CHAPTER 1

Negotiating Ecology in an Age of Climate Change

Ecology is nothing but this: the evaluation of place.
—Eduardo Viveiros de Castro (2013, 33).

The machine is stuttering and the engineers are in panic. They are wondering if perhaps they do not understand it as well as they imagined. They are wondering whether they are controlling it at all or whether, perhaps, it is controlling them.
—*Uncivilisation: The Dark Mountain Manifesto*

Imagine that as you watch the day go by you are sitting on your front porch whittling on a stick with a knife. With each whittle the stick is reduced. The wood shavings are at your feet. There is barely a stick left in your hand, and the shavings are swept up and used as kindling to light a fire that night. The whittling stick is a metaphor for how nature is whittled away by our continued use and abuse of the planet's ecosystems. The impacts of this whittling away of nature are often difficult to perceive and realize. For instance, the impacts of global climate change and other human impacts on nature and society are, at first glance, hard to recognize. Springtime may arrive late, or the sounds of spring birds may be missing from a forest. In his Nobel Prize–winning book *Raga*, Le Clézio describes the ocean as an "invisible continent" with its life flourishing unperceived or unnoticed. Akin to the sea life under the surface of the blue horizon, ecosystems are a mere shadow of their referential state. The natural world seems to be receding like a mirage in the Arizona desert. We are whittling away at the great circle of animals, plants, and insects that were once part of our communities.

"Precisely at the moment when we have overcome the earth and become unearthly in our modes of dwelling" (Harrison 1996, 428), we need to restore our kinship with the animate world and the places we inhabit. We suffer these days from a new form of collective anxiety: *species loneliness*. We are disabled creatures dislocated in a wounded landscape. Species loneliness in a wounded landscape moves us to want to restore our relationship with place and others, or, to put it another way, modern humanity yearns to re-establish and restore an ecology of shared identity. Rather than understanding the world through a relationship with earthly entities, our culture emphasizes the human ability to experience nature as a quality (or quantity) that springs from scientific, technological, bureaucratic, and economic understanding. Human beings remain isolated actors in an earthly cage; the world is technologically divided, scientifically categorized and manipulated, and perceived as absent of spiritual and intrinsic worth. Yet, the natural world is something more than the image depicted on the television or computer screen. Nature is more than an environment to behold, control, and manage.

How can we adapt to the social and ecological changes brought on by climate change if we hardly notice the changes? This chapter explores the wicked characteristics of global climate change, and the challenge of adaptation. Cultural adaptation requires a deep connection to place and one's region; it requires an understanding of the uniqueness of particular places that human beings are dependent on.

One consequence of industrialization is that we have created a "secondary nature"—a nature transformed by our use of it, by our technologies and machines, and by our behavior. Indeed, the science of ecology cannot tell us what is *natural* about ecosystems. The meanings of *nature* and *place* have significantly changed over time. Even the term *landscape* has lost its meaning. The root meaning of *landscape* is a forest stripped of trees, a hilltop cleared of native brush, a place where the natural terrain was removed and settled. *The natural landscape* is an oxymoron (Park 2006, 9). We inhabit landscapes transformed; so there is less nature or nativity to draw from, less to sense and perceive. This is particularly the case in marine systems, as marine scientist Jeremy Jackson (2001, 5411) explains:

> The persistent myth of the oceans as wilderness blinded ecologists to the massive loss of marine ecological diversity caused by overfishing and human inputs from the land over the past centuries. Until the 1980s, coral reefs, kelp forests, and other coastal habitats were discussed in scientific journals

> and textbooks as "natural" or "pristine" communities with little or no reference to the pervasive absence of large vertebrates or the widespread effects of pollution. This is because our concept of what is natural today is based on personal experience at the expense of historical perspective. Thus, "natural" means the way things were when we first saw them or exploited them, and "unnatural" means all subsequent change.

For instance, polar bears of the Arctic face a secondary nature in the ice ecology, and their abundance and distribution will likely diminish as a consequence (Post et al. 2013). As the Arctic ice retreats, polar bears are changing their behavior. In some areas, white-beaked dolphins are moving to areas of the northern pole where they have not been seen before. Polar bears have shifted from those species that are ice dependent, such as ringed seals, to these white-beaked dolphins (Aars et al. 2015). Polar bears are also moving farther north, where there is still persistent ice. In addition, scientists have discovered that polar bears are mating with grizzly bears (Barnosky 2009). These changes in polar bear behavior are consequences of the secondary nature they face in a changing Artic ecology.

Changes in the Arctic ice ecology will also lead to further economic exploitation of the coastal and marine areas of the region. As the United Nations Environmental Programme (2013, 5) reports:

> Warming and melting of the sea ice and land snow offers greater human access to the Arctic region. Limited offshore oil, gas and mineral exploitation is already underway and will certainly increase in coming years, bringing new opportunities as well as increased risks of oil spills and pollution. Summer shipping through the Northern Sea Route along the Russian northern coast is beginning to increase, and traffic through the Northwest Passage is expected to grow, as is tourism and marine transport of goods. Some Arctic marine fisheries will become more accessible to regional and foreign fishing fleets.

