



Chapter 1

Eden Ablaze: Why the World's Forests Are Burning

Walled by dry hills and high plateaus to east and west, the Okanagan Valley is a sliver-shaped Shangri-La set about a long Zen brush stroke of blue lake. Warmer and drier than California's Napa region, and about the size of Long Island, the Valley was a fruit-growing centre in the last century. Now aerospace companies encroach on premium-label wineries, condos colonize the lake-shore, and million-dollar houses command the views above.

Among the Valley's many successful transplants are brothers Leo and Andy Gebert. Born in southern Switzerland and married there to two sisters, Barbara and Suzanne, the Geberts moved with their wives to Canada in 1984, choosing the Okanagan as the place to chase their dreams. Together, the two couples acquired 75 acres of land near Kelowna with heart-stopping views out over Okanagan Lake. Two-thirds of the acreage was planted in maturing grapevines. In 1992, after eight years of growing grapes for established wineries, the two families made the risky jump into producing wine themselves. Named for the patron saint of hunting, the favourite pastime of the brothers' late father Franz, the new winery's "St. Hubertus" German-style whites and refined reds soon earned a good reputation among discerning oenophiles.

Close to where the Geberts' vineyard runs down to the shore of Okanagan Lake, the narrow lace of blue water doglegs sharply west. Off toward the sunset, a vast thrust of bare, grey-brown rock rises sheer from the waves. When the Geberts first laid eyes on Okanagan Mountain, an open forest of tall lodge-pole and ponderosa pine softened its stony slopes. Woodland extended to the very edge of the new landowners' grape fields. The brothers appreciated the trees' presence for reasons both aesthetic and practical: owls and hawks residing in the forest helped control the rodents and smaller birds that liked their grapes.

Then came the summer of 2003. Through July and August that year, day followed day of blue skies, unbroken UPF-40 sunshine, dry breezes and afternoon temperatures that soared into the high 30s c.

As night fell on August 15, 2003, thunderheads began to thicken over the Valley. Toward midnight, a strong wind came up from the southwest. Lightning flickered in the velvet dark. Shortly before 2:00 a.m., a blue-white flash split the sky. A hundred million volts of electricity struck the forested mountain a little north of an area known as Wild Horse Canyon. Grey lichen and rust-red pine needles sent up small bright tongues of flame.

Within 10 minutes a phone rang at the nearest fire-control centre. An officer drove out to examine the reported red glow on Okanagan Mountain from across the lake. The lightning had struck a steep slope far from the nearest house. In any case, the fire centre had other worries. Nearly 900 fires were already burning across Canada's third-largest province. The latest alarm was only one of two dozen the centre would receive that day. Fire commanders put off any response until first light.¹

Some 20 kilometres away on the far side of the mountain, Leo and Barbara and Andy and Suzanne Gebert and their five children slumbered peacefully in the two houses they occupied, one on either side of the main winery building. The coming day, a Saturday, would be busy at the growing family business. There were wine-tasting tourists to welcome at the tent pavilion, protective netting to be spread

over ripening grapes, and the contents of the last barrels remaining from the previous season—the tenth-anniversary vintage for St. Hubertus—to ready for bottling.

Dawn broke clear and cloudless once again. A faint haze staining the blue sky beyond the mountain was the only sign of anything out of the ordinary. Andy Gebert thought nothing of it: “I remember looking out and seeing one single helicopter piddling about.”² Even when radio news reports mentioned the newest fire among the many then burning across the province, he never thought it would pose an imminent danger to his family’s property.

Neither did the first fire crew to reach the remote mountainside shortly after daybreak. Fuelled by dry mosses and fragrant sage, the flames ignited overnight had quickly run uphill into standing pine. Trees were burning across nearly 40 acres of forest. Still, fire bosses were confident they could contain what looked like a run-of-the-mill burn. They called in helicopters to bucket hot spots with water, and for an hour, three fixed-wing planes spread bright red chemical retardant along the fire’s northern front. When those efforts seemed to check the advancing flames, the aircraft returned to base. Within minutes they refuelled and were aloft again to attack other fires.

