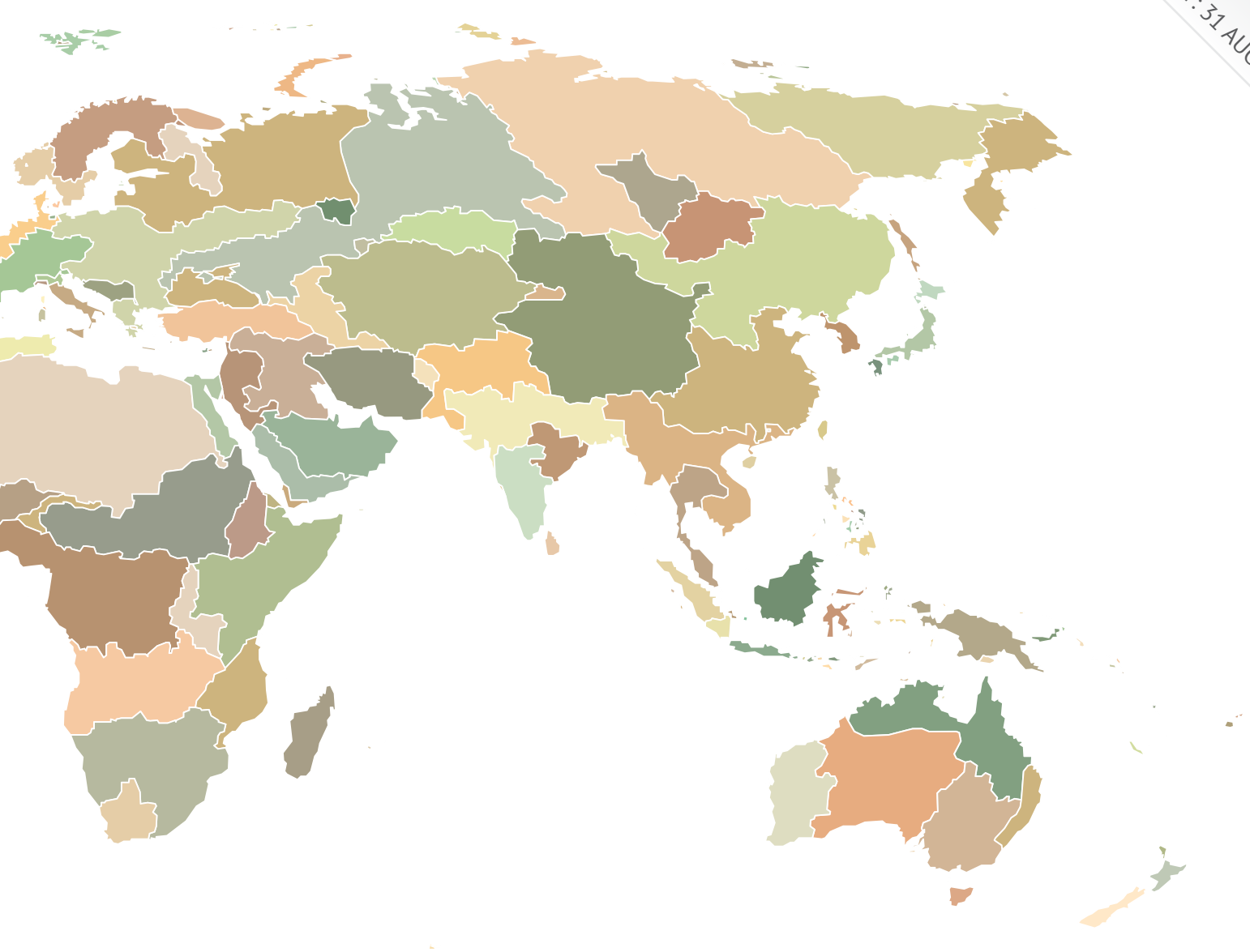


RESILIENCE & TRANSFORMATION

IN NORTH PACIFIC AMERICA

Old ways are failing. The world of 6+ billion people has not been fed or educated or satisfied, let alone the one of 9 billion to come. We need a new operating system to survive the 21st century.

What does real transformation look like? We can gain an understanding through the practice of resilience. Human resilience is the capacity to effectively influence and adapt to change.

This is a report on resilience and transformation, here in North Pacific America. It is our sincere hope that it might lend itself to adaptation by others, in other regions around the world.

PREFACE: Learn by Going

Two decades ago, we at Ecotrust charted course. We fixed bearings for where conservation meets development. On modern maps, this was mostly uncharted territory: the common ground on which economy works with ecology to create a more reliable form of prosperity.

Our first project was to characterize the status of the world's temperate rain forests. If we could understand the particular significance of this forest type — which hugs the coast of North Pacific America from the Alaska Peninsula to the Californian redwoods — perhaps we might learn how to live better here.

Our subsequent work has largely centered on this region, at smaller and overlapping geographic scales: from support of local leadership in Clayoquot Sound and Copper River communities, to marine spatial planning off the West Coast, and restorative forestry and rural-urban food networking across Oregon and Washington.

Then, in 2006, we received a surprise. A group of Australian scientists and philanthropists reached out to learn about the "Ecotrust model." Might our approach be used to understand the very different terrain of Australia's North? Listening to their stories, we experienced a sense of common cause — and saw the potential of connecting across cultures and continents.

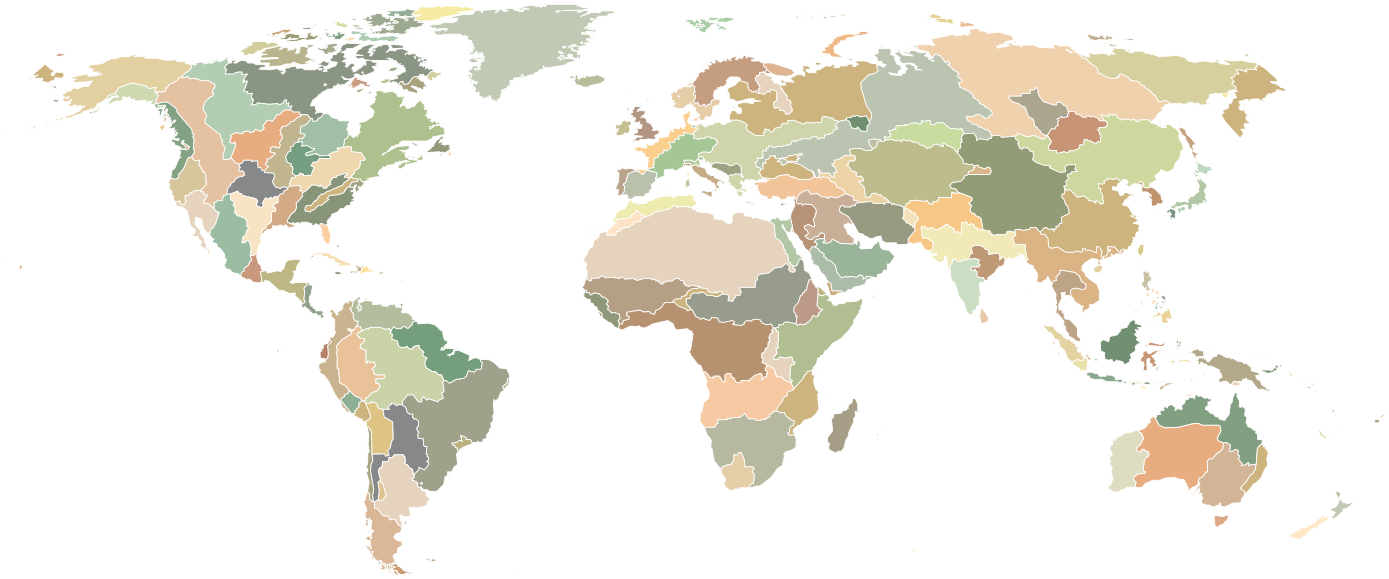
New communication technologies offer a powerful means of sharing information, aligning intentions and developing leadership. The Clinton Climate Initiative's C40 cities and ICLEI — Local Governments for Sustainability are examples of compelling leadership networks. Both groups are helping urban leaders connect with each other and build capacity for addressing issues at home.

We at Ecotrust sense the need for such networks. As urban leadership is critical for issues such as transportation and infrastructure, regional leadership is needed for both urban and rural people to have more reliable access to essentials like food, water and energy.

Yet, unlike cities, regions seldom have official representatives. The "natural leaders" that have emerged are people who sense the urgency of the moment. They are people who are challenging the inertia of outmoded ideas and institutions, and who are developing transformational strategies for integrating social, economic and ecological wellbeing.

These are the people we have invited to join us in Portland in September 2011. We are convening the committed core of a leadership network. We seek to enable and embolden a community of practitioners that puts above all else the wellbeing of peoples — connected to the places where we live. And we propose that, at this moment in history, the means for cultivating this wellbeing are best understood through the rich language and practice of resilience.

The time is right. We will learn by going where we have to go.



Resilience Regions
The Resilience Regions map presents a new way of looking at the relationships between people and place. As presented here, lines are fixed, but a dynamic view would reveal smaller, nested and overlapping scales, from the local and regional on up to the global.

INTRODUCTION:
A New Operating System

It is a time of flux. The operating systems that guided human development in the 20th century — the institutions of governance and of economic and social relations — are failing.

The people of the world have not been adequately fed or educated or satisfied. Few societies have been able to organize for broadly shared benefits. And in fulfilling our demand for natural resources, we have weakened the capacity to provide for years to come.

Resilience thinking and practice are now more critical than ever. Stated simply, human resilience is the capacity to effectively influence and adapt to change.

If resilience could be designed into our policies and economies, if it could become part of our cultural narratives: what would that look like?

We picture it as a world of diversity and innovation, dependent on openness and flexibility. It would be a world in which social and economic relationships support the wellbeing of peoples in the places we live. Perhaps most strikingly, it would be a world of regions. For in the social-ecological systems through which basic human needs are met — systems like food, water and energy — local and regional activities are critical to resilience, and vulnerable to its loss.

This, then, is a story of transformation, from the vulnerabilities of current systems to plausible and more resilient alternatives. By necessity, it is also an introduction to the language of resilience — and an opportunity to explore resilience in practice, as applied to the landscapes of North Pacific America.

We hope what we've learned here is applicable and adaptable beyond our own region, for in a time of global challenges, the practices of regional resilience are anything but isolationist. Given that national and international institutions have proven rigid and inflexible, real leadership now depends on the emergence of regional novelty and creativity..

