CASCADIA SCORECARD

SEVEN KEY TRENDS SHAPING THE NORTHWEST

2005

FOCUS ON ENERGY

NORTHWEST ENVIRONMENT WATCH
SEATTLE

NORTHWEST ENVIRONMENT WATCH is a not-for-profit research and communication center in Seattle, Washington. Its mission is to promote a sustainable economy and way of life throughout the Pacific Northwest—the biological region stretching from southeast Alaska to northern California and from the Pacific Ocean to the crest of the Rockies.

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Northwest Environment Watch is a 501(c)(3) tax-exempt organization. To order publications, become a member, or learn more, please contact:
Northwest Environment Watch
1402 Third Avenue, Suite 500
Seattle, WA 98101-2130 USA
(206) 447-1880; fax (206) 447-2270
www.northwestwatch.org

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CASCADIA AND ITS SCORECARD

This book begins with place: Cascadia, the Pacific Northwest. Encompassing British Columbia, Idaho, Washington, Oregon, and adjoining parts of Alaska, Montana, and California (see map inside front cover), Cascadia is a region with a dawning sense of itself. Its population is larger than that of the Netherlands, its economy is larger than Russia's, and its land area is larger than France, Germany, and the United Kingdom combined—with Belgium, Italy, and Switzerland thrown in for good measure.[1]

Named for the Cascade Mountains, for the earthquake-prone Cascadia subduction zone offshore under the Pacific, and—above all—for the cascading waterfalls that pepper the region, Cascadia has a common indigenous cultural heritage and a common history.[2] It is bound by salmon and rivers, snowcapped mountains and towering forests. Its people share not only geography but also an aspiration: to live well in their place.

Cascadia has traditions of innovation in the public and private sectors, a well-educated populace, and a long-standing commitment to conservation and quality of life. These traits show: the Northwest retains a larger share of its natural heritage intact than perhaps any other part of the industrial world and has helped set the conservation agenda for the continent.[3]

Still, Cascadians are in only the early phases of rising to the next great challenge for humanity: gradually but fundamentally realigning the human enterprise so that the economy and its supporting ecosystems both can thrive. Daunting, complex, systemic, seemingly quixotic,

this goal—balancing people and place—is nonetheless more attainable here than anywhere else on this continent. If northwesterners can reconcile themselves with their landscapes, they can set an example for the world.

The Cascadia Scorecard measures long-term progress in the Pacific Northwest. An index of seven trends shaping the future of the region, it is a simple but surprisingly far-reaching gauge. The Scorecard's indicators—health, economy, population, energy, sprawl, forests, and pollution—provide status reports for Cascadia and, by highlighting successful communities, offer a practical vision for a better Northwest.

The Scorecard puts a spotlight on the long view and the questions that most matter over great spans of time

Above all, the Scorecard puts a spotlight on the long view and the questions that most matter over great spans of time: Are we living longer, healthier lives? Are we building strong human communities? Are we handing down to our children a place whose natural heritage is regenerating?

This 2005 edition of the Cascadia Scorecard comes a year after the original 2004 edition. That book presents a complete exposition of the seven trends: why they matter,[4] what they mean, and what Cascadians can do about them. *Cascadia Scorecard 2005* does not replace or restate that volume; instead, it is an update and companion. It presents additional and—in all but two cases—more-current data for the seven trends, with an in-depth special section on one: energy.

Cascadians who wish to learn more about the Scorecard and how to turn its indicators in the right direction can find ample additional information—including supplementary state-, provincial-, and local-level Scorecard data and a version of this book with complete sources and citations—at *www.cascadiascorecard.org*. While there, they can sign up for free electronic updates on the Scorecard in the concise *Cascadia Scorecard News*.

Where are the citations?

A footnoted and annotated online version of *Cascadia Scorecard 2005* is posted at *www.cascadiascorecard.org.* It contains hypertext notes with full documentation in support of factual statements in this book, along with animated, time-lapse versions of many Scorecard maps. It also offers supplementary data, technical material, links, and notes on methods and definitions.

INTRODUCTION: SECURITY SCORECARD

If news headlines are the first draft of history, then the history of 2004 in Cascadia was dominated by security and energy: fears and controversies about global terrorism and how to counter it; deployment of troops from Cascadia to war in oil-rich Iraq; and debate about that war during the most divisive American election in decades. In 2004, an oil spill of mysterious origin struck Puget Sound and, for the first time ever, gasoline prices breached $2 a gallon and briefly kissed Can $1 a liter in parts of British Columbia.[5] The price of Alaskan crude shot above $50 a barrel and, for the first time in years, the price of petroleum regularly returned to the front pages. The conjunction of the themes of energy and security—energy security—even became a small part of the public discourse, at least in the American parts of Cascadia, with the slogan "energy independence" bandied about by politicians on both the left and the right.

Cascadia Scorecard 2005 pays close attention to security (as an organizing theme), energy (as a focal point), and their conjunction (in a special section), not in order to follow the headlines but rather to provide context for them. Cascadians' discussions of security often seem underinformed about its true nature and roots; worse, many northwesterners, including the region's leaders, seem woefully uninformed about the profound vulnerability of the region's energy system.[6] The Cascadia Scorecard itself dictates a focus on energy: as the 2004 edition made clear, the region performs far worse on energy than on any other indicator. Finally, the region's weakness in energy actually

creates staggering opportunities: a clean-energy revolution that is already gathering force promises to enhance the region's economy, quality of life, and natural heritage, even while tightening its security.

Security is not just defense against military or terrorist attacks. It is the protection of our families, communities, and homeland from profound threats, whether to our life and liberty, to our health and quality of life, or to the cultural and natural inheritance that we hold in trust for our children. It is, at root, not so much a department of government ("homeland security") or a branch of industry ("home security") as a characteristic of systems—social, economic, and physical—that makes them low-risk, resilient, and stable. "Secure" is from the Latin words *se cura*, meaning "free from care." It means reliable, safe, hard to destroy, unlikely to fail, and free from danger or fear. In practical terms, security is the control of risks to our lives and futures.

What makes Cascadians secure is not only the firepower held by their governments but also the systems that keep their prospects bright

What makes Cascadians secure, therefore, is not only the firepower held by their governments but also, and more importantly, the systems—both tangible and intangible—that keep their prospects bright. These include, at the highest level, things such as the rule of law; democratic governance; the social "capital" of civic, educational, and religious organizations; and social norms such as reciprocity and tolerance. At a less abstract level, they also include the physical form of the region's built environment and the public and private policies (from tax codes to government budgets, from land-use plans to insurance rules) that shape northwesterners' health, livelihoods, communities, and landscape.

In this full sense, security—and the systems designs that promote or degrade it—is a theme stitched through all seven Scorecard trends (see Table 1 on page 4). Cascadians' health continues to improve slowly, but enhancing economic opportunities and access to medical care (both are forms of security) would hasten progress. The economy has performed poorly of late, generating troubling insecurity for many. This economic insecurity may have contributed to a slight increase in average family size (the Scorecard's population indicator), which is often a sign of worsening

living conditions for women. Energy security also seems to have declined in 2004 as northwesterners somewhat increased their consumption of expensive fuels that require safeguarding at home and overseas. And the energy system itself is profoundly insecure, even in the narrow, military sense, as detailed in the special section that begins on page 29.

Sprawl trends also have important security implications. Sprawl—a dysfunctional community design—limits transportation options, necessitating reliance on private vehicles that are dependent on vulnerable, imported fuels and crowded road space; sprawl also degrades health, worsens the air, and undermines watersheds. The sprawl indicator, while impossible to update since *Cascadia Scorecard 2004*, has mostly showed slow improvement from a disappointing record. Sprawl is Cascadia's second-worst-performing indicator.

Forest clearing, an indicator of broader trends in the status of Cascadia's natural heritage, poses a long-term risk to ecosystems that animate the region's cultures and on which northwesterners depend for flood control, water storage, biological diversity, and climate moderation. Indeed, ecosystems are models of systems that are secure in their very design: they are rich with options; they are—notwithstanding popular notions of nature's fragility—tough and resilient; and they generate the means of their own success, converting daylight and inanimate minerals into elaborate communities of life. Safeguarding ecosystems ensures northwesterners a habitable and vibrant home. Forest clearcutting slowed dramatically in the 1990s in the limited areas covered so far by the Scorecard. It has sped up again in recent years, although no data are yet available that are more current than what appears in *Cascadia Scorecard 2004*.

Finally, the Scorecard's pollution indicator shows that northwesterners hold in their bodies—and in the mother's breastmilk that feeds their newborns—toxic flame retardants called PBDEs, at 20 to 40 times the levels found in Japan and Europe. These levels are likely rising. How secure are Cascadians when hazardous compounds intervene in the gestation

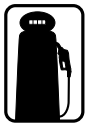
	Key trend	Indicator	**Target:** Place with world's (region's) best record[7]	Target
	Health	Life expectancy at birth, in years	Japan, 2001	81.3 years
	Economy	Composite index of unemployment rate, median income, and poverty rate, 1990 = 100	Selected high-performing states, provinces, and European nations, recent years	108.6 points
	Population	Total fertility rate, in children born per woman	Netherlands and Sweden, 2001–02	1.7 births
	Energy	Per capita use of highway fuel and nonindustrial electricity, in gallons of gasoline-equivalent per week	Germany, 2001	7.4 gallons
	Sprawl	Percentage of metropolitan-area residents in compact, transit-friendly neighborhoods	Interim target: Vancouver, BC, 2001 (European and wealthy Asian cities do better, but data not comparable.)	62 percent
	Forests	Annual percentage of forests clearcut in five Cascadia study areas	Interim target: five Cascadia study areas, 1996–99 (Some forests elsewhere do better, but data lacking.)	0.4 percent
	Pollution	Median concentration of toxic chemicals in breastmilk, in parts per billion (PBDEs reported here; additional chemicals forthcoming, 2005)	Japan, 2000	1.3 parts per billion
Average:				

Table 1. Cascadia Scorecard 2005: The Northwest lags, on average, 32 years behind the world's leaders.

Cascadia Scorecard 2005	Scorecard gap With steady progress, how many years to match target?	Status and trend
79.2 years	13 years	Eighth best in world; improving slowly.
99.7 points	19 years	Strong by international standards; underperforming national averages since 1990; declined 1999–2003.
1.81 births	11 years	Close to world's best, but variable; improved since 2000, but worsened in 2004.
14.6 gallons	88 years	Performance very poor; improved since 2000, but worsened in 2004.
32 percent	58 years (Data problems make this figure optimistic.)	Region lags far behind Vancouver, BC; has seen slow, steady improvements since 1990.
0.5 percent	3 years (Data problems make figure optimistic.)	Stewardship improved since 1990, but worsened since 2000.
50 parts per billion	? years (Time-series data are unavailable.)	PBDEs among highest in world; concentrations likely rising; other toxics may be declining.
	32 years	**Improved in 1990s, stagnant since 2000.**

and nursing of the young—when the biology of motherhood itself is contaminated? A secure Cascadia would be free from such dangers.

Overall, the Cascadia Scorecard—which is designed as a gauge of long-term progress but also reflects the closely related concept of true security—shows that the Pacific Northwest has stalled in the new millennium. After making major gains in the 1990s, it has returned to the doldrums characteristic of the 1980s (see Figure 1).[8] From 2001 to 2003, the region's aggregate Cascadia Scorecard score did not budge. On average among the six indicators for which time-series data are available (which excludes pollution), Cascadia lags 32 years behind the world's best performers on those indicators—Japan for health, Germany for energy, and so on. It would take 32 years of slow and steady progress, on average, to bring Cascadia up to what those places had already achieved by 2001 or 2002.[9] Preliminary data suggest that 2004 may have been a fourth consecutive year of stagnation on the Scorecard.[10] And meanwhile, the regions in the world that perform best on these indicators are not standing still but are racking up further improvements.[11]

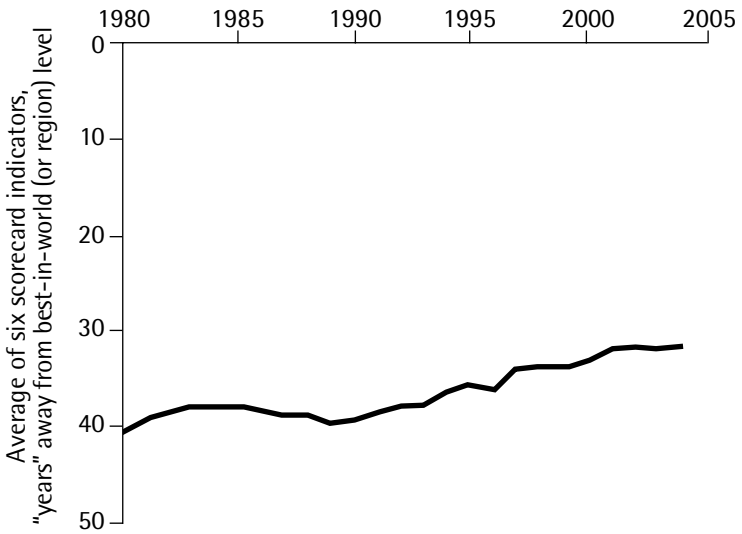


Figure 1. Overall, the Cascadia Scorecard's indicators made steady progress during the 1990s, but stalled in the new millennium.

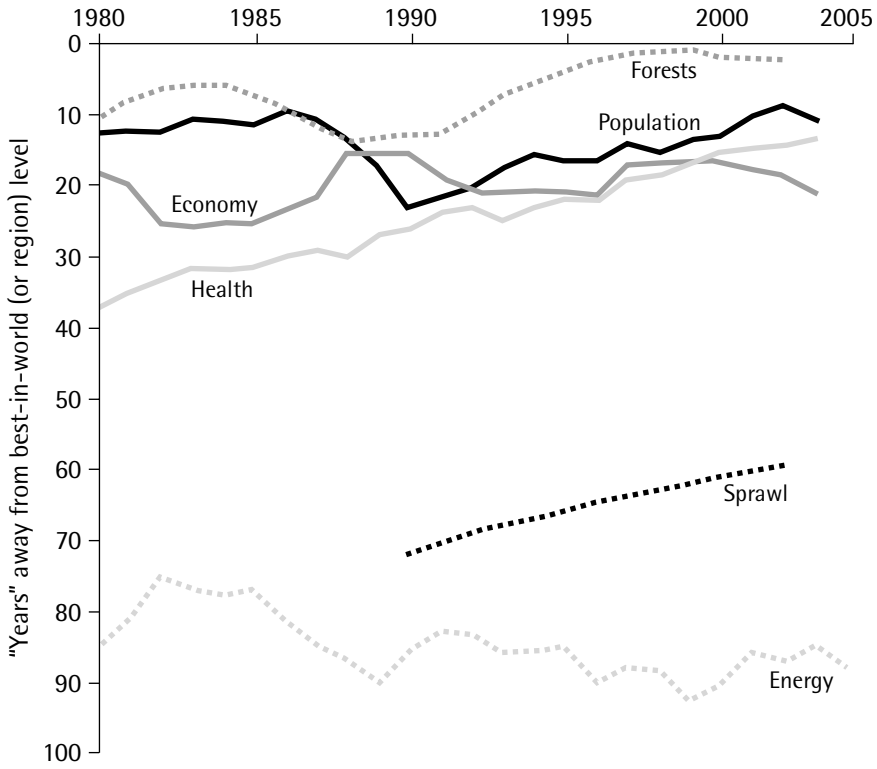


Figure 2. Cascadia scores worst on energy and sprawl.

The seven Scorecard trends have never moved in lockstep. In 2003, for example, health improved as measured by the Scorecard's indicator—lifespans—and Cascadians used energy a little more efficiently than in 2002. But those advances were counterbalanced by deterioration in economic security and an increase in family size (see Figure 2). Partial results for 2004 show that falling unemployment rates may have improved economic security but that energy efficiency worsened.

Three notes of caution are in order: First, any aggregation of such disparate trends can never be definitive; it can only be indicative, as detailed in *Cascadia Scorecard 2004*. Second, the sprawl and forest indicators remain less robust than the others. The forest indicator in

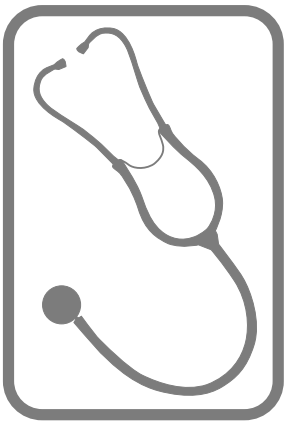
particular covers only a small share of Cascadia and is, for technical reasons, less well tethered to international best practices than the other indicators. It likely gives too rosy a picture of forest stewardship.[12]

Third, detailed time-series trends for the Scorecard's pollution indicator are not yet available and therefore are not included in Figures 1 and 2. PBDE pollution in the Northwest has grown alarmingly over the past several decades. Levels of the compounds in northwesterners' bodies appear to be at least 20 times higher today than in the mid-1980s.[13] However, data from sediment samples, fish and wildlife, and human tissues suggest that levels of other persistent toxics targeted for elimination internationally, such as DDT, dioxins, and PCBs, are gradually falling.[14] The net effect of these divergent trends may well be that the overall burden of persistent toxics carried in northwesterners' bodies is diminishing.[15]

In all these cases, the key to better performance is in innovation

In all these cases, the key to better performance—the key to greater security—is in innovation: new technologies, business models, and public policies that can better align Cascadia's economy and way of life with its shared aspirations. Such systemic innovations are already emerging. (Some of the most promising are detailed in the concluding chapter, "Security by Design.") Indeed, they have been gathering momentum for some time, proving their potential and, often, their profitability. All that is lacking is a critical mass of northwesterners acting in their own lives and through the region's governments, businesses, and civic organizations to speed the change.

1. HEALTH



Northwesterners' health, arguably the most fundamental form of security, continues to improve, slowly but steadily.[16] A baby born in 2002, the most recent year for which data are available across the entire region, could expect to live past 79 years of age—about a month longer than a baby born in 2001. This gradual increase in longevity continues a trend: life expectancies in Cascadia have grown by nearly four years since 1979 (see Figure 3).

Life expectancy is the best single measure of a population's health. Lifespan reflects all of the diseases, accidents, and lifestyle choices that shorten people's lives, as well as the effectiveness of medical care.[17] Contrary to first impressions, it does not simply reflect medical practices that extend lives without improving them: across nations, every added month of life expectancy tends to bring more than a month of good health.[18]

Health trends are not uniform across the region, as the life-expectancy map on page 40 makes clear. The 49th parallel, which marks the boundary between British Columbia and the Northwest states, also delineates a profound divide in human health. Residents of British Columbia can expect more than 2 additional years of life, compared with their counterparts in Washington, Oregon, and Idaho. Life expectancy in the province was 80.5 years in 2002, versus about 78.4 in the Northwest states. In fact, British Columbia is the healthiest Canadian province, and Vancouver is Canada's healthiest big city. A Vancouver resident can expect 81.1 years of life,[19] nearly on a par with the life expectancy of Japan, which has the longest life expectancy of any nation in the world.

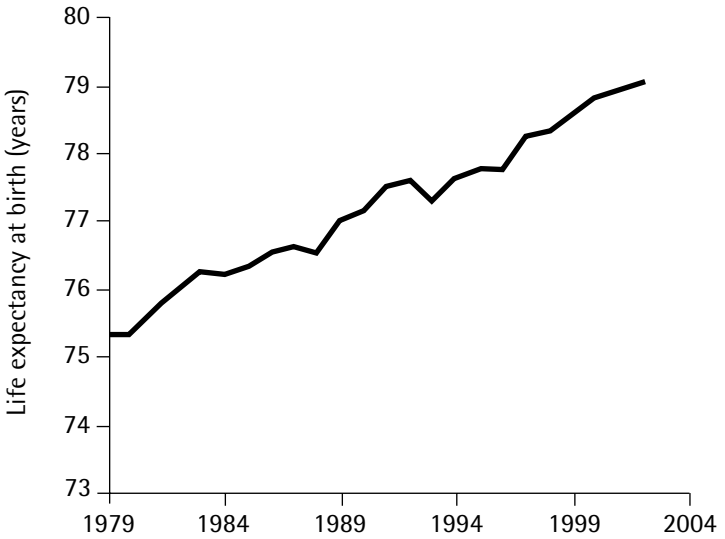


Figure 3. Average life expectancy in Cascadia has increased by nearly four years since 1979.

The international boundary is just one of many lines, both political and social, that demarcate health outcomes in the Northwest. Within each state or province of Cascadia, there are divides in the quality of health that are just as deep as the one that separates British Columbia from the American Northwest.

No place shows such health discrepancies more clearly than greater Portland. Residents of Washington County, the largely suburban county to the west of the city, home to Nike and Intel, can expect to live about 79.7 years. But for residents of adjacent Multnomah County, which contains the city of Portland proper, life expectancy is 3 years shorter.

It might be tempting to attribute the difference in life expectancy between the two counties to the stresses and risks of urban living. But that explanation is wrong. All else being equal, living in a sprawling suburban community—where low densities discourage walking and biking—is a drag on health. In highly sprawling US cities, for example, nearly one in ten adults, on average, has a chronic health problem that can be traced to low-density, car-dependent community design.[20]

The far likelier explanation for the difference in health between Multnomah and Washington counties concerns economic security and, specifically, income disparities: Multnomah County has pockets of poverty that are both larger and deeper than those found in Washington County.[21] And poverty worsens health, not only because the impoverished have less access to high-quality medical care, but also because they tend to be under greater stress and to have fewer of the close social ties (call it "community security") that can help buoy health.[22] Studies from around the world show that economic inequality[23] and social isolation are major barriers to health.[24]

Similar divides are seen in the state of Washington: life expectancy in relatively wealthy King County is about two years longer than in more financially distressed Pierce and Yakima counties.

Although health is generally improving in the Northwest states, longevity gains have lagged behind other parts of the industrialized world.[25] Indeed, the real issue might be not why BC lifespans are rising so quickly, but why the gains in Idaho, Oregon, and Washington have been so meager. The keys to matching or bettering BC's health status are likely enhanced access to medical care and, as important, innovations in economic and social policy that drive lasting reductions in poverty.

2. ECONOMY

Economic well-being is conventionally gauged by gross domestic product (GDP)—the total output of a region's economy. But in a society in which wealth is increasingly concentrated in a few hands, GDP may rise even as the fortunes of middle- and lower-income Cascadians falter.

In order to gauge the economy's real-world effects on working families, the Cascadia Scorecard tracks a fourfold index that integrates typical household incomes, the unemployment rate, the poverty rate, and the child poverty rate.[26] Economic security is also important to measure because the fortunes of ordinary people are so closely tied to the region's future. For Cascadia, one of history's richest places, economic insecurity is a systemic flaw, one that slows long-term progress and generates unnecessary risks. For example, poverty slows learning in children (ultimately making the workforce less competitive), amplifies crime and delinquency (eroding quality of life), and increases the prevalence of teen pregnancy (weakening families).[27]

The year 2003—the last year for which complete income and poverty data for US states are available—was a disappointment, the culmination of four consecutive years of declining economic security in the region. By the end of the year, virtually all of the economic gains that accrued to middle- and lower-income families during the late 1990s had evaporated (see Figure 4). Partial data for 2004—falling unemployment rates for the first ten months of the year—suggest that the Northwest states may be shaking themselves from their economic doldrums. But they have a lot of ground to make up.