While climate change will contribute to serious ecological and cultural impacts, economic growth and development in some areas will contribute to the globalization process.

Historically, indigenous peoples adapted to and responded to climate-related events (Barnes and Dove 2015). Cultural adaptation has long been one product of the coevolutionary relationships that exist between diverse peoples, places, and regions (Costanza, Graumich, and Steffens 2006). Cultures have adapted or failed to adapt to food and water insecurity brought on by climate change (Barnes and Dove 2015). Cultural adaptation requires a knowledge of place that is gained through direct human participation in nature. In time, experiential, intuitive forms of knowledge

are developed and serve adaptation. These knowledge systems are based on a unique and intimate understanding of an ecology of place.

There is no guarantee that a culture will adapt to change, and there are many examples of cultures that failed to respond to changes in their ecological conditions. In many cases, adaptation required a deep place-based knowledge system that took thousands of years to develop. In *Collapse: How Societies Choose to Fail or Succeed* (2005), Jared Diamond describes five key factors that contribute to cultural collapse: climate change, hostile neighbors, collapse of essential trading partners, ecological problems, and failure to adapt to these ecological threats. Diamond describes several serious ecological threats that jeopardize our capacity to adapt: habitat destruction, loss of soil, drought, overuse of resources, the introduction of invasive species, pollution, energy shortages, and climate change. Whether we can adapt to the challenges we face will essentially be based on choices we make as individuals and as members of institutions. This places the burden of responsibility on each of us and on our respective communities. It is not merely a question of relying on government to respond.

The choice to continue to whittle away at nature's substance and integrity (the metaphorical stick) threatens our shared capacity to adapt. My fear is that our capacity to adapt and respond to the social and ecological changes brought on by the overuse of resources and climate disturbance is being diminished. Ecological insecurity is the direct result of turning away from the places we once depended on for nourishment and sustenance. We have little control over our own destiny—our water is transported from thousands of miles away, our food is imported by container ships that travel thousands of miles across the ocean, and our energy is derived from sources well beyond our horizon. As a consequence, we are increasingly vulnerable and at risk from the changes that are likely to occur in water, food, and energy availability. Substantial declines in water, food, and energy resources will result from climate change. Our dependence on the global economy leaves us increasingly at risk from climate-related changes to ecosystem services.

The scale of climate-related impacts has a tragic dimension. We live under threat of tragedy. The tragedy endangers what we hold in common and is produced by how we act in common. Everything is fundamentally at stake. If we are to adapt and respond to both the overuse of resources and the multiple impacts of climate change we will need to face tragic choices—choices about how we consume resources, how we treat and relate to nature, how we treat one another, and how we begin

to restore our relationship to nature and community. Calabresi and Bobbitt (1978) describe the inevitability of tragic choices in modern institutions. Basic to the tragic form is the recognition of the inevitability of unresolved tensions that exist between diverse interests, beliefs, and values about government, nature, society, and our economy. In this case, the continued growth orientation of modern society is in conflict with the basic life-giving values associated with the planet. Simply reducing greenhouse gas emissions, for example, without addressing the deeper cultural (e.g., economic) and biophysical consequences of globalization is a tragic choice that contributes to ecological injury and social degradation. The question is whether human beings and their institutions are willing and able to make the tragic choice to protect and sustain the life-giving values carried by nature. If so, we will need to change the way we use resources, and protect enough of the remnant nature that exists to forge a future that can maintain the life-producing values of the biosphere. Industrial society lacks the ecological and communal sensibilities that are needed to respond and adapt to the substantive loss of ecosystem health and integrity. As consumers in a global economy, we remain disconnected from the place we inhabit, and are less aware of our surroundings. We are less capable of noticing the changes that we are causing. At diverse scales of social interaction we avoid taking the necessary steps to change and respond to risks and vulnerabilities. At stake is the diversity of the planet's life-support mechanisms, and the likely diminishment of the planet's cultural diversity.

At the same time that we are losing ecosystems we are losing the traditional cultures and their knowledge and ways (Maffi 2008; Maffi and Woodley 2010; Berkes 2012). In this sense there are biocultural impacts from climate change and overuse of resources. First, climate change has impacts on the biosphere by changing the life-giving characteristics of the planet. Second, climate change erodes the diversity of language and knowledge systems associated with the ethnosphere (e.g., the ethnic diversity of the biosphere). Ecological collapse is proceeded by the loss of a profound knowledge base that once served adaptation and cultural resilience. As we lose traditional cultures and their knowledge systems, we lose the capacity to learn from them.

SOMETHING WICKED THIS WAY COMES

One answer to the crisis is to turn to one's home place. A necessary first step to address the range of social and ecological threats and impacts we

are facing is for individuals and communities to become more familiar with the places they inhabit. We need to cultivate an intuitive and experiential knowledge of our respective place, bioregion, or community.