This report has four parts:

A Lexicon of Resilience — Drawing from the scientific literature to develop an understanding of "resilience in practice."

Looking Around: North Pacific America — Examining the growth of business-as-usual operating systems, and the ways in which they leave us more vulnerable.

Looking Forward: Sharing a Vision — Developing a sense for what the future could look like, based on our and others' experiences.

Start Here: Examples of Transformation — Recognizing innovators that are transforming institutions to create wellbeing for peoples and the places in which we live.

"Civilization needs a new operating system, you are the programmers, and we need it within a few decades."

Paul Hawken
University of Portland
Commencement Address, 2009

THE LANGUAGE AND PRACTICE OF RESILIENCE

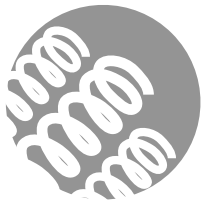
This short lexicon of resilience answers the following pressing questions:

Are there principles for cultivating the capacity to influence and adapt to change?

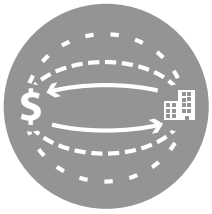
In what ways are geographic scales significant?

How might we transform institutions that no longer provide for wellbeing?

Resilience Principles



Anticipate shocks



Tighten feedbacks

Expand opportunities

Design for learning

Consider scales
up and down

Resilience in Practice

These five principles help us address the question: How might public and private individuals and organizations cultivate more resilient communities and regions, around the world?

Anticipate shocks

Prices rise. Supply chains fracture. Things fall apart. How might such changes be accommodated? When the unexpected happens, how readily available are alternatives? Will system failures be graceful or disastrous?

- Seek to develop systems that are diverse and adaptable, require a minimum of scarce inputs and benefit from what nature does for free.
- Encourage recognition of uncertainty (and acceptance of ignorance) as complements to human knowledge.

Tighten feedbacks

Clean water, fresh air, abundant foods, shelter: these things are precious to life. Today's social feedbacks are mis-aligned, leading people to think that the precious is merely common. Social norms and, specifically, prices can provide feedback on choices that support wellbeing.

- Support stewardship of nature's services for social and natural wellbeing.
- Seek to ensure that prices, metrics and other system feedbacks are direct, transparent and supportive of social and natural wellbeing.

Expand opportunities

Human potential is vast, yet we are limited by social rules and norms of our own making. Our true potential is realized only in concert with the rest of nature.

- Seek to ensure that basic human provisions, security and education are accessible to all.
- Encourage a diversity of ownership and ownership types.
- Seek to provide future generations with improvements in natural, social, human, financial and manufactured capital.

Design for learning

What social rules, practices and norms support wellbeing? Current assumptions may no longer hold true. For knowledge to be effective, it must be continually shared, re-evaluated and re-created.

- Encourage collaborative engagement with issues at the smallest effective scales.
- Encourage the flexibility to modify or abandon ineffective rules or practices.
- Encourage innovations that have a low cost of failure.
- Seek to protect accumulated knowledge and incorporate it into long-term thinking and decision-making.
- Develop connections to share learning within and across regions.

Consider scales up and down

Just as a misguided political regime squashes individual wellbeing, the dominant energy regime disrupts the planet's climate system. From government to individual, from energy system to climate system: these are examples of system scales. A regime operating at one scale may undermine the resilience of another, up or down.

- Seek to encourage and enable systems transformation, when such transformation is essential to the resilience of critical systems at larger or smaller scales.

Social-Ecological Systems

The latin word *resilire* means to leap back or to rebound from a disturbance. We commonly understand resilience as the endurance and fortitude that carry us through challenges. "Think of resilience in terms of the old Timex commercial," an expert on earthquakes explained in a W*ashington Post* article, "it can take a licking and keep on ticking."

This common sense approach to resilience is part of our understanding as well. But it is incomplete. Here are additional ways to explore the practice of resilience.

Resilience of what?

Cockroaches, kudzu and jellyfish are known for their resilience. They can endure environmental stresses and return to repopulate their ecosystems. But humans differ in important respects from other life on earth. With advanced capacities for foresight and self-reflection, we not only respond to change, we intentionally seek to influence it. And so the resilience of individuals and societies relies not only on the capacity for endurance, but also on capacities for intentional adaptation and transformation.

Resilience to what?

A 2011 World Economic Forum survey of global power brokers ranked energy price volatility and climate change among the top global risks. Resilience to these types of environmental stresses is critical for human wellbeing in the 21st century — and social and environmental stresses are tightly linked. In this publication, we examine resilience in systems that provide for essential needs: food, water, energy and finance. A more comprehensive look would also examine resilience and wellbeing in systems like education and health care.

Resilience, efficiency and vulnerability

There are direct relationships between resilience, efficiency and vulnerability. In marine ecosystems, for example, attempts to optimize for "efficient" fish harvest have led to population crashes, and thus are not really efficient over the long-term. Efforts to optimize production from forest, agricultural and grazing lands have yielded similar results. A narrow focus on short-term efficiency reduces resilience, resulting in greater vulnerability to environmental stresses.

Other efficiency-resilience conundrums arise as well. Efforts to optimize food distribution leave many big cities with limited food supplies on hand at any time. They are vulnerable to supply shocks, as evidenced in the aftermaths of Hurricane Katrina in 2005 or the Tōhoku earthquake in 2011. Greater functional diversity — many types of distribution channels, supplying food from many types of sources — would increase food system resilience.

A single-focus on efficiency can also undermine resilience by locking us into problematic infrastructure. More fuel-efficient cars, for example, improve energy efficiency. But investment in gasoline-powered cars also strengthens an existing energy regime that is changing the planet's climate, leaving us more vulnerable in the long term.

Resilience and transformation

The relationship between energy and climate systems is a maladaptive state, a trap. The current energy regime, based on fossil fuels like coal and petroleum, is highly profitable and, in a narrowly economic sense, seemingly resilient. But it undermines the resilience of a more critical system, the planet's climate regime. For the sake of human wellbeing, the current energy regime must be transformed.

"The problems that face us are linked. It's not a set of problems. It's a system of problems. Now it's time to look for a system of solutions."

Janine Benyus
Nobel Laureate Symposium, 2011

Regions

Watersheds, food systems, electric grids and forest biomes — each occupies a specific geography — and their geographies matter more than our institutions and economies give them credit for. We live in neighborhoods and regions, but interact through jurisdictions and supply chains.

Despite the many benefits of international trade and communication, globally interconnected economies also leave societies more vulnerable. We propose that a more resilient world would be based *in part* on local and regional self-sufficiency — and also on trade particular to the assets of people and place, as well as novelty and inspiration shared from one to another place.

As Jane Jacobs wryly noted, regional boundaries are hard to pin down. A region acquires a discrete character and form only with respect to a given watershed, food-shed or energy-shed. To further complicate matters, the watershed boundary aboveground may not correspond to that of the aquifer below. These "problemsheds," as geographer Tony Allan calls them, demand an "ad hoc regionalism." Precise and fixed boundaries may be less important than adaptive collaboration among the people and organizations relevant to the geographic context.

We are vulnerable where we live. Geography, financial resources, political access and social capital turn environmental stresses turn into vulnerabilities. Residents of the Ganges, Pearl, Mekong, Mississippi, and Rhine Deltas each face flood and displacement risks, but they are not equally vulnerable. As environmental stresses multiply, the ability to organize and act at local and regional scales becomes more critical.

To describe some of the ways in which regional economies can bolster resilience, we propose that:

- Diversity within and among regions reduces vulnerability to stresses and shocks from climate change, disease, shortages, transmission or transport failures, and so on;
- Diversity within and among regions offers greater opportunities for ownership;
- Regional trade networks offer opportunities for more immediate and transparent feedback about the true costs of production and consumption; and
- Regional trade networks offer opportunities for shared responsibility, stewardship and community.

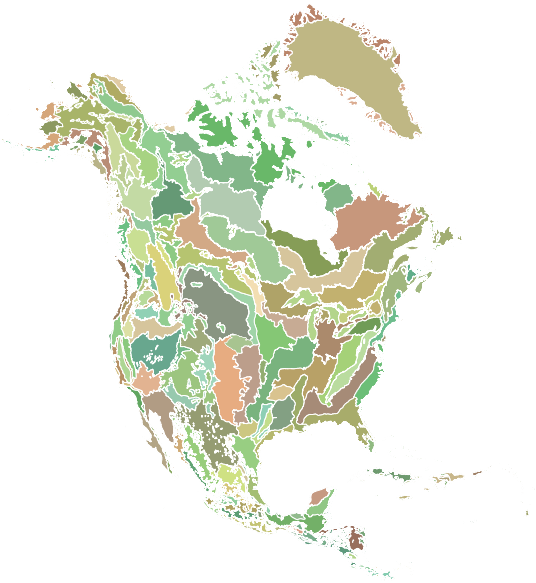
In addition, we propose that:

- Especially when national and international institutions prove rigid and inflexible, the emergence of novelty and creativity at local and regional scales can be critical to leadership on global problems such as climate change.

"A region is an area safely larger than the last one to whose problems we found no solution."

Jane Jacobs
The Death and Life of Great American Cities, 1961

Terrestrial Ecoregions Map
The World Wildlife Fund, 1987



Based on expert opinion
of ecological factors

Resilience Regions Map
2011

Based on spatial analysis
of both ecological and cultural factors

Food Traditions Regional Map
Renewing America's Food Traditions, 2004

Based on expert opinion
of cultural traditions

Comparing Regions
Three maps of North American regions are shown for comparison. The Resilience Regions map (center) is based on spatial analysis of both ecological and cultural factors. Starting with population centers, we examine variations between adjoining map cells. Greater variation entails a greater "cost" of inclusion in a region, until the point when cumulative costs between adjoining regions are equivalent, indicating a boundary. Costs are assigned based on variations in biophysical characteristics, such as temperature, elevation, vegetation and precipitation, as well as variations in language group.

Regimes

Business as usual cannot continue. Social and environmental stresses pose critical threats to human wellbeing. But what is "business as usual" — and how does it exert such a powerful force on human affairs?

"Business as usual" is a type of regime. By definition, it is the dominant regime, but other regimes are possible — regimes based on other values and other business practices. For example, the local food, food sovereignty and seed saving movements have created alternatives to the dominant food regime. These types of social alternatives are all around us, but they are overshadowed by dominant worldviews and institutions.

Transforming the landscape of dominant and possible regimes can be difficult. As Thomas Kuhn described, our worldviews evolve, but only with the greatest reluctance and resistance. We develop social and cognitive attachments to ways of thinking and living that are made possible by dominant regimes.

