problem” that Gilbert encountered in his New Deal reviews of federal flood control proposals that almost entirely relied on dams, levees, and channel improvements to reduce losses. In an oft-cited quote he wrote, “Floods are ‘acts of God,’ but flood losses are largely acts of man. Human encroachment upon the flood plains of rivers accounts for the high annual total of flood losses” (White, 1945, p. 2). Specifically, he wrote,

Every year receding flood waters in one or more sections of the United States expose muddy plains where people were poorly prepared to meet the overflow. Small-town shopkeepers digging their goods out of Ohio River silt; Alabama farmers collecting their scattered and broken possessions; and New England manufacturers taking inventory in water-soaked warehouses, testify to the dislocating effects of floods and to the unsatisfactory adjustment which man has made to them in many valleys. For the most part, floods in the United States leave in their wake a dreary scene of impaired health, damaged property, and disrupted economic life. (White, 1945, p. 1)

But he also described alternative arrangements, and the beginnings of a concept of human adjustment that was contrary to the frequent proposals for more dams, levees, and channel changes.

The effect of floods are not everywhere disastrous, however, or even disturbing to the economy. Each year ebbing flood waters also reveal plains in which a relatively satisfactory arrangement of human occupance has taken place. Pittsburgh merchants returning to stores where, because of adequate preparations, suffered only minor losses; Montana ranchers appraising the increased yields of hay to be obtained because of fresh deposits of moisture; and New Orleans citizens carrying out their business behind a levee withstanding a flood crest high above the streets, illustrate wise adjustments to flood hazard. (White, 1945, p. 1)

Gilbert created an eightfold typology for these adjustments: (1) elevating land above the level of likely floods; (2) managing land upstream to abate flood flows; (3) protecting flood plains by levees, channel improvements, and reservoirs; (4) taking emergency measures to create temporary protection and evacuate people and property; (5) making physical structures less exposed to floods; (6) using flood plain lands for low-damage uses; (7) providing relief for flood victims; and (8) insurance for flood losses. Gilbert argued that public policy should consider all possible adjustments and take into account the full social costs and benefits incurred by society for these adjustments and not just those that are easy to measure.

On his return to Chicago in 1956, Gilbert initiated a 15-year effort with colleagues and students to elaborate on these themes, beginning with identifying actual flood plain use (White et al., 1958; Burton, 1962), exploring understudied adjustments (White, 1964b; Murphy, 1958; Sheaffer, 1960), and observing the perception and choice of adjustment (White, 1964b; Kates, 1962). These studies, intended to change public policy, resulted in a new expression of such policy as a Unified National Program for Floodplain Management (U.S. Water Resources Council, 1979). Going beyond the staples of flood protection and relief, the program included a large set of adjustments that involved building

construction, flood plain mapping, height restrictions, insurance, and land use zoning.

Beginning in 1969 Gilbert posed a more universal problem.

How does man adjust to risk and uncertainty in natural systems and what does understanding that process imply for public policy? This problem raised initially with respect to one uncertain and hazardous parameter of a geophysical system—floods in the United States—provides a central theme for investigating on a global scale the whole range of uncertain and risky events in nature. (White in Kates and Burton, 1986, p. 326)

Using the network of the International Geographical Union, he organized a set of standard studies of 10 different natural hazards at 40 sites in 17 countries (White, 1974b; Burton et al., 1978). Based on these global studies, Gilbert (along with Burton and Kates) estimated that the widespread adoption of current adjustments on a global basis could reduce the loss of life by 80 percent to 85 percent and property damage by 40 percent to 50 percent (Burton et al., 1978, p. 174).

Thirty years later the three authors in their last joint paper (White et al., 2001) wondered why global losses continued to rise at a rapid rate despite greater knowledge of natural hazards and disasters, their human-induced causes, and the range of adjustments utilized in best practice. Surely they thought a large part of the explanation lay in the rapid growth in hazardous locations of property and population. In many places such locations are freely chosen because of the attractiveness of such sites, but more often such locations, especially in developing countries, are the result of marginal livelihoods and opportunities.

These risks and hazard losses are set to climb even more rapidly with human-induced climate change. Three generations of Gilbert's students have participated in the assessments of the Intergovernmental Panel on Climate Change,

especially around the theme of adaptation, where they are carrying forward essentially the same insights that Gilbert formulated 60 years ago in his dissertation on *Human Adjustment to Floods* (White, 1945).