In 2003, for example, poverty rates in the Northwest states stood at their highest levels since 1995, elevated by a striking increase in the share of children who are impoverished. And nearly one in eight

Figure 4. By 2003, the economic gains attained by the Northwest states in the late 1990s had evaporated.

residents of the Northwest states lived below the federal poverty line, meaning that more US northwesterners than ever before could be called poor: 1.3 million in total, including half a million children.

In part, poverty peaked because jobs became scarce. Oregon had the highest unemployment rate in the country in 2003, briefly topping 9 percent; it was the worst year to look for a job in the state since 1986. Washington fared only slightly better, though Idaho's unemployment rate was considerably lower than its western neighbors'. Overall, the three states added 416,000 new residents between 2000 and 2003, but only 6,300 new jobs. Many eligible workers simply gave up looking for work—which, ironically, made unemployment statistics look unduly rosy. Potential workers are considered unemployed only if they are actively looking for paid jobs. With employment so scarce, incomes stagnated: the typical household earned slightly more in 2003 than in the previous year, but nearly $4,000 less than in 1998, adjusted for inflation.

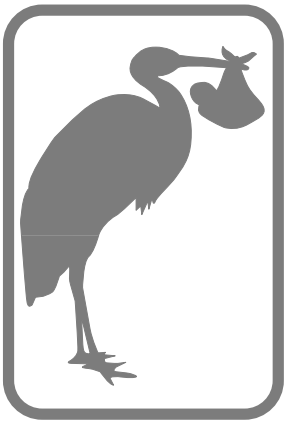
Complete poverty and income data for British Columbia were available only for 2002. But the province's economic performance was similar to its southern neighbors': poverty, child poverty, and unemployment became more prevalent in 2002, and median income declined slightly from the previous year. Still, these measures had changed little over the

Figure 5. British Columbia's economy took a step backward in 2001 and 2002.

previous decade: unlike the rest of Canada, British Columbia appears to have made little headway in improving the economic security of the poor and the middle class (see Figure 5).

Perhaps the single most important key to improving economic security in Cascadia is a shift in public consciousness and political debate. If northwesterners replaced GDP as the Northwest's bellwether measure of livelihood with the Scorecard's economy indicator, the region would see a gradual but profound realignment in public policies. Systems currently designed to boost growth for its own sake would move instead to strengthen economic security. For one thing, this shift would move poverty reduction, which currently languishes as an objective of welfare and social-service programs, to the economic-development heart of policymaking in the region.

3. POPULATION



Cascadia's average family size improved in 2002, reaching an all-time low of 1.78 births.[28] But it reversed course and expanded again in 2003 to 1.81 births (see Figure 6). Average family size (lifetime births per woman or, more precisely, the "total fertility rate") is an excellent gauge of women's—and families'—well-being. In nations where women have more opportunities and greater equality with men, women tend to have smaller families, later in life; in particular, they have fewer teen births and markedly lower rates of unplanned pregnancies.

Growing up in economic insecurity tends to boost women's birthrates, because young women with few options or hopes for the future often look on motherhood as one meaningful way of life they cannot be denied. Physical and sexual abuse of girls—among Cascadia's most important and most hidden forms of insecurity—also markedly raises birthrates in girls' teen years. Abuse victims often accept childbearing in hopes that their child's love will make them feel whole again.[29]

Family size is also a gauge of the Northwest's population growth, which powerfully shapes the Northwest's environment. Births—unlike migration—account for the share of this population growth that has global as well as local implications.

As displayed in the map on page 41, average family size varies dramatically across the Northwest. British Columbians have the smallest families, at 1.4 lifetime births per woman, likely as a result of lower poverty rates and better access to reproductive health care and contraceptive services. Idaho families are the largest at 2.3 children, on average. Washington and Oregon fall in between, at 1.9. Localities differ even more dramatically. Over their lives, for example, women in Yakima County in eastern Washington have an average of 2.7 children. Near

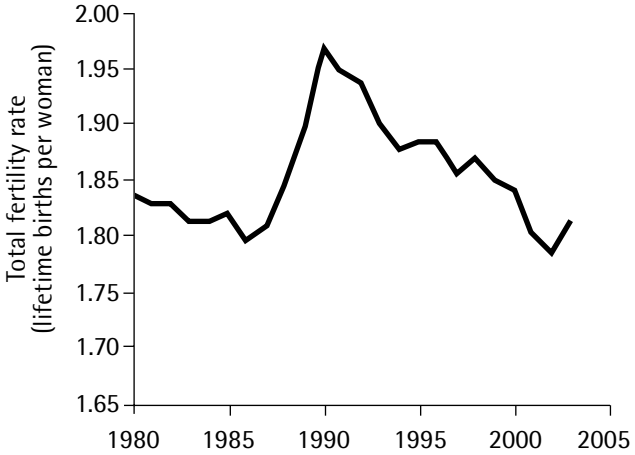


Figure 6. Cascadia's average family size reached a record low in 2002, but increased in 2003.

Boise, in suburban Canyon County, Idaho, women have 2.6 children. But women in Lane County, Oregon, which surrounds Eugene, have only 1.5 children apiece, and their counterparts in Vancouver, British Columbia, have an average of just 1 child each.

Family size tends to be inversely proportional to population density: urban counties typically have the smallest families, suburban counties have larger ones, and rural areas have the largest. To some extent, this pattern is a reflection of households with children seeking affordable single-family housing and finding it in the suburbs and beyond. But rural economic insecurity also plays a large role. Notable exceptions to the rule are rural areas such as northern Idaho and rural western Oregon, which have small families.[30]

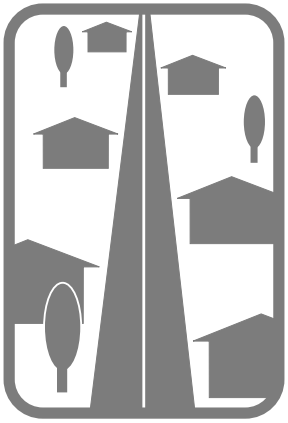
Declining total fertility rates, especially when they stem from falling birthrates among very young women, are a hopeful sign for societies that aspire to gender equality. The world's leading nations in women's equality and pro-family policies, such as excellent child care and paid parental leave, are the Netherlands and Sweden.[31] They have total fertility rates of around 1.7.[32]

Cascadia can match this rate by better preventing unplanned pregnancies. Some 9 percent of births in the Northwest states (but fewer in British Columbia) result from "unwanted" pregnancies: they are conceived accidentally at a time when the mother wants no children, or no more children. Another 30 percent come earlier in women's lives than these women intended.[33] The prospects for life are better for children who are born wanted. Children conceived intentionally receive better prenatal care and are less likely to have dangerously low weights at birth or to die in infancy. They display superior verbal development in their early years and are less likely to endure abuse and neglect. Consequently, fewer wanted children end up in the child welfare system, including juvenile courts and foster care. Wanted children are more secure.[34]

A worthy population goal for Cascadia would simply be that every child be born wanted.

Universalizing one-stop access to emergency contraception at pharmacies, as British Columbia and parts of Washington have already done, could be the next step toward that goal.[35] Princeton University researcher James Trussell calculates that this step could cut the unintended pregnancy rate (and the abortion rate) by as much as half.[36] In 2005, the US Food and Drug Administration will rule on a proposal to make the emergency contraceptive Plan B available without a prescription to everyone over the age of 16.[37]

4. SPRAWL



Sprawl[38]—dispersed, compartmentalized, automobile-oriented urban development—figures into the Scorecard because it contributes to a distressing array of ills. Sprawl locks northwesterners into an auto-dependent lifestyle, with an attendant burden on their pocketbooks, the world's oil fields, and the planet's atmosphere. Sprawl also consumes farmland and open space and ruins lowland ecosystems. It endangers health by putting people behind the wheel (and in danger of crashing) an average of nine hours a week,[39] by tainting the air and water with toxic pollutants,[40] and by turning walking into recreation rather than transportation. In short, sprawl is a paradigm case of an insecure system: a community design that endangers the community's residents and their home place.

The Scorecard measures the best single indicator of sprawl: residential density, or the number of people who live on each acre. Density reveals to what extent growing populations are consuming new land. And studies of more than 100 cities on four continents show that neighborhood density is the most important determinant of how much people drive.

Cascadia Scorecard 2004 showed that greater Vancouver, British Columbia, controlled sprawl better than any other Northwest metropolis, with nearly two-thirds of the city's residents living in compact neighborhoods (those with population densities of 12 or more people per acre). Although more recent data on the region's sprawl trends have not become available, a fresh analysis of 12 non-Cascadian cities from across the continental United States puts the Northwest cities in better context. Even among this larger pool of cities, Vancouver's sprawl record is still the cream of the crop. Of the non-Cascadian cities, the

least sprawling was—perhaps surprisingly—Las Vegas, Nevada. Half of Las Vegas residents live in compact neighborhoods, twice as large a share as in greater Seattle or Portland (see Las Vegas map on page 42).

Study of these other US cities did reveal that Portland is a model of a different sort: while not as compact as Vancouver, it is a star at protecting rural land from suburban development (see Portland map on page 43). Among the non-Cascadian cities, only Sacramento and Salt Lake City did better, and only by the slimmest of margins. Apparently, Oregon's land-use laws, in place since the 1970s, have helped curtail the loss of open space at the urban fringe.

Portland's performance is even more impressive considering another pattern that emerges among non-Cascadian cities: cities in arid zones sprawl little, compared with cities where water is abundant. This dryness largely explains the impressive smart-growth performance of the desert city of Las Vegas. It also explains why Denver, Phoenix, Salt Lake City, and Sacramento are more compact than water-rich cities such as Portland and Seattle. In arid zones, it is costly to provide water service to dispersed suburbs; water scarcity serves as a natural brake on low-density sprawl.[41]

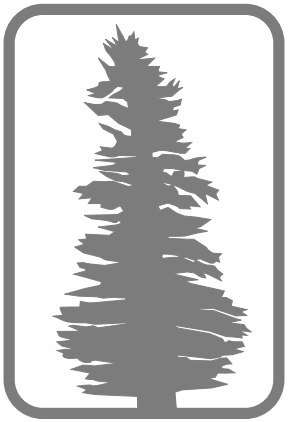
Compared with other rainy US cities, Portland's sprawl record truly shines

Compared with other rainy US cities, Portland's sprawl record truly shines. If greater Portland had sprawled like the typical high-rainfall city over the 1990s, it would have lost at least 150 additional square miles[42] of rural land and open space on the urban fringe—an area larger than the city of Portland itself. That area would have almost doubled if Portland had mirrored Charlotte, North Carolina, the most sprawling of the cities studied (see Charlotte map on page 42). In arid regions, the natural environment limits sprawl; in Portland, the policy environment did.

Unfortunately, Portland's policy environment changed in November 2004 with the passage of Ballot Measure 37, which made it dramatically more complicated and expensive for governments to implement land-use plans.[43] The result: despite greater Portland's strong record in protecting farmland at the urban fringe, its future success is uncertain.

The challenge for Oregon cities, as for cities elsewhere in Cascadia, is to develop means to grow up, rather than out, even in the era of Measure 37. One lesson of Vancouver's success is to aggressively promote dense, walkable downtown development through planning and through public investments in parks, transit, and other urban amenities (but not in over-building the road network). Pulling growth inward helps tremendously, even when policies such as Measure 37 make it harder to discourage low-density development on the urban edge.

5. FORESTS



Monitoring the health of the Northwest's ecosystems may be the Scorecard's greatest challenge, given the lack of good data on the condition of natural systems, the innate complexity of these systems, and the many stresses they endure. As a limited but informative substitute, the Scorecard tracks forest cover in five areas of the region by measuring acres of clearcuts over a 30-year period with imagery from the NASA Landsat system (see map of forest study areas on page 39).[44] Tracking clearcuts provides a rough gauge for how extensively humans have altered the forests of the Northwest—and for how effectively northwesterners are safeguarding their distinctive natural heritage. Clearcut logging alters natural ecosystems and constricts the habitat of old-forest species. All forms of logging emit greenhouse gases, which are responsible for global warming, and require road building, which causes erosion and degrades streams. Clearcuts, then, indicate the gradual undermining of the ecological security of Cascadia's human residents and the regional economy on which they depend.

Because the Landsat system suffered extended malfunctions, updated forest trend data from these study areas have been unavailable since *Cascadia Scorecard 2004*. That volume showed that, in all the study areas, the rate of cutting fell over time and then rebounded modestly in recent years.

During 2004, many signs suggested accelerated clearcutting. In September, the Washington Board of Natural Resources approved a large hike in the cut rate on the state's public holdings.[45] Strong demand for home building in the United States fed a boom in the timber industry in British Columbia.[46] The province also rewrote its logging rules to accelerate the cut on the coast.[47] In the interior, the province has been

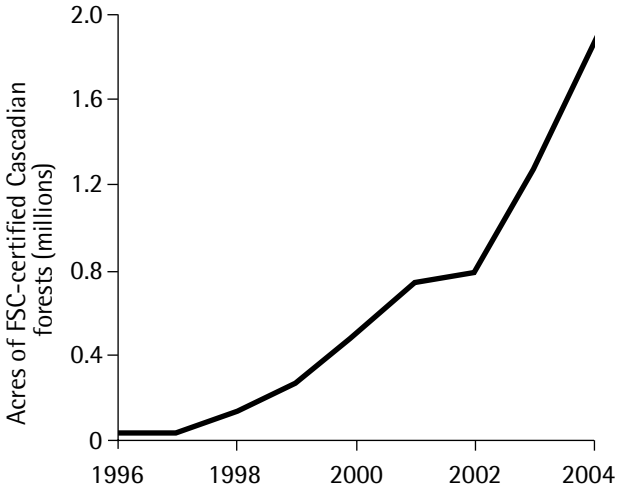


Figure 7. Since 1996, the number of acres of Cascadian forests certified by the Forest Stewardship Council has grown rapidly.

encouraging accelerated logging in pine forests in (arguably vain) hopes of heading off a massive climate change–induced infestation of mountain pine beetles.[48] The US federal government has sought to accelerate logging on its lands, which cover a quarter of Cascadia,[49] through the deceptively named "Healthy Forests Initiative."[50]

A more encouraging trend in 2004 was the rapid growth in forests managed in compliance with the demanding standards of the Forest Stewardship Council (FSC; see Figure 7). Some 1.8 million acres of Cascadian forests—roughly 1 percent of Cascadia's forestland—had passed muster with FSC certifiers by December; fully 36 percent of the total was in the hands of the Potlatch Corporation in Idaho. This well-run land is a piece of the region's ecological security infrastructure.[51]

A comparison of forest clearing on state and provincial lands inside the Scorecard's study areas provides fresh insight into how the governments of British Columbia, Oregon, and Washington manage forests that they hold in public trust. It shows that Oregon has been the most reluctant to log its state lands. Washington cut the largest share of its lands, but British Columbia—with its vast holdings—cut an order of magnitude more forest per day.[52]

Study area	State- or provincial-owned forestland clearcut, 1971–2002	
	Cumulative share	Average acres per day
Southern Oregon	17 percent	2
Central Cascades, OR	11 percent	5
Central Cascades, WA	20 percent	10
Olympic Peninsula, WA	30 percent	15
Williams Lake region, BC	21 percent	124
Inland Rainforest, BC	21 percent	104

Table 2. Over three decades, Washington clearcut the largest share of its state lands, but British Columbia cut far more area.[55]

In the Scorecard's southern Oregon study area, centered on Roseburg, the Oregon Department of Forestry authorized the clearcutting of 17 percent of state-owned forests from 1971 to 2002, a rate of roughly 2 acres per day (see Table 2). State lands were relatively lightly touched compared with the vastly larger private holdings in the study area, of which 35 percent were clearcut. Even the nearby national forest and Bureau of Land Management holdings in the study area were clearcut more severely; nearly 22 percent of these federal lands were cut.

Further north, in the Central Cascades study area spanning the Oregon-Washington border between Mount Hood and Mount Rainier, Oregon allowed 11 percent of state forests to be cleared. Across the Columbia River, in the larger forest holdings of the state of Washington, the rate of clearcutting was almost twice as high (see Figure 8). To the west, in the Olympic Peninsula study area, clearcutting on state lands exceeded that in the Olympic National Forest.[53] In British Columbia's

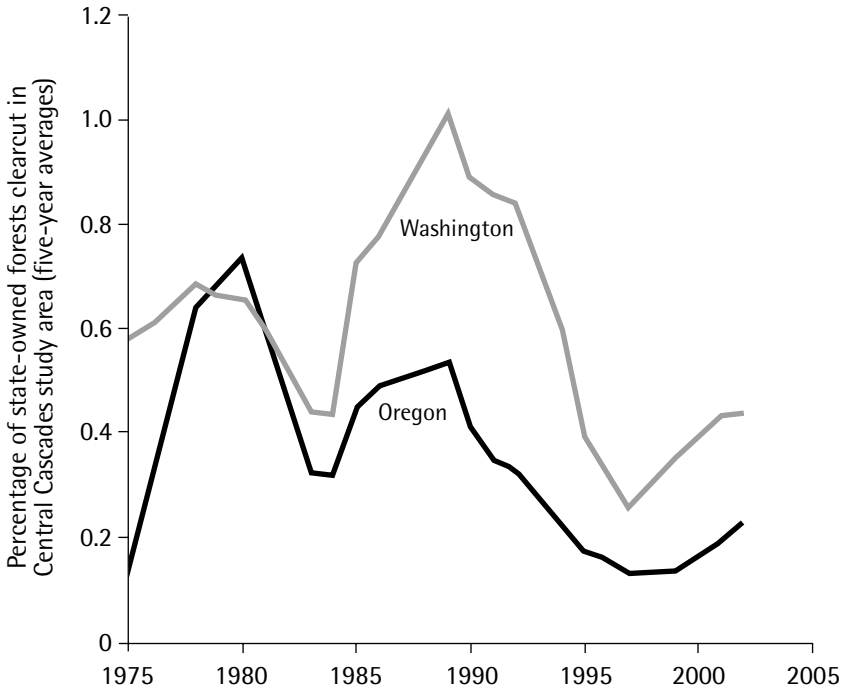
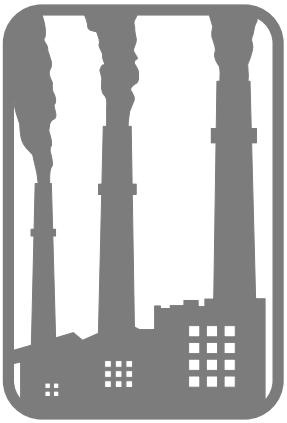


Figure 8. In the Central Cascades, Washington's state-owned forests were logged more heavily than Oregon's in the past 30 years.

two large study areas, virtually all logging is on provincial land: 91 percent of the area logged was on the 85 percent of forests held by the province.[54]

A decisive step toward institutionalizing careful management of state and provincial lands would be for governments to seek FSC certification of public forestland. Proposals to do so in Oregon and Washington made remarkable headway in 2004, but so far, the distinction of being the first Cascadian state or province to win certification as a globally responsible forest steward remains unclaimed.

6. POLLUTION



Within the body of each Cascadian is a thin broth of dozens, or even hundreds, of industrial chemicals,[56] many of which did not exist a century ago.[57] Some of these compounds may be harmless. Others, science has shown, are not. The most troublesome share three characteristics. They are slow to break down, persisting in the environment for years or decades after they are released. They accumulate in living things, including human bodies. And they are toxic, interfering with hormonal activity or other bodily functions, often at unimaginably small concentrations.

Such persistent, bioaccumulative toxics ought to be understood for what they are: security threats, and systemic ones at that. They endanger human health and child development, sometimes for generations, along with the health of orcas and other wildlife. They undermine industries that work in direct concert with the region's natural heritage, such as fishing and farming. They impose colossal financial burdens on both citizens and businesses for cleanup, and those burdens divert capital from productive investments in the future to the least productive ones—correcting old mistakes. The inverse of security by design, they generate harm that compounds itself over time and space.

Perhaps the most infamous persistent toxic is the pesticide DDT, which was finally banned in the 1970s. Levels of this chemical menace in northwesterners' bodies and environment have declined since, but this remedial success has not yet taught its lesson. The full class of synthetic compounds deserves treatment under the precautionary principle, an ethic of environmental management codified in international agreements and many nations' laws. The principle dictates that producers prove the safety of substances first, before they put them into widespread use.

In the late 1990s, scientists started noticing an alarming rise in environmental concentrations of flame retardants known as PBDEs

Unfortunately, the Cascadia Scorecard, which analyzes human breastmilk from mothers across the Northwest for persistent toxics, shows that this principle has been largely ignored.

Take, for instance, the flame retardants known as PBDEs (polybrominated diphenyl ethers). For decades, these compounds have been added to furniture foams, industrial textiles, electronics, and other products found in homes and offices. But in the late 1990s, scientists started noticing an alarming rise in environmental concentrations of PBDEs. The findings were uniform: PBDE concentrations were increasing rapidly in the blood, fatty tissues, and breastmilk of humans, as well as in fish, wildlife, and the sediments of water bodies. In Sweden, for example, PBDE levels in human breastmilk rose roughly 60-fold between 1972 and 1997.[58]

Closer to home, PBDE concentrations rose more than 10-fold in samples of human breastmilk from Vancouver, British Columbia, between 1992 and 2002,[59] and up to 12-fold in whitefish from British Columbia's portion of the Columbia River system between 1992 and 2000.[60] High PBDE levels also showed up in fish in Washington and in Puget Sound orcas.[61] Globally, PBDE levels in the environment and in people appeared to be rising exponentially, doubling every two to five years.

While scientists were becoming aware of the remarkable rise of PBDEs in living things, other researchers were discovering that PBDEs were far more toxic than they had previously believed. Studies of laboratory animals showed that PBDEs can, among other things, impair memory and learning,[62] alter behavior,[63] delay sexual development,[64] and disturb thyroid hormone levels.[65] PBDEs are similar, both in their chemical structure and in the harm they cause,[66] to PCBs (polychlorinated biphenyls), a now-banned class of chemicals that have been linked with a host of developmental delays and other adverse health effects in children and wildlife.

Because the lion's share of the most-toxic forms of PBDEs has been used in North America, levels on this continent are the highest on the planet. Northwest levels are no exception.