In addition, current social organizations seek to use their power and influence to shape rules, practices and norms to their own advantage. And existing infrastructures represent sunk costs and constrain habitual patterns of activity.

These are examples of the rigidities that can inhibit regime change. In addition to the challenges of rigidity are the challenges of poverty. How will fresh thinking be recognized, supported and financed? How might memories of older worldviews and institutions inform what might work now?

In sum: what does real transformation look like?

Transformation

"When you find yourself in a hole," quipped Will Rodgers, "stop digging." Options for transforming possibility landscapes are much the same. To stop digging means to stop supporting — or oppose — regimes that undermine wellbeing. And then to assist the development of alternatives.

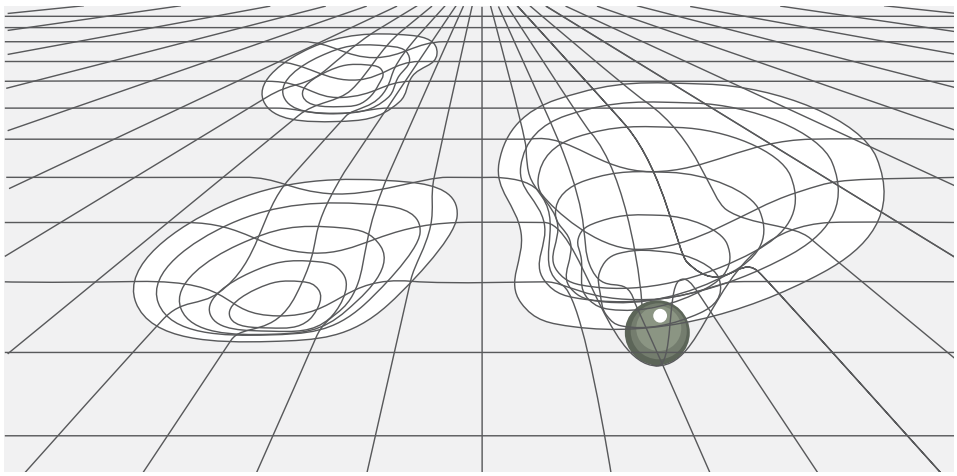
Some innovators are able to jump right in — by developing new policies, new relationships or new ways of making a living. We will describe these transformative innovations in the section titled "Start Here."

But first, in order to better understand current situations and vulnerabilities, we take a look at the status and emergence of dominant regimes in our home region of North Pacific America. Then we pause to scan the landscape: what other types of regimes might be possible? We look ahead, share our vision and listen to others as they share theirs.

Possibility Landscapes
The possibility landscape illustrates the extent of all potential regimes in a system. Regimes are pictured as basins, and a ball indicates the dominant regime, with alternatives also in view. The contours of the landscape and its basins are constantly evolving, through both "natural" ecosystem processes and social-ecological interactions.

A "regime shift" takes place when there is a change in dominance, a transformation, from one basin to another. For example, in a lake environment, a shift might occur when phosphorous discharge causes algal blooms to replace the clear water. The regime has crossed a threshold to another basin on the possibility landscape.

In social-ecological systems, the factors that support the stability of a particular regime include worldviews, institutions, infrastructures and technologies. In this publication, we explore the human capacity to intentionally influence and transform the landscape – so as to support regimes that better provide for the wellbeing of people and place.



LOOKING AROUND: North Pacific America

Today's world leaves individuals and societies vulnerable to environmental stresses like resource depletion and climate change. In order to better understand our efforts at transformation, we take a look back at the evolution of today's dominant regimes: the worldviews and institutions that guided growth in the 19th and 20th centuries.

We examine seven systems of significance to our home region of North Pacific America. In each of these systems, regimes have operated at numerous geographic scales, and we choose the name "North Pacific America" for its ability to evoke our home region without implying specific borders. Each of these regimes has a distinct history — and their collective future is open to human influence.

Our guiding questions are:

- What types of worldviews, institutions and relationships contributed to the development of today's dominant regimes?
- At what geographic scales do these regimes operate?
- In what ways do these regimes leave individuals and societies more vulnerable?

Systems: North Pacific America

Marine
Services include: Food provision, energy provision, climate regulation, habitat and biodiversity, aesthetic and spiritual values, recreation.

Forests
Services include: Fiber provision, energy provision, food provision, climate regulation, air quality regulation, habitat and biodiversity, water regulation, aesthetic and spiritual values, recreation.

Water
Services include: Water provision, energy provision, food provision, natural hazard regulation, habitat and biodiversity, water regulation, aesthetic and spiritual values, recreation.

Food
Services include: Food provision, energy provision, soil formation and retention, nutrient regulation, water purification, pollination, habitat and biodiversity, climate regulation, aesthetic and spiritual values.

Energy
Services include: Energy provision, natural hazard regulation.

Built Environment
Services include: Shelter, sanitation, transportation, communication, food provision, water provision, energy provision, stormwater management, recreation.

Finance
Services include: Means of exchange, storage of economic value, credit.

A more comprehensive view would include examinations of systems such as: geology, atmosphere, rangelands, education, health care and religion.

Marine

The North Pacific and California Currents flow eastward across the Pacific, the former turning north to the Gulf of Alaska and the latter turning south at Vancouver Island. The cold upwelling of the California Current supports phytoplankton production that feeds fish, whale and seabird populations. Migrations of Pacific salmon transport these nutrients inland, contributing to the diets of over 130 species, including humans, and fertilizing algal and plant growth with their carcasses.

Waves of 19th-century immigrants found ample fishing opportunities: from the Strait of Georgia lingcod fishery to the San Francisco Bay shrimp fishery. Then, one species after another, populations crashed. The Fraser River's white sturgeon catch plummeted from over a million pounds in 1897 to just three percent of that figure a few years later. By the mid-20th century, valuable Pacific sardine fisheries had collapsed all along the coast. Salmon, herring and other species declined.

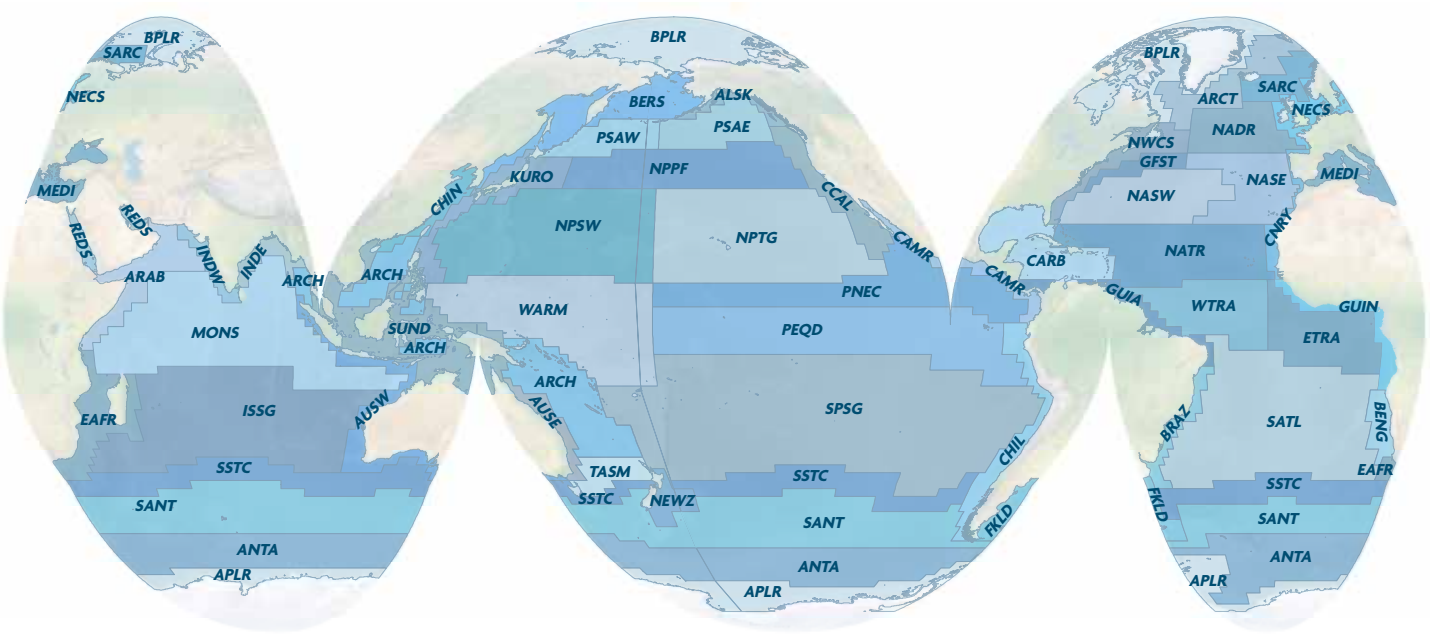
Challenging efforts to better understand marine systems, ocean conditions are naturally variable. Variability increases the likelihood of overharvest and complicates efforts by scientists to estimate safe harvest levels. Reliance on harvest targets identified as "maximum sustainable yields" reflected a focus on optimization of resource use, rather than on broader values such as community and ecosystem wellbeing. And scientific recognition of the cyclical Pacific Decadal Oscillation, a significant influence on productivity, did not come until the 1990s.

The domestication of salmon represents an attempt to control for this natural variability. Partial domestication through hatcheries and complete domestication through aquaculture each provide greater reliability as a food source. However, both methods of production discount ecosystem interactions that can harm wild salmon populations. Salmon aquaculture, unlike that of herbivorous fish like tilapia or catfish, results in a net loss of available edible protein. Most salmon hatcheries could not survive financially without government subsidies, as the cost of production per harvested fish is greater than market value.

Coastal waters are publicly owned, and governance of fisheries activity is largely shared across the U.S. North Pacific Fishery Management Council, the International Pacific Halibut Commission, Fisheries and Oceans Canada and the U.S. Pacific Fishery Management Council, in coordination with provincial and state authorities, and Alaska Natives, First Nations and tribes. Administrative mismatches and gaps are common. For example, the Dungeness crab fishery that spans the West Coast is managed by each state individually, even though fishing vessels routinely cross state boundaries.