MAKING PEACE BY MANAGING WATER

In 1961-1962 Gilbert chaired a Ford Foundation advisory group to the United Nations Mekong River Committee on the socioeconomic dimensions of joint international management and development of the Lower Mekong Basin. Out of that experience came his proposal in 1964 for an alternative course to the escalating war in South Vietnam and Laos through a joint effort on river basin development. He wrote, "It is just barely possible that out of this most incredible of places—the swirling political caldron of Southeast Asia—may come a new pattern for international action in harnessing nature's riches to achieve peaceful change" (White in Kates and Burton, 1986, p. 184).

Gilbert had long been interested in river basin development as a tool of cooperative action, beginning with his New Deal efforts and his support of the development of the Tennessee Valley Authority. But his highest aspiration was to make a difference in the realm of peace, beginning in the late 1930s at the Florida Avenue Friends Meeting House in Washington, D.C., and extended by his wartime years as a conscientious objector in France.

Gilbert reached out both publicly and privately to interest the Johnson administration in achieving peace through a water management alternative but failed in the end. Nonetheless, a vision of cooperative river basin development survives as the Mekong River Strategic Plan for 2006-2010, which provides for making effective use of water and other resources to alleviate poverty.

While continuing to work on integrated river basin management, another opportunity for peace through water management arose in 1994 when Gilbert became chair of the National Academy of Sciences Committee on Sustainable Water Supplies for the Middle East. He described this effort,

Representatives of the principal science councils of Israel, Jordan, the Palestine Authority, and the United States first met in Washington D.C. in 1994 to consider ways in which they might collaborate for the mutual benefit of their communities...and] concluded that the most critical of these problems was ensuring sustainable water supplies in the Middle East...

While during the period of the study the international political scene in the study area was marked by tensions and contending charges, this situation did not color or interfere with the participation of the committee members or scientific agencies from which they drew their information and expert opinion....All shared the sense that this was a unique opportunity, a chance to demonstrate the ability of concerned scientists and engineers to jointly help lay the groundwork for peaceful solutions to issues of critical social and environmental import in the foreseeable future.(NRC, 1999, p. xi)

Today, as wars and terrorism persist, these examples of idealism and Gilbert's persistent pursuit of peace through water management may seem unsophisticated to some. But the effort to use the common language of science to bridge conflicts and address human rights concerns continues and frequently have become initiatives of the National Academies.

SCIENCE IN PRACTICAL SERVICE TO HUMANITY

Today it is widely accepted that scientific advice needs to be salient, credible, and legitimate: salient to the needs of potential users, credible as the available science and research that supports it, and legitimate in the fair, open, and transparent process by which it is assembled. In many ways these three criteria describe the standards of the National

Academies and their hundreds of reports annually that offer scientific and technological advice. Gilbert was familiar with these criteria even before election to the National Academy of Sciences in 1973, having served as chair of the Committee on Water in the 1960s and chair of the International Environmental Programs Committee in 1972.

His deep-felt concern that science should be of practical service to humanity began with his own discipline, geography, and later extended to science as a whole. Writing in 1969 and dissatisfied with what he took to be the sometimes introverted and complacent world view of his colleagues, he remembered,

[W]hen we entertained serious doubt that man could avoid a nuclear holocaust or genuinely prevent global disorganization or keep from fouling his nest irreparably...

Let it not be said that geographers have become so habituated to talking about the world that they are reluctant to make themselves a vital instrument for changing the world. This position will no longer do for research, for teaching at the college level, or for teaching at the high school level. It can survive only at the peril of the society which permits its comfortable and encapsulated existence...What shall it profit a profession if it fabricate a nifty discipline about the world while that world and the human spirit are degraded? (White in Kates and Burton, 1986, pp. 318, 321-322)

Over time Gilbert's fears may have softened a bit and his concern for the tension between scientific advocacy and evidence may have increased but his concern for the practical application of knowledge to public policy (Wescoat, 1992) expanded internationally. Shortly after the 1972 Stockholm Conference on the Environment, Gilbert and meteorologist Tom Malone brought together the Scientific Committee on Problems of the Environment (SCOPE) under the aegis of the International Council of Scientific Unions (ICSU). Their intention was to create a group that could offer independent

scientific assessments of global environmental problems. Under their leadership (Gilbert became its president in 1976), SCOPE issued reports modeled on the approach used by the National Research Council (NRC) of the National Academies. Some were on scientific methods, such as simulation modeling, environmental impact assessment, and risk assessment, and others dealt with global interdisciplinary problems, such as biogeochemical cycles, ecotoxicology, human settlements, and land transformation.

