Windshield wipers couldn’t keep up.

The world outside was blurred, changing, and threatening. I couldn’t even see clearly, let alone forecast what was going to happen.

Rain had begun falling in the night. At 3 a.m. I first heard it as faint but steady static on the roof. It grew in my tossing sleep to a staccato drumbeat that kept me awake before my usual 6 a.m. get-up-and-go. I drove to work on a wet road that reflected the gray sky. In low spots I dodged rippling puddles that were quickly filling to the brim, their depths cryptic.

The downpour continued all day. People complained because the spring and summer of 1972 had already been too wet, bad for gardening and ball games, with mildew oozing where you wouldn’t expect it, all accompanied by a sour whiff of rot in the woods and suspicion that something was wrong, somehow wrong. Plus, we simply missed the sun in what was feeling like a different world from what we had always known, leading some to wonder if the climate itself was changing.

Few thought of it at the time—I certainly didn’t—but a fateful setup, far beyond our reach, had fallen into place. A rainy spring had saturated the soil, a lineup of storms had dampened the first weeks of June, and a prolonged buildup of clouds were all followed by the approach of
hurricane-driven air that had earlier swept across the South, causing minor flooding before tracking northeastward and sojourning to sea. Good riddance! But then, from the warming ocean of early summer, the stubborn storm resupplied itself with additional moisture—a lot of it—and unexpectedly doubled back on the mid-Atlantic states with renewed punch, power-packed in ways no one realized or imagined. The soggy atmosphere, swirling in a counterclockwise cyclone filling the weather-map of eight states, no less, bore directly down on central Pennsylvania.

As the hours passed, the radio warned of high water and local drainage problems. Though the full scope of rude reality had not yet sunk in for any of us, my boss had a sixth sense for sniffing out trouble, and he gave us all a greenlight to head home. I had a lot to do, but to play it safe, I grabbed my raincoat and left my job as Lycoming County’s environmental planner a bit early.

Though it was only 4 p.m. on the year’s longest day, June 21, the cloud-shrouded sunlight dimmed behind a murky overhead brew that just wasn’t going away or even budging. The gloom made the hour seem crepuscular, twilight elbowing in ahead of time, cheating us out of the solstice with its normally lingering daylight that conveys leisure, comfort, and celebration of nature’s more benign cosmic inevitabilities, not to mention expectations of summer with its smiley themes of carefree youth, hope, and renewal. Instead, runoff gushed from houses’ overloaded downspouts and through culverts tunneled under roads in channels churning full and angry, belching with mean backups that could cover all signs of the pavement. The ground had become a saturated sponge capable of absorbing no more. But the water continued to pound down from the sky anyway, and while a single day of hard rain was not uncommon at that moist, temperate latitude—due west of New York City but hidden within rugged folds of the Appalachian Mountains—the veil of moisture and its relentless accumulation augured something strange.

The water’s impatient overtopping of ditches, its brown foam sudsing every stream leading to the Susquehanna River, and its insistence on flowing even in usually dry places all spoke of something even darker than the unseasonably dim light. It was only rain, only water. Yet its rise, as I neared my home, hinted at a fate bending off the charts. As the currents of river-sized Pine Creek came into view from the road, their menacing effects
The coming storm seemed to multiply. A lot of runoff is one thing, but the push, the urgency, the whirlpools, the furious violence of something as artistically fluid and normally appealing as water all seemed to dismiss not only any reasonable expectations we might have had, but also any lingering sense of control and security. If any of us had clung to illusions about being in charge of what happened around us or, for that matter, to any wishes regarding our own immediate fate, those ideas were called into question the way a naive sense of immortality might fade when one is being wheeled into the local hospital’s ICU.

The Hurricane Agnes Flood of June 1972 would grow to become the most damaging and costly flood in American history up to that time. I happened to live at the epicenter of the storm.