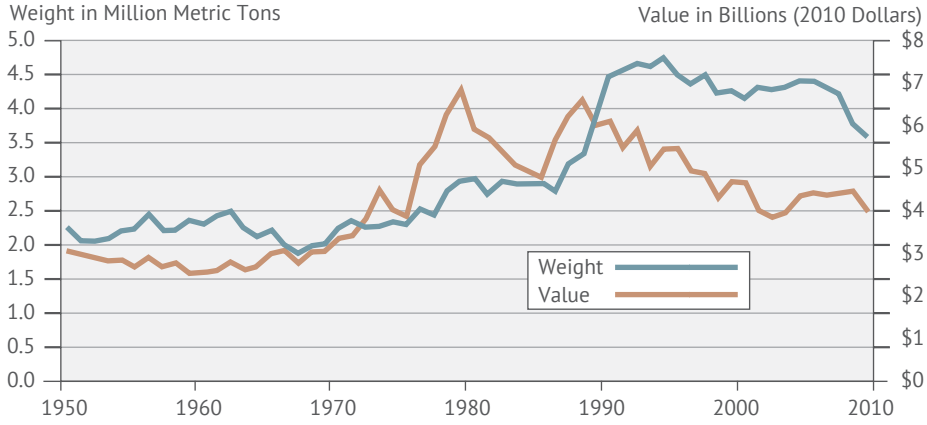
Major Vulnerabilities in North Pacific America

- Oceans acidify as carbon dioxide emissions are absorbed from the atmosphere.
- Memories of past fisheries abundance are lost and recent levels are accepted as normal (shifting baselines syndrome).
- Concentrations of ownership in vessels, fishery quota, processing and distribution weaken social wellbeing.
- Markets reward some values (efficiency, scale of production) over others (community wellbeing, ecosystem health).



Ocean Biogeographic Provinces
This partition of the world's oceans into provinces is one way to understand "natural" scales of ocean activities. Provinces are dynamic, with cyclical and seasonal fluctuations, and their delineation is based on the role of currents in distributing phytoplankton. Migratory species move among provinces, exploiting multiple domains.

Data source: Vlaams Instituut voor de Zee, 2009.



Weight and Value of U.S. Fish Brought to Market, 1950–2009
Over the last two decades, while U.S. fishery landings have been at 60-year highs, revenues to fishermen have gone down. Rising production and falling prices are indicative of commodity systems, in which efficiency and scale of production are valued over community wellbeing and ecosystem health. These patterns are prevalent in fisheries, agricultural, ranching and forestry markets..

Data source: NOAA, 2010.

Forests

Stretching from the redwoods of California to the spruce and hemlock of Alaska, North America's temperate rain forest is characterized by abundant rainfall, cool summers and infrequent fire. Inland, east of the Cascade and coastal mountains, conifers grow in a drier environment — and are more immediately vulnerable to changes in climate.

Early U.S. land policy directed the distribution of public lands to private ownership as a means of economic expansion and tribal "pacification." In places like Oregon's Willamette Valley, immigration's initial effect was an expansion of woodlands. Indigenous peoples had burned the hills every year, and this practice was discontinued.

Forests in the U.S. Northeast and Great Lakes regions were rapidly depleted, and by 1882, *The Oregonian* could claim for the Pacific Northwest the country's "last great supply of first-rate timber." Alarm among some in Washington D.C. prompted Congress in 1891 to authorize the reservation of public lands. This distinction in forest regimes, public and private, is reflected in today's management practices.

The region's timber industry emerged in the 1850s, shipping to San Francisco from Puget Sound, Gray's Harbor, the Columbia River and Coos Bay. Railroads extended markets, and land parcels granted to railroad companies — 131 million acres in total — created checkerboards of forestland ownership that fragment today's landscape. Until the 1940s, when public-land harvests increased during World War II, private forests supplied 95 percent of U.S. domestic timber. Timber production peaked in Washington (1929), Oregon (1955) and California (1959), then moved northward, expanding in British Columbia, where harvests are licensed by the provincial government, and Alaska, where Native Corporations play a major role.

The 1994 Northwest Forest Plan, which halted logging on large areas of national forestlands, sought to stop overharvest and protect endangered species.

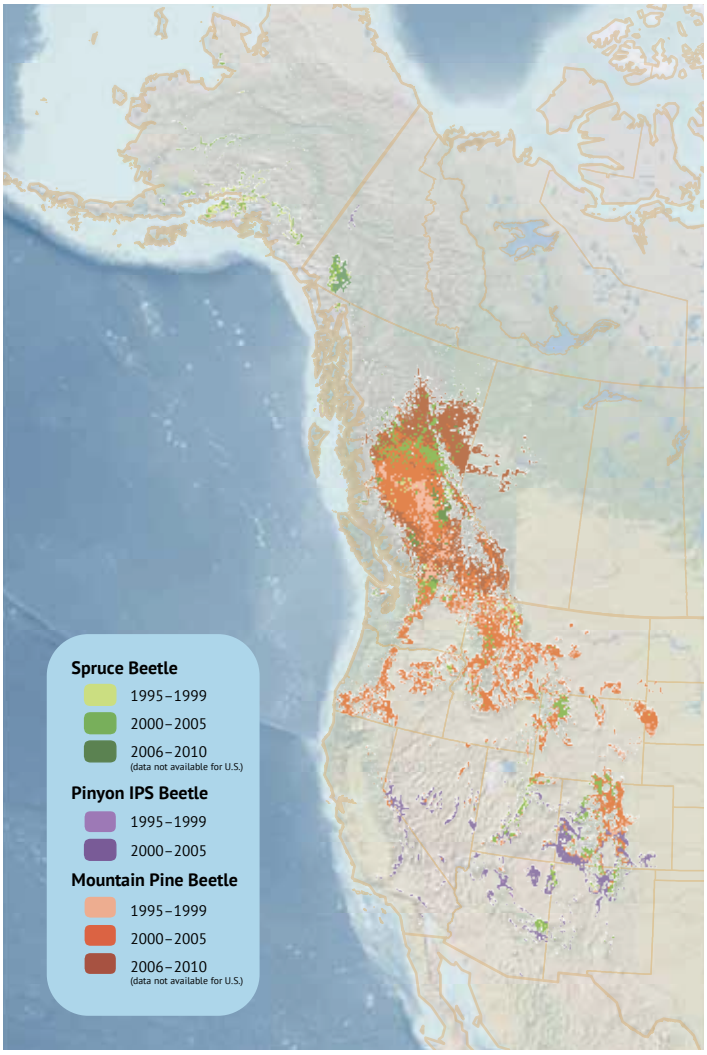
Timber-dependent communities bear the costs of the industry's boom-and-bust cycles. Factors contributing to these cycles include overharvest and overextended investment, as well as technological development.

Since the 1990s, U.S. forestland ownership as an investment class has grown significantly. Integrated forest management companies, which own manufacturing facilities as well as forestland, have in many areas been replaced by investment management organizations and real estate trusts.

Social values and services provided by forestlands include carbon sequestration, which helps mitigate human influences on a changing climate. Temperate rain forests are the world's most productive, storing more carbon than any other forest type and reaching peak rates of growth at ages up to a hundred years or more. On the private industrial lands of North America's temperate rain forest, this productivity is seldom realized. The dominant practice is to clearcut at about 40 years and replant: an early harvest encouraged by financial considerations based on interest rates and discounted expectations of future earnings.

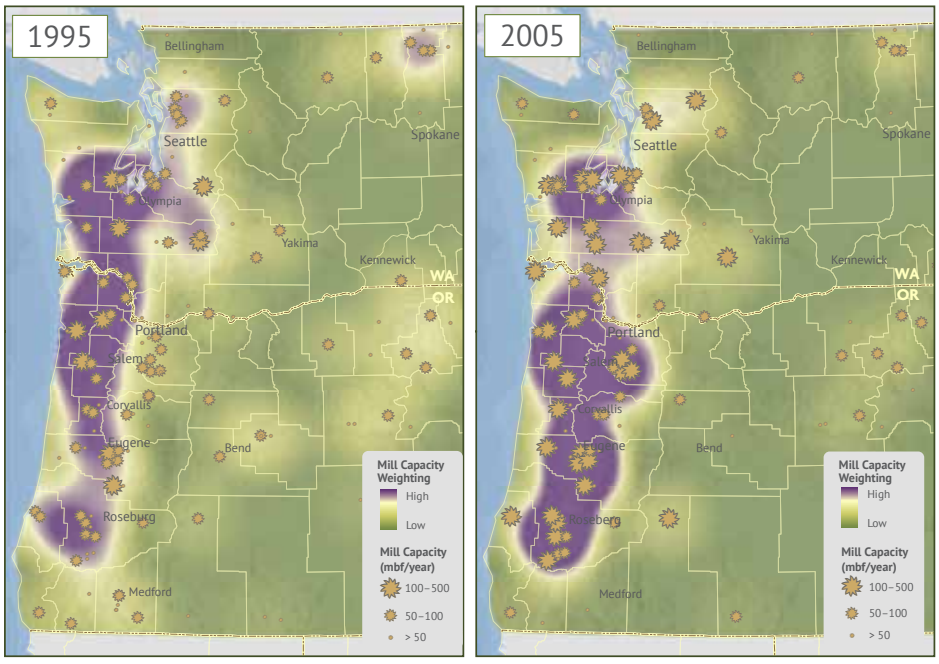
Major Vulnerabilities in North Pacific America

- Homogenous, landscape-scale management results in simplified forest structure, reduced ecological diversity and increased vulnerability to fire and insect disturbances.
- The decades-long regrowth necessary to restore forested landscapes represents an opportunity cost to landowners.
- Markets reward some values (efficiency, scale of production) over others (community wellbeing, ecosystem health).



Recent Mortality of Conifers to Bark Beetles Across the North American West
Recent warmer winters have led to bark beetle outbreaks across the North American West. The legacy of harvests, fire suppression and simplified forest structure have increased the vulnerability of dense, young forests to these indigenous pests.

Data sources: Alberta Sustainable Resource Development; British Columbia Ministry of Forests, Lands and Natural Resource Operations; Government of Yukon Energy Mines and Resources Forest Management Branch; Canadian Forest Service; and USDA Forest Service.



Concentration of Mills in Oregon and Washington
From 1995 to 2005, Oregon and Washington milling capacity concentrated along the I-5 corridor that runs from Roseburg to Eugene to Portland, Olympia and Seattle. In 1995, logs were hauled 21,683 board-foot miles to mills. (Two logs of equal size transported from one place to another cover twice the "board-foot miles" as a single log.) In 2005, this figure had risen to 28,434 miles, an increase of 31%, despite the drop in harvests during this period. The closure of rural mills has made some logging operations economically unfeasible and constrained harvest management options.

Water

As moist Pacific air crosses the coastal mountains, it rises and cools, releasing from 40 inches to upwards of 200 inches of rain and snow a year. Inland, precipitation levels drop, and a more arid landscape is nourished by the region's mighty rivers and their tributaries.