Gilbert was also a member of the International Group on Greenhouse Gasses, another ICSU committee. Under the leadership of Bert Bolin of Sweden the group evolved into the Intergovernmental Panel on Climate Change (IPCC) and has just embarked on its fifth assessment of climate change. For the recent one it was awarded the Nobel Peace Prize. The IPCC is seen as a novel combination of independent scientific assessment and governmental involvement, going beyond the NRC model, to require governmental acceptance of major findings. While respectful of the process, Gilbert never approved of it, concerned that the mix of international science assessments and intergovernmental authority might compromise the independence of the science. Variants of the SCOPE-IPCC model of international science assessments have been completed for global ecosystems, Arctic climate impacts, agriculture, and have been suggested for water, biodiversity, and numerous other concerns, but none has been as successful as the IPCC.

For scientific assessments to be credible they rely on peer-reviewed published knowledge. This database often has research gaps, especially for more integrated knowledge and the understudied societal dimensions of environmental and development issues. To fill this gap Gilbert in his last decade saw the rise of sustainability science (Kates et al., 2001), which he much encouraged.

Gilbert's commitment to salient, credible, and legitimate scientific knowledge on environmental issues and the longer-term vision of sustainable development began in his youth in New Deal Washington and persisted to the last years of his long life when he still served on three committees addressing flood and coastal erosion issues.

HUMAN DEVELOPMENT AND ENVIRONMENT

Today, closely coupled systems of nature and society (sustainable development) are the subject of much research. The challenge to reconcile human development and environment is a major policy objective, and sustainability science is a major effort to link the research with policy and move knowledge into action. Akin to agricultural or health science, sustainability science is "an emerging field of research dealing with the interactions between natural and social systems, and with how those interactions affect the challenge of sustainability: meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems" (www.pnas.org/misc/sustainability.shtml). All three of these trends Gilbert anticipated and helped create.

Beginning with drought and flood plains in the 1930s, Gilbert always saw the need to integrate nature and society as closely coupled systems whose interactions needed to be understood by science. How early that began can be illustrated with a personal anecdote. In 1999 Gilbert and I were in Washington, and I asked him whether he had ever seen the FDR memorial, which opened in 1997. He said he hadn't, and we planned a trip there together. We were walking through the passageway to room two where I wanted him to see the inscription taken from a message to Congress in 1935 on natural resources: "Men and nature must work

hand in hand. The throwing out of balance of the resources of nature throw out of balance also the lives of men.”

“Gilbert,” I asked, “Had you seen that quote before?” He looked at me shyly and replied, “Yes, I have. I wrote it.” I then recalled that he helped draft a number of speeches, messages, and reports for President Roosevelt.

Writing in 1980 on life support systems and in many similar statements over the years, Gilbert said,

The health of the land and its associated plants and animals is basic to preservation of the resource base, yet it is rarely investigated in a fashion that permits recognition of the interactions that affect its net ability to support life. Reductionist research prevails and is encouraged by the organization of most universities. We know a great deal about such matters as crop yields per acre and rates of soil loss in test plots and about the effects of specified pesticides on a few insect and bird populations, but we have no fully adequate means of estimating the capacity of land areas as units to permanently sustain a diverse population of species under prevailing techniques. (White in Kates and Burton, 1986, p. 429)

Anticipating the need for sustainable development, Gilbert wrote in the 1970s,

The high-income countries are enthusiastic about convening in 1972 in Stockholm a world conference on the human environment. The developing countries are far from enthusiastic and have lagged in expressions of interest. Why, it is asked, are the rich countries calling for caution in the use of fertilizers and pesticides and the development of power plants and mineral extraction for a growing population after they, having polluted their environment in the process, arrive at a point of economic and political dominance? The environment issue places in sharp focus the question of what stance the rich will take toward the poor as the income gap widens and export sources are depleted. It should not be a stance of condescension, or of moral condemnation of the spawning poor to an eternity of suffering. A new level of understanding and of scientific and economic cooperation will be required. (White in Kates and Burton, 1986, pp. 287-288)