Little did we know, during the first day of rain, that the impending flood would inundate whole cities by surprise, overtop dams no one ever expected to fill, and sever levees that for decades had created a false sense...
of security and ultimately an expensive fantasy for all who lived behind them. A rainstorm of three days’ duration transformed our world by running off the land in currents making a war zone out of the places where we had so peaceably been living. Following the flood, the aftermath in stagnant water would breed mold and disease that overnight turned cherished homes into biological battlefields. With the waters, the emotions and apprehensions grew, ascending toward fear while whole communities plummeted toward chaos, their lines of access and communication cut by a few strokes of a sharpened climatic knife. Beyond the nightmare that lay ahead of us, the opaque depths of every river and stream would lead to extended uncertainties, troubled introspection, and eventually public deliberation and divisive uncertainty about how to deal with the next flood. That uncertainty and divisiveness continue to this day.

My wife and I and my visiting twin nephews—an impressionable nine years old and thoroughly game for what I was successfully spinning to them as “adventure”—schlepped our belongings up to the second floor of the cabin where we lived along Pine Creek, and we all slept in the rustic loft through that second night of rainfall while the storm continued to savagely transform my beloved and tame little waterway, known for its scenery as the “Grand Canyon of Pennsylvania,” into a torrent with as much flow as might normally be expected in a whole branch of the arterial Susquehanna, which, 250 miles southward, became the principal source of Chesapeake Bay—largest estuary on the East Coast. Spanning it all, the stage had been set for a flood like never before seen. The drama unfolded hour by hour in the days ahead.

Strangely intrigued, being stranded there, with water bearing down all around, I could feel something inevitable and timeless beyond the imminent destruction and mayhem—something mysteriously suspenseful and undeniably exciting about the raw power of nature. What I felt seemed almost like an appreciation of beauty that would not have been so secondary to a powerful element of dread had we not been standing and living directly in the water’s path. But we were, our lives and homes a bull’s-eye in the storm’s massive, slowly spinning target.

Dawn broke the next morning with continuing rain, and the main road offered temptations to escape, but reports already circulated about its closure. We couldn’t get out. Little did we know then that even before the
flood’s crest, we couldn’t have driven up or down the Appalachian valley more than a few miles, owing to mud-sliding hills, undercut banks, overflowing tributaries, and historic iron truss bridges soon to be tipped over by the force of flow, twisted, crumpled like ERECTOR-set toys carelessly stepped on and then—as if kicked across the room—gone.

Reduced in our seclusion to spectator status, my wife and nephews and I suited up in rain gear and walked down to the edge of the flood to watch a half-floating parade of whole mobile homes along with amputated garages, sinking appliances, and waterlogged furniture, all speaking of people’s suffering upstream and all now ingloriously battered by floating logs speeding buoyantly on the crest. The unsorted mess—liquid, solid, and a full continuum in between—rolled on waves that looked more like ocean swells than anything ever before seen that far from sea.

People’s response in the face of this spill and peril from the sky had begun, as mine did, with carrying treasured belongings up to a second story, provided the flood victims had one. But in many cases a second story was not enough. Other measures—sandbagging doorways, trenching lawns, pumping basements, blaming, regretting, praying by some, and finally, soaked and muddy, evacuating just in the nick of time—were all hopelessly vexed if not fully thwarted by forces far greater than any response we could muster. Expectations of security were crushed. Whatever they might have been, every person’s prospects for the future were severely diminished, all in a matter of just days and hours, all by just one storm falling out of the heavens above us.

It occurred to me that many of our decisions about where to live might have been mistakes, grievous ones overlooking a limitation as serious as high water delivered by something as inevitable as rain. I was reminded, somehow from distant memories, of my efforts years before to craft and then place wooden birdhouses for bug-eating swallows outside the home where I lived. In spite of my best offerings, the birds never settled there. Later I learned that an overhead telephone wire, strung within a short flight of the boxes, was close enough for predatory English sparrows to station themselves and successfully target the eggs and chicks in the homes I had intended for the swallows—something the invasive sparrows can’t do if they lack a nearby perch for staging their ambush. Fortunately the birds I sought to lure in with my cute little houses harbored a deep
evolutionary imperative to go somewhere else. They knew that my choice for their homesite was no place to lay eggs and raise chicks. Regarding floods, I wondered if we had lost that bird-brain instinct for survival. It was nowhere evident.