In these lands, Southwest Native Americans, California Franciscans and Utah Mormons all diverted water for agriculture. California gold miners depended on water and formulated a principle to match their mining claims: "first in time, first in right." This doctrine of prior appropriation, affirmed by California in 1851 and Congress in 1866, became central to U.S. Western water law. With state-by-state variations, these laws declare: water belongs to the public; states issue allocation permits; older permits take priority over newer; and allocations must be used or be forfeited. Canadian law, like that of the Eastern U.S., follows the English riparian doctrine: property owners adjoining a water body are entitled to use, as long as their use does not diminish that of others.

The U.S. Reclamation Act of 1902 authorized engineering projects to divert water from public lands and sought to enable small farm ownership by limiting recipients to 160-acre tracts. Irrigation and flood control were primary goals of California's Central Valley Project. On the Columbia River and its tributaries, project goals also included hydroelectric generation and navigation. There are 14 dams on the main stem Columbia. In contrast, there are none on the main stem Fraser, where proposals were rejected over concerns for salmon.

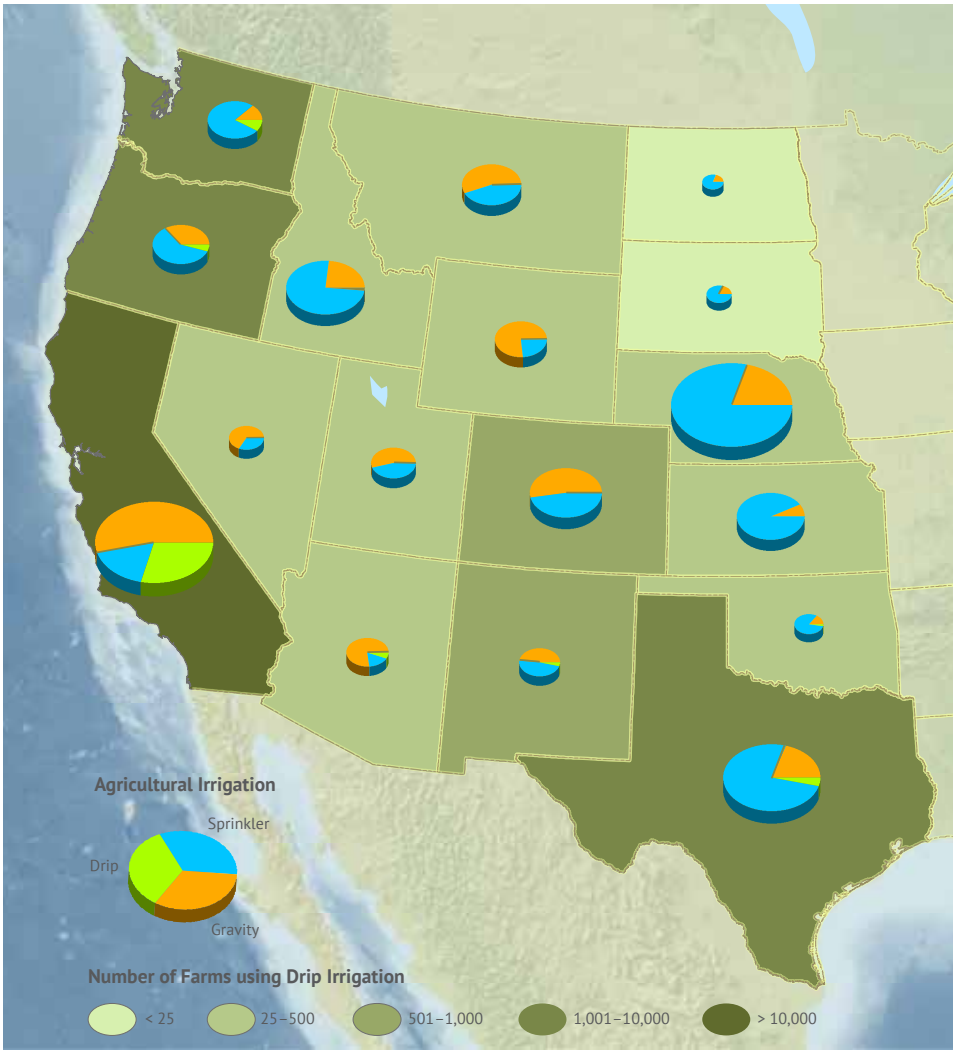
While the U.S. and Canada have succeeded in supplying nearly universal water and sanitation, gaps and concerns still exist. Nearly one in 20 households lacks complete indoor plumbing among American Indians and Alaska Natives. The effects of water pollution and chemical runoff remain a concern in many places. Vancouver, Seattle and Portland metropolitan areas are supplied by nearby watersheds: the Capilano, Seymour and Coquitlam in Vancouver (serving 2.3 million people); the Cedar and Tolt in Seattle (1.3 million); and the Bull Run in Portland (800 thousand).

Because long-distance liquid water transport, except when enabled by gravity, is generally unfeasible or costly, vulnerabilities to drought or water depletion are largely experienced locally and regionally. In California, water use consumes 19 percent of the state's electricity, partially due to long-distance pumping. But while these vulnerabilities are regional, water consumption is, in effect, global. Regions export their water through international trade in goods and services, which embody the water required for their production. The majority of the world's water trade is in the form of agricultural products. From 1997-2001, Australia, Canada and the U.S. were the world's leading water exporters, and Japan was the leading importer.

Water is essential to all life, yet the price of water hardly reflects its value. Current institutions have not developed the flexibility to value water according to the many ways it is understood: as a blessing, a right and a commodity.

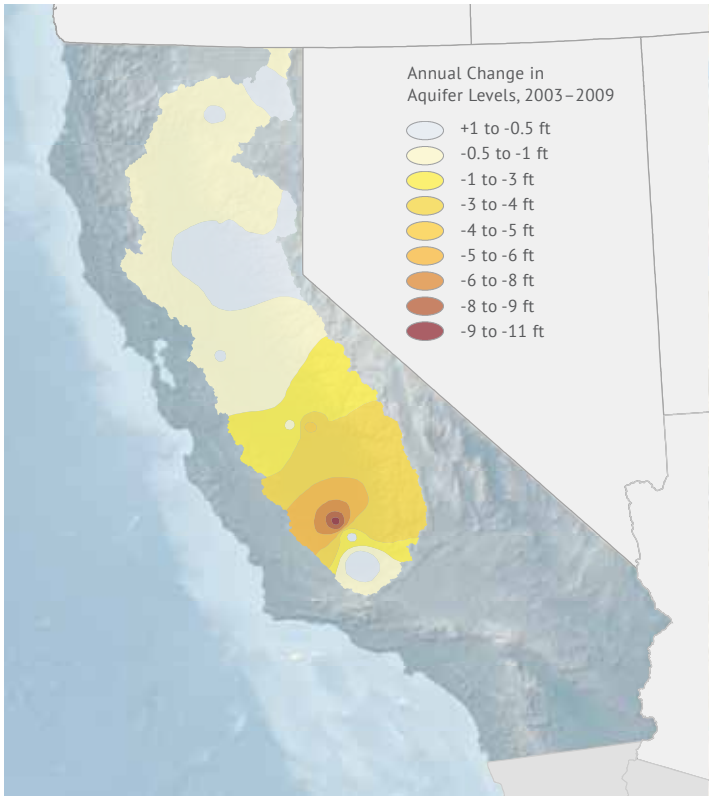
Major Vulnerabilities in North Pacific America

- Cumulative water claims leave many streams and rivers oversubscribed.
- Climate projections forecast reduced snowpacks and, hence, diminished summer water availability.
- Current water metering systems are insufficient for understanding changes in supply or demand.
- Existing infrastructure fails to distinguish water quality required for final use — and does not enable reuse of water already in the pipes.
- Inefficient use of water exacerbates regional vulnerabilities.



Types of Irrigation Used in Agriculture, 2008
State-by-state agricultural irrigation is shown by type of system (slice of each pie), amount of land under irrigation (relative size of the pies), and number of farms using drip irrigation (color of each state). Irrigation efficiency depends on factors such as precision, uniformity and timing of application. According to the U.S. National Research Council, "Shifting to trickle or drip irrigation has been the greatest strategic improvement in water-use efficiency and energy savings over the past three decades."

Data source: USDA farm and ranch irrigation survey, 2008



Satellite View of California's Groundwater Depletion, 2003–2009
NASA's GRACE satellites find groundwater depletion across most of California's Central Valley, most seriously in the San Joaquin. Much of California's agricultural production depends on irrigation, and more than a third of that irrigation depends on underground aquifers. Monitoring aquifer use rates has been confounded by multiple factors, but NASA's satellites can detect groundwater fluctuations through the strength of the Earth's gravitational forces.

Data source: NASA, 2009.

Food

People obtain food through various methods (fishing, hunting, foraging, agriculture, aquaculture, animal husbandry). Trading food may include activities like processing, distribution and marketing. All food is consumed or disposed. The sum of these types of activities, as well as supporting activities and infrastructures, among a particular people in a particular place, is described as a food system.

Evidence indicates that indigenous peoples along the West Coast actively cultivated the landscape for numerous foods, including salmon, deer, huckleberries and camas. In the 1800s, immigrants to the region brought non-native plant and animal species, creating intentional and unintentional changes. Pigs ate camas; livestock grazing led to invasions of Canadian thistle; and California's Tulare Lake Basin was planted "wall-to-wall wheat."

As the railroad connected distant markets, food production increased. Numbers of farms nearly tripled in the Willamette Valley between 1870 and 1900. Salmon canneries shipped out 30 million pounds of fish from the Columbia River in 1885 and 300 million pounds from around the North Pacific in 1913.

A pattern of agricultural industrialization emerged: concentration of land, mechanization and specialization of production, and increased use of inputs such as patented seeds, fertilizers, pesticides and irrigation. U.S. Secretaries of Agriculture urged farmers to "get big or get out." The result was a boom in productivity: fewer people produced more food at cheaper prices. These practices were exported and adopted elsewhere, and over the 20th century, worldwide average farm yields increased fourfold. For many, a globally connected food system became the norm.