In 2004, Northwest Environment Watch completed an analysis of breastmilk samples donated by 40 Pacific Northwest mothers—10 each

from Montana, Oregon, Washington, and British Columbia. Testing breastmilk has clear advantages over testing other body fluids or tissues. Monitoring human breastmilk, particularly if samples are taken soon after birth, provides a useful indicator for exposure levels in early fetal development, the period when humans are most susceptible to toxics.[67] And unlike blood or tissue samples, breastmilk can be collected inexpensively and without invasive medical procedures. It is also high in fat, and PBDEs collect in fat, which makes it possible to run comprehensive tests with small amounts of milk. Breastmilk tests may even be a reliable proxy for measuring PBDE levels from environmental exposures in males of a similar age.[68]

Chemical analysis of northwesterners' breastmilk revealed high levels of the flame retardants in every sample tested. Levels in Cascadia were among the highest in the world. The median level among Northwest mothers was 50 parts per billion; the maximum concentration was 321 parts per billion. In contrast, tests of blood samples from Japan and breastmilk samples from Sweden showed median concentrations of 1.2 and 2.1 parts per billion, respectively (see Figure 9).

Scientists are uncertain about the developmental effects that may be caused by such levels of PBDEs. No tests of PBDEs have been conducted on humans. But some scientists believe that levels found in the most exposed northwesterners are comparable to those that have been found to affect development in laboratory animals.[69]

Though contaminants in breastmilk are certainly unwelcome, an extensive body of research demonstrates that breastmilk is still the best food for babies, and that breastfeeding is one of the most important contributors to infant health.[70] Infants who are not breastfed do not receive optimal nutrition, important hormones, protective immune factors, and promoters of brain development.[71] Among other benefits, breastfeeding reduces infant mortality and may lead later in life to lower rates of obesity and heart disease.[72]

After the evidence of PBDEs' risks mounted, regulators finally took action. The US Environmental Protection Agency persuaded the

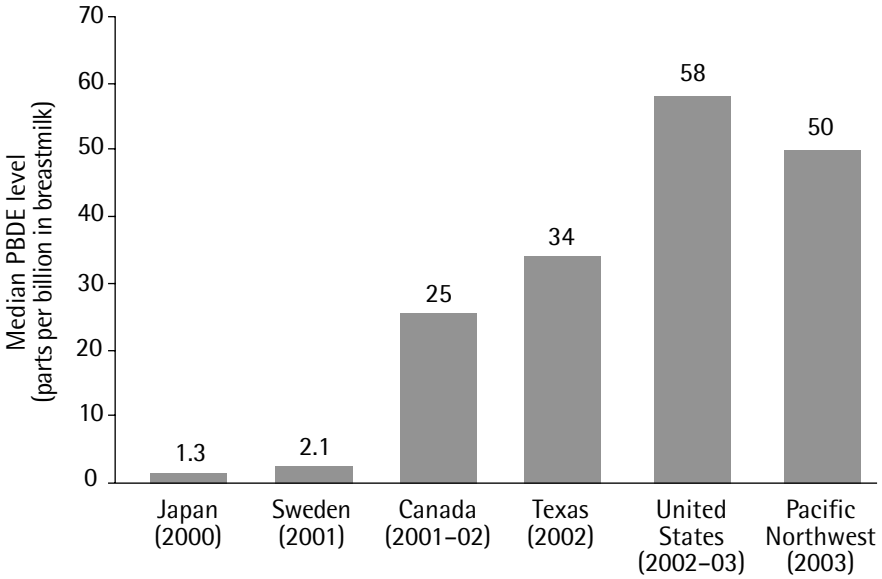
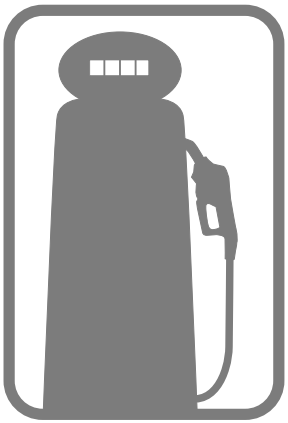


Figure 9. Levels of PBDEs in the Pacific Northwest are 20 to 40 times higher than levels in Japan and Sweden.

manufacturer of the most troubling forms of PBDEs to remove their products from the market; the manufacturer was scheduled to cease production in December 2004.[73] California, Maine, and Hawaii passed legislation to ban or restrict some forms of the compounds.[74] Canada is considering taking similar action.[75] And recently, the State of Washington drafted a plan to ban most forms of PBDEs from commerce in the state and to investigate ways to remove PBDEs from people's homes.[76]

This belated response is encouraging, but it is not proof of how well Cascadia secures itself from chemical attackers. To the contrary, it is another in a long string of tragic cases—lead, arsenic, asbestos, DDT, PCBs, dioxins, and many others—that demonstrate the region's failure to look before it leaps by observing the precautionary principle. By the time the evidence of a compound's harm is incontrovertible, it is often too late to contain the hazards. Perhaps soon, the region will embrace the systemic innovation of requiring better safety tests before a compound is used in commerce, just as the national governments of the United States and Canada already do for new medicines and food additives.

7. SPECIAL SECTION: ENERGY AND SECURITY



Of all the commodities produced and consumed in Cascadia, none casts a longer security shadow than energy.[77] This shadow extends to the economy and the environment. It also extends to some profound but little-known physical vulnerabilities—the main focus of this chapter. In the age of what *New York Times* columnist Thomas Friedman calls "people of mass destruction,"[78] Cascadia's energy system, long among its greatest strengths, has become one of its greatest security vulnerabilities. This is true not only in the long-term sense that the energy system is slowing the economy and changing the climate, but also in the conventional, military sense: a lone terrorist could bring Cascadia's economy to its knees for days; an organized band could make it weeks or months.[79]

The region has massive dams that generate cheap hydropower, but that power is transmitted across mountains and deserts on power lines that are impossible to defend against hikers with backpacks of explosives. The Northwest runs on oil and gas from Alaska and Alberta, but it receives those fuels through a handful of pipelines that are equally indefensible.[80] And, unfortunately, Cascadia's energy security appears to have worsened in 2004 as per-person consumption of energy increased despite a slack economy and high fuel prices.

The only good news is that the same energy transition that can protect the region from malice—decentralizing and diversifying Cascadia's energy system—can also generate thousands of new jobs, help restore the region's natural heritage, and breathe new life into farm communities.

ENERGY ARTERIES

The region's vulnerability starts with oil, the lifeblood of Northwest transportation. Cascadia produces virtually none of its own petroleum (and hardly any of its natural gas), nor does it have appreciable reserves in the ground.[81] Much of Cascadia's oil comes from Alaska's Prudhoe Bay, through the Trans-Alaska Pipeline, to a loading dock in Valdez, Alaska, where it is pumped onto tankers that sail to five refineries along Puget Sound.[82] Most of the oil, once it is refined into products, reaches consumers through the Olympic Pipeline (see map of oil pipelines on page 46).[83]

At about 20 inches in diameter, and typically buried just a few feet underground, the Olympic Pipeline connects northern Washington with Portland and Eugene along a well-marked route through forests, farm fields, and residential neighborhoods.[84] It delivers the majority of Washington's and more than three-quarters of Oregon's[85] gasoline. In 1999, it sprang a leak that caught fire, killing three boys along Whatcom Creek in Bellingham.[86]

The demographic heart of British Columbia gets most of its oil from Alberta through the Trans-Mountain Pipeline, which traverses hundreds of miles of hinterlands before reaching the lower Fraser Valley and, eventually, connecting with the Olympic Pipeline.[87] The province has just two refineries, in Prince George and Burnaby,[88] while Idaho, Oregon, and Cascadia's parts of California and Montana have none.[89]

These pipelines are radically exposed to mischief. The Trans-Alaska is 800 miles long, sits elevated above the ground for more than 400 of those miles, and was long ago deemed indefensible by the Pentagon.[90] It is aging and corroding and is near the end of its design life. It has already been sabotaged once, bombed twice, and shot more than 50 times, most recently in 2001 by a drunk with a hunting rifle. In 1999, a disgruntled Canadian ex-convict was apprehended just months before he had planned to blow up three key segments in midwinter, when repair could have taken months. He had begun assembling 14 sophisticated bombs and

had pinpointed the pipeline's weak points.[91] Other near misses are much rumored but classified. The US Department of Homeland Security did reveal in 2004 that its late 2003 "elevated terror alert" was motivated by intelligence suggesting terrorists might attempt to ignite the fuel stockpiles at the pipeline's Valdez terminus.[92] The opening of the Arctic National Wildlife Refuge to oil extraction, if it happens, would redouble and extend Cascadia's dependence on this single, insecure pipeline.[93]

The Olympic—and two lesser pipelines that supply the inland Northwest—are, if anything, more worrisome. If the Trans-Alaska is impaired, Cascadia could still buy tankerloads from more distant sources, as Washington already does for a quarter of its crude.[94] But losing the Olympic would create a distribution meltdown that could take weeks to rectify; Cascadia doesn't have the vehicles or loading facilities to replace the pipelines. When a similar gasoline pipeline ruptured in Arizona in 2003, it took authorities almost two weeks to *begin* repairs and 17 additional days to complete them. Average fuel prices in Phoenix rose 60 cents a gallon and did not revert to their preaccident level for four months.[95]

In Cascadia, therefore, dependence on imports of Middle East oil is a smaller security threat than is the domestic oil infrastructure.[96] And al Qaeda has already targeted such systems, calling oil the "umbilical cord and lifeline of the crusader community."[97]

In Cascadia, dependence on imports of Middle East oil is a smaller security threat than is the domestic oil infrastructure

The region's natural gas infrastructure is the same story but in some ways worse. The Northwest's natural gas comes across the Canadian Rockies through two pipelines and from Wyoming and other Rocky Mountain states via a third (see map of natural gas pipelines on page 47).[98] These pipelines are just as vulnerable to sabotage as the oil pipelines they sometimes parallel. The main differences are that they are more explosive and they have no substitutes. Unlike liquid fuels, natural gas cannot simply be put in a truck or railcar and wheeled to its destination. It has to be compressed or cooled first. The region does stockpile natural gas underground in two locations near Portland, to buffer against shortages, but the pipelines leading from those facilities are as vulnerable as all the others.[99]

Cascadia also has four small liquefied natural gas (LNG) facilities, in Nampa, Idaho; Newport and Portland, Oregon; and Plymouth, Washington. These plants cool gas and store it at –259 degrees Fahrenheit. Larger LNG facilities were proposed in 2004 by at least three companies, two for the lower Columbia River and a third for Coos Bay on the Oregon coast—all of them intended to receive fuel from around the Pacific Rim.[100] LNG is quite safe in most circumstances, but it does carry one special danger. Lighter than water but heavier than air, it can flow across large areas and, if conditions are exactly right as it warms and vaporizes, a spark can ignite it in a massive explosion. The LNG payload of standard marine tankers is the energy equivalent of 50 Hiroshima-size bombs, which may make tankers targets for terrorists. Fortunately, successfully igniting a spill would be difficult.[101]

Power-transmission lines constitute a third type of energy artery in Cascadia. Three long-distance power lines connect the Northwest states' power grid with California's; a fourth connects it with British Columbia's; and a fifth with the northern plains' (see map of transmission lines on page 48).[102] All of these lines, like the approximately two dozen major wires connecting dams and other generators with cities, are also vulnerable to attack. The power network is more secure than the pipeline infrastructure, because it has so many more routes and connections. On the other hand, it is less stable: it is a massive, interconnected balancing act. Losing three key lines or power plants is more than the system is designed to bear,[103] and losing even two creates some probability of cascading blackouts.[104] In the summer of 2003, the malfunction of a generating station and transmission line in Ohio unleashed a bizarre chain reaction that eventually shut down power for as much as four days in areas stretching north into Canada and east to the Atlantic seaboard. Along the way, any number of system weaknesses and operator errors worsened matters, revealing how imperfect the grid actually was.[105]

Transmission lines are vulnerable to attacks with weapons: rifle fire knocked out transmission systems three times between December 2003

and July 2004 in Oregon and Washington alone.[106] But they are also vulnerable to hand tools. In November 2004, an attacker loosened some bolts and let gravity fell a transmission tower in Wisconsin, interrupting electricity to the Milwaukee airport and 17,000 other utility customers. *USA Today* reported that authorities admitted, "Anyone with a common wrench could have removed the standard, two-inch bolts that connected the tower to the base."[107] This sabotage took place just one year after Michael Devlyn Poulin of Spokane, Washington, was finally apprehended by the FBI. Over a period of weeks, Poulin, who described himself to the Associated Press as "62 years old, overweight, arthritic, diabetic, half-blind and a cancer patient," unscrewed bolts with impunity from about 20 transmission towers across the Northwest and California. Poulin's avowed purpose was not to crash the grid but to illustrate its vulnerability.[108] He succeeded.

The oil, gas, and power distribution systems are triply insecure in combination

The oil, gas, and power distribution systems are all insecure individually, but they are triply insecure in combination. Pipelines need electricity to run their pumps and controls. Cascadia's electric grid needs fuel for the natural gas turbines that account for one-seventh of its generating capacity.[109] And many of the region's pipelines share the same routes with each other and with power lines. The pipelines are literally underneath the wires.[110] In at least one place in the region—prudence argues against naming it—a night's work with a backhoe could sever regionally vital arteries for oil, natural gas, *and* electricity.

Cascadia's energy system casts a shadow on security in other ways as well. Economically, the energy system's famous upside—inexpensive, nonpolluting, plentiful hydropower—has proved to have a downside too. It lured the Northwest into wasteful ways;[111] inefficient electric space- and water-heating equipment, for example, consumes half of residential electricity in the Northwest states and more than a quarter in British Columbia.[112] Now, with demand far outstripping hydropower supply and prices up, this installed equipment is deadweight on household budgets.

The energy system's security shadow extends further: spending on petroleum and natural gas siphoned an estimated $30 million out of the economies of the Northwest states *each day* in 2004—nearly 3 percent of the region's economic output.[113] And energy price spikes, which are increasingly common, are among the leading triggers of inflation and recession.[114] The California electricity crisis of 2001, for example, deepened Cascadia's recession by sucking as much as $6 billion out of the region.[115]

Energy's environmental shadow is better known.[116] The power infrastructure has decimated wild salmon runs by blocking the region's rivers with dams, as shown in the maps of dam locations on pages 44 and 45.[117] Fossil-fuel combustion is responsible for most of the region's emissions of local air pollutants and of climate-changing greenhouse gases[118]—a global security issue that rivals even terrorism[119]—and tankers pose the gravest water-pollution risk: massive oil spills.

CLEAN ENERGY

The key to defusing these threats is the more decentralized, resilient, and self-reliant energy infrastructure made possible through rapid gains in efficiency. Yet in 2004, despite elevated prices, energy efficiency actually suffered; the Pacific Northwest's performance on the Cascadia Scorecard's energy indicator deteriorated an estimated 1.5 percent—the equivalent of 11 extra gallons of gasoline per person per year (see Figure 10). The energy indicator did, however, remain about 3 percent below its all-time, 1999 high. (This indicator uses per capita consumption of highway fuels and nonindustrial electricity as a proxy for total energy use, as discussed in *Cascadia Scorecard 2004*. Highway fuels and nonindustrial electricity usually move in tandem with total energy use and are reported much more quickly and reliably.)

From a longer view, energy use is stuck in the same range it has occupied for 25 years (see Figure 11), a range that makes energy the region's weakest-performing Scorecard indicator. Some areas of Cas-

cadia do worse than others. Residents of the Northwest states, for example, use 45 percent more highway fuel and nonindustrial electricity apiece than BC residents. But the fundamental story of the past quarter century is this: rapidly rising technological efficiency has barely kept pace with expanding appetites.

Fortunately, new technologies, business models, and policy approaches offer to unstick the energy system, unleashing rapid gains that can wring dramatically more service from each unit of energy and turn the region toward secure, decentralized supplies. This clean-energy revolution involves the application of digital technology, advanced materials, and other new tools to energy generation and to transportation, buildings, and industry. And scores of Cascadian companies are already leading the way, generating sales measured in the billions of dollars.[120]

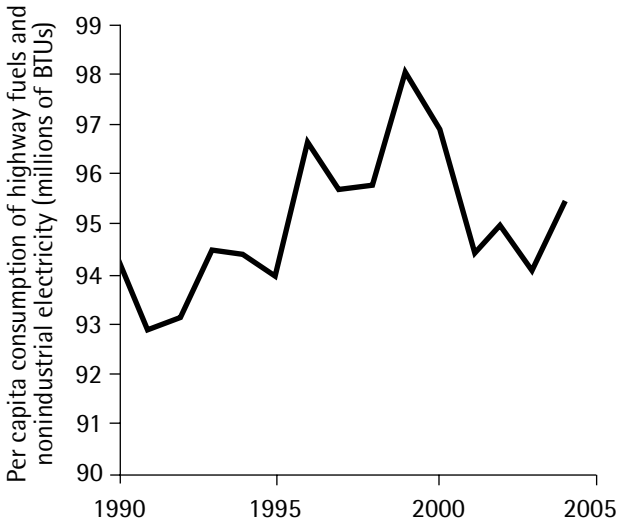


Figure 10. Cascadians used more fuel and power in 2004, despite high prices.

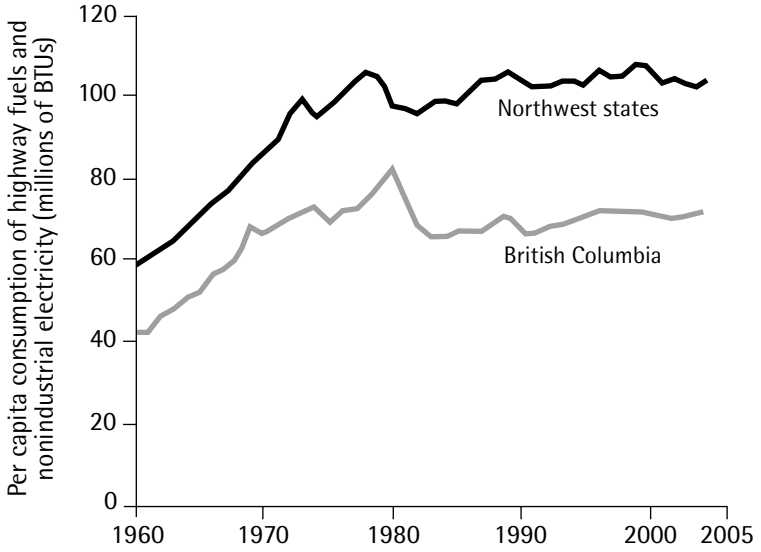


Figure 11. Residents of the Northwest states use 45 percent more energy apiece than British Columbians.

Like other innovations that bring security through design, clean energy creates compounding, mutually reinforcing benefits

These approaches deal head-on with the largest energy security problem: the architecture of the system itself. Cascadia's energy infrastructure is inherently unsafe because of its reliance on a few, centralized facilities: seven refineries, five oil pipelines, five natural gas pipelines, and roughly two dozen major transmission lines. Systems that are secure by design are versatile, resilient, redundant, and decentralized: they rely on thousands of dispersed, interconnected agents, each flexible and responsive.[121]

"Hardening" the existing infrastructure by, for example, reinforcing pipelines and patrolling transmission towers is the reflexive security strategy, and some hardening is justified. Diversifying the existing infrastructure, through construction of a thicker web of pipe- and power lines, would help, too. But both approaches can make only marginal improvements, and they both raise the cost of energy, slowing the economy and taxing household budgets. Security through clean energy, on the other hand, saves money; it yields returns that can help finance further progress. Like other innovations that bring security through design, clean energy creates compounding, mutually reinforcing benefits.

The Northwest Power and Conservation Council (NPCC), the federally mandated regional coordinator of the Northwest states' electricity system, is pushing in this direction by encouraging utility investment in "demand response"—systems that allow utilities to temporarily turn off certain power-using devices on the consumers' side of the meter.[122] Demand-response programs, such as the experimental Non-Wires Solutions project of the Bonneville Power Administration,[123] recruit consumers (usually businesses) who agree to such cutbacks in exchange for cheaper rates. Demand response allows the Northwest to avoid the construction of expensive "peaking" power plants or the purchase of expensive peak power on the spot market.[124] Demand response is also a security booster: if large transmission lines are attacked, demand response can keep vital functions operating. It would even help in the event of the loss of natural gas pipelines, since some 22 percent of the region's natural gas goes into power plants.[125]

The Pacific Northwest National Laboratory in Richland, Washington, is taking demand response to a higher level of sophistication.[126] The "smart grid" electronic tools they and others are developing will allow millions of electricity-using and -generating devices to adjust their operation to real-time grid conditions. If demand and prices soar, for example, preprogrammed "smart-grid" thermostats would ease up. If attackers were to disable a transmission line, decentralized energy sources such as co-generators in factories would feed power into the grid. The result: a smart grid would largely heal itself.[127]

Demand response and the smart grid allow instantaneous rebalancing of power and gas demand. But they are only the tip of the efficiency iceberg: the potential to improve energy efficiency at a profit has actually grown over time. This fact may be surprising, considering that Cascadia has been investing in energy efficiency for a quarter century, with respectable success. The Northwest states' electricity diet, for example, is at least 10 percent smaller now than it would have been without the regional efficiency programs coordinated by NPCC since 1980. British Columbia has saved electricity at an even faster annual pace since 1990.[128]

Yet new energy-saving technologies keep emerging more quickly than they can be deployed. In just the past five years, for example, compact-fluorescent lamps got small enough and versatile enough to work in almost all light sockets, and their price fell an astounding 75 percent.[129] The application of dozens of similarly ingenious technologies—more-frugal DC converters in the region's roughly 100 million TVs, VCRs, and credit-card machines; rooftop cooling units that are smart enough to circulate air from the outdoors when the temperature is right rather than continuing to pump machine-chilled air; light-emitting-diode (LED) exit signs that use 5 percent as much power as the incandescent bulbs still installed in 80 percent of commercial buildings;[130] and on and on—is the cheapest, most profitable, least polluting, and most pro-jobs energy strategy. It is also the most secure: the less electricity needed, the more likely that even a sabotaged grid can provide it.[131]

The provincewide public utility BC Hydro and the NPCC both know this. BC Hydro, for example, sees enough energy efficiency opportunities to allow it 40 percent greater energy savings in the next 10 years than it achieved in the past 10.[132] NPCC's 2004 draft of its next 20-year plan also sees future savings exceeding past savings. It identifies so much cost-effective efficiency that it calls for no new power plants, except wind farms, for at least 5 years. For the duration of the plan, efficiency would be by far the biggest, cheapest source of new energy, followed by wind power.[133]

Neither NPCC nor BC Hydro is likely to succeed in implementing its plans unless it can decouple utility profits from electricity sales—a systemic innovation discussed in the next chapter. But fortunately, with that change there is no reason NPCC and BC Hydro cannot outperform their plans substantially. Neither agency, after all, has set terribly aggressive targets. California recently established mandatory statewide efficiency goals for utilities that are at least 50 percent more ambitious.[134] And California's new policy will call on gas utilities to match the electricity sector in its commitment to saving energy—a long-overdue innovation.[135]

FUELING TRANSPORTATION

If anything, the efficiency potential in transportation is larger, because vehicles are replaced more quickly than buildings. The typical car or light truck in the United States operates for just 14 years. Unfortunately, fuel economy improvements in Cascadia have been completely wiped out by rising vehicle weight, as SUVs and other light trucks have gained popularity.[136] (The tragic irony, of course, is that SUVs, which many drivers buy for their supposed added safety, are actually less safe for people in them than are regular automobiles.[137] And they are an even greater menace to people in other vehicles.)[138]

In public consciousness, Cascadia's recent vehicle trends are epitomized by the Hummer, a four-wheeled emblem of security. But in the marketplace, Hummers and other jumbo SUVs are actually being

To make downloads easier, this version does not contain the maps, pages 39-48.