In describing a major effort to link the research with policy and move knowledge into action, keystones of sustain-

ability science today, he would write in 1971 about natural hazards research,

[I]t is too early to venture an appraisal of how influential...natural hazards research has been upon either public policy or geographic thinking...In the short run it clearly has been linked to changes in methods of managing water and associated land changes...What effect these changes will have in the long run is impossible to predict. As of 1971 they pointed to more searching examination of the range of choice available to man in coming to terms with his environment...In essence, the activity was problem oriented and interdisciplinary. Such work is often tiresome and sometimes exhilarating. It requires research findings in a form highly intelligible to workers in other fields. It ignores conventional divisions of an academic field. One lesson emerges...that if environmental problems are pursued rigorously enough and with sufficient attention to likely contributions from other disciplines, they may foster constructive alteration in public policy but at the same time stimulate new research and refinements of research methodology...Both may serve man's painful, faltering, and crucial struggle to find his harmonious place in the global system of which he is a part. (White in Kates and Burton, 1986, pp. 342-343)

Years later, there were many appraisals of the influence of his work, often in the form of honorary degrees, membership in the major U.S. and Russian science academies, prizes and awards (e.g., Sasakawa, Tyler, Volvo, Cosmos), and medals (e.g., National Geographic Society Hubbard Medal, Public Welfare Medal of the National Academy of Sciences, U.S. National Medal of Science). The Public Welfare Medal citation said it well: "For 65 years of educating colleagues, students, and governments—through research, institution-building, and policy analysis—on how to change the ways we manage water resources, mitigate hazards, and assess the environment, enabling people to aspire to a more humane coexistence with the natural world." But there was more than just scientific understanding of human environment interactions or the early anticipation of sustainable development and sustainability science as he wove his Quaker values into his pragmatism.

I believe...that people around the world in the 1990s are perceiving the earth as more than a globe to be surveyed, or developed for the public good in the short term, or to be protected from threats to its well-being both human and natural. It is all of those in some degree, but has additional dimensions. People in many cultures accept its scientific description as a matter of belief. They recognize a commitment to care for it in perpetuity. They accept reluctantly an obligation to come to terms with problems posed by growth in numbers and appetites. This is not simply anxious analysis of economic and social consequences of political policies toward environmental matters. The roots are in a growing solemn sense of the individual as part of one human family for whom the earth is its one spiritual home. What an exciting time to be looking back and to be looking forward, in such good company, to the ways the world community views and may view its tenure on earth! (White, 1993, p. 12.)

The last years of Gilbert's life were difficult with failing health and pain. Anne had died in 1989, and he had outlived many friends and colleagues. In those years he was fortunate to have the support of his second wife, Claire Sheridan, his children, friends, and neighbors. He died from dehydration, as he had wished, at home on October 5, 2006.

As this memoir is written the Gilbert F. White Memorial has just been completed on the flood plain of Boulder Creek in Boulder, Colorado. It was assumed that Gilbert with his well-known modesty would never have wanted a memorial. So the committee of friends, family, colleagues, students, and city officials, and the hundreds of contributors that made it possible, thought that a memorial with an educational function, continuing Gilbert's long-term concern with encroachment onto the Boulder flood plain, would be in keeping with his life and memory. Towering above the creek the stone and recycled glass memorial, partly designed by his daughter Mary, warns residents of the potential height of past and future floods and reminds them that "floods are 'acts of God,' but flood losses are largely acts of man."



Gilbert F. White Memorial.
Boulder Creek, Boulder, Colorado.
Photo by David Butler.

Several quotations from Gilbert White are drawn from Kates, R. W., and I. Burton. 1986. *Geography Resources and Environment*, vol. I, *Selected Writings of Gilbert F. White*. Chicago: University of Chicago Press and used with the permission of The University of Chicago.