Quiet retrospection such as this, throughout the days to come, was interrupted by the gusty loud approach of National Guard helicopters in Army-green military modus bringing our isolated and needy Appalachian village food, their whacking rotors sounding a lot like newscasts from horrors of the war that still raged in Vietnam. Cut off from the world, as anachronistic as a cluster of thatched-roofs predating technology but suddenly exposed to napalm, my little burg under postflood conditions might, for all its vulnerability and damage, have reminded you of a scene not unlike that of the Southeast Asian jungle. But there we were, twentieth-century Americans only an afternoon’s drive from the glamour and galleries of New York City.

The Hurricane Agnes Flood impressed me as a force of nature that could not be challenged. Since it resulted from only a few days of heavy rainfall, it seemed as though it would inevitably happen again, in one form or another, in many parts of our country. And in fact, it has.

In the pages ahead, I could focus on the hardships of flooding and on people’s heroic and personal responses to them, as nearly all journalists do when adopting this topic. Tempting and compelling as those personal narratives are, I’m drawn to the larger picture of flooding in America. What has it meant? How have we responded? What should we anticipate? What have we done wrong? What must we do differently? I’m driven by my own personal memories and by intimate knowledge that difficulties during floods are real. However, as an investigator and reporter here, I’m motivated more by what floods mean to rivers, to nature, to society, to public policy, and to all who have literally or intellectually ventured into the rising waters’ path. As challenging as floods have been, they’re now becoming more threatening, and in the years ahead they bode greater importance in our lives, economy, and environment.

I’m prompted to tell this story now, a half-century after the clouds of Hurricane Agnes stubbornly darkened my home, because now we know beyond doubt that a warming climate fuels the storms of the future, and that it portends not just more floods like those of the past, but manifestly
stronger ones. The changing climate will occur everywhere, and for the rest of time as we know it. The floods of the future will make those irrepressibly rising waters that threatened my cabin along a Susquehanna tributary look exactly like what they were: just one incident, one moment in a timeline that now reaches beyond all horizons to new floods and to new truths, doubts, and resolutions. As we will see, much of what we’ve done about floods has not been adequate or, for that matter, well-conceived, and now our responses will be decidedly more consequential to our lives, our communities, our rivers, our surroundings, our everything.

To be unaware of what was going to happen back on June 21, 1972, might have been understandable, but to ignore the hazards of our climatic and hydrologic future in 2024, or any forthcoming date, would be inexcusable, in every sense of the word, to ourselves and to the coming generations. Quite simply, we need to rethink and reform our approach to the perennial and intractable problem of flooding.

Back in 1972 I didn’t know that federal initiatives and public responses to deal with this most-common and profoundly inevitable form of natural disaster amounted to one costly attempt after another, the two common denominators being extreme expense and frustrating futility. It’s not that what we’ve done has always been a mistake—many efforts have served us well—but too often we’ve paid a lot to do the wrong things. First came levees that too often got overtopped or breached. Then we built dams to catch runoff, but they often failed to reduce water levels when they mattered most, during catastrophically big floods. Some dams—cracked, leaking, or otherwise weakened—have ended up being more hazardous than the danger they were intended to avert.

Finding that our dam- and levee-building were not adequate, Congress launched a flood insurance effort, worthy if not compelling in concept and foresight but compromised by special interests, marinated in the worst kind of politics, and entangled in bureaucratic complications, ultimately delivering only a token of the intended reform and reduction of damage while ringing up a deficit of $24 billion and counting, as I write this line. The insurance program has become as unsustainable as people’s occupation of the low-lying properties the program sought to insure. Worse, it has ended up incentivizing new development on floodplains rather than preventing it—exactly the opposite of what was needed, and directly
counter to outcomes desired by all but the most cynical of self-interested power-players. The law of unintended consequences looms large in this story.

After two centuries of attempts to control floods and fifty years after my confrontation with Hurricane Agnes, the damage floods do is now greater than ever. Congress continues to dole out billions of taxpayer dollars for relief on a never-ending cycle: suffer, spend, recover; suffer, spend, recover, repeat, repeat, repeat.

I knew none of this back during the 1972 deluge, and here’s something I knew even less about: healthy rivers depend on floods through natural patterns and cycles. If we want fish, and if we want whole river ecosystems to function, including their provision of essential water supplies, we need floods, strange as that may sound. Over time I came to realize that the tragedy is not that floods occur, but that we’ve built homes, businesses, industries, roads, railroads, and even hospitals directly in harm’s way.