Please click here to go to a PDF of the maps. Hit your back button to return to this document.

eclipsed by something less armored but more ingenious and, in the final analysis, more secure: the hybrid-electric engine. Hybrid vehicles were introduced in 1999, seven years after Hummers, but by July 2004 had outsold them almost six to one.[139] And while Hummer sales stagnated in 2004, hybrids rocketed out of showrooms.[140] Cascadians who wanted the award-winning 2004 Toyota Prius, for example, typically faced waits of six months or longer.

A more efficient vehicle fleet sends fewer dollars out of the region and fewer pollutants into the atmosphere

Hybrids and Hummers are little more than the bookends of the car world; in Washington, they make up just 1 in 500 passenger vehicles. But the drama they have played out—with the unheralded victory going to the cars that travel four times as far on each unit of fuel—augurs well for Cascadia's future. A more efficient fleet sends fewer dollars out of the region and fewer pollutants into the atmosphere; it also buffers the region against pipeline disruption and oil price hikes.

The most comprehensive and authoritative recent assessment of the transportation future is the Rocky Mountain Institute's (RMI) encyclopedic 2004 volume *Winning the Oil Endgame*.[141] In it, Amory Lovins and his research team make a compelling case that the combination of advanced hybrid engines with ultralight (but ultrasafe) vehicle designs can yield at least a doubling of fuel economy, while producing vehicles that are better in almost every way. In fact, the report's authors make a strong case for quadrupled-efficiency vehicles and even for midsize SUVs that get 99 miles per gallon.[142] Such cars and trucks—combined with similar improvements in other oil-using sectors—could save half of Cascadia's projected 2025 petroleum consumption. And it could do so for the equivalent of $12 per barrel conserved.[143] As Lovins and his coauthors write, the fuel in such vehicles' tanks combined with their added range "acts as a fine-grained, highly distributed Strategic Petroleum Reserve—already delivered to customers, presenting no high-value targets, invulnerable to cascading system failures (such as vulnerable pipeline networks), and profitable to boot."[144]

Even if RMI is too optimistic, the efficiency potential for vehicles is large. A 2002 technical assessment by the National Research Council

(NRC) concluded that over 10 to 15 years, fuel economy could rise from an average of 27 miles per gallon to 41 miles per gallon, costing somewhere between $2,350 and $3,050 extra per vehicle. That cost would be worth paying even in strict financial terms; it would pay for itself about twice over in fuel savings during the vehicle's operating life. (The report's excessive pessimism became apparent within months when the 2004 Prius entered the market, triply beating NRC's projections: it got better mileage, at a lower price, a decade early.)[145]

This impending revolution in vehicle efficiency could prove a huge boon to the region's high-wage job base

The best news for Cascadia concerning this impending revolution in vehicle efficiency is that it could prove a huge boon to the region's high-wage job base.[146] Already, the North American leader in manufacturing efficient, ultralight vehicles is not in Detroit but in the Pacific Northwest. It's Boeing, whose next-generation jet (the 7E7) will be the most efficient airplane in the sky by at least 20 percent, partly thanks to the company's wholesale embrace of advanced, light-but-strong carbon-fiber polymers.[147]

Boeing, the Northwest's largest manufacturing employer, is zealous about saving energy, because fuel economy is key to airline profits. The industry loses some $180 million a year for every one-penny rise in the price of a gallon of jet fuel.[148] The 7E7 will likely reach at least 30 percent fuel savings (compared with Airbus's next jet, the A380) on many international routes by enabling point-to-point flight patterns. The Boeing jet's modest size and extended range will allow airlines to profitably connect most origins and destinations directly, rather than wasting fuel (and time) shuttling passengers through off-route "hub" airports.[149] To compete with the 7E7, Airbus announced plans in December 2004 to begin designing a similar plane of its own.[150]

The Northwest's second biggest vehicle maker, heavy-truck manufacturer PACCAR, has as much to gain from efficiency as Boeing. Trucking, like commercial aviation, is among the industries most exposed to fuel costs: diesel price spikes commonly precipitate waves of bankruptcies among truckers.[151] And trucking is amenable to the same fuel-saving innovations that work for smaller vehicles: ultralight materials, better

aerodynamics, and improved engines have the power to double fuel economy or more, for about 25 cents per gallon (8 Canadian cents per liter) of diesel fuel saved.[152]

The profitable efficiency potential in transportation grows from impressive to staggering when one considers not just vehicle engineering but the architecture of transportation systems. More-compact, walkable communities, which substitute proximity for mobility, can reduce driving by as much as two-thirds and improve health too.[153] Congestion pricing—variable, electronic tolls that eliminate traffic jams—improves vehicles' actual (as opposed to rated) fuel economy by preventing stop-and-start driving.[154] Mileage-based auto insurance—now being market-tested in Minnesota, Australia, the Netherlands, and the United Kingdom—is inching toward implementation in the Northwest, promising savings of fuel (and money) of 10 percent or more.[155] Transit improvements; vanpool, carpool, and car-sharing programs; pedestrian infrastructure investments; and a variety of innovations in how parking is regulated and taxed can also render internal combustion less necessary.[156]

Together, these and other systemic innovations might lead Cascadians to eliminate as much as another quarter of their highway fuel consumption,[157] beyond the 50 percent reduction from vehicle improvements. And Cascadia could get some—perhaps much—of the remaining quarter from plant-based "cellulose ethanol." Best estimates from Oak Ridge National Laboratory, Washington State University, and the Oregon Department of Energy are that the region could meet at least 5 percent and possibly more than 20 percent of its current gasoline demand with this locally produced fuel.[158]

Unlike biodiesel and conventional ethanol—the large-scale production of which ultimately creates competition for food crops such as soybeans and corn—cellulose ethanol comes from crop and forest residues, urban wastes, and even grass clippings. This quick-maturing technology may prove a bonanza for the rural Northwest. The Canadian firm Iogen is hoping to build a 50-million-gallon-a-year facility in Idaho to spin wheat straw into motor fuels. This plant would likely spend

$30 million a year on straw. At that rate, rural Cascadians could reap at least $250 million a year selling residues to biorefiners—an amount almost half the value of Idaho's potato harvest.[159] (On more optimistic assumptions, rural Cascadians could earn more than $1 billion a year from residue sales—roughly equal to Washington's apple revenue.[160]) Royalties from wind farming, another possible bonanza for farmers and ranchers, would be additional.

Hydrogen's environmental benefits are well understood, but its security benefits are also great

The final step of the clean-energy revolution could be hydrogen and fuel cells, and again Cascadia has world-leading firms, such as Ballard Power Systems of Burnaby, British Columbia. Emissions-free and versatile, hydrogen is now regarded in many circles as the dream fuel[161] for both transportation and distributed power generation. But most informed observers expect the hydrogen economy to be several decades in the future. Debate now centers on when and how hydrogen will emerge as a serious competitor to the stalwarts of today's energy system.[162]

Hydrogen's environmental benefits are well understood, but its security benefits are also great: the smart grid and distributed fuel cells are made for each other. Freestanding fuel cells and even fuel cell–powered vehicles could be engineered to plug into the grid and serve as backup or peaking power sources.[163] Highway fuels and electricity, in other words, would become interchangeable, which means redundant, which means secure. And hydrogen generation and distribution can be far more flexible and decentralized than the current fossil-fuel infrastructure.[164]

A stronger, safer economy for Cascadia depends on shifting away from inefficient, centralized systems of distribution for fuel and power toward more-dispersed, interconnected, and resilient ones. Fortunately, this transition has long since begun. It comes in small steps, each of them profitable to investors and advantageous to communities in the short run. And each step builds momentum for the next. A little better steering from the region's governments—the topic of the next chapter—is the catalyst that could bring the clean-energy revolution to liftoff.

CONCLUSION: SECURITY BY DESIGN

Imagine if a foreign power had seized Cascadia's communities and imposed an economy that shortened lives unnecessarily, that mired half a million children in poverty, that laid out cities in which travel was nearly impossible without a private car or truck, and that razed forests and endangered the salmon and other animals that give spirit to the place. And imagine that these outsiders upholstered northwesterners' living spaces with suspected poisons, which soon began appearing in mothers' breastmilk.

Surely, northwesterners would rise in rebellion.

That they do not is testament to the power of business as usual. Threats from the outside, even if their likelihood is remote, galvanize humans to action. But threats that emerge from the way people have set up their lives and society—the threats to long-term progress tracked in the Cascadia Scorecard—those threats are too easily ignored, discounted, or shrugged off as "just the way it is."

This blind spot, while lamentable, is also an opportunity. It means that quantum leaps in security—and therefore in long-term progress—are available to the region, if enough Cascadians act to make them happen. Those quantum leaps all create security by design. They reorient dysfunctional systems around progress that is resilient, low-risk, and stable. Such reorientations are sorely needed in a place that has so many advantages but that nonetheless lags far behind the world's leaders on one indicator after another: 58 years in sprawl, 88 years in energy, and 19 years in economy. Cascadia's slow but steady gains of the past decade have given way to stagnation in the new one; since 2001, the Scorecard average has been stuck at a 32-year gap behind best practices.

Systemic innovations that lead to security by design are plentiful. For example, if Cascadians focus consistently on making every child a wanted child, they will—simply by following the chains of cause and effect—take actions that improve access to health care and contraceptive services, that lower poverty rates among children, and that combat sexual abuse. All of these social ills markedly elevate unintended pregnancy rates.[165] As bonuses, the region will reap improved child development;[166] lowered rates of poverty, out-of-wedlock births, and single parenting; higher rates of marriage;[167] and the environmental (and traffic) benefits of slower population growth.

Likewise, combating sprawl through good urban design—building neighborhoods compact enough that every eight-year-old can walk to a library—brings compounding, mutually reinforcing benefits for jobs, nature, human health, community, and security. It replaces the vicious circle of worsening traffic and air quality, rising energy costs, and a fragmenting countryside with a virtuous circle of less driving, traffic, and energy use, and more time, money, and open space.

Similarly, if the Pacific Northwest adopts an approach to synthetic compounds such as PBDEs that insists on proving safety first, before the widespread distribution of these compounds, the benefits will multiply. Contamination will decline, massive cleanup and remediation costs will disappear, and the health of both humans and wildlife will be spared future insults.

Above all, if Cascadia embraces the clean-energy revolution, it can unleash a self-propelling process of improvement and social benefit that starts with more profit and jobs and runs through to a tamper-resistant energy system. The clean-energy revolution, which could be as important to the next decade as the Internet was to the last, is already beginning. Collective action through Cascadia's governments needs only to hasten it through three steps: stepping up to "clean car" standards; hitching utilities' bottom lines to their customers' efficiency; and breaking new ground with innovative incentives called "feebates."

A powerful next step for the Northwest states would be to join together and commit to California-style vehicle emission standards for carbon dioxide.[168] These clean-car standards, phased in from 2008 to 2016, will trim petroleum use in new vehicles by as much as 30 percent.[169] British Columbia is already on board by virtue of Canada's national commitment to a 25 percent drop in emissions per mile by 2010, an even more ambitious target than California's.[170] By joining with their neighbors to the north and south, the Northwest states can help to leverage change in the entire auto industry.[171]

A powerful next step for the Northwest states would be to join together and commit to California-style vehicle emission standards

Cascadia could further bolster clean energy by adopting reforms that would ensure the region not only meets but exceeds the Northwest Power and Conservation Council's and BC Hydro's newest efficiency-centered plans, perhaps matching California's 50-percent-higher ambitions. During the late 1990s, the region got lazy about electrical efficiency investments, lulled by a temporary glut of cheap natural gas–fired power. In 1999, the Northwest states accomplished scarcely one-third of the efficiency gains stipulated in the not-so-ambitious NPCC plan then in effect.[172] The region's natural gas utilities have never pursued efficiency with as much conviction as warranted. More-concerted encouragement of efficiency, and the addition of more renewables, could not only meet all demand but also begin to supplant existing fossil fuel–fired power plants, according to 2003 research by the independent Tellus Institute in Boston.[173]

Along with conventional approaches to this goal such as revising building codes, Cascadia could put wind in the sails of efficiency by making it more profitable for utilities. Utilities are not like other companies. Their profits are dictated by state utility regulators, based on complicated formulas. At present, profits rise in direct proportion to sales, so utility investments in improving efficiency can drain away profits. In the case of PacifiCorp, a Portland-based investor-owned utility that serves parts of the Northwest states, every investment that allows its 121,000 Washington state customers to save 1 percent of their power

through better efficiency subtracts well over $1 million from shareholders' earnings in the first year. Such a move subtracts an equal amount in each subsequent year, often for a decade or more.[174] Not surprisingly, many utilities are halfhearted about efficiency, even if they are legally obligated to encourage it.[175]

Decoupling helped convert Puget Sound Power and Light from a laggard to a leader in energy efficiency

But by decoupling sales from earnings, utility regulators can write Cascadia's long-term progress and security into utilities' bottom lines and turn utilities—precisely the organizations that have the requisite know-how and capital—into vanguards of the clean-energy revolution. At present, only one US Cascadian utility has decoupled rates: NW Natural, a Portland-based gas company. An assessment in 2005 will tabulate the benefits, but earlier experience is encouraging. For example, Puget Sound Power and Light (now Puget Sound Energy) operated under a decoupling rule from 1991 to 1996 before a tangentially related lawsuit—and more importantly, the ill-fated electric deregulation movement—put decoupling on hold.[176]

Decoupling helped convert Puget Sound Power and Light from a laggard to a leader in energy efficiency. In its first decoupled year, the company's efficiency programs saved almost as much electricity as they had saved during the three previous years combined. In its second year, it boosted savings another 60 percent and single-handedly accounted for 40 percent of all electricity savings in the Northwest states—outdoing even the regionwide federal Bonneville Power Administration—at half the cost.[177] Decoupling is returning to the fore of regional policy debates, just in time to turbocharge implementation of NPCC and BC Hydro's efficiency-centered plans.

A systemic innovation with potential to greatly accelerate the spread of clean-car technology, and other energy-efficient devices, is the adoption of feebates.[178] These point-of-purchase incentives—graduated fees charged to the buyers of less-efficient products that fund graduated rebates given to the buyers of more-efficient ones—systematically nudge manufacturers and consumers toward saving energy. The more

efficient the car or other energy-using device, the smaller the fee—or bigger the rebate. Feebates, unlike CAFE standards and building codes, keep efficiency snowballing: the feebates reset themselves each year at the average energy efficiency of new models.

Feebates correct documented market failures, such as the "payback gap" between energy consumers and producers. Motorists refuse to pay for fuel-economy improvements that take more than three years to pay for themselves in fuel savings, while oil companies typically drill in remote locations hoping to recoup their costs and begin earning profits much further down the road. Indeed, they operate in a business where payback periods as short as three years are rare exceptions.[179] The result is a massive, economy-wide misallocation of resources that results in lost jobs, amplified environmental harm, and higher costs for consumers. Feebates fix this market flaw by making purchase prices a better reflection of life-cycle costs—by making prices tell the truth.

Cascadia has come close to feebates twice before, in California in 1990 and in British Columbia in 2000.[180] In both cases, political conditions were not quite right.[181] The Canadian federal government is now considering feebates as part of its climate action plan.[182] And the West Coast Governors' Global Warming Initiative, a regional effort to combat climate change, presents the perfect political opportunity to introduce synchronized regionwide feebates on new vehicles, appliances, and other energy-using devices.[183]

With clean-car standards, profit-motivated utilities investing in their customers' efficiency, and revenue-neutral feebates, clean energy will surge. And the insecurity of Cascadia's current energy system will give way to an array of benefits: a rekindled farm economy; strengthened, high-wage aerospace and truck-making sectors; an emerging industrial cluster in advanced materials, green buildings, energy efficiency and renewables, fuel-cell energy, and tools for the smart grid; the continuous economic stimulus of keeping up to $10 billion a year circulating locally rather than leaking away from the region;[184] plummeting emissions of

pollution to the air; world leadership on slowing climate change; and an energy system that is largely immune to "people of mass destruction."

For energy—as for population, sprawl, pollution, and the other Cascadia Scorecard trends—security, like progress, lies in design. It lies in converting perverse and dysfunctional systems into resilient, self-correcting ones. It lies in emulating the alchemy of the Pacific Northwest's natural ecosystems, which takes sunshine and muck and transforms them into whale song, the fight of steelhead on the line, and other means of sustenance and inspiration. Best of all, the rewards of success in this endeavor are as immediate and tangible for present northwesterners as they are essential for the next generation of northwesterners: Cascadia becomes a model of *se cura,* of being free (or, at least, freer) from care.

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Steve Trautman

ENDNOTES

1. Population of the US portions of Cascadia from US Census Bureau, American Factfinder, *factfinder.census.gov/home/saff/main.html*; Population of British Columbia from BC Stats, *www.bcstats.gov.bc.ca/data/pop/pop/BCPop.html/*; Population of the Netherlands from Central Intelligence Agency, "Netherlands," *CIA World Factbook*, Jan. 1, 2004, *www.cia.gov/cia/publications/factbook/geos/nl.html*. Size of Cascadia's economy from US Bureau of Economic Analysis, "Regional Accounts Data," *www.bea.doc.gov*; and BC Stats, "BC GDP at Market Prices and Final Domestic Demand 1981-2003," *www.bcstats.gov.bc.ca/data/bus_stat/econ_acct.htm*. Russia's gross national product for 2001, not adjusted for purchasing power, was $253 billion, from US Census Bureau, *Statistical Abstract of the United States 2003*, Table 1333, Washington, D.C., *www.census.gov/prod/www/statistical-abstract-04.html*. Land area of Cascadia estimated by CommEn Space, Seattle, a geographic information systems consulting firm, *www.commenspace.org*, based on the boundaries of the watersheds whose rivers flow through the temperate rainforests on the Pacific Northwest coast, from Northern California through Southeast Alaska. The land area of Cascadia is approximately 614,944 square miles (393.6 million acres, or 159.3 million hectares). European nations' land areas from US Census Bureau, *2000 Statistical Abstract of the United States*, Section 30, pp 822-4, *www.census.gov/prod/www/statistical-abstract-us.html*. Return.
2. A synopsis of the region's history can be found in Alan Durning, *This Place On Earth,* (Seattle: Sasquatch Books, 1996), p. 23, *www.northwestwatch.org/publications/tpoe.asp*. Return.
3. Northwest's leadership from John C. Ryan, *State of the Northwest*, 2000 ed. (Seattle: NEW, 2000), *www.northwestwatch.org/publications/sonw2.asp*. Return.
4. A discussion of why NEW selected these seven indicators is at "Cascadia Scorecard: Why These Seven Trends?" *www.northwestwatch.org/scorecard/seven_trends.pdf*. Return.
5. Price of gasoline in BC from the gasoline price charts at VancouverGasPrices.com, *vancouvergasprices.com/retail_price_chart.asp?city1=BC&city2=Canada+Average&city3=Vancouver&period=24&unit=CAN+c%2FL&num=20*. Price of Alaskan oil from "Money and Business," *Anchorage Daily News*, *www.adn.com/business*. Return.

6. A US effort to develop a prioritized national list of infrastructure vulnerabilities to terrorism, including the energy system, was in disarray as of December 2004. Mimi Hall of Gannett News Service reported that, "Members of Congress who have seen parts of the classified list (which runs to more than 80,000 facilities) being created by the Department of Homeland Security say it's a haphazard compilation that includes water parks and miniature golf courses but omits some major sites in need of security. 'Their list is a joke,' said Rep. Ernest Istook (R-Okla.), a member of the House Homeland Security Committee." (Mimi Hall, "Lawmaker: Database of Critical Sites 'A Joke,'" *Olympian,* Dec. 9, 2004, *www.theolympian.com/home/news/20041209/topstories/46218.shtml*.)

   Ascertaining the extent to which Northwest leaders understand the energy system's insecurity is difficult. But they do not behave as if the region's energy system were vulnerable. NEW made repeated attempts to contact several of the relevant authorities to learn what precautions they were taking but were rebuffed or ignored. This could mean that those authorities are unaware of the threats or, as likely, that they are intentionally tight-lipped on the subject. Of course, many in the energy industry and relevant agencies are acutely aware of the energy system's fragility. For example, there are various references to pipeline and transmission lines in *The National Strategy for The Physical Protection of Critical Infrastructures and Key Assets*, The White House, Washington, DC, Feb. 2003, *www.dhs.gov/interweb/assetlibrary/Physical_Strategy.pdf*. This document notes that most of the nation's critical infrastructure is owned and operated by the private sector and commits government to little more than communication with relevant companies. Likewise, the US Dept. of Energy maintains an Office of Energy Assurance, whose mission includes coordinating with the Dept. of Homeland Security to prevent use of energy infrastructure as a means to carry out terrorist attacks. The Pacific Northwest National Laboratory discloses little about its energy-system security programs. The Dept. of Homeland Security's Directorate of Information Analysis and Infrastructure Protection is secretive. Return.
7. Explanation of the targets and their justification can be found in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 67, *www.northwestwatch.org/publications/scorecard.asp*. Return.
8. Note for Figure 1: Average for 2004 is a preliminary estimate; 1980s trend is based on estimates for sprawl. Return.
9. To compare the disparate trends of the Cascadia Scorecard, NEW employs a three-step method for placing the various Scorecard indicators on a single scale.

   First, NEW calculates how much each indicator changes—whatever the direction—in a typical year. For example, northwesterners' per capita energy con-

sumption (or, more specifically, consumption of fuel on roads and electricity in buildings) rises in some years and falls in others, but the average yearly change over the last several decades has been equivalent to about four gallons of gas more or less each year. Almost by definition, the average rate of annual change for each indicator is a pace to which northwesterners have become accustomed, part of the unnoticed background of their lives.

Second, for each indicator NEW identifies a part of the world (or, where data are limited, a part of the bioregion) that has performed particularly well, and we use that region's performance as a "model" or target for Cascadia. Japan, where life spans are consistently the world's longest, serves as a model for health. Likewise, Germany has been a leader among wealthy nations not only in maintaining relatively low per capita energy consumption, but also in promoting renewable energy generation. Germany's level of per person energy consumption—though high by developing world standards—nevertheless serves as a target to which northwesterners can aspire.

Third, NEW calculates how long it would take Cascadia, at the average annual rate of change—the slow, steady pace to which its residents are accustomed—to achieve "model" performance on each indicator. This final step puts all of the disparate indicators, each measured in its own way, on the same scale: the number of years until target performance is reached.