But the young monster on Okanagan Mountain had only been thrown back, not defeated. Weeks of drought had left the forest exceptionally dry. Around noon the wind freshened. Hot gusts picked up glowing embers and blew them out ahead of the main fire front, igniting new blazes. Soon flames leapt uphill faster than the helicopters, returning every two or three minutes, could douse them. The Incident Commander radioed for aircraft to drop more fire retardant, but with every available plane already in action elsewhere it was an hour before the first water bomber came free. For the rest of that long, hot afternoon, it and the helicopters continued to assault the fire. But the flames proved stronger, consuming even branches stained the colour of blood by retardant. With two hours of daylight left, the smoke from the burning forest became too thick to fly into. The fire crews withdrew and flames leapt forward unchecked. The monster had broken out of its cage.

Back at the St. Hubertus winery, Andy and Suzanne's son and daughter, both under 10, had spent the day splashing in the family pool. Leo's three teenagers, two sons and a daughter, had joined in winery chores or spent time with their grandmother Gebert, who was visiting Canada for the summer. Apart from the faint tang of smoke in the hazy air, the fire burning in a remote corner beyond the mountain still seemed nothing to be concerned about.

The following day was a Sunday, another day of summer tourists for the winery and frustration for the firefighters. As the flames burned through rugged ravines and cliffs inaccessible to heavy equipment, commanders again called in helicopters and water-bombers. But heavy smoke blunted their effectiveness. By nightfall, the fire front had come within six kilometres of Kelowna's city limits. Police evacuated the half-dozen houses closest to the fire and warned the occupants of another 40 to be ready to leave. The Geberts were not among them. In fact, Kelowna's emergency planning officials considered their green expanse of irrigated vines part of the city's protection against the fire burning up from the south.

The next day firefighters from Kelowna and several surrounding communities joined the battle. But not even these reinforcements could prevail against continuing strong winds and the almost unlimited dry fuel available on the mountain. Over the next 48 hours, flames and flying embers repeatedly leapt over fire breaks, extending the blaze to a front more than 10 kilometres long. On Wednesday afternoon, an emergency-response officer appeared at the winery gate to warn the Gebert families that they should be prepared to evacuate on short notice. Still, Andy considered the warning "an absolute non-event. You could see flames and little white puffy spots of smoke miles away, but it was nothing too serious."

The next day, Thursday, dawned "absolutely gorgeous," Andy remembers. "The fire was going away to the northwest. The kids were in the pool, playing. The winery was going like crazy, preparing for harvest. We were serving wine to tourists." That evening, Andy lingered with a neighbour over a plate of cheese and a bottle of the family's

Northern Summer red. Leo drove into town to attend the weekly meeting of his Rotary Club.

Partway through the meeting, Leo's cell phone trilled. It was Barbara, urging him to come home. A nervous-looking police officer had just been to the door, warning everyone to get out—*now*.

By the time Leo turned into the winery's drive, choking smoke obscured the hill beyond the vineyard. Orange light flickered and glowed eerily in the murky air. Together the brothers ran up the hill to open the gates in the fence along the tree line so that any animals fleeing the fire could get through. Smoke stung their eyes. Flames burst from treetop to treetop across the entire hillside. The ground fire disappeared to either side in swirling smoke. White ash fell like warm snow, and even from a distance the heat on their skin was unbearably intense. The roar of the fire surrounded them. "It was like a 747," Leo remembers.³

Back in the winery drive, Andy's wife Suzanne had their two youngsters and a suitcase of clothes for each in their Blazer. Andy had his laptop beside him in the passenger seat of his Mustang; three cases of wine filled its back seat. Leo ran into the house and spotted his own laptop and new video camera. Grabbing those he raced back out to rejoin his family in their camper and second car. As the little convoy pulled out, the first flames reached the vineyard fence.

That night you might have thought the gates of Inferno had opened and the Devil himself was stalking Eden. Viewed from across the lake, a terrifying arc of flame and glowing smoke seemed to march across a vast darkness glimmering with secondary fires. By dawn the heat of the conflagration, consuming incalculable volumes of air, drew winds into the firestorm at over 70 kilometres an hour. Great gusts of flame leapt to the height of 40-storey buildings. Burning debris the size of dinner plates rode the roaring winds to ignite fresh fires as much as eight kilometres away from the main front.