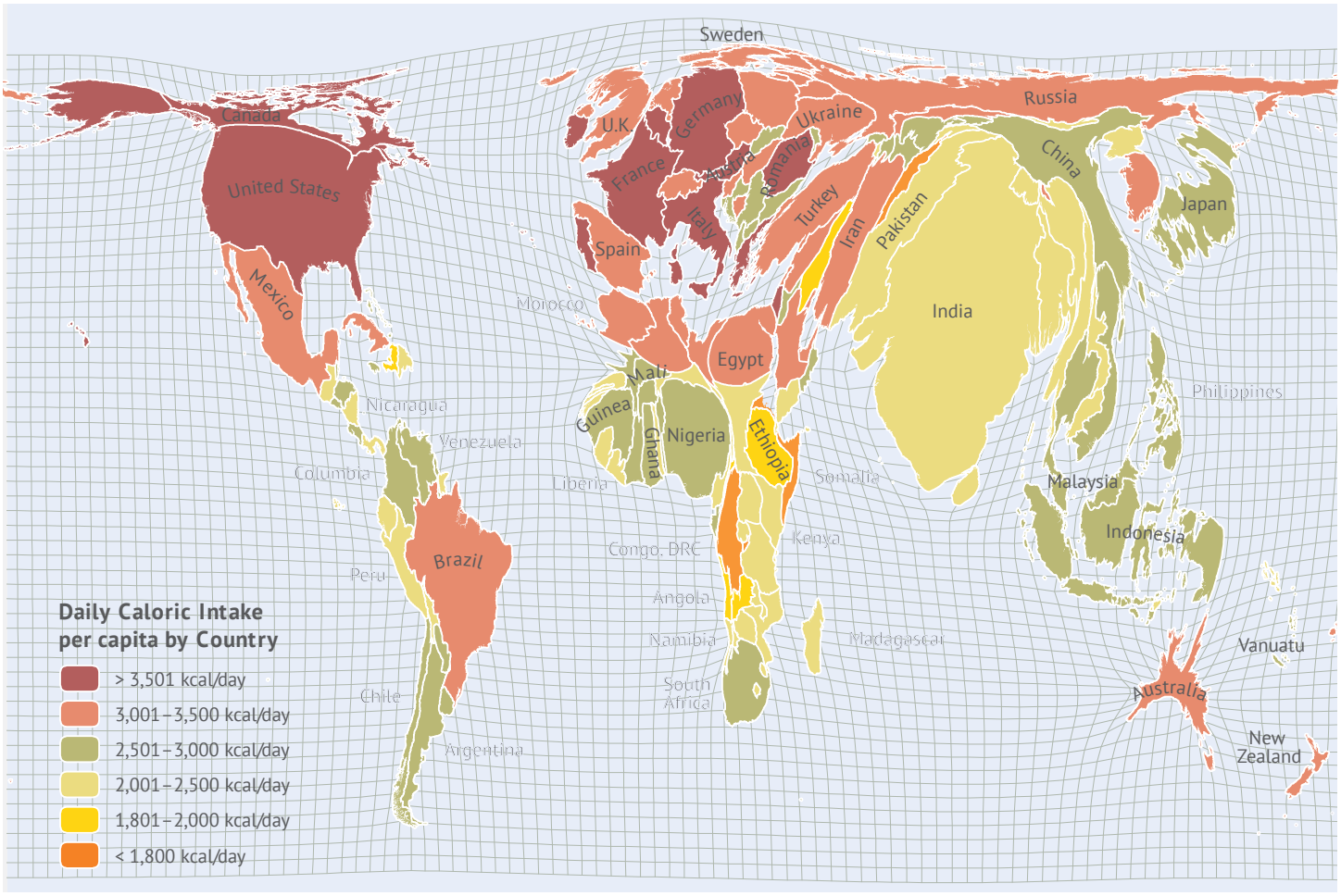
The paradox of this accomplishment is that nearly a billion people around the world continue to live in chronic hunger. Food abundance does not necessarily mean food availability to people in need.

Ongoing concerns over the social and ecological implications of agricultural industrialization include:

- Dependence on inputs: Global energy inputs, mostly from fossil fuels, increased 80 times over the 20th century.
- Increasing cost of inputs: Since 1970, the increase U.S. farm revenues has been cancelled out by an increase in costs of production.
- Impaired water quality: Crops absorb an estimated 30–50% of applied nitrogen fertilizer; the rest is lost to the environment. Pesticides are found in nearly all major rivers and streams around the U.S.
- Loss of on-farm diversity: In 1920, U.S. farms sold an average of 5.6 primary products; by 2002, they specialized in just 1.3 products.
- Intensification of production: In 2002, seven percent of U.S. farms accounted for 75 percent of farm sales.
- Concentrations of ownership: Five or fewer firms account for 45-85 percent of the U.S. market in sectors that include corn seed supply, broiler production, beef packing and food retailing.
- Labor concerns: The median wage for U.S. hired farm labor is roughly the minimum wage, for work that is often only seasonally available.

Major Vulnerabilities in North Pacific America

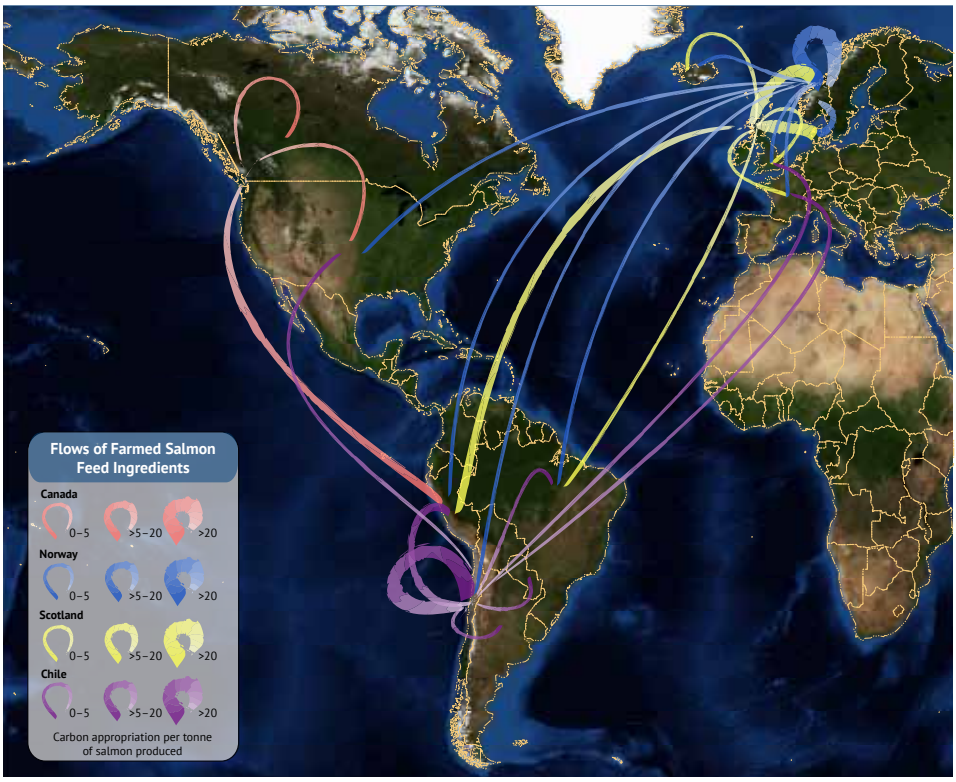
- Dependence on a food system that puts ecological productivity at risk.
- Dependence on a food system that undermines the individual and social wellbeing of food producers.
- Loss of agricultural land to the built environment.
- Health risks from over- and malnourishment for some; food insecurity for others.



Daily Caloric Consumption, by Country , 2005–2007

Daily consumption of calories is shown in two ways for each country: per capita (in color), and for the total population (in area, as a distorted size). The U.S. and Austria have the highest per capita consumption; India has the highest total consumption. The UN Food and Agriculture Organization finds that malnutrition occurs at less than 1,800 kilocalories (kcal) per day. The U.S. Food and Drug Administration recommends that adults consume 1,800–2,500 kilocalories per day

Data source: FAO Statistics Division, 2010.



Global Flows of Salmon Feed Ingredients, 2007

Flows of farmed salmon fish meal ingredients illustrate the globally interconnected food system. Ingredient flows to farmed salmon producing countries (Canada, Norway, Scotland and Chile) are standardized and calculated as primary productivity, the appropriation of carbon from the environment. Chilean farmed salmon, for example, are fed fish meal that includes ingredients derived from: poultry products from France and Brazil, anchoveta meal from Peru, maize gluten meal from the U.S., sunflower meal from Argentina, and wheat gluten meal from the UK.

Data source: Pelletier et al., 2009

Energy

Annual migrations of Pacific salmon brought abundant food energy to indigenous peoples of the Pacific Rim, enabling the development of advanced, settled societies. Food energy, thermal energy for heating and cooking, and the use of fire for brush clearing were the primary energy services of pre-industrial times.

Expanded energy services have largely depended on carbon-based, effectively finite, geological materials: petroleum, coal and gas. In the language of a 1952 General Electric film, "A world that had plodded down the centuries suddenly found out how to use a force that had waited to go to work since before the daybreak of history." Transformations in lifestyle were wondrous, and vulnerabilities were little understood or easily overlooked.

Energy systems can be characterized in a variety of ways, such as by sources and materials, or by environmental impacts. Characterizing these systems as *services* — electricity, mobility, heating and so on — places emphasis on the quality, scale and infrastructural delivery of desired energy performance.

Electric services

In 2003, the U.S. National Academy of Engineering named electrification the top achievement of the 20th century. The grid that covers much of North America instantaneously balances supplies to meet variable demand, offering cheap and reliable service.

Regulatory and market institutions emerged in an era of resource abundance. Companies benefited from economies of scale and regulated profit margins. But this regulated ecosystem, with its complicated institutional authorities and over 3,000 U.S. electric utilities, is less well suited to an era that demands innovation.

Generation portfolios vary by region, and hydropower supplies a majority of demand in British Columbia (86%), Washington (70%) and Oregon (58%). Hydropower offers numerous benefits. With sufficient water flow, it operates continuously, smog and carbon free. However, dams hinder fish passage — and thus reduce the productivity of another resource.

Mobility services

Liquid fuels are highly dense and versatile, and their depletion poses unique challenges, including the circular conundrum of fuels required to access and process new fuels. In the 1930s, U.S. oil flowed easily, and the energy return on investment was roughly 100 to 1: a hundred barrels gained for every one spent on recovery. This ratio for energy from today's more challenging environments and materials, like the Alberta tar sands, is estimated to be as low as 6 to 1.

People in San Francisco, Portland and Vancouver are less dependent on vehicles than in some other cities. For Portland, that savings in time and transportation costs has been estimated at $2.6 billion a year over other large U.S. metropolitan areas.