Obviously, the choice of a model is somewhat subjective: "model" performance is not the best that is possible for a given indicator. Germans, for example, could use energy more sparingly and the Japanese could live longer lives. Similarly, because the method for estimating sprawl and forestry trends is unique to NEW, our choice of a "model" is limited to places we have already studied—for these indicators, the scope of our method is limited. Nonetheless, the Cascadia Scorecard does provide a common basis of comparison for different trends, and, more importantly, identifies areas where Cascadia needs the most improvement in order to match performance that some part of the world has already attained. Return.

10. Because no new data were collected for forests and sprawl since the previous edition of Cascadia Scorecard, NEW assumed that recent trends were continued for those two indicators. Pollution trends will be included in the Scorecard as trend line data becomes available. Return.
11. Indeed, Japan has notched steady growth in life expectancy since 2001, the "target" year chosen for the health indicator in *Cascadia Scorecard* 2004. According to the United Nations Human Development report, Japan's life expectancy reached 81.5 years in 2002, a two month increase over its 2001 level. And Japan's Ministry of Health reports that life spans in the country reached

approximately 81.8 years in 2003 (calculated by averaging male and female life expectancies); from Japan Ministry of Health, Labour, and Welfare, Statistics and Information Dept., "Abridged Life Tables for Japan: Life Expectancies at Specified Ages," *www.mhlw.go.jp/english/database/db-hw/lifetb03/1.html*. Return.

12. The Cascadia Scorecard's forest indicator relies on an analysis of Landsat satellite imagery to determine the pace of clearcutting in selected forested regions of the Pacific Northwest. NEW's method, developed in partnership with CommEn Space, a Seattle-based geographic information systems consulting firm, *www.commenspace.org*, yields consistent data for the bioregion, but is not directly comparable to forestry data from other parts of the world. For this reason, NEW is only able to use locations within the bioregion. For more information, see chapter 5, "Forests." Return.
13. Compounds in northwesterners' bodies from Figure 2 in NEW, "Flame Retardants in the Bodies of Pacific Northwest Residents," Sept. 29, 2004, *www.northwestwatch.org/toxics/PBDEs_in_NW.pdf*. Return.
14. Levels of many persistent toxics, including lead, PCBs and DDT, have fallen in recent years in both the Northwest and through most of the industrialized world. See, for example, Puget Sound Action Team, "Status, Trends, and Effects of Toxic Contaminants in the Puget Sound Environment," State of Washington, Oct. 2003, *www.psat.wa.gov/shared/PSAT_Final_10_03.pdf*; and Gina M. Solomon and Pilar M. Weiss, "Chemical Contaminants in Breastmilk: Time Trends and Regional Variability," *Environmental Health Perspectives*, 11(6): A339–347 (2002). Return.
15. Levels of persistent toxics are almost certainly higher than in pre-industrial and early industrial times. However, body burdens of lead and other toxic metals, organochlorine pesticides, and many persistent toxics used in industry have been on the decline in recent decades. See, for example, Natural Resources Defense Council, "Chemical Pollution and Mother's Milk: The Chemicals, One by One" May 22, 2001, *www.nrdc.org/breastmilk/chems.asp*. Return.
16. Life expectancy data used in "Health" chapter from British Columbia Ministry of Management Services, BC Stats, "Population and Demographics: Vital Measures," *www.bcstats.gov.bc.ca/data/pop/popstart.htm#vital*; Washington Dept. of Health, Center for Health Statistics, *www.doh.wa.gov/ehsphl/chs/chs-data/death/dea_VD.htm*; Idaho Dept. of Health and Welfare, Bureau of Vital Records and Health Statistics; and for Oregon, NEW calculated life expectancy using data from the Oregon Dept. of Human Services, Center for Health Statistics, the Center for Population Research and Census at Portland State University, the US Census Bureau, and the US Centers for Disease Control and Prevention, CDC Wonder, *wonder.cdc.gov*. For Northwest counties and aggregations

of counties, life expectancies were calculated using data from CDC Wonder; they refer to the average of 1999, 2000, and 2001. Cross-national comparisons of life expectancy from United Nations Development Program, "Human Development Report 2004," *hdr.undp.org/reports/global/2004*. See especially "Human Development Indicators," Table 1, *hdr.undp.org/reports/global/2004/pdf/hdr04_HDI.pdf*. Figures used herein exclude very small independent states such as Monaco, and semiautonomous regions such as Hong Kong.

For more information on the Health indicator, see the "Health" chapter in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 14, *www.northwestwatch.org/publications/scorecard.asp* and NEW, "Cascadia Scorecard: Health," *www.northwestwatch.org/scorecard/health.asp*. Return to text. Return to map.

17. Statistically, life expectancy also tends to be a particularly reliable measure of the health of a population, as it is based on complete counts of death that are tabulated by state and provincial governments. Other measures, such as Health-Adjusted Life Expectancy and Disability-Adjusted Life Expectancy, may provide a more nuanced view of health, but are difficult to compile and are not calculated regularly for jurisdictions in the Northwest. Methods for calculating life expectancy vary slightly by jurisdiction, but such differences typically affect life expectancy calculations by only a month or two. For a more thorough discussion of why NEW selected life expectancy as a proxy for overall health trends, see the "Health" in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 14, *www.northwestwatch.org/scorecard/health.asp*. Return.
18. International correlation between life expectancy and healthy life expectancy derived by NEW from World Health Organization, Statistical Information System, "Core Health Indicators from the WHR," *www3.who.int/whosis/core/core_select.cfm*. Return.
19. Life expectancy in Canadian cities from Jason Gilmore, "Health of Canadians Living in Census Metropolitan Areas," Statistics Canada, Health Statistics Division, July 2004, *www.statcan.ca/english/research/89-613-MIE/2004002/summary.htm*. Return.
20. Sprawl worsens health from R. Sturm and D.A. Cohen, "Suburban sprawl and physical and mental health," *Public Health*,118(7):488-496 (2004). Return.
21. Poverty rates from US Dept. of Agriculture, Economic Research Service, "2002 County-level Poverty Rates for Oregon," *www.ers.usda.gov/Data/povertyrates/PovListpct.asp?st=OR&view=Percent*. Return.
22. Links between poverty and access to medical care, and poverty and the lack of social ties, from Stephanie Robert, "Health Priority: Social and Economic Factors that Influence Health; Economic and Social Determinants of Health: An Overview," Wisconsin Dept. of Health and Family Services, *dhfs.wisconsin.gov/statehealthplan/Implementation/pdf-files/Social-overview.pdf*. Return.

23. Effects of income inequality on health from University of Washington, International Health Program, "Income Inequality and Population Health," *depts.washington.edu/eqhlth/pages/issues.html*; Stephen Bezruchka, University of Washington, Dept. of Health Services, Seattle, private communication, Oct. 8, 2001; and Ichiro Kawachi and Bruce P. Kennedy, *The Health of Nations: Why Inequality is Harmful to Your Health* (New York: The New Press, 2002). Return.
24. Effects of social isolation on health from, among other sources, John T. Cacioppo and Louise C. Hawkley, "Social Isolation and Health, with an Emphasis on Underlying Mechanisms Perspectives," *Biology and Medicine,* 46(3): S39–S52 (2003); and L. F. Berkman and S. L. Syme, "Social Networks, Host Resistance, and Mortality: A Nine-year Follow-up Study of Alameda County Residents," *American Journal of Epidemiology*, Feb. 1979. For more perspectives on behavioral, social, economic, and environmental influences on health, see Lisa F. Berkman, ed., *Through the Kaleidoscope: Viewing the Contributions of the Behavioral and Social Sciences to Health* (Washington, DC: National Academy Press, 2002), *www.nap.edu/openbook/0309084423/html*; and Institute of Medicine of the National Academies, *Health and Behavior: The Interplay of Biological, Behavioral, and Societal Influences* (Washington, DC: National Academy Press, 2001), *www.nap.edu/books/0309070309/html*. Return.
25. For example, life expectancy growth in the Northwest states over the last two decades trails that of Japan, Sweden, Great Britain, and Canada. Japanese life expectancy trends from Japanese Ministry of Health, Labour and Welfare, Statistics and Information Department, "Life Expectancies at Specific Ages," *www.mhlw.go.jp/english/database/db-hw/lifetb03/1.html*; and the Japan Pharmaceutical Manufacturers Association Databook 2002, *www.jpma.or.jp/12english/publications/databook/databook2002/14DATA/whtml/078.html*. Swedish life expectancy trends from Statistics Sweden, "Average life expectancy 1751-2003," *www.scb.se/templates/tableOrChart 25831.asp*. United Kingdom life expectancy trends from the UK Office for National Statistics, "Healthy Life Expectancy at Birth and at 65 in Great Britain and England, 1981 – 2001," *www.statistics.gov.uk/STATBASE/ssdataset.asp?vlnk=8486*. Canadian life expectancy trends from Statistics Canada, "Table 102-0025: Life Expectancy: Abridged Life Table, at Birth and at Age 65, by Sex, Canada, Provinces and Territories, Annual (Years)" CanSim, *cansim2.statcan.ca*. Return.
26. NEW's economic security index for the Northwest states and British Columbia is derived from four components: poverty rates, child poverty rates, unemployment rates, and inflation-adjusted median household incomes. Each component represents an important and distinct facet of economic security; data are credible

and available on an annual basis at state and provincial levels; and the components tend to vary in tandem, thereby mitigating statistical anomalies. The components are aggregated using a method similar to that used to calculate the Index of Leading Economic Indicators. Each component in the index is assigned a weighting factor based on its statistical variability; wide fluctuations earn a component a lower weighting. The year-to-year changes in each component are weighted and summed, and then put on a scale in which the figure for 1990 is equal to 100. In practice, a one point increase in the economic security index is roughly equivalent to a one percentage point decline in poverty, child poverty, and unemployment. For more information, contact NEW.

Poverty and child poverty in the United States and Northwest states from US Census Bureau, March Supplement of the Current Population Survey (CPS). For poverty data, see US Census Bureau, "Historical Poverty Tables: People," *www.census.gov/hhes/poverty/histpov/perindex.html*; and CPS, March Supplement, "Table 25: Poverty Status By State and Ten Large Metropolitan Areas," by year, *www.bls.census.gov/cps/ads/sdata*. Child poverty for 1990 through 2001 from CPS, March Supplement, "Table 23: Single Years of Age: Poverty Status of People in 1999," by year, *www.bls.census.gov/cps/ads/sdata.htm*; for 2002, from CPS, March Supplement, "POV46: Poverty Status by State: 2002: Below 100% and 125% of Poverty: People Under 18 Years of Age," *ferret.bls.census.gov/macro/032003/pov/new46_100125_03.htm;* for 2003, from CPS, March Supplement, "POV46: Poverty Status by State: 2003: Below 100% and 125% of Poverty: People Under 18 Years of Age," *ferret.bls.census.gov/macro/032004/pov/new46_100125_03.htm*. NEW also consulted US Census Bureau, "Poverty in the United States: 2002," *www.census.gov/hhes/www/poverty02.html*, which is based on CPS data, and American Community Survey's data profiles 2002, "Table 3: Selected Economic Characteristics," *www.census.gov/acs/www/Products/Profiles/Single/2002/ACS/index.htm*.

Poverty and child poverty in Canada and British Columbia, from Statistics Canada, "Table 202-0802: Persons in low income, before and after tax, showing rate and number, annual," CanSim, *cansim2.statcan.ca*. The Canadian "poverty rate" refers to the share of those in households that earn less than the low-income cutoff, before taxes and transfers. Low-income cutoffs are not directly comparable to the US poverty rate, both because different income levels are used for each and because the low-income cutoff is adjusted for the cost of living in rural communities, small towns, and cities.

Unemployment rates in United States and Northwest states from US Bureau of Labor Statistics, "Local Area Unemployment Statistics" and "Labor Force Statistics from the Current Population Survey.," *www.bls.gov*.

Unemployment rates in Canada and British Columbia from Statistics Canada, "Table 282-0086: Labour Force Survey Estimates (LFS), Supplementary Unemployment Rates by Sex and Age Group, Annual," CanSim, *cansim2.statcan.ca*. NEW used rate "R3," which is most comparable to the US rate. This rate is as much as 0.7 percent lower than the official rates reported for Canada and provinces. For more information, see Statistics Canada, "The UR Gap: Small Differences in Measurement May Matter," *Labour Force Update,* Catalogue No. 71-005-XPB or contact NEW.

Median income in United States and Northwest states estimated from Carmen Denavas, Housing and Household Economics Statistics Division, US Census Bureau, Washington, DC, private communication, May 5, 2003; and from US Census Bureau, "Historical Income Tables: Households, Table H-8," *www.census.gov/hhes/income/histinc/h08.html,* May 2003.

Median income in Canada and British Columbia from Statistics Canada, "Table 202-0201: Distribution of Market Income in 2001 Constant Dollars, For Economic Families, Unattached Individuals and All Units, Annual," CanSim, *cansim2.statcan.ca*. To reduce sampling error, median income was calculated using three-year averages; for example, 1990 refers to the period 1988–90; 2001 refers to 1999–2001. All figures are adjusted for inflation. NEW also consulted US Census Bureau, "Income in the United States: 2002," *www.census.gov/hhes/www/income02.html,* which is based on Current Population Survey data, and American Community Survey's data profiles 2002, "Table 3: Selected Economic Characteristics," at *www.census.gov/acs/www/Products/Profiles/Single/2002/ACS/index.htm*.

For a more thorough discussion of the "Economy" indicator, see NEW, "Cascadia Scorecard: Economy," *www.northwestwatch.org/scorecard/economy.asp*; the "Economy" chapter in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 19, *www.northwestwatch.org/publications/scorecard.asp*; NEW, "Falling Behind: The Economic Security of Northwest Families Since 1990," June 2003, *www.northwestwatch.org/press/recent_econ.asp*; or contact NEW. Return.

27. Poverty slows learning from National Center for Children in Poverty, "Poverty and Brain Development in Early Childhood," Joseph L. Mailman School of Public Health, Columbia University, New York, June 2, 1999, *www.nccp.org/media/pdb99-text.pdf*; and Childstats.gov, "America's Children 2001: Health Indicators," *www.childstats.gov/ac2001/ac01.asp*. Poverty amplifies crime and delinquency from David P. Ross and Paul Roberts, *Income and Child Well-Being: A New Perspective on the Poverty Debate* (Ottawa: Canadian Council on Social Development, 1999), *www.ccsd.ca/pubs/inckids/index.htm*; Melissa Sickmund et al., *Juvenile Offenders and Victims: 1997 Update on Violence*

(Washington, DC: Office of Juvenile Justice and Delinquency Prevention, 1997), *www.ojjdp.ncjrs.org/pubs/juvoff/index.html*; and B. B. Robbie Rossman, "Longer-Term Effects of Children's Exposure to Domestic Violence," in Sandra A. Graham-Bermann and Jeffrey L. Edleson, eds., *Domestic Violence in the Lives of Children: The Future of Research, Intervention, and Social Policy* (Washington, DC: American Psychological Association, 2001). Poverty increases the prevalence of teen pregnancy from Alan Thein Durning and Christopher D. Crowther, *Misplaced Blame* (Seattle: NEW, July 1997) p. 31, *www.northwestwatch.org/publications/mpblamedownload.asp*. For further discussion of the implications of poverty see NEW, "Falling Behind: The Economic Security of Northwest Families Since 1990," June 2003, *www.northwestwatch.org/press/recent_econ.asp*. Return.

28. Data for the "Population" indicator are derived from various federal, state, and provincial sources. See NEW, "Population Reprieve: Births and Migration in the Pacific Northwest," July 30, 2003, *www.northwestwatch.org/press/recent_pop.asp*; US, Canadian, and international data from Population Reference Bureau, "World Population Data Sheet," by year, *www.prb.org*.

    Population for Northwest states from US Census Bureau, particularly "Intercensal Estimates of the Total Resident Population of States," *www.census.gov/population/estimates/state/stts*; and "Population Estimates," *eire.census.gov/popest/estimates.php*; Idaho Division of Financial Management, "Idaho Economic Forecast," Apr. 2003, *www2.state.id.us/dfm/ief/2003/April/0304ief.html*; Oregon Office of Economic Analysis, "Appendix C: Population Forecasts by Age and Sex," in *Oregon Economic and Revenue Forecast* (Salem, Ore.: Oregon Dept. of Administrative Services, 2003), *www.oea.das.state.or.us/economic/appendixc.pdf*; and Washington Office of Financial Management (OFM), "Preliminary Intercensal Population Estimates, Population Change, and Percent Population Change, 1990 through 2000 with Estimates for 2001, 2002, and 2003," *www.ofm.wa.gov/pop/april1/intercensalto03.pdf*. Data for Washington for 2003 estimated from Washington OFM, Forecasting Division, "2004 Population Trends," Olympia, Sept. 2004; the Washington Dept. of Health's Center for Health Statistics, had not published official statistics at the time of publication.

    Population for British Columbia from Statistics Canada, "Series A2: Population of Canada, by Province, Census Dates, 1851 to 1976," *www.statcan.ca/english/freepub/11-516-XIE/sectiona/sectiona.htm#A2_14*; and BC Statistics, "BC Population Forecast 03/01: Table 1: Summary Statistics" and "British Columbia Quarterly Population Estimates 1951 to 2002," *www.bcstats.gov.bc.ca/data/pop/pop/project/bctab1.htm*. International growth rates from World Resources

Institute, "Table HD1: Demographic Indicators," EarthTrends, *earthtrends.wri.org/pdf_library/data_tables/hd1n_2000.pdf*.

Total fertility rate (TFR) is a "synthetic measure": it calculates how many children a hypothetical woman between the ages of 15 and 45 would give birth to, if at each year of age she had as many births as was average among Northwest women of that age during the period in question. When the average age of mothers is rising (as in the Northwest), the TFR understates how many children women are typically having; from John Bongaarts, "The End of the Fertility Transition in the Developed World," *Population and Development Review,* Sept. 2002. NEW also calculated completed fertility rates—how many children 45-year-old women have had, on average—for the Northwest. Women in the region are having families larger by about 0.1 to 0.2 children than suggested by the total fertility rate. Total fertility rates calculated from David O'Neil, BC Stats, Population Section, Victoria private communication, July 2, 2003; Teneale Chapton, Idaho Bureau of Health Policy and Vital Statistics, Health Statistics, Boise, private communication, July 15, 2003; Karen Hampton, Oregon Center for Health Statistics, Portland, private communication, July 15, 2003; Oregon Dept. of Human Services, "Table 2-2: Age-Specific Birth Rates, Fertility Rates, and Total Fertility Rates, Oregon, 1940, 1950, 1960, 1970, 1975–2001," *Oregon Vital Statistics Report 2001*, *www.dhs.state.or.us/publichealth/chs/arpt/01v1/2-02.pdf*; Oregon Dept. of Human Services, *2003 Vital Statistics County Data*, *www.dhs.state.or.us/publichealth/chs/cntydata/cdb2003/codat03.cfm*; Phyllis Reed, Vital Statistics, Washington Center for Health Statistics, Olympia, private communication, June 2003; Washington Office of Financial Management (OFM), "Intercensal and Postcensal Estimates of County Population by Age and Sex: 1980-2002," *www.ofm.wa.gov/pop/coagemf/index.htm*; Washington Dept. of Health, Center for Health Statistics, "Birth Data," *www.doh.wa.gov/ehsphl/chs/chs-data/birth/bir_vd.htm*; Washington OFM, "2003 Population Trends for Washington State," Table 14; and Washington OFM, "2004 Population Trends," Sept. 2004, *www.ofm.wa.gov/pop/poptrends/index.htm*; Alain Belanger and Genevieve Ouellet, "A Comparative Study of Recent Trends in Canadian and American Fertility, 1980–1999," *Report on the Demographic Situation in Canada 2002* (Ottawa: Statistics Canada, 2002); Marie Drolet, "Motherhood and Paycheques," *Canadian Social Trends,* Spring 2003; StatCan, "Age-Specific Fertility Rate," cat. no. 82F0075XCB, *www.statcan.ca/english/Pgdb/health08.htm*, June 19, 2003; and Joyce A. Martin et al., "Births: Final Data for 2001," *National Vital Statistics Reports* 51(2), Dec. 18, 2002, *www.cdc.gov/nchs/data/nvsr/nvsr51/nvsr51_02.pdf*.

For a more thorough discussion of the "Population" indicator, see NEW, "Cascadia Scorecard: Population," *www.northwestwatch.org/scorecard/population.*

asp; the "Population" chapter in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 24, *www.northwestwatch.org/publications/scorecard.asp*; NEW, "Population Reprieve: Births and Migration in the Pacific Northwest," June 30, 2003, *www.northwestwatch.org/press/recent_pop.asp*; or contact NEW. Return to text. Return to map.

29. Birthrates and poverty, and birthrates and sexual abuse from Alan Thein Durning and Christopher Crowther, *Misplaced Blame* (Seattle: NEW, July 1997) p. 50, *www.northwestwatch.org/publications/mpblame.asp*; *Sex and America's Teenagers* (New York: Alan Guttmacher Institute, 1994); US Centers for Disease Control and Prevention, "Fertility, Family Planning, and Women's Health: New Data from the 1995 National Survey of Family Growth," *Vital and Health Statistics,* May 1997, *www.cdc.gov/nchs/data/series/sr_23/sr23_019.pdf*; and Amara Bachu and Martin O'Connell, "Fertility of American Women: June 1998," *Current Population Reports,* Sept. 2002, *www.census.gov/prod/2000pubs/p20-526.pdf*. Return.
30. All but one (Spokane, Washington) of the most urbanized counties and health service delivery areas in Cascadia have total fertility rates below the average for their state or province: in British Columbia, Victoria and Vancouver; in Idaho, Ada (Boise) and Kootenai (Coeur d'Alene); in Oregon, Multnomah (Portland) and Lane (Eugene); and in Washington, King (Seattle). Suburban areas often slightly exceed the average TFR in their state or province, as in British Columbia's Fraser Valley health service delivery area; and in Idaho's Canyon County; Oregon's Washington County; and Washington's Clark, Kitsap, Pierce, and Snohomish Counties. Return.
31. Cross-national comparison of women's status from Save the Children, "State of the World's Mothers," *www.savethechildren.org/publications/sowm2002.pdf*; and United Nations Development Fund for Women, "Progress of the World's Women 2000," *www.unifem.undp.org/progressww/2000*. Return.
32. The fertility rate cited in the text represents the population-weighted average of the two nations. In 2002, the total fertility rate was 1.6 children per woman in Sweden, and 1.7 in the Netherlands. Calculated from the United Nations Development Program, *Human Development Report*, "Human Development Indicators: Table 5, Demographic Trends," *hdr.undp.org/reports/global/2004/pdf/hdr04_HDI.pdf*. Return.
33. Unwanted and unintended pregnancies, for Idaho, from Idaho Bureau of Health Policy and Vital Statistics, *2001 Pregnancy Risk Assessment Telephone Survey*, (Boise: Idaho Department of Health and Welfare, 2003); excludes mothers under the age of 18; for Oregon, from Oregon Dept. of Human Services, "Pregnancy Risk Assessment Monitoring System (PRAMS) Survey Results for 2001," *www.dhs.state.or.us/publichealth/pch/prams/2000/feelpreg.cfm*; for Washington, from

private communication with Linda Lohdefinck, Washington Dept. of Health, Pregnancy Risk Assessment Monitoring System, Olympia, Summer 2002 and Sept. 10, 2004. Comparison of BC and Northwest states from Institute of Medicine, *Best Intentions: Unintended Pregnancies and the Well-Being of Children and Families* (Washington, DC: National Academy Press, 1995). Return.