A local farmer and I are walking his walnut orchard. He tells me that this is the first year in four generations that the walnut trees have not borne fruit. His cattle no longer have feed, and the grass is dry. The river has vanished. He has had to sell off his herd. We sit under a great old oak tree, and look across the Santa Ynez River valley. The branches of the walnut trees are blowing in the wind, and in the distance the fingers of a distant fog are spread out across the valley and foothills. There is a chill in the wind. He wonders out loud. He describes the impact of climate change on his crop and cattle, and wonders if his family ranch can survive.

A similar story is told by a fisher. His nets are empty. The sardines off the coast of California have crashed, and the federal government has closed the fishery this year. He tells me stories of fishing with his father for giant black sea bass and swordfish. Swordfish were harpooned while they slept on the surface of the sea. But now the big fish are gone. In their place, new marine resources are caught and exported. We have been fishing down the food chain for fifty years.

Ray Bradbury's *Something Wicked This Way Comes* (1962) is a novel that reveals the conflicting nature of good and evil that exists in individuals and society. Climate change is the wicked and dark by-product of our thirst for the "black gold" and coal used to feed industrialization and economic growth. For some, this dark side of modern civilization and our continued dependence on fossil fuels will culminate in a social, economic, and political diaspora, an unraveling of industrial civilization and biospheric destruction. Rather than perpetuating the denial of the inevitable collapse, the Dark Mountain Project is a network of writers, artists, and philosophers who are committed to reflecting the ecological reality of this diaspora. The project grew out of the despair and the belief that the humanities were failing to be honest about the scale of the impacts of wicked climate change. The members of the project hope that by writing and creating art they can offer a way of healing to establish a new foundation for changing the world.

This chapter represents a more hopeful response. There is a light emanating from the hearth and firepit. The darkness exists beyond the hearth, and is worth recognizing. The darkness exists on the horizon. But closer to home and in the warmth of the firepit we can find a hope and avoid the fear of that darkness.

There is no "silver bullet" that can resolve the climate crisis. Climate adaptation will require a variety of responses at diverse scales, and across different locations and regions. Richard Lazarus (2009, 1159) refers to the challenge posed by climate change as a "super wicked problem" that "defies resolution because of the enormous interdependencies, uncertainties, circularities, and conflicting stakeholders implicated by any effort to develop a solution." The super wicked nature of the multiple threats posed by climate change has to do, in part, with the complexity associated with the multiple scales of the impacts of the changing climate. While we are members of particular places we are also dependent on the life-giving values of the biosphere. The biophysical scale of climate change has local, regional, and global characteristics.

The wickedness of climate change has impacts on local ecosystems and the global biosphere. In this sense, the global impacts of climate change can vary from one region to another, and it can be difficult to predict local impacts on species diversity, habitats, and ecosystems. The diverse scales in the ecology of the planet's biosphere are analogous to the notion of the Sri Yantra. The *yantra* is a ritual object of Nepal, which represents the nucleus of the visible, and knowable, a linked diagram of lines that reflect particular energy sources. There are different kinds of *yantra*s, such as the Sri Yantra or Great Yantra. Other lesser *yantra*s (Om Yantra, Kali Yantra) are segments of the great embracing Sri Yantra. The notion of *yantra* serves as an analogy for the substance and energy of earth—the source of life, the connecting energy source that unites all earthly entities, including places and the people who inhabit ecosystems (see figure 1.1). It is this maintenance of the energy of the Sri Yantra or Planet Earth that is at stake today. The life-giving values of ecosystems produce our water, energy, food, and the air we breathe. We remain dependent on healthy ecosystems to survive. We also inhabit many of the lesser *yantra*s of earth. The sea can be considered a lesser *yantra* of the earth, and most of us depend on it for the protein it produces. The ocean is also a major contributor to the oxygen we breathe, and stores the carbon emissions from our burning of fossil fuels. A creek or river can be considered a lesser *yantra* of an entire watershed or river basin, with its tributaries linked to the sea. Water is the source of all life. Our hydrological modifications, pollution, overuse, and degradation of watershed ecosystems also contribute to our rising ecological insecurities. Each animal and habitat is connected to the greater *yantra* of the biosphere. The salmon swims upstream and downstream.

FIGURE 1.1 Sri Yantra of language, place, and knowledge.

These ecological connections are also reflected in the diversity of and interdependence of cultures and societies. Each aspect of the ethnosphere, as reflected in language and knowledge, can be considered a part of this biospheric *yantra*. Languages and knowledge systems are derived from generations of living in a particular place, as the stories are passed on from one generation to another, and as life's lessons are taught, remembered, and retold. Across the ethnosphere, communities are based on the intergenerational development of place-based language and knowledge that connects human beings to one another and to the natural world.