NOTES

1. The author was Gilbert's student (1958-1962), collaborator (1960-2006), and family friend (since 1958). He followed Gilbert into the National Academy of Sciences two years after Gilbert's election in 1973. This memoir draws considerably in concept if not in words from Kates and Burton (2008).
2. A detailed account of Gilbert's life and work may be found in Robert Hinshaw's biography published just before Gilbert's death (Hinshaw, 2006). A comprehensive publication list, vita, honors list, and other materials are available at www.colorado.edu/hazards/gfw/.

REFERENCES

- Barrows, H. H. 1923. Geography as human ecology. *Ann. Assoc. Am. Geogr.* 13:1-14.
- Burton, I., R. W. Kates, and G. F. White. 1978. *The Environment as Hazard*. New York: Oxford University Press
- Burton, I. 1962. *Types of Agricultural Occupance of Flood Plains in the United States*. Department of Geography Research Paper No 75. Chicago: University of Chicago.
- Hinshaw, R. E. 2006. *Living with Nature's Extremes: The Life of Gilbert Fowler White*. Boulder, Colo.: Johnson Books.
- Kates, R. W. 1962. *Hazard and Choice Perception in Flood Plain Management*. Department of Geography Research Paper No. 78. Chicago: University of Chicago.
- Kates, R. W., and I. Burton. 1986. *Geography Resources and Environment*, vol. I, *Selected Writings of Gilbert F. White*. Chicago: University of Chicago Press.
- Kates, R. W., and I. Burton. 2008. Gilbert F. White, 1911-2006: Local legacies, national achievements, and global visions. *Ann. Assoc. Am. Geogr.* 98(2):1-8.
- Kates, R. W., W. C. Clark, R. Corell, J. M. Hall, C. C. Jaeger, I. Lowe, J. J. McCarthy, et al. 2001. Sustainability science. *Science* 292:641-642.

- Murphy, F. C. 1958. *Regulating Flood-Plain Development*. Department of Geography Research Paper No. 56. Chicago: University of Chicago.
- NRC (National Research Council). 1999. Committee on Sustainable Water Supplies in the Middle East. *Water for the Future: The West Bank and Gaza Strip, Israel and Jordan*. Washington, D.C.: National Academy Press.
- Reuss, M. 1993. *Water Resources People and Issues: Interview with Gilbert F. White*. Ft. Belvoir, Va.: Office of History, United States Army Corps of Engineers.
- Sheaffer, J. R. 1960. *Flood Proofing: An Element in a Flood Damage Reduction Program*. Department of Geography Research Paper No. 65. Chicago: University of Chicago.
- Thompson, J., I. T. Porras, J. K. Tunwine, M. R. Mujwahuzi, M. Katui-Katua, N. Johnstone, and L. Wood. 2002. *Drawers of Water II: 30 Years of Change in Domestic Water Use and Environmental Health – Overview*. London: International Institute for Environment and Development.
- U.S. Water Resources Council. 1979. *A Unified National Program for Floodplain Management*. Washington, D.C.: Government Printing Office.
- Wescoat, J. L. Jr. 1992. Common themes in the work of Gilbert White and John Dewey: A pragmatic appraisal. *Ann. Assoc. Am. Geogr.* 82(4):587-607.
- White, G. F. 1935. Shortage of public water supplies in the United States during 1934. *J. Am. Water Works Assoc.* 27(7):841-854.
- White, G. F. 1945. *Human Adjustment to Floods*. Department of Geography Research Paper No. 29. Chicago: University of Chicago.
- White, G. F. 1964a. Vietnam: The fourth course. *Bull. At. Sci.* 20(10):6-10.
- White, G. F. 1964b. *Choice of Adjustment to Floods*. Department of Geography Research Paper No. 93. Chicago: University of Chicago.
- White, G. F. 1970. The meaning of the environmental crisis. Paper presented at the University of California, December 7.
- White, G. F. 1972. Geography and public policy. *Prof. Geogr.* 24(2):101-104.
- White, G. F. 1973. Natural hazards research. In *Directions in Geography*, ed. R. J. Chorley, pp. 193-216. London: Methuen.