34. Benefits of intended pregnancies and resulting births from Sarah S. Brown and Leon Eisenberg, editors, *The Best Intentions: Unintended Pregnancy and the Well-Being of Children and Families* (Washington, DC: National Academy of Sciences, Institute of Medicine, 1995), pp. 66-74. Return.
35. British Columbia and Washington have made emergency contraceptives available from pharmacists without requiring a separate trip to a medical office, although emergency contraceptives are not "over-the-counter" medicines. In Washington, pharmacists themselves have authority to write prescriptions for a limited number of medications, including emergency contraceptives. See section 16, *This Place on Earth 2001* (Seattle: NEW, 2001), p. 50, *www.northwestwatch.org/publications/tpoe01.asp*. Return.
36. Trussell's research findings from Family Planning Advocates of New York State, Inc., "Survey Shows Gaps in NY Hospital Treatment for Sexual Assault Survivors," Jan. 27, 2003, *www.fpaofnys.org/mediacenter/1272003.html*. Return.
37. Plan B ruling from Martha Irvine, "Debate Rages Over Contraceptive Sale," *Seattle Post-Intelligencer*, Oct. 18, 2004. Return.
38. Population density. Urban area population and residential density are based on population counts for city and suburban blocks, obtained from the US Census Bureau and the Census of Canada. For each location in an urban area, local population density was calculated as the density of the smallest circle that contained at least 500 residents—a rough proxy for a neighborhood. The analysis of residential density was conducted using software tools developed by CommEn Space, a nonprofit organization based in Seattle that specializes in geographic and spatial data analysis.

    Urban area definitions. NEW analyzed the census-defined metropolitan areas surrounding the each of 15 US cities; metropolitan areas included Metropolitan Statistical Areas, Consolidated Metropolitan Statistical areas, or Consolidated Statistical Areas, depending on the city. Each metropolitan area contained a different amount of surrounding rural land, so to make comparisons among different metropolitan areas consistent, NEW focused its analysis on trends in suburban and urban areas, rather than in the surrounding rural land.

    Definition of "rural land" and "compact community," and relationship between density and driving. For this report, rural areas are defined as having an average of fewer than 0.5 people per acre, the equivalent of a five-person household on

a ten acre lot, which is not atypical of the most scattered suburbs surrounding many metropolitan areas. Compact neighborhoods are defined as those that have at least 12 people per acre—-densities typical of the older "streetcar neighborhoods" that were built before World War II and that still surround downtown Portland, Seattle, and Vancouver. In some respects, the thresholds dividing "rural" from "suburban," and "low-density" from "compact" neighborhoods, are arbitrary. Some suburban areas with large-lot zoning may be classified as rural under this definition; and some neighborhoods with 12 or more people per acre have poor access to transit and services, and thus do not fully benefit from "compact" densities. Indeed, some researchers have suggested that local densities above 12 people per acre may be required to support transit cost-effectively. Still, the 12-person-per-acre marker provides a convenient, if not absolute, reference point for transit-oriented neighborhoods. A robust body of international research suggests that below 8 to 12 people per acre, a city's land use patterns are inherently car dependent. See Peter Newman and Jeffrey Kenworthy, *Sustainability and Cities: Overcoming Automobile Dependence* (Washington, DC: Island Press, 1999), and Jeffrey R. Kenworthy, et al., *An International Sourcebook of Automobile Dependence in Cities, 1960–1990* (Boulder, Colo.: University Press of Colorado, 1999).

For a more thorough discussion of the "Sprawl" indicator, see NEW, "Cascadia Scorecard: Sprawl," *www.northwestwatch.org/scorecard/sprawl.asp*; the "Sprawl" chapter in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 35, *www.northwestwatch.org/publications/scorecard.asp*; NEW's sprawl reports, *www.northwestwatch.org/publications/books.asp#reports*; or contact NEW. Return to text. Return to maps: Charlotte and Las Vegas, Portland.

39. Hours behind the wheel estimated at 72 minutes each day, from Carl Honore, "In Praise of Slowness: How a Worldwide Movement Is Changing the Cult of Speed," HarperCollins.com, *www.harpercollins.com/global_scripts/product_catalog/book_xml.asp?isbn=006054578X*; and 84 minutes each day, from Surface Transportation Policy Project, "Aggressive Driving: Where You Live Matters," Apr. 1, 1999, *www.transact.org/report.asp?id=58*. Return.
40. Pollutants from Alan Thein Durning, *The Car and the City* (Seattle: NEW, April 1996), pp. 25-26, *www.northwestwatch.org/publications/carcity.asp*. Return.
41. Among the 15 cities NEW studied, rainfall was the strongest single predictor of how much each city sprawled. Cities with less than 18 inches of average annual rainfall were 35 percent denser—and had 75 percent more people in compact neighborhoods—than rainier cities. And between 1990 and 2000, low-rainfall cities channeled twice as much of their growth into compact neighborhoods, and consumed half as much rural land to accommodate each newcomer, as did

rainier cities.

Based on these findings, NEW concludes that water scarcity has served as de facto urban containment. Arid and semi-arid cities such as Las Vegas and Denver are typically served by centralized water systems and rely on scarce surface water. In such cities, new development is largely dependent on the extension of water mains, which limits far-flung, low-density development. In regions with more rainfall, however, development is less constrained: there are more, and more abundant, sources of water, and local water systems can tap into groundwater and surface water supplies with less legal wrangling over water rights.

For more details of this analysis, see NEW, "The Portland Exception: Sprawl, Smart Growth, and Rural Land Loss in 15 US Cities," Oct. 25, 2004, *www.northwestwatch.org/scorecard/portland04.asp*. Return.

42. This is based on the average per-person sprawl of 7 water-abundant cities, excluding Portland, Ore. but including Boise, Ida., which has little rainfall but abundant ground and surface water supplies. For each city, NEW calculated the acreage of land that was considered "rural" in 1990 (i.e., had a population density of less than 0.5 people per acre) but that entered a suburban or urban density category in 2000. NEW then calculated the acreage of "rural" land lost per new resident in urban and suburban areas. At the average value for 7 water-abundant cities studied, new suburban growth in metropolitan Portland would have consumed an additional 150 square miles of land over the period. Return.
43. Characteristics of Oregon's Measure 37 from State of Oregon, *Voter's Guide for November 2, 2004 General Election*, "Measure 37: Text of Measure," *www.sos.state.or.us/elections/nov22004/guide/meas/m37_text.html*. Return.
44. Deforestation and clearcut statistics calculated by NEW and CommEn Space, a geographic information technology center, *www.commenspace.org*. Data and maps based on five scenes whose boundaries are defined by scenes from NASA's Landsat satellites. For each scene CommEn Space analyzed a series of images taken from the early 1970s through 2002 and identified human-caused disturbances to forest cover of roughly 2 acres or greater. The analysis excluded natural disturbances such as avalanches or forest fires, as well as disturbances in urban areas. In British Columbia, data for some years were estimated because satellite images were not available. Figures given for US Forest Service land do not include designated wilderness areas, which are often administered by the Forest Service. Because fewer satellite images were available for British Columbia, the analysis there covers only the period from 1976 to 2002; in some cases, this results in an understatement of clearcut logging.

    The study areas, while informative in themselves, are not necessarily representa-

tive samples of the Northwest's forests. Indeed, no study area could be. Clearcut logging is by no means confined to these five parcels, nor can we deduce much about the rate of clearcutting elsewhere based on the pace of deforestation in the study areas.

For a more thorough discussion of the "Forests" indicator, see NEW, "Cascadia Scorecard: Forests," *www.northwestwatch.org/scorecard/forests.asp*; the "Forests" chapter in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 57, *www.northwestwatch.org/publications/scorecard.asp*; or contact NEW. Return to text. Return to map.

45. Cut rate hike from Washington Dept. of Natural Resources (DNR), "Board of Natural Resources Unanimously Approves Innovative New State Forestry Direction for Washington," Sept. 7, 2004, *www.dnr.wa.gov/htdocs/adm/comm/nr04_078.htm*; and Washington DNR, "State DNR releases Final Environmental Impact Statement on Sustainable Forestry Alternatives," Aug. 3, 2004, *www.dnr.wa.gov/htdocs/adm/comm/nr04_063.htm*; and *Final Environmental Impact Statement on Alternatives for Sustainable Forest Management of State Trust Lands in Western Washington* (Olympia: Washington DNR, 2004). Return.
46. US home building demand from US Census Bureau, "New Residential Construction: Building Permits, Housing Starts, and Housing Completions," especially Table 1, *www.census.gov/const/www/newresconstindex.html*. BC timber boom from Associated Press, "New Pricing System Boosts Coastal Logging in Province," *Skagit Valley Herald*, June 8, 2004, *www.skagitvalleyherald.com/articles/2004/06/11/business/business02.txt*; and "Beetle Infestation Triggers Logging Boom," *CBC News British Columbia*, Sept. 15, 2004, *vancouver.cbc.ca/regional/servlet/View?filename=bc_beetles20040915*. Return.
47. New logging rules for BC's coast from Associated Press, "New Pricing System Boosts Coastal Logging in Province," *Skagit Valley Herald*, June 8, 2004, *www.skagitvalleyherald.com/articles/2004/06/11/business/business02.txt*. Return.
48. Accelerated logging to slow beetle infestation from BC Ministry of Forests, "Cut Level Increased in Response to Beetle Epidemic," Sept. 14, 2004, *www2.news.gov.bc.ca/nrm_news_releases/2004FOR0040-000707.htm*; and David Suzuki Foundation, "The Forests of British Columbia," *www.davidsuzuki.org/Forests/Canada/BC/default.asp*. Return.
49. One-quarter of Cascadia is forested from Alan Thein Durning, *This Place on Earth* (Seattle: Sasquatch Books, 1996), p. 200. Return.
50. Healthy Forests Initiative from Environmental Media Services, "'Healthy Forests Initiative' Background and Reaction," May 22, 2003, *www.ems.org/wildfires/healthy_forests.html*. Return.
51. Percent of forests FSC certified calculated from Katie Miller, communications director, Forest Stewardship Council US, Washington, DC, private communica-

tion, Sept. 15, 2004. Help identifying the locations of certain forests from Greg Blomstrom, forest analyst, Forest Stewardship Council US, Arcata, CA, private communication, Sept. 15, 2004. BC certification data from Forest Certification Resource Center, "Certified Forests," *www.certifiedwood.org/search-modules/SearchForests.aspx*. Return.

52. Jurisdiction comparisons from Eric de Place and Todd Burley, "Sustainable Forest Management of State Trust Forestlands," NEW, May 26, 2004, *www.northwestwatch.org/scorecard/Washington_forest_comments.pdf*; and Eric de Place and Todd Burley, "2004 Draft Elliott State Forest Management Plan," NEW, May 26, 2004, *www.northwestwatch.org/scorecard/Oregon_forest_comments.pdf*; and Forest Stewardship Council, "Certified Forests," *www.fscus.org/certified_companies/index.php?num=*&type=forests*. Return.
53. Olympic National Forest figures actually overstate the cutting on national forest lands because these figures do not include the national forest's five wilderness areas, which were not logged at all. Return.
54. BC's figures understate total area logged because they cover only 1973 and 1976 to 2001. Return.
55. Average acres per day for BC span 1976 through 2001. Return.
56. Findings in "Pollution" indicator from breast milk testing. Breast milk from 40 first-time Northwest mothers with infants between two and eight weeks of age was collected from April through November of 2003. Ten mothers were recruited from each of four metropolitan areas: Seattle, Portland, Vancouver, BC, and Missoula, Montana. These samples have been tested for the twelve most widely-produced types of polybrominated diphenyl ethers (PBDEs), dioxins and dioxin-like compounds (including furans and coplanar polychlorinated biphenyls (PCBs)), as well as a suite of non-coplanar PCBs. All tests were performed by the California Environmental Protection Agency's Hazardous Materials Laboratory in Berkeley, California, using high resolution gas chromatography/high resolution mass spectrometry. Results for PBDEs have been reported in NEW, "Flame Retardants in the Bodies of Pacific Northwest Residents," Sept. 29, 2004, *www.northwestwatch.org/toxics*.

    For a more thorough discussion of the "Pollution" indicator, see NEW, "Cascadia Scorecard: Pollution," *www.northwestwatch.org/scorecard/pollution.asp*; NEW, "Flame Retardants in the Bodies of Pacific Northwest Residents," Sept. 29, 2004, *www.northwestwatch.org/toxics*; the "Pollution" chapter in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 62, *www.northwestwatch.org/publications/scorecard.asp*; or contact NEW. Return.
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org/reports/bodyburden; Centers for Disease Control and Prevention, *Second National Report on Human Exposure to Environmental Chemicals* (Atlanta: National Center for Environmental Health, 2003), www.cdc.gov/exposurereport; and Theo Colburn et al., *Our Stolen Future* (New York: Dutton, 1996). Return.

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61. Findings in Washington and Puget Sound from A. Johnson and N. Olson, "Analysis and Occurrence of Polybrominated Diphenyl Ethers in Washington State Freshwater Fish," *Archives of Environmental Contamination and Toxicology,* 41: 339–344 (2001); Lewis Kamb, "Toxic Fire Retardants Turn Up in Orcas," *Seattle Post-Intelligencer*, August 27, 2004, seattlepi.nwsource.com/local/188163_orca27.html; Sierra Rayne et al., "PBDEs, PBBs, and PCNs in Three Communities of Free-Ranging Killer Whales (Orcinus orca) from the Northeastern Pacific Ocean," *Environmental Science and Technology*, 38(16):4293–4299 (2004). Return.
62. PBDEs impair learning from Per Eriksson et al., "Brominated Flame Retardants: A Novel Class of Developmental Neurotoxicants in Our Environment?" *Environmental Health Perspectives*, 109(9): 903–907 (2001). Return.
63. PBDEs alter behavior from Per Eriksson et al., "A Brominated Flame Retardant, 2,2',4,4',5-Pentabromodiphenyl Ether: Uptake, Retention, and Induction of Neurobehavioral Alterations in Mice during a Critical Phase of Neonatal Brain Development," *Toxicological Sciences,* 67: 98–103 (2002). Return.
64. PBDEs delay sexual development from Linda S. Birnbaum and Daniele F. Staskal, "Brominated Flame Retardants: Cause for Concern?" *Environmental Health Perspectives,* 112(1): 9–12 (2004). Return.
65. PBDEs disturb thyroid hormone levels from Tong Zhou et al., "Developmental Exposure to Brominated Diphenyl Ethers Results in Thyroid Hormone Disruption," *Toxicological Sciences,* 66(1): 105–116 (2002). Return.

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67. Infants are most susceptible to toxics is accepted conventional wisdom. See, for example, Curtis D. Klassen, ed, *Cassarett and Doull's Toxicology* (New York: McGraw-Hill, 2001), ch. 10. Return.
68. Value of breastmilk testing from Kim Hooper and Jianwen She, "Lessons from the Polybrominated Diphenyl Ethers (PBDEs): Precautionary Principle, Primary Prevention, and the Value of Community-Based Body-Burden Monitoring Using Breastmilk," *Environmental Health Perspectives,* 111(1): 109–114 (2003). Return.
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70. Value of breastmilk and breastfeeding from US Dept. of Health and Human Services, "HHS Blueprint for Action on Breastfeeding," 2000, *www.4woman.gov/Breastfeeding/bluprntbk2.pdf*. Return.
71. Problems arising from not breastfeeding from US Dept. of Health and Human Services, "HHS Blueprint for Action on Breastfeeding," 2000, *www.4woman.gov/Breastfeeding/bluprntbk2.pdf*. Return.
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73. EPA's action from US Environmental Protection Agency, "Brominated Flame Retardants To Be Voluntarily Phased Out," Nov. 3, 2003, *yosemite.epa.gov/opa/admpress.nsf/0/26f9f23c42cd007d85256dd4005525d2?OpenDocument*. Return.
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76. Washington's plan from Washington Dept. of Ecology, "Washington State Polybrominated Diphenyl Ether (PBDE) Chemical Action Plan: Interim Plan," Dec. 31, 2004, *www.ecy.wa.gov/biblio/0403056.html*. Return.
77. Findings in the "Energy" indicator are derived from the following sources.

    Highway fuel. Prior to 2004, from US Federal Highway Administration, "Table MF-266: Highway Use of Gasoline, By State, 1949–1995," "Table MF-225: Private and Commercial Highway Use of Special Fuels, by State, 1949-1995," "Table MF-27: Highway Use of Motor Fuel," for 1996 through 2002, and "Table MF-21: Motor Fuel Use," for 2003, *Highway Statistics Series*, *www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm*. For 2004, estimated from the US Energy Information Administration, "Transportation Fuels: Prime Supplier Sales," by state, *www.eia.doe.gov/emeu/states/_states.html*; Candi Minkler, Washington Dept. of Licensing, private communications, Sept. and Dec. 2004; Darel Capps, fuels tax supervisor, Oregon Dept. of Transportation, private communications, Sept. and Dec. 2004; Dar Walters, fuels tax manager, Idaho State Tax Commission, private communications, Oct. and Dec. 2004. For BC and Canada, for 1978 to 2003 from Statistics Canada, "Table 128-0002: Supply and Demand of Primary and Secondary Energy in Terajoules, Quarterly," CanSim, *cansim2.statcan.ca*. In BC, for 2004, estimated from Dave Barnett, BC Ministry of Finance, Tax Policy Branch, Victoria, private communications, Sept. and Dec. 2004. Gasoline includes gasoline-ethanol mixes. Contact NEW for details about highway fuel consumption estimates in each region.

    Electricity. In United States and Northwest states, for 1960 to 2000, from US Energy Information Administration (EIA) State Energy Data 2000 Consumption tables (formerly the State Energy Data Reports), *www.eia.doe.gov/emeu/states/_states.html*. For 2001 through 2004, estimated from EIA's Form EIA-826 Database, "Monthly Electric Utility Sales and Revenue Data," *ww.eia.doe.gov/cneaf/electricity/page/eia826.html*. In Canada and BC, from 1978 through 2003, from Statistics Canada, "Table 128-0002: Supply and Demand of Primary and Secondary Energy in Terajoules, Quarterly," CanSim, *cansim2.statcan.ca*; for British Columbia, 2004, estimated from BC Hydro quarterly reports, *www.bchydro.com/info/reports/reports855.html*, and BC Hydro annual reports, *www.bchydro.com/info/reports/reports853.html*.

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For a more thorough discussion of the "Energy" indicator, see NEW, "Cascadia Scorecard: Energy," *www.northwestwatch.org/scorecard/energy.asp*; the "Energy" chapter in *Cascadia Scorecard* (Seattle: NEW, 2004), p. 29, *www.northwestwatch.org/publications/scorecard.asp*; NEW, "Fueling Up: Gasoline Consumption in the Pacific Northwest," Sept. 12, 2002, *www.northwestwatch.org/press/recent_gas.asp*; or contact NEW. Return.

78. Thomas Friedman, "The Search for P.M.D.s," *New York Times,* May 23, 2004, *www.nytimes.com/2004/05/23/opinion/23FRIE.html*. Return.

79. Not wanting to create a manual for those who might intend to harm Cascadia, this chapter leaves out various specifics about the vulnerability of the region's energy system. If it is alarming to readers, it may be more alarming to learn that this special section was assembled entirely from information that is readily available to anyone with an Internet connection and library card. Return.

80. Map of electric transmission lines and supporting data derived from BC Transmission Corporation, "Provincial Transmission System," May 3, 2004, *www2.bctc.com/system/pdf/transplt.pdf*; John Taves, public interest liaison, Bonneville Power Administration, private communication, Nov. 19, 2004; and Montana State Legislature, *Understanding Electricity in Montana* (Helena, Mont.: Legislative Environmental Policy Office/Environmental Quality Council, Dec. 2002), *leg.state.mt.us/css/publications/lepo/deq_energy_report/deqenergytoc.asp*. The map depicts only individual lines of towers carrying 500 kilovolts or more, and does not specify how many circuits are on a particular tower. There are also many other lines in the 120-375 kilovolt range that are not displayed. In several cases two large lines running parallel have been included on the map as a single 500-plus kilovolt line, because they are in close enough proximity that for purposes of security concerns they can be considered as one line.
Map of pipeline locations and supporting data derived from Philip L. Jackson and A. Jon Kimerling, eds., *Atlas of the Pacific Northwest*, 8th ed. (Corvallis, Ore.: Oregon State University Press, 1992). (Map reprinted without change in 9th ed., 2003.); William G. Loy, ed., *Atlas of Oregon* (Eugene, Ore.: University of Oregon Press, 2001); and Montana State Legislature, "Petroleum and Petroleum Products in Montana," Legislative Environmental Policy Office/Environmental Quality Council, Mar., 2003, p. 6, *leg.state.mt.us/content/publications/lepo/deq_petroleum_report/reporttext.pdf*. Map of natural gas, for visual clarity, depicts only the main trunk transportation, not the small feeder lines

that branch out to communities near the main line. Map of petroleum depicts both crude oil and refined products line; minor spurs are removed for clarity. For both natural gas and petroleum, in many cases lines outside of Cascadia's bioregion but within the borders of the overall map are not depicted. Return to text. Return to maps: oil pipelines, gas pipelines, electricity transmission lines.