Most house fires burn at around 1,000°C. On that day temperatures more than twice that hot ignited wooden structures even before the flames could reach them. In the forested hills on Kelowna's

southern fringe, where nearly 4,000 families had fled their homes, firefighters poured water on any house they could reach until the tanks in their trucks ran dry, embers burned through their hoses or the heat simply became too fierce. By nightfall over 200 houses lay in ashes. One-third of Kelowna's population slept in cars or camped with friends, in motels or emergency shelters.

At last, long after midnight, the wind finally dropped. The monster was far from extinguished—flames would continue to flicker here and there for another three weeks—but for the first time since lightning struck Okanagan Mountain above Wild Horse Canyon, the inferno was contained. The worst was over.

Two days later, troops allowed Leo Gebert back to inspect the family property. With ferocious caprice the flames had bypassed Andy and Suzanne's house entirely. But of the building in which the brothers had turned grapes into St. Hubertus wine, only a few scorched and twisted metal tanks remained. Of Leo's own Tudor-style house, filled with old-country furniture inherited from his and Barbara's grandparents, nothing was left but an ash-filled grave marked by two bare masonry chimneys.

Why begin a conversation about water with an account of fire? The two are opposites, after all, in symbol and experience. One ignites only where the other is not. The first quenches the second.

Yet the Promethean nightmare that roared down off Okanagan Mountain embodies the very extremity of the danger we face. Dry forests burn. Wet ones don't. And more forests are burning now than in the past, even the recent past. They're burning longer and more violently. And they're burning all over the world.

A month after fire destroyed the St. Hubertus winery, grassland fires swept Southern California for weeks. Their flames killed more than a dozen people, destroyed hundreds of houses and reduced an area three times the size of San Francisco to ashes.⁴ That same pitiless season, fires in Europe blazed across nearly half of Portugal.⁵ The

next year, fires blackened an area of Alaska as big as Massachusetts. Other monster outbreaks have consumed thousands of acres of forest and grassland in Saskatchewan and Northern Ontario, in Florida, Texas and Oklahoma. The same fiery plague has visited wildlands from Sweden to Siberia, Indonesia to the Amazon. The early onset of the southern hemisphere summer late in 2006 helped ignite what Australian firefighters described as “the worst spring bushfire in living memory,” near the Tasmanian capital of Hobart. One survivor, teenager Teegan Speakman, described howling winds that sent flames spiralling through dry gullies around her family’s farm: “I couldn’t breathe. I couldn’t see in front of me, and the tractor blew up in the shed.”⁶

Forests burn every year. Humans start many forest fires, either accidentally or intentionally. Lightning causes more. In some areas, fire suppression in years past has built up a larger stock of unburned fuel than nature might have allowed. Still, those factors cannot explain the full extent of the pandemic of flame. Never in human memory have so many fires burned for so long over so much terrain. The area ablaze every summer around the Arctic Ocean in North America and Russia in the 1990s was more than twice what had burned there 30 years earlier.⁷ Alaska’s 7,600 fires in 2004 were 10 times the seasonal average over the previous decade.⁸ Overall, the American West has experienced four times as many large wildfires each year in the new century as in the years of the 1970s; the fires typically burn four to five times longer and destroy six times more woodland.⁹ The acreage burned in Portugal, Spain, Italy and Greece has similarly quadrupled in the new century compared to the 1960s.¹⁰

The violence of these blazes has staggered even firefighters of long experience. Jesús Abad, the only survivor of a 12-person crew trapped while fighting a monster blaze near Guadalajara, Spain, in 2005, described a “hurricane of fire” that seemed almost demonic in its malice. “I think it saw us and said, ‘You, you’re mine,’” he recalled from his hospital bed, his arms and face swaddled in white bandages.¹¹

New megafires sometimes stretching across hundreds of kilometres overwhelm the best-equipped firefighters. After a shift in the wind finally checked a raging California wildfire in 2006, veteran San Bernardino fire chief Mat Fratus said in awe, "Everything we had to throw at it, we did, and it just seemed to burn right through us."¹²

It's been the same experience down under and everywhere else the globe is burning, finds Australia's Bushfire Cooperative Research Centre. "These fires can't be controlled by any suppression resources that we have available anywhere in the world," the Centre's chief executive Kevin O'Loughlin says. "They basically burn until there is a substantial break in the weather, or they hit a coastline."¹³

The increase in number, extent and ferocity of fires burning worldwide is no coincidence. It reflects unprecedented periods of dry weather. Hot, dry days, often accompanied by wind, act on grassland and forests exactly as a household blow-dryer does on hair, drawing out every possible molecule of moisture. Leaves, living twigs and the vegetation decaying beneath them transform into spark-ready fuel. Such days, formerly exceptional in many places, are now becoming the norm. Weeks of them preceded the Okanagan fire, as well as those that blazed before and after it across Southern California, Europe, Africa, South America, Southeast Asia, Russia and Australia.