- White, G. F. 1974a. Domestic water supply: Right or good? In *Proceedings of Ciba Foundation Symposium on Human Rights in Health, July 4-6, 1973*, pp. 35-59. Amsterdam: Associated Scientific Publishers.
- White, G. F., ed. 1974b. *Natural Hazards: Local, National, Global*. New York: Oxford University Press.
- White, G. F. 1980. Environment. *Science* 209:183-190.
- White, G. F. 1993. Perceptions of the earth. Paper presented at receipt of 30th Cosmos Club Award, April 15. Washington, D.C.: Cosmos Club.
- White, G. F. 1994. Reflections on changing perceptions of the earth. *Annu. Rev. Energ. Env.* 19:1-13.
- White, G. F., D. J. Bradley, and A. U. White. 1972. *Drawers of Water: Domestic Water Use in East Africa*. Chicago: University of Chicago Press.
- White, G. F., R. W. Kates, and I. Burton. 2001. Knowing better and losing even more: The use of knowledge in hazards management. *Env. Hazards* 3:81-92.
- White, G. F., W. C. Calef, J. W. Hudson, H. M. Mayer, J. R. Shaeffer, and D. J. Volk. 1958. *Changes in Urban Occupance of Flood Plains in the United States*. Department of Geography Research Paper No. 57. Chicago: University of Chicago.

SELECTED BIBLIOGRAPHY

1935

Shortage of public water supplies in the United States during 1934.
J. Am. Water Works Assoc. 27(7):841-854.

1945

Human Adjustment to Floods. Department of Geography Research Paper No. 29. Chicago: University of Chicago.

1956

Ed. *The Future of Arid Lands.* Washington, D.C.: American Association for the Advancement of Science.

1958

With W. C. Calef, J. W. Hudson, H. M. Mayer, J. R. Shaeffer, and D. J. Volk. *Changes in Urban Occupance of Flood Plains in the United States.* Department of Geography Research Paper No. 57. Chicago: University of Chicago.

Integrated River Basin Development. New York: United Nations Department of Economics and Social Affairs.

1960

Science and the Future of Arid Lands. Paris: United Nations Educational, Scientific and Cultural Organization.

1964

Choice of Adjustment to Floods. Department of Geography Research Paper No. 93. Chicago: University of Chicago.

Vietnam: The fourth course. *Bull. At. Sci.* 20(10):6-10.

1966

With the Task Force on Federal Flood Control Policy. *A Unified National Program for Managing Flood Losses: A Report.* Washington, D.C.: 89th Congress, second session, House Document 465.

1969

Strategies of American Water Management. Ann Arbor: University of Michigan Press.

Geography and public policy. *Prof. Geogr.* 24(2):101-104.

1972

With D. J. Bradley and A. U. White. *Drawers of Water: Domestic Water Use in East Africa*. Chicago: University of Chicago Press.

1974

(a) Domestic water supply: Right or good? In *Proceedings of Ciba Foundation Symposium on Human Rights in Health, July 4-6, 1973*, pp. 35-59. Amsterdam: Associated Scientific Publishers.

(b) Ed. *Natural Hazards: Local, National and Global*. New York: Oxford University Press.

1975

With J. E. Haas. *Assessment of Research on Natural Hazards*. Cambridge: MIT Press.

1978

With I. Burton and R. W. Kates. *The Environment as Hazard*. New York: Oxford University Press.

1980

Environment. *Science* 209:183-190.

1984

With J. London, eds. *The Environmental Effects of Nuclear War*. Boulder, Colo.: Westview Press.

1988

The environmental effects of the high dam at Aswan. *Environment* 30(7):4-11, 34-40.

1991

Greenhouse gases, Nile snails, and human choice. In *Perspectives on Behavioral Science: The Colorado Lectures*, ed. R. Jessor. Boulder, Colo.: Westview Press.

1994

Reflections on changing perceptions of the earth. *Annu. Rev. Energ. Env.* 19:1-13.

1999

With Committee on Sustainable Water Supplies in the Middle East. *Water for the Future: The West Bank, Gaza, Israel, and Jordan*, Washington, D.C.: National Academy Press.

2001

With I. Burton and R. W. Kates. Knowing better and losing even more: The use of knowledge in hazards management. *Env. Hazards* 3:81-92.

2002

Autobiographical essay. In *Geographical Voices*, eds. P. Gould and F. Pitts, pp. 341-364. Syracuse, N.Y.: Syracuse University Press.

2003

With J. L. Wescoat Jr. *Water for Life: Water Management and Environmental Policy*. Cambridge: Cambridge University Press.