81. British Columbia does extract oil and gas, but only in its far northeast, outside of the Cascadia bioregion and at considerable remove from its population centers. The province is considering allowing oil exploration off the northern coast; from BC Ministry of Energy and Mines, "Opening Up Oil and Gas Opportunities in British Columbia: 1993-2003: Statistics and Resource Potential," *www.em.gov.bc.ca/Publicinfo/Oil&GasStats-93-03-outside-web-version.pdf*. Return.
82. Much of Cascadia's oil comes via the Alaska pipeline to Puget Sound refineries; from Oregon Office of Energy, "State of Oregon Energy Plan 2003-2005," Dec. 2002, *www.energy.state.or.us/Publications/Energy%20Plan-Final.pdf*; and Washington Dept. of Community, Trade and Economic Development, "Monthly Petroleum Data," through April 2004, *cted.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&alias=CTED&lang=en&ItemID=1215&MId=863&wversion=Staging*. Approximately 75 percent of Washington's oil; 75 percent of Oregon's refined petroleum products. Return.
83. Most oil comes through the Olympic Pipeline from special series, "Pipelines: America's Hidden Hazards," *Seattle Post-Intelligencer*, multiple dates, *seattlepi.nwsource.com/pipelines*, especially Paul Nyhan, "Small Olympic Backed by Big Money," *Seattle Post-Intelligencer*, Aug. 12, 1999; and Oregon Office of Energy, "State of Oregon Energy Plan 2003-2005," Dec. 2002, *www.energy.state.or.us/Publications/Energy%20Plan-Final.pdf*. Return.
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85. Olympic Pipeline deliveries from Washington Dept. of Community, Trade and Economic Development, "Monthly Petroleum Data," through April 2004, *cted.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&alias=CTED&lang=en&ItemID=1215&MId=863&wversion=Staging*; special series, "Pipelines: America's Hidden Hazards," *Seattle Post-Intelligencer*, multiple dates, *seattlepi.nwsource.com/pipelines*, especially Paul Nyhan, "Small Olympic Backed by Big Money," *Seattle Post-Intelligencer*, Aug. 12, 1999; and

Oregon Office of Energy, "State of Oregon Energy Plan 2003-2005," Dec. 2002, *www.energy.state.or.us/Publications/Energy%20Plan-Final.pdf*. Return.

86. Pipeline leak from special series, "Pipelines: America's Hidden Hazards," *Seattle Post-Intelligencer*, multiple dates, *seattlepi.nwsource.com/pipelines*. Return.
87. Oil distribution in BC from Natural Resources Canada, "Chapter 3. Canada's Energy Markets," *Energy in Canada 2000*, especially "Crude Oil and Petroleum," *www2.nrcan.gc.ca/es/ener2000/online/html/toc_e.cfm*. In addition, in 1997, British Columbia needed to import 75 percent of its petroleum; from Historica Foundation of Canada, "Natural Resources: Energy," *Canadian Encyclopedia*, *thecanadianencyclopedia.com/index.cfm?PgNm=TCE&Params=J1SEC783395*. Return.
88. BC has only two refineries from Natural Resources Canada, CANMET Energy Technology Centre – Varennes, "Oil Refining," *cetc-varennes.nrcan.gc.ca/en/indus/rafp_oref.html*; and BC Ministry of Energy and Mines, "Opening Up Oil and Gas Opportunities in British Columbia: 1993-2003: Statistics and Resource Potential," *www.em.gov.bc.ca/Publicinfo/Oil&GasStats-93-03-outside-web-version.pdf*. Return.
89. Absence of refineries from US Energy Information Administration, "Petroleum Profile," by state, *www.eia.doe.gov/emeu/states/_states.html*. Return.
90. Pipeline was deemed indefensible from Amory B. Lovins and L. Hunter Lovins, "Fool's Gold in Alaska," *Foreign Affairs*, July/August 2001, annotated version, *www.rmi.org/images/other/Energy/E01-04_FoolsGoldAnnot.pdf*. Return.
91. Pipeline attempted bombing from L. Hoffman, "Ex-inmate Tips Off Bizarre Bomb Plot," *Albuquerque Tribune*, Aug. 24, 1999; M. Hume, "Alaska Pipeline Target: Party Night Won't Be a Blast for Bomb Suspect," *National Post*, Dec. 24, 1999. Pipeline sabotage and attacks, and pipeline deemed indefensible, from Amory B. Lovins and L. Hunter Lovins, "Fool's Gold in Alaska," *Foreign Affairs*, July/August 2001, annotated version, *www.rmi.org/images/other/Energy/E01-04_FoolsGoldAnnot.pdf*. According to Lovins and Lovins, in late 1999, a Canadian machinist/engineer was arrested in Vancouver, BC, four months before completing an elaborate eight year plot to detonate 14 sophisticated high-explosive bombs at three strategic locations along TAPS, including two river crossings, amidst expected Y2K confusion at the dawn of 2000. His goal was to make a fortune in the oil futures markets while avenging his previous conviction and deportation in the US. He had already obtained PETN explosive, timers, and bomb casings, built components for the 14 bombs, and tested for operability in winter cold. A spokesman for the US arresting agency stated that without a tip off from an invited US accomplice, an explosives-trained former Green Beret who had once sold roughly 18 homemade bombs to undercover

agents, the plot would not have been uncovered. Return.

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93. ANWR increases dependence from Amory B. Lovins and L. Hunter Lovins, "Energy Forever," American Prospect, Feb. 11, 2002, *www.rmi.org/images/other/Energy/E02-01a_EnergyForever.pdf*. The article reports that ex-CIA chief Woolsey testified against drilling in ANWR as too risky. The Trans-Alaska pipeline is currently running about half full. Return.
94. Origins of Washington's crude oil from Washington Dept. of Community, Trade and Economic Development, "Monthly Petroleum Data," through Apr. 2004, *www.cted.wa.gov*. Return.
95. Average gasoline prices in Phoenix from AAA Arizona, "2003 Fuel Gauge Report Archives," *www.aaaaz.com/news/archives.htm#2003*. Length of time to make pipeline repairs from "Kinder Morgan Energy Partners Restarts Pipeline," *Houston Business Journal*, Aug. 25, 2003, *www.bizjournals.com/houston/stories/2003/08/25/daily1.html*. Return.
96. The United States' dependence on imported oil is a strategic concern for the country, because it makes access to oil a major consideration in foreign policy. But that doesn't mean oil imports are a direct security threat. In conventional warfare, they might be. They certainly were for Germany and Japan, which lost World War II in part because their oil supply routes were long and vulnerable. But in an age of terrorism, things are different. In a global market, terrorism that shuts down even the largest Saudi oil port wouldn't stop oil coming to America. Many other oil exporters would be happy to provide their crude. It would raise prices, of course. On the other hand, the United States distributes its fuel through an infrastructure of refineries and pipelines that, if disabled, could not be replaced quickly. Return.
97. Quote from Al Qaeda from Amory. B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security* (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 11, *www.oilendgame.org*; and Gal Luft and Anne Korin, "Terror's Next Target," Journal of International Security Affairs, Dec. 2003, *www.iags.org/n0111041.htm*. Return.
98. Oil and gas pipeline map data in the Northwest from Stuart Allen, Aileen R. Buckley and James E. Meacham, *Atlas of Oregon*, second edition (Eugene, Ore.: University of Oregon Press, 2001), p. 101. Return.
99. Natural gas storage facilities from Washington Dept. of Community, Trade and

Economic Development, "2004 Natural Gas Study: Transition: The Natural Gas Market in the Pacific Northwest and North America," *www.cted.wa.gov/portal/alias__CTED/lang__en/tabID__543/DesktopDefault.aspx*, especially "Section 7. Natural Gas Pipeline and Storage Capacity," p. 74. Natural gas extraction is declining in North America, and the price of gas is therefore rising. The state of Alaska is seeking billions of federal dollars to build a natural gas pipeline—with the same vulnerability as the Trans Alaska—to the continent's populous areas. The pipeline into Canada would connect to the existing network in Alberta, gas from which would enter the Northwest by pipeline at Kingsgate, Idaho. But a more likely scenario is growth in imports of supercooled, liquid natural gas, either from Alaska or the Far East. Cascadia has four small liquid natural gas storage facilities, in Nampa, Idaho; Newport and Portland, Oregon; and Plymouth, Washington. And more could be on the way. Return.

100. LNG facilities proposals from Associated Press, "Natural Gas would bring Jobs, Risk to Clatskanie," *KATU News*, Portland, Aug. 2, 2004, *www.katu.com/news/story.asp?ID=69764*; Kate Ramsayer, "Energy Firm Eyes Warrenton Site," *Daily Astorian*, Nov. 4, 2004, *www.dailyastorian.info/main.asp?FromHome=1&TypeID=1&ArticleID=19894&SectionID=2&SubSectionID=398*; and Lori Tobias, "Coos Bay Gas Project Harbors Concerns," *Oregonian*, Sept. 14, 2004, *www.oregonlive.com/news/oregonian/index.ssf?/base/news/1100351120219690.xml*. Return.

101. Explosive dangers of LNG from Mike Hightower et al., "Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water" (Albuquerque and Livermore, Calif.: Sandia National Laboratories, Dec. 2004), *www.fossil.energy.gov/programs/oilgas/storage/lng/sandia_lng_1204.pdf*; (The Sandia study's findings are summarized in H. Josef Hebert, Associated Press, "Attack on LNG a deadly scenario," *Press-Telegram.com*, Dec. 20, 2004, *www.presstelegram.com/Stories/0,1413,204~21474~2609379,00.html*.); and Amory Lovins and L. Hunter Lovins, "Reducing Vulnerability: the Energy Jugular," in James Woolsey, editor, *Nuclear Arms: Ethics, Strategy, Politics* (ICS Press, 1984), pg 173. The study by Sandia National Laboratories concluded that a terrorist attack on a giant LNG tanker was a low probability event, but the consequences could be high: the resulting fire could burn skin and damage buildings nearly a mile away. LNG is safe while it remains at 259 degrees below Fahrenheit, but a LNG spill would be dangerous. The liquid is lighter than water but heavier than air and flows quickly across large areas. In special circumstances, it can ignite as it vaporizes. But again, a spill turning into an explosion is unlikely though not impossible. Return.

102. Map of power-transmission lines and supporting data derived from BC Transmission Corporation, "Provincial Transmission System," May 3, 2004, *www2.*

bctc.com/system/pdf/transplt.pdf; John Taves, public interest liaison, Bonneville Power Administration, private communication, Nov. 19, 2004; and Montana State Legislature, *Understanding Electricity in Montana* (Helena, Mont.: Legislative Environmental Policy Office/Environmental Quality Council, Dec. 2002, *leg.state.mt.us/css/publications/lepo/deq_energy_report/deqenergytoc.asp*. Return.

103. System susceptibility from Brendan Kirby and Eric Hirst, "Reliability Management and Oversight," National Transmission Grid Study, May 2002, p. 12, *www.eh.doe.gov/ntgs/issuepapers/ISSUE_2.PDF*; and Ralph Cavanagh, energy program director, Natural Resources Defense Council, private communication, Nov. 30, 2004. Return.
104. Most of Cascadia's grid is likely to withstand two failures of critical grid components, but two failures takes the margin for error to null, so if other grid equipment or operators do not react quickly and appropriately, cascading blackouts could result. Return.
105. Eastern power outage and system weakness from Amory Lovins, "Towering Design Flaws," *The Globe and Mail,* Aug. 21, 2003, *www.rmi.org/sitepages/pid542.php*; and US-Canada Power System Outage Task Force, "Final Report on the August 14, 2003 Power Blackout in the United States and Canada: Causes and Recommendations," Apr. 2004, *reports.energy.gov*. Return.
106. Transmission line vulnerabilities from Bonneville Power Administration: "BPA Offers $25,000 for Identity of Power Line Vandals," July 22, 2004; "Reward Offered for Spring Vacation Power Line Vandals," Mar. 23,2004; and "Snohomish County Christmas-time Line Vandalism," Jan 16, 2004, *www.bpa.gov/corporate/BPAnews/2004/index.cfm*. In July 2004, one or more vandals in western Oregon shot out insulators on a power line, halting local service for 5 hours and starting a small brush fire. In January 2004, a transmission line in Snohomish County, Washington became disabled during a cold snap two days before Christmas; fortunately, BPA operators were able to reroute electricity and prevent a blackout. Return.
107. Transmission tower sabotage from Juliet Williams, "Two Transmission Towers Intentionally Knocked Over," USA Today, Oct. 11, 2004, *www.usatoday.com/news/nation/2004-10-11-tower-sabotage_x.htm*. Return.
108. Poulin's sabotage from "Tower Tampering Nets 2-Year Term," Record Searchlight, Feb. 19, 2004, *archive.redding.com/story.asp?StoryID={55C40308-0A8B-4B62-AC87-0E6943293E9F}*; Meg Fox, "Burney Man Led To Capture of 'Environmental Terrorist'," The Intermountain News, Feb. 4, 2004, *www.burneycalifornia.com/04-02-04s%20News.pdf*; and Associated Press, "Two Year Sentence for Washington Man in Power Towers Tampering," *Union Tribune*, Feb. 18, 2004, *www.signonsandiego.com/news/state/20040218-1253-*

ca-transmissiontampering.html. Return.

109. Gas turbines account for about 14 percent of the Northwest states' electricity generation capacity and 21 percent of its electrical output in recent years; from Northwest Power Planning Council, "How Much Northwest Energy Comes From Hydropower?" *www.nwcouncil.org/energy/powersupply/source.htm*. Gas turbines account for about 8 percent of Cascadia's total electricity generation; estimates for BC derived from BC Hydro, "Quick Facts for the Year Ended March 31, 2004," *www.bchydro.com/rx_files/info/info3519.pdf*, and "Generation System" *www.bchydro.com/info/system/system15240.html*; estimates for Northwest states derived from state electricity data sheets from US Energy Information Administration, *www.eia.doe.gov/emeu/states/_states.html*. But these figures understate the region's dependence on natural gas for electricity generation. During peak periods of demand, such as cold winter nights, or during droughts when water levels behind dams are low, the region sometimes generates larger shares of its power using natural gas. During such peaks, natural gas provides the grid's margin of safety; from Jeff King, Northwest Power and Conservation Council, private communication, Nov. 30, 2004. Return.
110. Pipelines and powerlines share routes from Associated Press, "Mayor Presses Olympic to Test Pipeline; Feds Say Not Necessary, *Olympian*, July 15, 2003, *www.theolympian.com/home/news/20030715/northwest/52320.shtml*. Return.
111. It is strikingly inefficient to use electricity to heat space and water. When using electricity generated from a natural gas-fired power plant, about half the energy content of the gas is simply wasted: about 45 percent is sacrificed in generating the electricity, and transmitting the energy through the grid wastes roughly a tenth of the remainder. In contrast, heating water and space directly with natural gas is up to 95 percent efficient, thereby reducing the wasted energy by 90 percent, compared with electric heating. An exception to this rule is electric heat pumps, which are actually more efficient (though typically more expensive) than gas furnaces and water heaters, as discussed in Clark Williams-Derry, "Pump It Up!" *Cascadia Scorecard Weblog*, July 8, 2004, *cascadiascorecard.typepad.com/blog/2004/07/pump_it_up.html*. Return.
112. Demand of inefficient heaters in Northwest states from Michael Lazarus et al., "Clean Electricity Options for the Pacific Northwest," (Boston: Tellus Institute, 2002), p. 11, *www.nwenergy.org/outreach/docs/Tellus_PNW_Oct15.pdf*; in BC from BC Hydro, "Conservation Potential Review Overview," June 2003, *www.bchydro.com/rx_files/info/info6471.pdf*. Return.
113. Money spent on petroleum estimated from US Energy Information Administration (EIA), tables, "Natural Gas Production and Use" and "Natural Gas

Prices," by state, *www.eia.doe.gov/emeu/states/_states.html*; and EIA, "Table 22: Domestic Crude Oil First Purchase Prices for Selected Crude Streams," *Petroleum Marketing Monthly*, Nov. 2004, *www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_marketing_monthly/pmm.html*; EIA, "Table 7: Energy Consumption Estimates by Source, 1960-2001," by state, *www.eia.doe.gov/emeu/states/_states.html*; and, in BC, estimated from 2003 data from Canadian Association of Petroleum Producers, "Industry Facts and Information: Western Canada: British Columbia," *www.capp.ca/default.asp?V_DOC_ID=674*. British Columbia is a net exporter of natural gas, but a net importer of oil. Regardless, the province's economy would benefit by using both fuels more efficiently, as it could import less oil and export more natural gas. Size of Cascadia's economy from US Bureau of Economic Analysis, "Regional Accounts Data," *www.bea.doc.gov*; and BC Stats, "BC GDP at Market Prices and Final Domestic Demand 1981-2003," *www.bcstats.gov.bc.ca/data/bus_stat/econ_acct.htm*. Return.

114. Price spikes are growing more common because North American natural gas production is declining, as is non-Middle East oil production. Price volatility increases as natural resources pass the half-way mark of exploitation. Energy price spikes are increasingly common from Bruce Henning et al., *Natural Gas and Energy Price Volatility*, (Arlington, Virginia: American Gas Foundation, Oct. 2003), *www.eere.energy.gov/de/pdfs/bchp/0310_natural_gas_price_volatility_vol1.pdf*. Energy price spikes foretell inflation and recession from Nouriel Roubini and Brad Setser, "The Effects of the Recent Oil Price Shock on the US and Global Economy," New York University, Stern School of Business, Aug. 2004, *www.stern.nyu.edu/globalmacro/OilShockRoubiniSetser.pdf*. Some analysts, however, believe that since the early 1980s the inflationary effects of energy price spikes have been less pronounced than they were previously. See, for example, Owen F. Humpage and Eduard Pelz, "Do Energy Price Spikes Cause Inflation?" Federal Reserve Bank of Cleveland, Apr. 1, 2003, *www.clevelandfed.org/Research/Com2003/0401.pdf*. Return.

115. California crisis sucked $6 billion from Northwest from Northwest Power and Conservation Council, "Draft Fifth Northwest Electric Power and Conservation Plan," Sept. 24, 2004, ES-2, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*. This estimate is for the cumulative impact of the power crisis, not the annual cost. The entire region did not suffer from the California power crisis. BC Hydro, for example, made roughly Cdn. $1 billion selling electricity at high prices to the Golden State, and most of those revenues were refunded to British Columbians through tax rebates. Certain utilities such as Grant County Public Utility District also reaped windfalls. Return.

116. The environmental impacts of energy production from, among others, Alan Thein Durning, The Car and the City (Seattle: NEW, Apr. 1996), *www.northwestwatch.org/publications/carcitydownload.asp*; John C. Ryan, Over Our Heads (Seattle: NEW, Nov. 1997), *www.northwestwatch.org/publications/carcitydownload.asp*; Alan Thein Durning and Yoram Bauman, Tax Shift (Seattle: NEW, Apr. 1998), *www.northwestwatch.org/publications/taxdownload.asp*. Return.
117. Dams decimate salmon runs from National Research Council, *Managing the Columbia River: Instream Flows, Water Withdrawals, and Salmon Survival*, (Washington, DC: National Academies Press, 2004), p. 1, *books.nap.edu/books/0309091551/html/index.html*; and John C. Ryan, *State of the Northwest*, 2000 ed. (Seattle: NEW, 2000). Map of dams courtesy of Ecotrust, Portland, Ore.; map derived from Dorie Brownell's cartography in Edward C. Wolf and Seth Zuckerman, eds., *Salmon Nation: People and Fish At the Edge* (Portland: Ecotrust, 1999), *www.ecotrust.org*. Return to text. Return to maps.
118. Fossil fuels produce pollutants and greenhouse gases from, among others, John C. Ryan, Over Our Heads (Seattle: NEW, Nov. 1997), *www.northwestwatch.org/publications/ooh.asp*. Return.
119. Climate change is a global security threat from Paul Brown and Mark Oliver, "Top Scientist Attacks US Over Global Warming," *The Guardian*, Jan. 9, 2004, *www.guardian.co.uk/uk_news/story/0,3604,1119070,00.html*. David King, chief scientist to the United Kingdom's government, warned that, "Climate change is the most severe problem we are facing today, more serious even than the threat of terrorism." Return.
120. The size and potential of the clean-energy industry in Cascadia from, among others, Athena Institute, *Poised for Profit II: Prospects for the Smart Energy Sector in the Pacific Northwest* (Seattle: Climate Solutions, 2003), *www.climatesolutions.org*; Patrick Mazza, "The Smart Energy Network: Electricity's Third Great Revolution," Climate Solutions, Seattle, June 2003, *www.climatesolutions.org*; and Patrick Thomas Hunt, "Energy Technology Gets Smart," *Sustainable Industries Journal,* Oct. 2004. Return.
121. Systems that are secure by design are versatile from Amory B. Lovins and L. Hunter Lovins, "Fool's Gold in Alaska," *Foreign Affairs*, July/August 2001, annotated version, *www.rmi.org/images/other/Energy/E01-04_FoolsGoldAnnot.pdf*; Amory B. Lovins and L. Hunter Lovins, *Brittle Power: Energy Strategy for National Security*, 2001 ed. (Andover, Mass.: Brick House Publishing Co., 2001), *www.rmi.org/images/other/EnergySecurity/S82-03_BrPwrParts123.pdf*; and Patrick Mazza, "The Smart Energy Network: Electricity's Third Great Revolution," Climate Solutions, Seattle, June 2003, *www.climatesolutions.org*. Return.

122. NPCC's demand response systems from Northwest Power and Conservation Council, "Draft Fifth Northwest Electric Power and Conservation Plan," Section 4, Sept. 24, 2004, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*.
Erratum: It may be more accurate to call the NPCC the federally mandated planner of the region's electricity system, rather than its coordinator. Only the Bonneville Power Administration is legally required to act in accordance with NPCC's plans. Other power agencies and utilities are under no requirements to do so, though many do. The day-to-day coordinator of the regional power grid, responsible for electric reliability and the like, is the Western States Coordinating Council. Return.
123. Non-wires solutions from Bonneville Power Administration, Transmission Business Line: Transmission, "TBL Studies Non-wires Solutions," *www.transmission.bpa.gov/PlanProj/nonwires.cfm*. Return.
124. The Northwest Power and Conservation Council (NPCC) admits that, without adequate mechanisms for demand response over the last several decades, Northwest utilities "probably built more generation, transmission and distribution facilities than would have been necessary otherwise." See NPCC, "Draft Fifth Northwest Electric Power and Conservation Plan," Sept. 24, 2004. Section 4, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*. Some demand response programs award cash or credits rather than cheaper rates. Return.
125. Share of natural gas used by electric power plants estimated from US Energy Information Administration, Natural Gas Navigator, *tonto.eia.doe.gov/dnav/ng/ng_sum_lsum_dcu_nus_m.htm*; and Statistics Canada, "Table 128-0002: Supply and Demand of Primary and Secondary Energy in Terajoules, Quarterly," CanSim, *cansim2.statcan.ca*. For 2001 through 2003, an average of 26 percent of natural gas consumed in the Northwest states was used to generate electricity, as was 13 percent of natural gas in British Columbia. Return.
126. National Laboratory and demand response from Patrick Mazza, "The Smart Energy Network: Electricity's Third Great Revolution," Climate Solutions, Seattle, June 2003, *www.climatesolutions.org*. Return.
127. Virtues of smart grid from Patrick Mazza, "The Smart Energy Network: Electricity's Third Great Revolution," Climate Solutions, Seattle, June 2003, *www.climatesolutions.org*; and related reports at Climate Solutions' website, *www.climatesolutions.org*; Athena Institute, *Poised for Profit II: Prospects for the Smart Energy Sector in the Pacific Northwest* (Seattle: Climate Solutions, 2003), *www.climatesolutions.org*; and Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004), *www.oilendgame.org*. Return.
128. Energy efficiency savings calculated from Northwest Power and Conservation

Council (NPCC), "Draft Fifth Northwest Electric Power and Conservation Plan," Sept. 24, 2004. p. ES-6, AP-1, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*; and BC Hydro, "Power Smart At Home," *www.bchydro.com/powersmart/index/index3199.html*. NPCC's estimate is conservative in several ways. It does not include the substantial fuel substitution of efficient natural gas heat for wasteful electric heating of space and water that has progressed throughout the region. It ignores all efficiency improvements that came through the independent action of consumers, without encouragement by utilities and other power-sector institutions. And it ignores all efficiency gains prompted by federal efficiency standards for electric appliances and the like. Together, these other categories probably raise efficiency's contribution to the region's power "portfolio" to at least one third of post-1980 capacity and possibly much more.