Perched on a bluff overlooking a sand beach north of San Diego, the Scripps Institution of Oceanography has been a world-ranked research centre since 1903. As the Scripps celebrated its centennial in 2003, grey columns of smoke were visible from its windows, rising over the hills to the east. At night, the darkness flickered with red flames fanned by what are known locally as Santa Ana winds, blowing down from the dry plateau beyond the Sierra Nevada. The connection spurred scientists at the venerable institution to compare decades of weather records with fire data from the U.S. Forest Service. They found that temperatures over the western Sierras had become steadily warmer, with the result that upland snow melted earlier each spring. That gave forests longer to dry out and fires more opportunities to start.¹⁴ By the dawn of the new century, the fire season in California

had become *more than two months* longer than it had been 40 years earlier. “People think climate change [is] 50 to 100 years away,” says Scripps researcher Thomas Swetnam. “It’s not. It’s happening now in forest ecosystems through fire.”¹⁵

As it has often been for humanity, fire is merely a messenger. Consuming forest and savannah and scarring innumerable lives, it races across landscapes to bear a warning: the weather is changing. Not in some distant decade at the end of the century, but now, today, all around us. In the next few chapters we’ll explore the manifestations of that change. *Inferno*, we will find, wears many faces.

The most ominous shifts over North America are taking place where its society is experiencing its most exuberant growth: in the American Southwest, the western Canadian Prairies, and our shared Great Lakes heartland. Later chapters will examine each of these more closely. Around the entire globe, the forces that bring us wind and rain, snow, and hot, drying days are undergoing a realignment; we’ll explore that in Chapter Eight. One shift in particular will stand out: what are known as the sub-tropics, the latitudes occupied by most of the continental United States, are getting drier, while higher latitudes where Canada lies, are getting wetter.

As we explore these changes in the air, we will also come to appreciate a great flaw in much of what is written about weather and climate. Climate forecasts couched in *average* global temperatures too often conceal the increasing severity of the *real* weather we get. This is a defect of arithmetic means: to a mathematician, a glass that is full to the brim and one that is bone-dry are, on average, each half full. While climate’s marble zips higher and higher up first one side of the bowl then the other, its average position may still place it resting somewhere on the bottom. It’s not the averages we have to fear, but the extremes.

Someone with the eyes of an eagle might stand between the rows of the St. Hubertus vineyards, look north across the dogleg reach of Okanagan Lake and pick out the modest white house that serves as an office for the Okanagan Nation Alliance. The Alliance is a common

front of seven Aboriginal bands that claim the Valley as traditional territory. Its small staff is overstretched in representing the varied interests of 3,000 constituents. Perpetually multi-tasking, Deana Machin is the Alliance's fisheries manager and also its voice on the Okanagan Water Stewardship Council, a volunteer forum created to advise municipal leaders.

"We were here before Europeans came," Deana told me. "That gives us a more long-term perspective. Elders talk about what is good for our grandchildren's children, and I hear a lot of them say we're not doing a good job of keeping our water clean."¹⁶ In particular, Deana says, "I'm very concerned about how rapidly development is happening." After bursting through every growth forecast of the last 40 years, the Okanagan's population of fewer than 300,000 at the turn of the millennium is expected to grow by a third within a dozen years. Deana wonders how the land will take it. "Every natural habitat has its carrying capacity."

"To the Okanagan Nation," Deana tells me, "water is sacred," inseparable from her people's sense of spirit and identity. At the same time, she regards water as just another asset seized from her people without so much as a shotgun treaty in the 19th and 20th centuries. It riles her greatly to see it "given away for free," to Valley residents. "The Okanagan Nation has never given up title over our territory. We don't view water as any different from trees, any different from fish. The Nations are getting a pittance for resources leaving their land."