Floods happen frequently and with force that ranks them among the most impressive of natural phenomena, right up there with the geologic extravaganzas of earthquakes and volcanoes. Momentous climatic events of our time also include hurricanes, whose coastal winds and battering surfs tend to overshadow, in the media, the intense rainfall delivered by those same storms inland from the coast and causing rivers to overflow. To the mix of these graphic geophysical dramas we can now add drought, which is ironically the opposite of flooding, and we must also add the subsequent western wildfires, which in recent years have raged with the searing fallout of a climate that’s desiccating whole regions—a continental blow-dryer with no “off” button, entirely out of control, hardwired to continue. But floods are the most common of all these disaster phenomena, and they cause some of the most regrettable human losses, elicit some of the most remarkable responses, and result in some of the most concerted public efforts in prevention and aid, if not the needed avoidance.

For me, the high water of 1972 was a formative and foreboding introduction to floods. It stretched my perception of the damage that can occur and of the myriad and profound ways that floods will influence our future, whether we live in the wet zone, as I did, or not.

While we’ve stumbled along in our reactions to floods for two centuries, the consequences have now caught up. Still, the most common response to
future floods’ inevitability and the need for us to get out of the way might best be described in one word: denial. But now, because of a warming climate, the floods of the future are rising. They’re becoming increasingly frequent, more intense, longer lasting. The age of denial needs to be over.

Let me note, here at the outset of my story, two disclaimers. First, while river flooding and coastal flooding both rank as ominous problems, this book is principally about flooding by rivers. Many of the issues are similar, but flooding along our ocean edges involves hurricane winds, terrifying waves breaking ashore, and rising sea levels, all of which have recently been addressed in other fine books. However, the coastal storms also bring drenching rainfall to entire river basins, and so I draw on relevant experience and data from the coastal regions and their hurricanes whenever needed in order to understand the big picture.

Second, though critical of what we’ve done, the following chapters are not an argument that building dams and levees for flood control was unconditionally a mistake. The structures have reduced flood damages in many cases. I do not suggest that all those efforts have been wasted or undertaken in bad faith. To the contrary, most decision-makers at the time did what they honestly thought was best. My point, rather, is that approaches of the past have proven inadequate. We’ve avoided alternative strategies that now must be pursued with more vigor, and the warming climate demands that we work more, better, and faster to address the problems that confront us. We’ve reached what must become a turning point. From this day forward, the changing climate with its rapidly rising waters will give us no choice but to regard floods differently.

As the stream in front of my house rose and then fell, the flood made me curious, and then it compelled me to learn more, and more, at a deeper and deeper level. As I became aware of our failing response to high water and of the cycles of life and economy surrounding it, I was drawn irresistibly into the currents. Some of these were both literally and figuratively clear as crystal, luring me along, while others swirled muddy and chaotic, challenging any form of navigation or transparency—physical, emotional, or intellectual.

I struggled to escape the classic trap that plagues the researcher, if not everyone, in so many endeavors: the easiest person to fool is yourself. Assumptions and predispositions can lead us dangerously astray. So I left
my own past and beliefs behind in order to see anew and to grasp what was real, consequential, and important in all perspectives of the picture that slowly came into focus. Together, those currents of curiosity led me to every problem of flooding that I encountered and to every solution that came to light. On that rainy day in 1972 I couldn’t even see clearly, let alone forecast what was going to happen to my river, my home, my job, and my life. But now I know.

In the murky floodwaters lies the clarity of an essential lesson, important to all: as a society, we’ve regarded the laws of nature as optional when in fact they are absolute. Meanwhile we regard our own habits, customs, and laws as immutable when in fact we can change them whenever we collectively decide to do so. In our minds we have perfectly reversed the way the world actually works, and nowhere is this delusion more evident than along a flooding river. Perhaps nowhere does this lesson make so much difference. For two hundred years, that troubling truth has accompanied the history of flooding in America.

In January 2023 a series of storms caused flooding along the entire length of California. Here the Russian River and its tributary, Fife Creek, have backed water into a low-lying neighborhood of Guerneville.