Clarification: NPPC recommends conservation programs rather than implementing them itself; they are implemented by the Bonneville Power Administration and the region's many public and private utilities. Return.

129. Decline in prices of compact-flourescent lights from Northwest Power and Conservation Council (NPCC), "Draft Fifth Northwest Electric Power and Conservation Plan," Sept. 24, 2004, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*. The NPCC plan estimates that 540 average megawatts of electrical capacity could be saved over the 20-year planning period from residential lighting improvements, at an estimated levelized cost of saved energy of 1.7 cents per kilowatt hour. Return.
130. Potential electricity savings in home appliances, lights, cooling systems, exit signs, and many other areas from Section 3 of Northwest Power and Conservation Council, "Draft Fifth Northwest Electric Power and Conservation Plan," Sept. 24, 2004, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*. Return.
131. Less electricity use is more secure from Northwest Power and Conservation Council, "Draft Fifth Northwest Electric Power and Conservation Plan," Sept. 24, 2004, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*. Return.
132. BC Hydro's energy efficiency opportunities from BC Hydro, "BC Hydro 2004 Annual Report," June 2004, p. 92, *www.bchydro.com/rx_files/info/info12355.pdf*; and BC Hydro, "Power Smart At Home," *www.bchydro.com/powersmart*. Return.
133. Wind power and efficiency savings from Northwest Power and Conservation Council, "Draft Fifth Northwest Electric Power and Conservation Plan," Sept. 24, 2004, p. ES-12, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*. Return.

134. Comparing different efficiency goals is complicated by different methodologies, assumptions about population and economic trends, and time periods. But California aims to cut projected electricity demand by 10 percent over 10 years; from Devra Bachrach and Sheryl Carter, "Memorandum: California Sets Nation's Most Aggressive Energy Savings Goals," Natural Resources Defense Council, San Francisco, Calif., Oct. 4, 2004. Neither BC Hydro nor Northwest Power and Conservation Council aim so high. Return.
135. California's policy from Devra Bachrach and Sheryl Carter, "California Sets Nation's Most Aggressive Energy Saving Goals," Natural Resources Defense Council, San Francisco, Calif., Oct. 4, 2004; and Ralph Cavanagh, energy program director, Natural Resources Defense Council, San Francisco, Calif., private communication, Nov. 30, 2004. Return.
136. Total fleet-wide vehicle fuel efficiency has been stagnant or declining for more than a decade in the Northwest states, despite incremental improvements in engine technology. While traffic congestion may account for some portion of the decline in efficiency, the far larger share is due to rising vehicle weight, including (but not limited to) a substantial increase in the prevalence of heavy trucks. Fleetwide fuel efficiency estimated from Federal Highway Administration (FHA), "Table VM-2," "Table MF-27," and "Table MF-21," *Highway Statistics Series*, by year, 1996 to 2003, *www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm*; and FHA, "Table MF-221" and "Table VM-202," *Highway Statistics Series*, by year, 1980 to 1995, *www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm*. Return.
137. SUVs are less safe to their drivers from Danny Hakim, "Safety Gap Grows Wider Between S.U.V.'s and Cars," *New York Times*, Aug. 17, 2004; and US National Highway Transportation Safety Administration, "2003 Annual Assessment," p. 55, Aug. 2004, *www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/PPT/2004/809-755/pages/TOC.htm*. Return.
138. SUVs are a menace to other drivers from Marc Ross and Tom Wenzel, "An Analysis of Traffic Deaths by Vehicle Type and Model," American Council for an Energy-Efficient Economy, Washington D.C., Mar. 2002, *www.aceee.org/pubs/t021full.pdf*. This study shows that for model years 1995 through 1999, passengers of SUVs were, on average, no safer—and perhaps slightly less safe—than the passengers of large and midsized cars. And in collisions with other vehicles, SUVs cause roughly twice as many deaths as cars. Return.
139. Hummers and hybrids in Washington from Judy Abern, Washington Dept. of Licensing, Vehicle Services Policy and Project Office, private communication, July 2004; in Oregon, from Renee Davis, Oregon Dept. of Transportation, Dept. of Motor Vehicle Services, private communication, Oct. 13, 2004; in BC, from Kari Martin, Insurance Corporation British Columbia, Corporate Management Reporting Services, private communication, Oct. 5, 2004. British

Columbia, Oregon, and Washington had 1,850 Hummers and 10,400 hybrids as of July 2004. Oregon had 3,595 hybrids and 470 Hummers; Washington had an estimated 6,199 hybrids and 1,100 Hummers; British Columbia had 647 hybrids and 287 Hummers. The Washington hybrid figure includes an estimate for one model of hybrids, the Honda Civic hybrid. Return.

140. Hummer and hybrid sales from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security,* (Snowmass, Colo.: Rocky Mountain Institute, 2004), *www.oilendgame.org*, p. 50; and Daniel Gross, "Hummer v. Hybrid," Slate, Feb. 26, 2004, *slate.msn.com/id/2096191*. Return.
141. Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security,* (Snowmass, Colo: Rocky Mountain Institute, 2004), *www.oilendgame.org*. Return.
142. Vehicle fuel efficiencies from Amory B. Lovins and D.R. Cramer, "Hypercars®, Hydrogen, and the Automotive Transition," *International Journal of Vehicle Design,* 35(1/2) (2004), *www.rmi.org/images/other/Trans/T04-01_HypercarH2AutoTrans.pdf*. The 99-mpg SUV designed by Rocky Mountain Institute is powered by a fuel cell, so it would more accurately be described as "equivalent to 99 mpg." Return.
143. Petroleum savings from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security,* (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 99, *www.oilendgame.org*. Figures are for the US overall, not for Cascadia, but Cascadia's oil use pattern is closely parallel to the US. Return.
144. Quote from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security,* (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 222, *www.oilendgame.org*. Return.
145. National Research Council findings from National Research Council, Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards, (Washington, DC: National Academies Press, 2002), *www.nap.edu/catalog/10172.html*; and Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security,* (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 50, *www.oilendgame.org*. Costs assume $1.50 per gallon gas, so it represents a conservative estimate. Return.
146. For Cascadia, efficiency is like an exportable resource: by selling more efficient planes and trucks, the region can compete with oil exporters. And the more successful its vehicle makers are at selling their wares, the less susceptible those manufacturers' employees will be to layoffs when fuel prices jump, because the airlines and trucking businesses will be better insulated against the prices.

Return.

147. Boeing's 7E7 from private communication with Jeffrey L. Hawk, director, Government, Environment, Certification, 7E7 Program, The Boeing Company, Everett, Wash., Nov. 19, 2004; and Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004), pp. 56, 157, *www.oilendgame.org*. Return.
148. Airline industry losses from fuel prices from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 17, *www.oilendgame.org*. Return.
149. Advantages of Boeing's 7E7 from Jeffrey L. Hawk, director, Government, Environment, Certification, 7E7 Program, The Boeing Company, Everett, Wash., private communication, Nov. 19, 2004; and Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004), pp. 56, 157, *www.oilendgame.org*. Return.
150. Airbus plans from Laurence Frost, "Airbus Owners Approve Launch of New A350," *Seattle Post-Intelligencer,* Dec. 10, 2004. Return.
151. Diesel price spikes and trucker bankruptcies from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 73, *www.oilendgame.org*. Return.
152. Fuel-saving innovations in trucks from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security,* (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 73, *www.oilendgame.org*. Return.
153. Compact communities reduce driving from Alan Thein Durning, *The Car and the City* (Seattle, NEW, 1996), *www.northwestwatch.org/publications/carcity.asp*; Peter Newman and Jeffrey Kenworthy, *Sustainability and Cities: Overcoming Automobile Dependence* (Washington, DC: Island Press, 1999); and Jeffrey R. Kenworthy, et al., *An International Sourcebook of Automobile Dependence in Cities,* 1960–1990 (Boulder, Colo.: University Press of Colorado, 1999). Compact communities improve health from *Cascadia Scorecard* (Seattle: NEW, 2004), *www.northwestwatch.org/publications/scorecard.asp*; Howard Frumkin, "Urban Sprawl and Public Health," *Public Health Reports,* May-June 2002, *phr.oupjournals.org*; Richard J. Jackson and Chris Kochititzky, "Creating a Healthy Environment: The Impact of the Built Environment on Public Health," Sprawl Watch Clearinghouse Monograph Series, *www.sprawlwatch.org*; and entire issue of *American Journal of Public Health,* Sept. 1, 2003. Return.
154. Virtues of congestion pricing from Todd Litman, "London Congestion Pricing: Implications for Other Cities," Victoria Transport Policy Institute, Victoria, BC, Feb. 18, 2004, *www.vtpi.org/london.pdf*. Page 5 notes that in London,

average traffic speed during "charging" days changed from 8 mph to 11 mph, a 37 percent increase. Return.

155. Mileage-based auto insurance from NEW, "Regional Solutions: Pay-As-You-Drive Car Insurance," *www.northwestwatch.org/reforms/payd.asp*; and Todd Litman, "Distance-Based Vehicle Insurance as a TDM (Transportation Demand Management) Strategy," Victoria Transport Policy Institute, Victoria, BC, Dec. 1, 2004, *www.vtpi.org/dbvi.pdf*. Return.

156. Car sharing from FlexCar, a Seattle-based car-sharing service with operations in several Cascadian cities, which reports that its customers drive far less than before they sold their own cars. FlexCar members save money every time they do not drive; car owners, in contrast, save very little money by not driving. They pay for their cars whether they drive or not. Innovative approaches to parking policy from Alan Thein Durning, *The Car and the City* (Seattle: NEW, 1996), *www.northwestwatch.org/publications/carcity.asp*; Alan Thein Durning and Yoram Bauman, *Tax Shift* (Seattle: NEW, 1998) p. 31, *www.northwestwatch.org/publications/tax.asp*; and *This Place on Earth 2001* (Seattle: NEW, 2001) p. 54, *www.northwestwatch.org/publications/tpoe01.asp*. Approaches to parking include parking "cash-out;" deregulating off-street parking in zoning and building codes; metropolitan-area-wide parking taxes to pay for reductions in other taxes; metering on-street parking to finance neighborhood improvement funds; and enforcing property taxes in ways that accurately reflect the real-estate value of surface parking lots in town centers, which are typically held as land speculation by investors. Other methods of reducing auto dependence from *This Place on Earth 2001* (Seattle: NEW, 2001), p. 54 *www.northwestwatch.org/publications/tpoe01.asp*. Return.

157. One-quarter reduction in highway fuel consumption is a rough estimate from the potential reductions resulting from smart growth, mileage-based insurance, congestion pricing, car sharing innovations, transit and pedestrian improvements, and parking reforms. Return.

158. Energy estimates from cellulose ethanol fuel based on studies by Washington State University's Energy Extension Service and the Oregon Office of Energy, and on primary data gathered from the US Department of Energy's Oak Ridge National Laboratory, which makes cautious assumptions about the practical and environmental constraints on use of crop and timber wastes. Bioethanol potential for the Northwest states estimated from Walsh et al., "Biomass Feedstock Availability in the United States: 1999 State Level Analysis," Oak Ridge National Laboratory, Jan. 2000, *bioenergy.ornl.gov/resourcedata/index.html*; Jim Kerstetter, "Biomass Contributions to Reduced Greenhouse Gas Emissions in Washington State," paper to BioEnergy '98: Expanding Bioenergy Partnerships, as cited in Patrick Mazza, "Ethanol: Fueling Rural Economic Revival,"

Climate Solutions, Olympia, Wash., May 2001, p.13, *www.climatesolutions.org/pubs/pdfs/EthanolReport.pdf*; and Angela Graf and Tom Koehler, "Oregon Cellulose-Ethanol Study: An Evaluation of the Potential for Ethanol Production in Oregon Using Cellulose-based Feedstocks," Oregon Office of Energy, June 2000, p. 2, *www.energy.state.or.us/biomass/document/OCES/OCES.PDF*. In British Columbia, from Martin Tampier, et al., "Identifying Environmentally Preferable Uses for Biomass Resources; Stage 1 Report: Identification of Feedstock-to-Product Threads," EnviroChem Services, Inc., North Vancouver, BC, Mar. 31, 2004, *www.cec.org/files/PDF/ECONOMY/Biomass-StageI_en.pdf*; and D.J. Gregg, summary notes of "Bioconversion of Wood Residues to Ethanol: A British Columbia Opportunity," May 1998, *www.ieabioenergy.com/library/67_ieanews3.htm*. Energy losses when feedstocks are converted to bioethanol estimated from Wang et al., "Effects of Fuel Ethanol Use on Fuel-Cycle Energy and Greenhouse Gas Emissions," Argonne National Laboratory, Argonne, Ill., Jan. 1999, ANL/ESD-38, p. 18, *www.transportation.anl.gov/pdfs/TA/58.pdf*. Cellulose ethanol is also commonly called cellolosic ethanol. Return.

159. Iogen's plans from Maurice Hladik, director of marketing, Iogen Corporation, private communication, Nov. 15, 2004. Economic benefits calculated from Maurice Hladik, director of marketing, Iogen Corporation, PowerPoint presentation to National Corn Growers Association, Sept. 2004. Idaho potato sales from Idaho Agricultural Statistics Service, "2004 Idaho Agricultural Statistics," p. 14, *www.nass.usda.gov/id/publications/annual%20bulletin/2004/tableofcontents.pdf*. Return.
160. Washington's apple revenue from Washington Agricultural Statistics Service, "Top Forty Agricultural Commodities, Washington," *www.nass.usda.gov/wa/annual04/top40_04.pdf*. Return.
161. Strictly speaking, hydrogen is not a fuel or energy source, like natural gas or wind, but an energy carrier. Like electricity, hydrogen is a way to move usable energy around and, unlike electricity, it's storable. Return.
162. Realistic appraisals of the short-term prospects of hydrogen and fuel cells are well articulated by Joseph J. Romm, *The Hype About Hydrogen: Fact and Fiction in the Race to Save the Climate* (Washington, DC: Island Press, 2004); Anna Monis Shipley and R. Neal Elliott, "Stationary Fuel Cells: Future Promise, Current Hype," American Council for an Energy-Efficient Economy, Washington, DC, Mar. 2004, *aceee.org/pubs/ie041full.pdf*; and Patrick Mazza and Roel Hammerschlag, "Carrying the Energy Future: Comparing Hydrogen and Electricity for Transmission, Storage, and Transportation," Institute for Lifecyle Environmental Assessment, Seattle, June 2004, *www.ilea.org/downloads/MazzaHammerschlag.pdf*. A somewhat more optimistic view is expressed in Amory

B. Lovins, "Twenty Hydrogen Myths," Rocky Mountain Institute, Snowmass, Colo., Sept. 2003, *www.rmi.org/images/other/Energy/E03-05_20Hydrogen-Myths.pdf*; and Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004), pp. 227ff, *www.oilendgame.org*. Return.

163. Similarly, hybrid-electric vehicles could be designed to plug into the grid, allowing them to run on battery-stored grid power some of the time and to feed motor-generated electricity into the grid, during peak periods. Return.
164. Hydrogen is more flexible and decentralized from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004), pp. 227ff, *www.oilendgame.org*. Hydrogen can be "made" several ways: it can be distilled from natural gas (or, later, other fossil and bio- fuels) or split from water through electrolysis. Return.
165. Social ills elevate unintended pregnancy rates from Alan Thein Durning and Christopher Crowther, *Misplaced Blame* (Seattle: NEW, 1997), especially chapters 1 through 3, *www.northwestwatch.org/publications/mpblame.asp*. Return.
166. Improved child development from Sarah S. Brown and Leon Eisenberg, eds., *The Best Intentions: Unintended Pregnancy and the Well-Being of Children and Families* (Washington, DC: National Academy of Sciences, Institute of Medicine, 1995). Return.
167. Lowered rates of poverty, out-of-wedlock births, and single parenting, and higher rates of marriage from Isabel V. Sawhill, "The Perils of Early Motherhood," *The Public Interest*, Winter 2002, *www.brookings.edu/views/articles/sawhill/2002winter.htm*; and Ron Haskins and Isabel Sawhill, "Work and Marriage: The Way to End Poverty and Welfare," Policy Brief #28, Brookings Institution, Sept. 2003, *www.brookings.edu/es/research/projects/wrb/publications/pb/pb28.htm*. Return.
168. The Northwest states would opt into the California track in the US Clean Air Act, thereby adopting all of California's emissions standards for motor vehicles, including the newly announced one for greenhouse gas emissions. Return.
169. Reduced petroleum use from Hal Bernton, "Tighter Vehicle Emission Standards Proposed for State," *Seattle Times,* Dec. 2, 2004, *seattletimes.nwsource.com/html/localnews/2002106808_greenhousecars2m.html*. Return.
170. California's and Canada's targets from Danny Hakim, "Canada Sets Goal to Cut Car Emissions," *New York Times*, Nov. 18, 2004, *nytimes.com/2004/11/18/business/18auto.html*. Return.
171. Northwest states can leverage auto industry from West Coast Governors' Global Warming Initiative, "State Fleets: Working Group 1: Final Staff Draft," July 26, 2004, *www.ef.org/westcoastclimate/G_Workgroup%20RPTs%20All.pdf*;

and, more generally, from West Coast Governors' Global Warming Initiative, *www.ef.org/westcoastclimate*. Return.

172. NPCC plan from Northwest Power and Conservation Council, "Draft Fifth Northwest Electric Power and Conservation Plan," Portland, Sept. 24, 2004. p. 1-6, *www.nwppc.org/energy/powerplan/draftplan/Default.htm*. Return.
173. Efficiency potential from Michael Lazarus et al., "Clean Electricity Options for the Pacific Northwest," Tellus Institute, Boston, Oct. 2002, *www.nwenergy.org/outreach/docs/Tellus_PNW_Oct15.pdf*. Return.
174. PacifiCorp's customer base from "PacifiCorps Facts," *www.pacificorp.com/Navigation/Navigation3877.html*. Efficiency hurts PacifiCorp's earnings from Ralph Cavanagh, energy program director, Natural Resources Defense Council, San Francisco, direct testimony to Washington Utilities and Transportation Commission in PacifiCorp, docket no. UE-032065, June 29, 2004. For example, a utility rebate that encourages vendors to stock more superefficient refrigerators would be paid out during year one, but efficiency benefits would continue for the life of the refrigerator, which might be 15 years. Return.
175. The dynamics are complicated for utilities by the volatility of power demand. Efficiency is often an excellent investment for utilities, because it allows them to avoid purchases of expensive new power plants or expensive spot-market power. This typically leaves utilities having a strong interest in trimming "peak power" but an equally strong interest in increasing "off-peak" power. Return.
176. Puget Sound Energy's history of decoupling from Ralph Cavanagh, energy program director, Natural Resources Defense Council, San Francisco, direct testimony before the Washington State Utilities and Transportation commission, re: PacifiCorp, Docket No. UE-032065, June 29, 2004. Return.
177. Puget Sound Energy's success at decoupling from Ralph Cavanagh, energy program director, Natural Resources Defense Council, San Francisco, direct testimony before the Washington Utilities and Transportation Commission, re: Puget Sound Power & Light Company, Docket No. UE-921262, May 13, 1993. Return.
178. Importance of feebates from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security*, (Snowmass, Colo.: Rocky Mountain Institute, 2004) p. 186, *www.oilendgame.org*; and Alan Thein Durning, *This Place on Earth,* (Seattle: Sasquatch Books, 1996). Return.
179. Payback gap from Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security,* (Snowmass, Colo.: Rocky Mountain Institute, 2004), p. 140, *www.oilendgame.org*. Return.
180. Feebates in California from *This Place on Earth 2001* (Seattle: NEW, 2001) Section 21, *www.northwestwatch.org/publications/tpoe01.asp*. Feebates in BC

from Dan Perrin, "Options to Reduce Light-Duty Vehicle Emissions in British Columbia: Final Report," prepared for PC MFCR by Perrin, Thora and Associates, Oct. 20, 2000. Return.

181. Both houses of the California legislature passed feebates but the governor vetoed them, under pressure from auto dealers. Feebates were proposed late in the term of a BC government that had already lost its popularity; voters no longer trusted the government, or its proposal. Return.
182. Canadian feebates from Simon Tuck, "Ottawa Wants Fuel-Efficient Cars on Canada's Roads," *Globe and Mail*, May 31, 2004. Return.
183. West Coast Governors' Global Warming Initiative, *www.ef.org/westcoastclimate*. Since 1992, when the US Department of Transportation (USDOT) gave a legal opinion to the state of Maryland discouraging implementation of its then-planned feebates, many policymakers and their key staff have held the belief that feebates on new vehicles and most appliances were forbidden by federal "preemption" in the form of the Clean Air Act and CAFE standards. This belief is mistaken. Federal laws that regulate what manufacturers can sell (the "supply side") do not forbid states from creating incentives to influence what consumers buy (the "demand side"). And the USDOT legal opinion was mostly about a side issue—the form that vehicle labels could take—not the feebates themselves. See, for example, Rachel L. Chanin, "California's Authority to Regulate Mobile Source Greenhouse Gas Emissions," *NYU Annual Survey of American Law*, 58:699-754, (2003), *www.nyu.edu/pubs/annualsurvey/html/issue.php?issueID=3*. BC is not officially a part of the West Coast Governors' Global Warming Initiative, but the province has participated in the initiative, and BC agency officials are members of some Initiative working groups. Return.
184. $10 billion a year estimated from US Energy Information Administration (EIA), tables, "Natural Gas Production and Use" and "Natural Gas Prices," by state, *www.eia.doe.gov/emeu/states/_states.html*; and EIA, "Table 22: Domestic Crude Oil First Purchase Prices for Selected Crude Streams," *Petroleum Marketing Monthly,* Nov. 2004, *www.eia.doe.gov/oil_gas/petroleum/data_publications/petroleum_marketing_monthly/pmm.html*; EIA, "Table 7: Energy Consumption Estimates by Source, 1960-2001," by state, *www.eia.doe.gov/emeu/states/_states.html*; and, in British Columbia, estimated from 2003 data from Canadian Association of Petroleum Producers, "Industry Facts and Information: Western Canada: British Columbia," *www.capp.ca/default.asp?V_DOC_ID=674*. British Columbia is a net exporter of natural gas, but a net importer of oil. Regardless, the province's economy would benefit by using both fuels more efficiently, as it could import less oil and export more natural gas. Return.