The liquid asset flowing so freely off what Deana considers unceded First Nation territory is what the Valley's booming new society runs on. Forty-five minutes south down Okanagan Lake from Westbank is a community optimistically named Summerland. A narrow paved road winds away from the water up onto a bench of land. There I found Lorraine Bennest early one morning, spading a trench along a line of matchstick-thin saplings. Her two dogs—Jack, a namesake Jack Russell terrier, and Sarah, a standard poodle—chased scents and small animals among the newly planted rows. A second-generation

orchardist, Lorraine bought her 15 acres of Eden more than a decade ago against the advice of her parents. “They thought it was a dumb business to be in,” she says. “They wanted us to get an education and go into a real business.” Instead, Lorraine now tends her own apple groves with a fierce pride.¹⁷

These aren’t just any apple trees, mind you. Fastidiously cloned and cared-for, these are precision growing machines for what Lorraine calls a “premium-price, fresh market eating experience,” producing fruits whose names are as embedded with promise as the town below: Ambrosia, Silken, and Aurora. They don’t come cheap. An acre of newly planted saplings ordered a year in advance, along with the plastic drip lines buried at their roots, costs \$30,000 to install. Lorraine must carry that debt for at least six years before the trees begin to generate enough fruit for her to start paying it down. Actual profit hovers a decade away.

It rests, moreover, on perpetual defiance of an unhelpful fact of nature that few visitors here stop to consider. Green, despite appearances, is not the Okanagan’s natural colour. That colour is brown. “Look up at the hills,” Lorraine told me on a June day. Above the emerald landscaping of the lower slopes, the hills around us were a dull tan, the colour of dry foliage. This popular valley is in fact one of the driest places in Canada. According to botanists, the Okanagan’s native vegetation reveals a climatic kinship with that of the distant Sonoran Desert in the American Southwest. “We get ten inches of rain a year here,” Lorraine tells me. “I can’t grow anything on ten inches of rain.”

What makes this Shangri-La bloom, bear fruit and seduce so many visitors into putting down roots is plumbing: a hidden network of reservoirs, creeks, canals and pipes. Out of sight in the hills above Summerland is a community reservoir. Scores just like it are concealed up and down the length of the Valley. When rain falls, or snow melts in spring, the reservoir fills. Through the rainless weeks of summer, it supplies the water that flows to Lorraine’s trees in amounts calibrated to the ounce by a small computer in a shed at the

foot of her property. “We’re spoon-feeding our plants,” she says, but during the most critical months from June through September, “We fucking well need it.”

So do we all. It wasn’t the wheel that made civilization possible. It was plumbing. From the earliest Mesopotamian city-states to the plains empires of southeast China to Southern California’s 20th-century metamorphosis from desert to shimmering oasis, our species owes its successes largely to the capture, storage and controlled distribution of water. Irrigated fields produced the food surpluses that allowed early societies to increase in number and afforded the spare time and specialized manpower that led to further inventions. Sanitation lets many of us live together in densities that otherwise would invite lethally epidemic infections (and that, before widespread urban plumbing, did). Where irrigation and sanitation are lacking today, as in sub-Saharan Africa, humanity’s condition is most miserable and our societies are most vulnerable.

On this score the Okanagan is very well served. Despite their semi-arid circumstances, the residents of Kelowna, Westbank and Summerland enjoy clean, fresh water for drinking, washing, growing and making things in more lavish volumes than almost any other humans on the planet. They pay less for it than the residents of many Developing World shantytowns do for jerry cans of water teeming with parasites, and they seldom worry that their taps may run dry. Still, even here, the pipes have gurgled an early warning once or twice. In the same month that flames raced up the opposite side of the Valley, Lorraine’s drip lines were nearly shut off in order to keep enough water in nearby Trout Creek that the namesake game fish would stay alive. Now Lorraine sits with Deana Machin on the Water Stewardship Council, trying to forestall a similar Hobson’s choice in the future. The two women share much the same fear. “My community has added residents in anticipation of more water being available,” Lorraine says. “The thinking is, ‘It’ll all be okay in the future.’ Why will it be okay in the future? It’s not okay now.” She surveys a row of newly planted trees. “I don’t know what we’re going to do.”