Over the past century and a half human activity has pushed the earth into a critical mode; four of the nine "planetary boundaries" have been crossed (Steffen et al. 2015). Biodiversity loss, fertilizer use, climate change, and land use are key planetary boundaries that have been crossed by human activity. A *tipping point* is the estimated point where an essential component of the planet's ecosystem can no longer function in the same way, nor can the system provide the types of ecosystem services that human beings depend on. Biodiversity loss is an important facet of the decline in the integrity of the biosphere. We are reaching the boundary of many of these biospheric tipping points, such as the sub-

stantive decline in native species diversity, and increasing social and economic risks and ecological insecurities will likely result.

One planetary boundary is the loss of biospheric integrity. This is the core of the entire planet's ecology, and will have cultural and social impacts. With respect to the warming of the globe, Steffen et al. (2015) write that a rise of 2 °C is a "risky target for humanity." An earlier study led by Hansen (2005) found that a warming of more than 1 °C, relative to 2000, will constitute dangerous climate change as judged from likely effects on sea level and extermination of species. Accordingly, Steffen et al. recommend a target closer to 1 °C in order to maintain both the climate and biospheric aspects of the planet's ecosystems.

We can expect substantive declines in primary and secondary levels of productivity of the world's ocean (Schubert et al. 2006). As the health of the ocean declines, the protein available from the sea declines. We can expect a major protein deficit in the near future; demand for protein sources from the sea increases, while the supply diminishes. A similar scenario is projected for cereals, grains, and other carbohydrates that are derived from farming. Supplies will be threatened by climate change, yet the demand from a growing population will continue to rise. All life will find it more difficult to adapt to the challenges that lie ahead. Scientific information clearly shows that we are losing essential terrestrial and aquatic ecosystems (Barnosky 2008; Steffen et al. 2015) and that significant degradation of the ocean's life-giving qualities is likely (Blunden and Arndt 2015; Baugrand et al. 2015; McCauley et al. 2015). In the journal *Science,* McCauley et al. (2015) indicate that marine ecosystem loss and degradation will increasingly become a major threat to the health and integrity of the biosphere. Climate change will impair the capacity of marine life to adapt to the other human impacts on coastal and marine ecosystems, and threats such as the continued warming of the ocean, sea level rise, and ocean acidification are likely unstoppable (Blunden and Arndt 2015). The major changes in ocean ecology will be longer-term. At least 1,141 of the 5,487 mammal species on earth are known to be threatened with extinction. One in four marine mammal species may go extinct. Between 1970 and 2010, the World Wildlife Fund (2014) reports the following global trends:

- Terrestrial wildlife is estimated to have declined by 39 percent.
- Marine life is estimated to have declined by 39 percent.
- Freshwater wildlife is estimated to have declined by 76 percent.
- Human population grew by 185 percent.

Simply reducing greenhouse gas emissions, for example, will not resolve the multiple problems and large-scale effects of ocean acidification (Feeley et al. 2008), or the steady decline in native-species diversity. There is no simple solution to the loss of endemic plants and animals that is caused by human activities. There is no simple institutional accommodation to the multiple threats and impacts associated with large-scale climate and ecosystem-based disturbance. In addition, we need to protect and preserve the traditional knowledge systems of the planet, because this knowledge has shown to be essential to cultural adaptation and resilience (Maffi and Woodley 2010).

Large-scale, centralized, and bureaucratic institutions are ill suited to address and respond to the social and ecological challenges associated with wicked climate change (Lazarus 2009). As Lazarus notes, "Ecological injury resists narrow redress; due to the highly interrelated nature of the ecosystem, it is almost always a mistake to suppose that one can isolate a single, discrete cause as the source of an environmental problem. A broader overview that accounts for the full spatial and temporal dimensions of the matter is needed. Failure to pursue such an overview is likely to result in an approach that is at best ineffective and at worst unwittingly destructive because of unanticipated consequences" (1181).

Lazarus provides a detailed characterization of why institutional reform and innovation is very difficult in the United States, given the intergovernmental framework and the fragmented nature of government authority. One reason for the failure of governmental response is the nature of intergovernmental conflict that is produced in climate-related adaptation and mitigation planning. In general, the larger the biophysical scale of the threat and pressure, the larger the scope of conflict between diverse interests, values, and belief structures in institutional processes. *Scope of conflict* is a term Schattschneider (1960) developed to explain how institutions often fail to address highly contentious issues and often respond by trying to control conflict rather than to resolve conflict. The scope of conflict is a reflection of the number of diverse participants in a decision-making situation. Schattschneider argued that government often attempts to control conflict by limiting the range of diverse voices, values, and interests expressed in an institutional context.