Thermal services

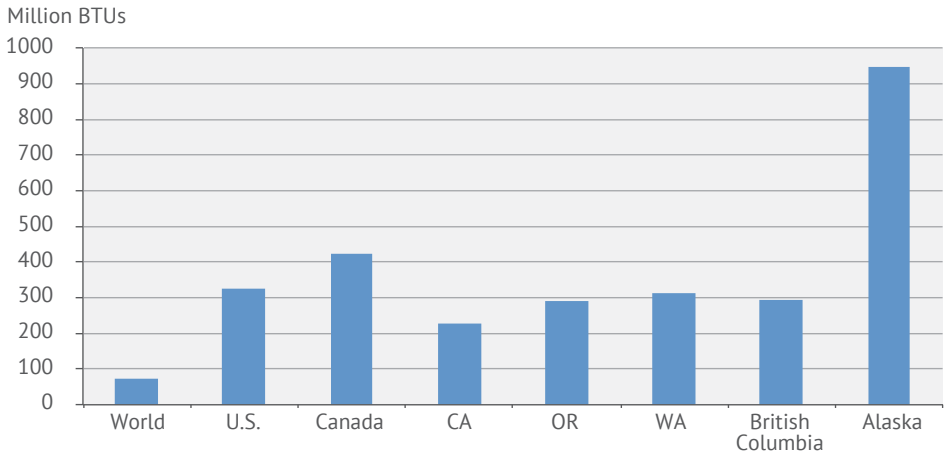
Among the most basic energy needs are thermal services such as heating and cooking. Woody biomass can be used efficiently for thermal energy but has proved controversial, due to social and environmental concerns. Meanwhile, British Columbia exports woody biomass for energy uses to Northern Europe, 775,000 tonnes of pellets in 2008, enough to heat over 250,000 homes.

Major Vulnerabilities in North Pacific America

- Remote and effectively finite material resources are vulnerable to supply shocks and price volatility.
- Toxic material wastes are harmful to human and environmental health.
- Imports of material resources create a drain on regional economies.
- The existing electric grid cannot accommodate significant quantities of variable sources like solar and wind.
- Carbon dioxide emissions disrupt the planet's climate system.

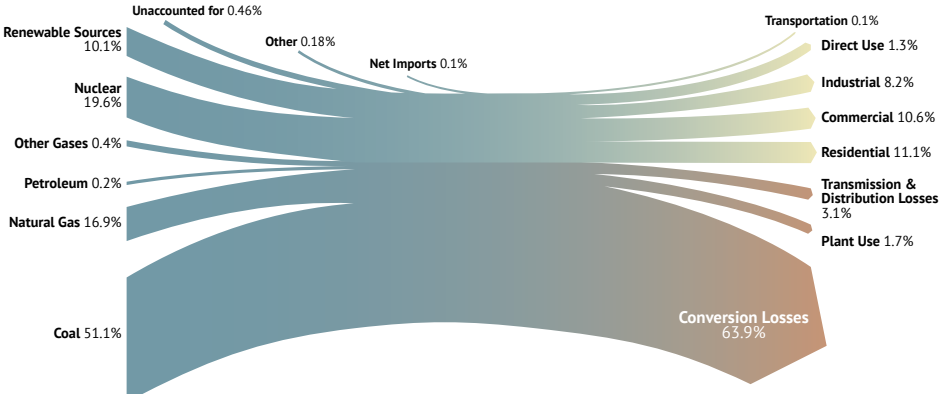
The Western Electric Grid and its Balancing Authorities
Balancing authorities each manage electric transmission within their domains of the Western grid (Western Interconnection). These territorial stakes illustrate the challenges of modernizing the electric grid — challenges that are as much about governance, coordination and standardization as they are about technology.

Data source: Western Electricity Coordinating Council as of August 17, 2011. (Boundaries are approximate and for illustrative purposes only.)



Energy Consumption per Capita
Per person consumption of energy varies greatly, both within and among countries around the world. North American consumption is four times the world average.

Data source: U.S. Energy Information Administration, 2009; Natural Resources Canada, 2008.



Efficiency of U.S. Electricity Generation
The efficiency of U.S. electricity generation has stagnated at roughly 34 percent since the 1960s, with nearly two-thirds of the energy lost as heat. This loss is partially due to the diseconomies of large-scale generation facilities. Smaller scale, distributed facilities, providing both electric generation and on-site thermal services, can offer opportunities for energy savings.

Data source: U.S. Department of Energy, Northwest Clean Energy Application Center, accessed August 20, 2011.

Built Environment

The built environment — including cities, buildings and supporting infrastructure — serves a variety of human needs: shelter, transportation, communication, sanitation, education, spiritual fulfillment and more. Invested with social energies and financial capital, these structures reflect the aspirations of their times and shape living patterns long after construction.

Cities are places of social and economic interaction. As their growth accelerates, it often leads to greater diversification, specialization and productivity — but also to *diseconomies*, such as air pollution and traffic congestion. City planning can influence both these economies and diseconomies.

Town planning on a street grid was introduced to the Americas in the Spanish colony of Santo Domingo, and nearly every town in the Western United States began as a planned settlement. Planning for streetcar lines guided the development of many North American cities, including Vancouver, Seattle and Portland.

In 1922, soon after U.S. urban populations first exceeded rural, the Supreme Court found that land use regulations might create a *negative externality*, an unjust *taking* of private property. The reverse occurs as well. A *reverse taking* is when private activities enclose or degrade public resources, and *positive externalities* are created when land use regulations support social wellbeing that benefits individual landowners.

By the mid-20th century, the automobile enabled growing populations to seek more dispersed settlement. A backlash against road building occurred in 1970s Portland, when citizens and officials concerned about urban livability stopped plans for the Mt. Hood freeway and removed a riverfront roadway. A similar freeway proposal was blocked in 1970s Vancouver. Daily travel is now roughly 78 percent by personal vehicle in both the Portland-Salem and Seattle-Tacoma areas, 73 percent in metropolitan Vancouver and 83 percent in U.S. metropolitan areas overall.

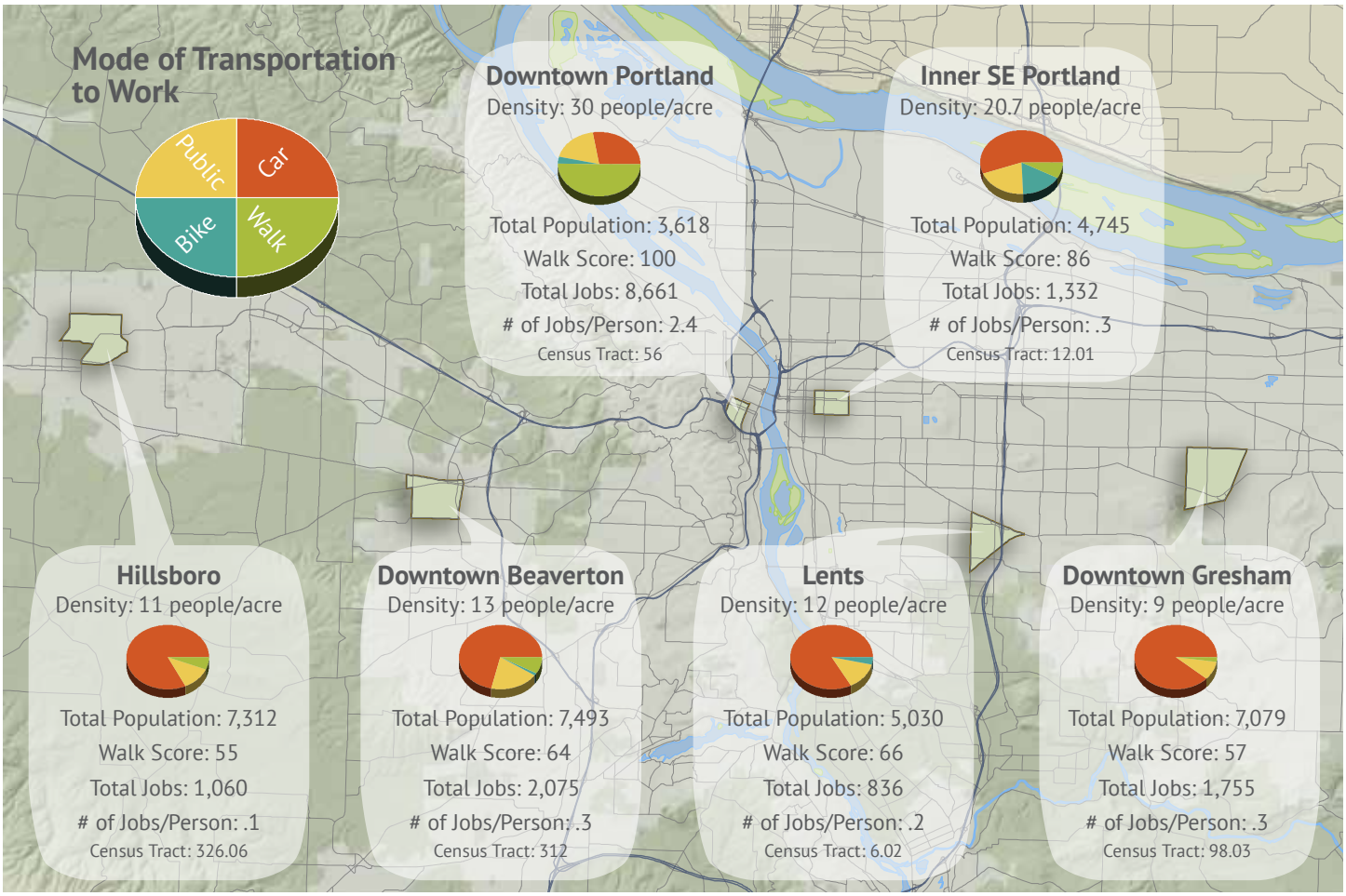
The built footprint creates social-ecological impacts that include loss of agricultural and forest land, diminished water quality and loss of biodiversity. Impervious pavement covering as little as 10 percent of a watershed can be harmful to salmon populations. In the 1970s, both British Columbia and Oregon adopted laws to protect farmland and open spaces from development: the former with Agricultural Land Reserves, the latter with Urban Growth Boundaries.

Settlement and housing regulations have often reflected historical racial and ethnic sensibilities. In Oregon, the first state constitution excluded black settlers, and in Seattle, housing restrictions enforced neighborhood segregation. Availability of affordable housing and equitable provision of public services remain challenges for most cities in North America.