The conundrum facing the Okanagan faces the wider world. Several books have catalogued the water shortages stalking many breadbasket regions. Although few listened, a warning bell sounded in 2006 when for the sixth time in seven years, humanity harvested less food than it consumed, and grain reserves hit their lowest point in decades.¹⁸

Particularly in Asia, populations are growing in expectation of ever-expanding harvests from these crucial plains, even as they are hardly “okay now.” In China, some 140 million rely on the Huang He (Yellow) River for drinking water, for water to irrigate an area the size of South Carolina, for water to flow in wells for miles on either side, and for water to help people realize Western-influenced lifestyle aspirations in scores of large industrial cities. These combined demands on the river already add up to 10 percent more than the Huang He typically provides, and yet economic expectations for the Chinese heartland imply that by 2030 withdrawals from the river will somehow rise by nearly half.¹⁹

This perfect brew, of growing populations, rising material demands and mounting calls for water, threatens developing regions from India to Egypt to Mexico. But it's not only the poor who are pinning their futures on impossibly optimistic expectations of water availability. Water tables beneath the American high plains have been falling for decades. So has the Colorado River, whose water keeps Southern California in bloom.

With so much depending on the water in the pipes, I wanted to know more about where the Okanagan's water comes from. To answer that question I drove back north to the top of the Valley and the town of Vernon. There I called on an engineer named Bob Campbell. A comfortably ruffled fellow in jeans and a plaid camp shirt, Campbell takes a boyish pride in the century-old water system under his charge. To show me its source, he bundled me into a four-wheel-drive Jeep for the bone-rattling ascent up a rough track into the hills above the Valley.

It's true that the Okanagan gets very little summer rain. Its southern half, moreover, is drier in general than its north. But in most years the Valley as a whole receives plenty of precipitation: more than enough, on average, to fill a dozen ocean-going tankers every day. But that generous water "income" doesn't come in regular paycheques, so much every week. In fact, as much as nine-tenths of the Valley's precipitation falls in the late autumn, winter and early spring when fields and vineyards are idle. And much of it falls as snow. Water *consumption*, by contrast, peaks between June and September. On some days during those months, Vernon homes and businesses and the area's farmers consume *four times* as much water as they do in wet January.²⁰

More than simply moving water from source to tap, Campbell's great challenge is to budget it between months of surplus and months of deficit. In that task, his main assets are three small artificial lakes named Aberdeen, Grizzly and Haddo, nestled out of sight of the Valley in upland cedar and pine forest. When filled to the brim, their low earthen dams hold nearly 20 billion cubic metres of water: enough, in theory, to supply everyone downstream for over a year. "That's our money in the bank" is how Campbell puts it. But theory is just that. The reality is that unlike bank accounts, the lakes can't ever be drained completely dry. Also unlike bank accounts, the reservoirs don't pay interest; instead, they all lose some volume to evaporation before the water can get to fields or houses. In some rainless summers, the water they contain barely lasts through the season.

Campbell's problem is a pocket-size version of humanity's. Viewed as a global whole, our species and planet aren't running short of water in an absolute sense. Our impending water crisis is not one of world scarcity: to the contrary, there is *more* water circulating through the atmosphere now than for a very long time past. Rather, the crisis we face is one of water's *distribution*: its surplus or deficit relative to our needs at particular times and places.

It's often pointed out that most of the blue on a world map doesn't represent water our species can actually use. This is true: 97 percent of it is salty. Nearly three-quarters of the fresh remainder is buried

too deep underground to be reached or is frozen (for now) in polar ice-caps. Less than four-fifths of one percent of all the water on earth is fresh, liquid and available for human and other terrestrial life. That's still a very great deal, more than five times the water contained in all of the earth's rivers combined.²¹ Averaged across the planet's entire human population, it's more than enough for each of us to guzzle down even on the gluttonous scale that North Americans do.

We don't live in the world of averages, however. We live, increasingly, at the extremes. Consider China's Huang He River again. Sixty percent of its water flows down between July and October, rainy months in north China when farmers don't need the water to irrigate their fields. When they do need it, in the year's driest quarter between March and June, the river is at its lowest ebb. The same asynchronism afflicts the world's second most populous country: India gets 90 percent of its rain during the four monsoon months of June to September, little in the rest of the year.