The importance of the connection between conflict and choice is described in Schattschneider's classic work, *The Semi-Sovereign People* (1960, 18): "There is nothing intrinsically good or bad about any given

scope of conflict. Whether a large conflict is better than a small conflict depends on what the conflict is about and what people want to accomplish. *A change of scope makes possible a new pattern of competition, a new balance of forces and a new result,* but it also makes impossible a lot of other things" (emphasis added). As the scope of conflict expands, institutions will attempt to control the conflict by reducing the scale under consideration in the negotiating process. With respect to the scope of conflict and the large-scale characteristics of climate change, this process of negotiating ecology can be considered as follows. First, value-based conflicts emerge and are shaped by the physical or "characteristic" scale of the level of risks and impacts to ecosystems and society. The larger the scale of impact, the greater the conflict between values, interests, and beliefs in society. The more conflict in society, the less likely it is that decision-makers and stakeholders will support the large-scale institutional responses that are needed to address the myriad threats and impacts from climate change. The more conflict, the more likely that major policy development in support of climate adaptation will be put off to the future. For instance, climate adaptation and mitigation plans from government continue to emphasize the reduction of greenhouse gases and renewable energy development. Yet, reducing greenhouse gas emissions and renewable energy development cannot address the long-term social and ecological impacts of climate change. In this sense, reducing greenhouse gas emissions is an example of reducing the scope of the wicked problem to that of an energy or emissions issue.

In super wicked problems we cannot depend on scientific consensus to resolve conflict. Indeed, scientific information can contribute to the conflict over how to address and respond to climate change. One challenge is that there is less predictability in climate science as the scale of the problem and threat expands to consider larger-scale threats and risks. There remains a paucity of information on the social and ecological threats and pressures associated with climate change, and this is particularly the case when one considers an entire oceanographic province or biome. The argument that we should accord deference to the sciences in adaptation planning and decision-making arises from the ability of scientists to advance claims about consequences with a high degree of confidence. With respect to climate change, scientific confidence is low (or uncertainty is high). Given the high degree of scientific uncertainty, scientists lose their claim to special political deference in debates over why or how to respond and adapt to climate threats and impacts. In these decision-making situations, scientific knowledge is

much less likely to be regarded as a reliable guide to the evaluation of loss or gain associated with particular consequences, such as the estimated loss of habitat or impacts on the integrity of a marine ecosystem.

The process of scientific discovery is not based on some type of general consensus among those who study nature. We cannot depend or rely on scientific consensus before we act. With respect to ecology as a science, Shrader-Frechette and McCoy (1993) show that ecology is fraught with basic uncertainties about issues central to the protection of native species and ecosystems. There are disagreements over methodology and epistemology that drive the scientific enterprise. The burden of proof, values, politics, and other qualitative aspects of decision-making play an influential role in the negotiation over how to address and respond to climate change. These disagreements and conflicts over how to respond are inevitable consequences of the intermingling of scientific facts and values.

Simply put, for the super wicked problem of global climate change (see box) there is no simple cultural resolution, legal remedy, institutional innovation, or social response that can address the multi-scale and multidimensional nature of the challenge. Building on this concept of the super wicked nature of climate change, Levin et al. (2012) define super wicked problems as having the following characteristics:

- Time is running out. The problem of climate change become more acute and difficult to resolve over time and across space.
- No central authority. There is a lack of policy and planning across scales to address ecosystem-wide and socio-cultural tipping points associated with climate change.
- Those seeking to solve the problem are also causing it. Our reliance on fossil fuels in the global economy continues to exacerbate the problem of global climate change. Government is unwilling to address and respond to climate change because of the perceived impacts on the global economy. While government focuses and defines the problems in terms of renewable energy use or greenhouse gas emissions, other issues related to climate change, such as biodiversity loss and the degradation of ecosystems, are not addressed by elected officials or by resource agencies.
- Policies discount the future irrationally. Issues of equity and fairness are deferred to future generations and those who are less capable of addressing and responding to the problem.

Properties of Super Wicked Climate Problems

- *The scope of change.* The more greenhouse gases continue to increase, the more dramatic will be the ecological and cultural consequences of climate change. The longer it takes to address and respond to the challenges of climate change, the harder it will be to maintain the ecosystems of the planet.
- *The challenge of adaptation.* Those who are more able to address and respond to the problems of climate change (e.g., developed countries) continue to cause more impact and have failed to develop plans to adapt to large-scale ecosystem degradation. There are few incentives in industrialized economies to curb the continued use of fossil fuels and to limit growth.
- *The scope of the problem.* No existing institutional frameworks and arrangements have the ability to develop an integrative, holistic, and comprehensive governance system that can address and respond to the multiple threats and impacts from climate change. Institutions rarely address the large-scale temporal and spatial features and properties of ecosystem-wide changes. There are no global-scale institutions to address and respond to the global-scale changes associated with climate-related threats and pressures.

Ultimately, adapting and responding to climate impacts necessitates ethical and economic choices about how to maintain security and how to resolve conflict (Barnett 2003; Barnett and Adger 2007). As a super wicked problem, the challenge of adapting to climate change inevitably involves a fundamental social, economic, and cultural paradox—we support the values associated with growth, and this growth is based on an addiction to oil and coal that significantly degrades and threatens the life-giving values of the biosphere. We continue to whittle away at the ecosystems we depend on for survival.