Both "trendsetter and hinterland" is how historian Carlos Arnaldo Schwantes characterizes the Pacific Northwest. Today, the region continues to attract new generations of immigrants.

Major Vulnerabilities in North Pacific America

- The built environment often displaces forest and agricultural lands.
- Impervious surfaces impair watershed function.
- Existing infrastructure represents a sunk cost and constrains habitual patterns of activity.
- Markets do not provide for equitable access to needs such as affordable housing, and governmental planning has not traditionally considered food access.



Comparing Neighborhoods
Neighborhoods in and around the Portland, Oregon metropolitan area exhibit variations in population densities, job opportunities and transportation options and choices. Where one lives and how land use decisions are made greatly affect social and environmental outcomes.

Data source: U.S. Census Bureau; American Community Survey, 2009; U.S. Census Bureau, Local Employment Dynamics Program, 2009 Area Profile Analysis of Primary Jobs; Walk Score, accessed August 9, 2011.

Finance

The indigenous peoples of North Pacific America had a monetary system based on blankets, small white shells (*higua*) and, later, ornamental coppers. These served as basic units of exchange and benchmarks of value, much as the dollar does today.

Native peoples in our region also practiced the *potlatch*, ceremonial exchanges of gifts. Along with other social and ritual functions, the potlatch served as a nascent financial system, distributing resources to those who needed them. The advent of the fur trade and influx of manufactured goods eventually triggered inflationary pressures that destabilized the potlatch's economic function. It was an early experience with the fragility of money and finance.

In all societies, money evolved to support greater divisions of labor and broader exchanges of goods and services. Modern money includes currency as well as credit. It is tied to neither land nor region, and financial systems facilitate the flow of credit and capital at increasingly larger scales.

The scope and speed of financial activity have eliminated critical feedbacks. Early financial markets channeled savings into local investments in economic activity, employment and infrastructure. In contrast, in today's global financial system, a dollar deposited in a commercial bank in the Northwest may wind up anywhere. Creditors are no longer familiar with their borrowers and may have little direct contact with the communities they support. Without social relationships to support creditworthiness and repayment, creditors instead require onerous collateral and credit standards.

Despite the great variation in credit needs worldwide, today's credit standards have been reduced to a single metric: the market rate of return. This narrow criterion tends to reward high-volume, quick-payoff transactions and exclude the capital needs of the majority. Women, minorities, indigenous communities, and middle and lower income borrowers struggle to attract affordable credit. Innovations and activities with long-term goals have difficulties as well. Funding from government, philanthropy, and community development banks satisfies some of these needs, but this funding has diminished due to financial instabilities.

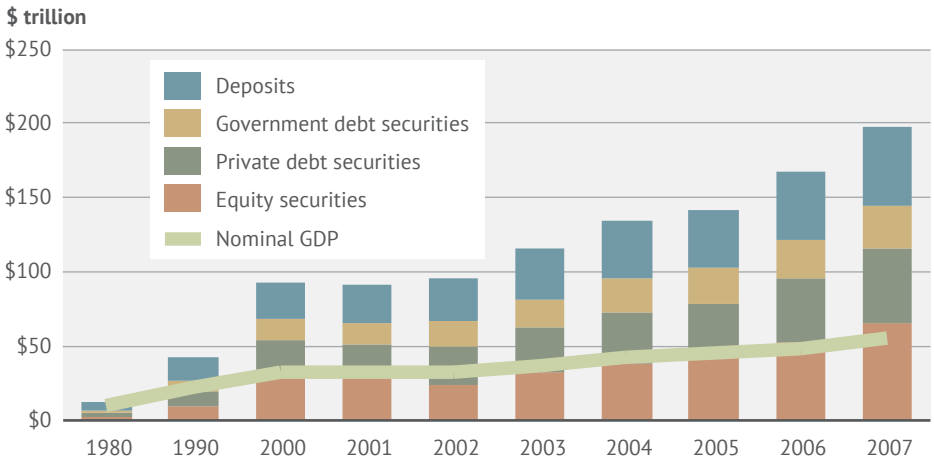
The Depression of the 1930s revealed the vulnerability of the economy to financial market speculation, and subsequent U.S. regulations led to a period of relative stability. Over the last several decades, however, most of these measures have been removed. Speculative activity has increased – with today's risks extending to individual retirement accounts and pensions.

In the wake of the financial meltdown, banks retrenched. Lending declined more sharply in 2009 than in any year since Depression, despite the fact that the real assets of the economy had not changed. Human capital, manufactured capital and natural capital was no less productive than it had been the year before, yet for lack of credit, it could no longer be fully utilized.

In Oregon, for example, lending to small businesses declined by 37 percent from 2007 to 2009, and unemployment rates jumped from five percent to near 12 percent. Regions of the country with greater reliance on community banks typically fared better. North Dakota, for example, is the only state to operate its own bank. It continues to run budget surpluses and enjoys some of the lowest credit default and employment rates in the country.

Major Vulnerabilities in North Pacific America

- Without capital controls, the global financial system is more susceptible to speculative shocks and bubbles.
- Speculative activity contributes to the price volatility of basics goods, such as housing, food and energy.
- Financial markets allocate capital based on market rates of return, without direct consideration of social wellbeing.
- Individuals lack sufficient mechanisms for investing directly in their own communities.



Value of Global Financial Activity and GDP: 1980–2007
Leading up to the 2007 financial crisis, the total value of the world's financial assets — including equities, deposits and private and government debt — outpaced growth in real economic activity, a process known as financial deepening. Financial assets topped $196 trillion in 2007, and global financial depth, the ratio of financial assets to GDP, reached 359%.

Data source: McKinsey Global Institute, 2008

LOOKING FORWARD: Sharing a Vision

The vision that has guided Ecotrust for twenty years is one of a more reliable prosperity, one that creates wellbeing for people and place. These ideas find rich expression in the language of resilience, with its emphasis on closely linked social and ecological systems.

As we incorporated resilience thinking into our own, we brought to the mix a practitioner's perspective. Our primary interest is not in resilience thinking, but in its *practice*.

"Visions become responsible through all sorts of processes," advised Donella Meadows, "and the best one that I know is sharing them with other people."

In order to better understand and identify plausible and desirable paths forward, we engaged a wide range of experts in scenario-based conversations. We asked:

- In what ways do current worldviews and institutions leave us more vulnerable?
- What are the "signposts" by which the future will be shaped?
- In what ways do geographic scales matter?
- What does transformative innovation look like?

The synthesis of these experiences, reflections and conversations serves as a new compass for the 21st century:

- A definition of resilience that incorporates human aspirations and intentions: human resilience depends on capacities to both influence and adapt to change;
- A set of principles for resilience in practice: anticipate shocks, tighten feedbacks, expand opportunities, design for learning, and consider scales up and down;
- A framework for acting to transform regimes that undermine wellbeing; and
- A set of propositions about the significance of activities at local and regional scales.

Our synthesis informs the following section, in which we present the sorts of innovations that point to a more resilient future.

"My experience is, having now many times created a vision and then brought it, in some form, into being, is that I never know, at the beginning, how to get there. But as I articulate the vision and share it with people, the path reveals itself. And it would never reveal itself if I were not putting out the vision of what I really want and finding that other people really want it too."

Donella Meadows
International Society for Ecological Economics, 1994

START HERE: Examples of Transformation

We seek operating systems that support the wellbeing of people and place, the qualities and components of which are all around us. But they are often modest, fragile or easily overlooked.

Broadly stated, our understandings — in effect, our criteria — for identifying examples of transformation include:

- **Recognizing effectiveness in public and private individuals and organizations:** Agents of transformation emerge in all areas of social activity.
- **Applying resilience in practice:** Effectiveness may be understood according to the principles of resilience: anticipate shocks, tighten feedbacks, expand opportunities, design for learning, and consider scales up and down.
- **Operating at local and regional scales:** When systems are rigid, novelty and creativity are more likely to emerge at local and regional scales.
- **Developing alternative regimes:** Transformative innovations support a "regime shift;" they develop the worldviews, institutions, infrastructures or technologies of alternative regimes.
- **Drawing from the old as well as the new:** Transformative innovations may be based on older ways of thinking or acting, reassessed for contemporary times.
- **Searching broadly, sharing widely and adapting to home:** Ideas and examples from around the world may be examined with an eye to plausible adaptation and replication back home.

Building on these understandings, we present a variety of ways in which innovators are creating resilience and enabling transformation.

"[I]nstitutional entrepreneurs [are] those individuals or networks of individuals who actively seek to change the broader social system through changing the political, economic, legal, or cultural institutions, in order that the social innovation can flourish."

Frances Westley and Nino Antadze
Making a Difference: Strategies for Scaling Social Innovation for Greater Impact, 2010

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EPILOGUE: What We Learned

If you are reading this working document, thank you. We are sharing this work with numerous collaborators, both in our region and around the world. And we seek to learn from your reading and reflection.

How coherent and complete are the principles of resilience in practice? Are they applicable to other regions around the world?

Do our descriptions of the challenges for North Pacific America ring familiar and true?

Does this new compass — this framework for transformation — assist in identifying innovations that matter? Would you use it in your region?

Our commitments to you are several. We will listen to and learn from your responses. We will use these ideas to inform our own path forward as an organization.

And we will work together with public and private individuals and organizations to cultivate resilience and transform regimes that undermine the wellbeing of people and place — both in our region and around the world.

Please email: resilience@ecotrust.org

Glossary

Human resilience: The capacity to effectively influence and adapt to change.

Institutions: The formal and informal structures that organize social and social-ecological interaction: rules, practices and social norms.

Possibility landscape: The total extent of potential regimes in a given system.

Region: A discreet area, ecologically influenced, that represents a set of social activities.

Social-ecological regime: A coherent set of worldviews, institutions, infrastructures and technologies that shape and are shaped by ecological interdependence.

Transformation: A change in dominance from one regime to another in the possibility landscape; a "regime shift."

Transformative innovation: An activity that supports a "regime shift"; an activity that develops the worldviews, institutions, infrastructures or technologies of an alternative regime.

Trap: A persistent maladaptive state; a dominant regime that undermines resilience and human wellbeing in a more critical system.

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Credits

Sharing a Vision Interviews (to date)

W. Ron Allen, tribal chairman/CEO, Jamestown S'Klallam Tribe

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Additional Graphics

John Hendrix - Resilient Economies: How Will We Create Wellbeing for People and Place?

Jeremy C. Joseph - Western Electric Grid and its Balancing Authorities

Wade Larsen - Efficiency of U.S. Electricity Generation; Possibility Landscape; Weight and Value of U.S. Fish Brought to Market

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