Water falling at the "wrong" time for human convenience is one side of the distribution problem. The other is water's unequal allotment across the map. In this, Canadians are the outsize winners. With less than one percent of humanity, Canada enjoys 20 percent of all the world's liquid fresh water and seven percent even of its renewable supply. Yet here too, nearly two-thirds of our renewable surface fresh water flows across the relatively unpopulated north, while the vast majority of us do our drinking, bathing and farming in the far south.²²

America's water divide is between east and west rather than north and south. Water studies of the United States divide the country along the 100th degree of longitude, a line running vertically through the middle of the Dakotas and almost directly over Abilene, Texas. Most places east of that line get 51 centimetres or more of rain a year, enough to grow crops on most soils without additional irrigation. Those to the west (apart from the Pacific Northwest) typically get much less. The most intensely irrigated acreages in America, in consequence, are all west of that line. So are 11 of the 15 fastest-growing cities in the United States.²³ Four are in the two driest states, Arizona and Nevada.²⁴

The same mismatch of people and water holds true everywhere else. Mexico's three largest cities and three out of four of its citizens are located in central and northern states that possess only a third of the country's water; the southeast and Yucatan, with less than a quarter of Mexico's people, are amply supplied. Most of Australia's rain falls in the north; most Aussies live in southern coastal cities. Nearly a third of Africa's water flows in the Congo River Basin, which only one African in 10 calls home.²⁵ Collectively, the lands where two-thirds of humanity live—four billion people—get only about a quarter of the globe's precipitation.

We are most reliant on water in its liquid state. Water frozen into snow or ice, or water suspended as airborne vapour, carry significantly different implications for both human and wild life. This turns out to be surprisingly important.

More than half the water the Okanagan Valley receives comes as snow, in most years blanketing the high-altitude plateau by January and piling up through March. When it eventually melts under the returning spring sun, the liberated water fills the Valley's creeks over many weeks. The more snow, the better Bob Campbell likes it. Two dates dominate his calendar: the last early-summer day when melting snow overflows his three reservoir spillways—his last chance to capture and save it—and the first day in the fall when it rains in earnest. Each year lately, the first seems to come sooner and the second later. Half a century of records kept by his predecessors back up this impression: the snow in southern British Columbia is melting at least three weeks earlier today than it did in the 1950s. At the other end of the season, the cold spells that usher in autumn are arriving up to a week later than they did in the past.²⁶ That means Campbell's water "in the bank" has to last longer too. Even were the Valley's population not growing, he observes, "When you start taking water out earlier and your users are wanting it longer, you've got a real potential for shortages."

Not only the timing but the very qualities of the seasons are changing in the Okanagan. The same detailed records that show the slow recession of spring reveal that the water contained in winter snow (what scientists call “snow water equivalent”) has declined by about 10 percent a decade for half a century. Summer days more often test the upper end of the thermometer while summer nights cool off less than in the past. Like that blow-dryer’s “high” setting, warmer days and nights increase the speed at which water evaporates from lakes and reservoirs, from forest underbush and the Okanagan’s fertile soil, as well as the rate at which plants “transpire” moisture into the air (together called “evapotranspiration,” or ET).

The person who has studied most closely what these changes mean for the Okanagan doesn’t live there. He is a reedy, bespectacled academic with an office off the broad green avenue that divides the campus of the University of British Columbia in Vancouver into faculties of arts and science. Stewart Cohen works on the science side. A geographer, he and a team of specialized associates have put the Okanagan under the microscope since the late 1990s, as a kind of living experiment in how changes in the climate may affect societies. They have reached two disturbing conclusions: that the Valley is already near the limit of its annual water income, and that the fiery summer of 2003 was merely a foretaste of what is to come.