We can hope for large-scale changes and policy innovation by centralized government elites or international agreements or conventions. But there are practical and necessary small steps that should be taken at local and bioregional levels that can foster longer-term changes in our behavior and lifestyles. Wendell Berry (2015) writes:

> The needed policy changes, though addressed to present evils, wait upon the future, and so are presently non-existent. But changes in principle can be made now, by so few as just one of us. Changes in principle, carried into practice, are necessarily small changes made at home by one of us or a few

> of us. Innumerable small solutions emerge as the changed principles are adapted to unique lives in unique small places. Such small solutions do not wait upon the future. Insofar as they are possible now, exist now, are actual and exemplary now, they give hope.

We can begin to address and respond to the impacts of climate change at the bioregional scale. I believe bioregional responses can be a hopeful turn to take responsibility for one's actions at a community-wide level; a community-based response can be the hopeful tone of light that is born out of the darkness and despair. Place remains a binding force, and a galvanizing force for change.

BIOREGIONAL ADAPTATION

A bioregional approach to adapt and respond to climate change can be an essential first step. A bioregional approach to climate adaptation can address issues that contribute to climate change and ecosystem decline, such as changes in local land use, regional biodiversity conservation, small-scale agricultural and fishing practices, and other human activities. A turn to greater understanding and strengthening of one's relationship to place can represent a first step toward addressing the range of local social, economic, and ecological challenges we face.

Bioregionalism is not another form of "environmentalism." An environment is something to behold, as if it exists outside of the human experience. The concept of "the environment" is a shallow one, devoid of the intimate relationships and partnerships that exist in diverse cultural systems. Ecological thinking reveals a much deeper approach to nature; the science and sensibility of ecology can provide us with way forward to strengthen our understanding and relationship with nature as a *life place*.

There are a number of articles and books on the subject of bioregional theory and practice (Sale 1985; Evanoff 2011; Lynch, Glotfelty, and Armbruster 2012; Cato 2012). I have provided a general survey of this literature elsewhere (McGinnis 1999a). Cultural historian Kirkpatrick Sale (1985) traced the evolution of bioregional theory to a two-hundred-year tradition of countercultural values that share a more critical stand against bureaucratic authority, centralized governance, and materialistic society. It can also be traced to the community-based lifestyles that exist across the world—from indigenous and tribal societies to contemporary provincial peoples. The diverse place-based bioregional movement can also be understood s a form of post-primitivism insofar as it is based on

an ecological identity that recognizes the value of being "native" to a place. Becoming native to a place can only be gained by careful observation of walking a watershed, upriver and downriver, into the bush or forest, to the peaks of a coastal range, and then sharing the knowledge with others. It takes a long time to be a true resident and inhabitant of a place, and it takes cooperation and hard work with the other members of a community to be a citizen of an ecosystem.

Thomas Berry (1988) describes six "functional" characteristics of bioregional practice: self-propagation, self-nourishment, self-governance, self-education, self-healing, and self-fulfilling activities associated with place-based lifestyles and community-based identification. For Berry, the "self" is part of a more-than-human community: there is no separate world. A sense of an ecological self emerges in the practice of place (Thayer 2003; Berg 2015). While place can carry the resources that are needed for human beings and other species to survive, a place is much more than a bundle of commodities to be packaged, like lettuce or sardines, to be exported overseas. A place is a living community. As Robert Thayer (2003, 6) writes: "Embedded in the bioregional idea, therefore, is a very general hypothesis: that a mutually sustainable future for humans, other life-forms, and earthly systems can best be achieved by means of a spatial framework in which people live as rooted, active, participating members of a reasonably scaled, naturally bounded, ecologically defined territory, or life place."

One early advocate and activist of bioregional lifestyles was Peter Berg, who wrote, "You are in a bioregion, an ecological home place that has distinct continuities that affect the way you live and are affected by you" (quoted in Glotfelty and Quesnel 2015, 4). Gary Snyder (1990, 43), one of the great ecologically grounded poets living today, expresses a bioregionally oriented sentiment that clearly notes the difference between relying on centralized government and a place-based manifesto: "We seek the balance between cosmopolitan pluralism and deep local consciousness. We are asking how the whole human race can regain self-determination in place after centuries of having been disenfranchised by hierarchy and/or centralized power. Do not confuse this exercise with 'nationalism,' which is exactly the opposite, the impostor, the puppet of the State, the grinning ghost of the lost community."

BIOCULTURAL RESILIENCE

There are a number of common dimensions to the concept of bioregionalism and the more recent notion of *bioculturalism*. An integrative and

holistic approach to viewing the world culturally and ecologically is through the lens of biocultural diversity (Maffi 1998). Bioculturalism recognizes the interdependence between cultural knowledge systems and language and the maintenance of ecological diversity (Hong 2013). Wade Davis describes the importance of language and diverse knowledge systems throughout the natural history of coevolution between peoples and places. In his 2007 TED talk, Davis stated, "Together the myriad cultures of the world make up a web of spiritual life and cultural life that envelops the planet, and is as important to the well-being of the planet as indeed is the biological web of life that you know as the biosphere." The ethnosphere comprises a diversity of place-based knowledge systems and languages. The relationship between situated knowledge, language, and place is a product of the evolutionary response of people who have adapted to the specific characteristics of a region's ecology. The coevolution of place and people is reflected in the language and knowledge systems that have been developed to respond to changes in bioregions (Maffi 1998). The synergy between social and ecological systems forms an experiential form of knowledge that fosters resilience and adaptation to changes that have often included major climate-related changes to regional ecosystems.

Maffi describes the importance of bioculturalism—the irrevocable connection between local peoples and their natural world and place—to cultural adaptation and survival. Place-based knowledge has long served cultural adaptation. Comprising about 4 percent of the world's population, traditional societies remain essential stewards of over 20 percent of the Earth's terrestrial and aquatic ecosystems, and therefore maintain roughly 80 percent of the native species diversity on the planet (Maffi 1998). The challenge today is to develop a place-based science and sensibility that can serve ecological resilience and adaptation.

The brutal facts of climate change have yet to sink in, and our adaptive capacity and capability are being put to the test. But more troublesome is the lack of intuitive and experiential knowledge of place. Accordingly, our choices of how to respond and adapt to climate change become shallower and less meaningful. As our collective responses to the multiple threats, pressures, and impacts of climate change are put off, the challenges of adaptation grow greater, our ecological insecurities become more pronounced, and our general capacity to adapt in time becomes less likely.

CALIFORNIA'S REVOLUTIONARY CLIMATE

California is one of the five Mediterranean-type ecosystems (MTEs) that have a rich natural history that includes long periods of ecosystem and climate-related disturbance events (Klausmeyer and Shaw 2009). Throughout the diverse histories of MTE-based cultures there have been many examples of adaptation and failed adaptation to climate change (Rundel, Montenegro, and Jaksic 1998). MTEs are far from homeostatic or stable systems (Blondel and Aronson 1999). The MTEs of the world are unique biomes that share a common natural history—human beings have had to adapt to major climate events such as flooding, earthquakes, fire, and changes in the availability of water and food (Barnes and Dove 2015). Indigenous societies in California adapted to climate change by migrating to other areas, changing their diet, and changing their behavior (Raab and Jones 2005).

This history of climate change is reflected in scientific studies in the Santa Barbara Basin that examine samples of sediment cores from the bottom of the Santa Barbara Channel. For the past twenty years scientists have been assessing sediment cores, and they find a history of oceanographic regime shifts that are both long-term and short-term climate events (Kennett and Ingram 1995). Long-term changes in sea surface temperature, or what oceanographers refer to as *regime shifts*, reflect consistent transitions from warmer to cooler water and back again. For thousands of years, marine life adapted to these shifts by moving north, up the coast, to the cooler waters of the California Current (Moffitt et al. 2015). There is no evidence that marine life became extinct during the last several thousands of years of long-term shifts in sea surface temperature. Shorter-term shifts in sea surface temperature are associated with the cycles of El Niño (warmer water) and La Niña (cooler water). Humans and other species coevolved to adapt to these colder and warmer water regimes. But because of human use of marine species and the destruction of habitat, both on land and in the sea, species like the white abalone were not able to adapt.

At the regional scale, the diverse ecosystems of California are influenced by climate change in many different ways. Changes in the oceanographic currents, the atmosphere, and biology influence the ecosystems of the state. In general, California is a "revolutionary" climate that includes a natural history of long-term droughts, major flood events, earthquakes, and fire. California experienced long-term droughts or

extreme hydrological shifts in 892–1112 (220 years) and 1209–1350 (141 years) (Davis 1991). The longest drought of the twentieth century lasted only six years, during 1987–1992 (Priest 1993). Today's drought is the worst in 1,200 years (Griffin and Anchukaitis 2014).

The California Floristic Province is one of the most important areas for biodiversity in the world. Like other inhabitants of Mediterranean-type bioregions, Californians are increasingly vulnerable to shortages of water, food security issues, changes in climate, and other potential threats and pressures. In virtually every place you walk, the history of a changing landscape is under your feet. Climate change will lead to dramatic loss of native species diversity. Many species that are listed as threatened or endangered due to human impacts, such as habitat fragmentation, overuse, and the introduction of invasive species, will find it more difficult to adapt to climate-related impacts. Climate change will impair the capacity of species to adapt.

One consequence of climate disturbance in California will be a shift of biodiversity to the north (Loarie et al. 2008). The native plants unique to California are very vulnerable to global climate change, such that two-thirds of these "endemics" could lose more than 80 percent of their geographic range by the end of the century (Loarie et al. 2008). Scientists at the U.S. Geological Survey developed the Coastal Vulnerability Index to assess the physical vulnerability of the California coast. They found that from San Luis Obispo to the Mexico border, communities have "high" or "very high" vulnerability to climate change. Many areas in the coastal watersheds of California are recognized as threatened "hot spots" for biodiversity (Stein, Kutner, and Adams 2000). Climate change has direct and indirect impacts on these species and their habitats, especially designated critical habitat and environmental sensitive habitat areas. Existing protected areas, such as ecological reserves, wildlife areas, mitigation sites, and easements will likely be impacted by climate change.