“If we don’t do anything,” Cohen warns, the Okanagan will inevitably hit a tipping point when its residents’ rising demands for water collide with dwindling supplies carried over from winter, and taps go dry. And given that averages are not real-life, that some winters are drier than others and some summers hotter, that rain and snow fall unevenly around the Valley and that some communities are growing faster than others, some parts of the Valley, “could pass that balance in the next 10 years.”²⁷

Getting water is never so simple as turning on a tap. Every North American city and acre of irrigated cropland relies on some version of Bob Campbell’s upland reservoirs, as do every other developed

and most of the developing regions of the world. In some cases those reservoirs are natural underground aquifers. In other places, large rivers serve the same purpose. And it is an under-appreciated fact that many of the world's warmest places, including populous parts of central Africa, the state of California and major cities in India, China and Australia rely as much as the Okanagan on snow and ice for their year-round supply of water. But the changes observed in southern British Columbia are happening elsewhere too. Around the entire globe the familiar cadence of precipitation and clear skies, of seasons themselves, is changing. The sky is releasing ample—sometimes too ample—supplies of water when it is least expected and withholding it at times when once it could be counted on. Campbell's reservoirs were designed to bank and budget the reliable water income of a vanished century. Like others around the world, they're straining now to accommodate unpredictable new extremes of precipitation.

To a casual observer, the lake that sparkles down the length of the Okanagan Valley embodies a pristine beauty. Housing developments springing up around its shores strive for the same unblemished image with names like Lakeshore Gardens, Pinnacle Point and Great Ranch Vineyard Estates. But this postcard image of bucolic perfection is carefully staged. The Okanagan watershed is one of the most hydraulically enhanced in Canada. In addition to the hidden reservoirs on virtually every stream running into the Valley, levees confine the rivers that used to wind freely between the lakes, turning them into straight-line culverts. Gated spillways precisely control the water released from each lake to the next.

The rise and fall of the Okanagan lakes are choreographed from an industrial building just off the highway in the city of Penticton. "I'm the guy with his hand on the tap," Brian Symonds says as he introduces himself. Tall, with a ready grin, he manages a plumbing system that has evolved over nearly a century. The first dam in the chain was installed at the outlet of Okanagan Lake at the turn of the

last century, holding back and later dispensing enough water to ensure that paddlewheel steamers on the river below would stay afloat all summer long. After a devastating flood in 1942, the governments of Canada and British Columbia built more dams to prevent similar disasters in the future. Now, while controlling floods remains his top mandate, Symonds says the system “is managed for multiple objectives.” That means balancing the competing demands of waterfront condo-dwellers, homeowners proud of their kelly-green lawns in July, fruit-growers and vintners, and the Valley’s expanding secondary industry and vital tourist trade—all while trying to keep a little water in the creeks for struggling trout and Kokanee salmon. “We have 300,000 ‘experts’ watching us,” Symonds jokes.²⁸

“The lifestyle people come here for relies on water,” he tells me. The trends in Bob Campbell’s records and Stewart Cohen’s forecasts alarm him deeply. “At the snowline, a single degree [of warming] can make a big difference,” Symonds says. “If climate change affects evaporation off the lake, we won’t be able to control that. In the future, the same storage may not be sufficient.” Another summer like the one of 2003 is a certainty, and similar seasons will strike more often. Those dry years will confront his neighbours with hard options, he says: learn to use less water, find a way to bring more of it from somewhere beyond the Valley or watch their treasured lifestyle shrivel up. “It comes down to which trade-offs people are willing to make. I don’t think people appreciate some of the hard choices.”

We can do a great deal to be ready for what is coming down the wind. If our reservoirs are too small, we could build larger ones. As we shall see, though, we probably don’t want to: there are countless other, more inventive and Earth-kindlier ways of making the water go around. Some of these ways are pedestrian, but necessary. Many are neither rocket science nor expensive; they are simply choices we need to make. Others will challenge us to think about water and nature in an altogether new relationship to our economy. We’ll meet them all in later chapters.

Fire didn't extinguish the Gebert family's dreams. Most of their grapevines survived being scorched to the roots. The brothers and their wives rebuilt their winery, bigger and better than before the monster visited. On the hill above, fresh green shoots rose within a season through black ash. "Nature regenerates," says Andy Gebert, but never exactly as before. "The forest is gone. I know I will never see those trees again."

Our species has built a society and economy on the experience—and in the anticipation—of seasons and weather patterns that have passed into history. New seasons are upon us. There is one more thing Brian Symonds thinks his resident "experts" are missing. "Do nothing' costs too," he says. "People need to understand that." What he means is that it takes time to prepare for a change in the weather. If the storm blows in before we're ready, our society is vulnerable. "It's coming," he says, "sooner than you think."