Indigenous cultures in California also adapted to short- and long-term changes in the climate. Anthropologists have shown that before the colonization, terror, and conquest of prehistoric California early tribal societies adapted to climate change in myriad ways (Raab and Jones 2004). Like other tribal societies, prehistoric societies in California adopted to the drought and famine that were often associated with long-term and large-scale climatic events (Barnes and Dove 2015). These resilient indigenous societies were irrevocably connected to the landscapes and seascapes they inhabited, and their biocultural knowl-

edge served adaptation across thousands of years. Biocultural knowledge was grounded in an intuitive sense of the changes that were occurring in their respective bioregions, and the knowledge gained by direct human participation in a more-than-human community.

The historical record shows that there have been long periods of drought, famine, fire, and other major disturbance events in California. For thousands of years indigenous peoples adapted to these events by developing new social norms and behaviors (Fagan 2004). In many cases, adaptation contributed to migration of traditional peoples to safe havens or refuge areas (Barnes and Dove 2015). In the case of California tribal peoples this included migration from inland areas closer to the coast and river systems. Migration was not without conflict, and new archaeological studies show that tribes were in conflict over scarce resources during difficult times like climate events such as long-term drought, flooding, and famine (Raab and Jones 2004). California's indigenous cultures adapted to long-term climate events by using traditional ecological knowledge systems (Johnson 2000). The coastal inhabitation by early maritime cultures of south-central California reflected unique place-based languages and kinship relationships (McGinnis and Cordero 2004).

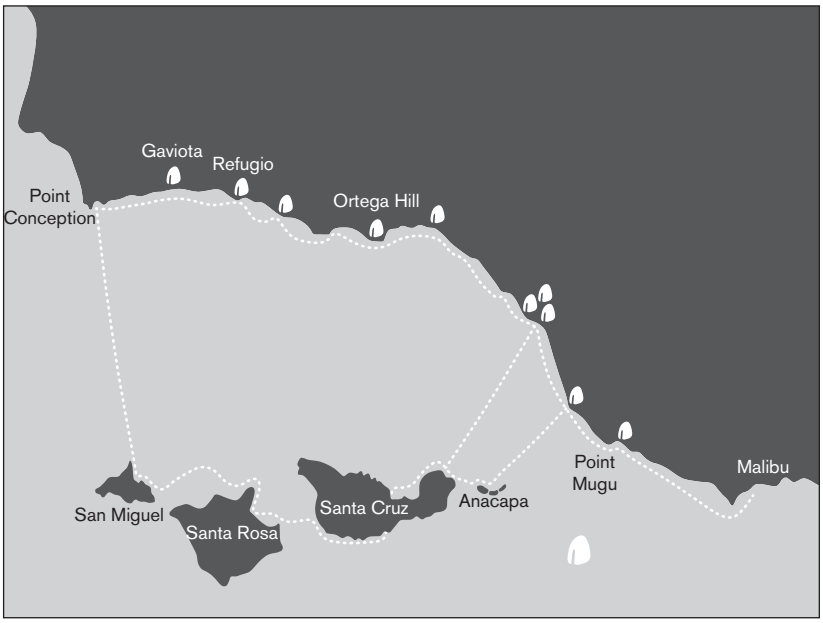
The languages and customs of diverse indigenous Californians often reflected the soft boundaries of a watershed, river basin, or bioregion. For example, the diverse Chumash people spoke different but related languages in distinct but interdependent parts of the bioregion. The people were heavily dependent on a healthy marine environment; the marine component of the Chumash diet consisted of over 150 types of marine fishes as well as a variety of shellfish including crabs, lobsters, mussels, abalone, clams, oysters, chitons, and other gastropods. Shellfish were essential to the Chumash economy and material culture (Erlandson et al. 2011). Archaeological research shows that Chumash people adapted to climate change by changing their use of coastal marine resources (King 1990).

Portions of coastal areas on the northern Channel Islands were sites of Chumash villages, and are now submerged by changes in sea level. Thousands of years ago the sea level was at least 150 feet lower than it is today, and the northern Channel Islands were joined as one island. Recently discovered paleontological remains have also contributed to the rich record of the coastal area. In 1994, for example, a relatively complete pygmy mammoth was discovered on a coastal bluff on the north shore of Santa Rosa Island. This discovery represents the most

complete pygmy mammoth discovered in the world to date. Early human remains of a woman (named Arlington Springs Woman) were discovered at Arlington Canyon on Santa Rosa Island, dating back to the end of the Pleistocene, approximately 13,000 years ago.

It is difficult to imagine the depth of cultural values and understanding of place in prehistoric California that fostered adaptation. New cultural norms and behavior emerged to respond and adapt to major climate-related events in California (Raab and Jones 2004). The establishment of sacred lands was likely an important part of the preservation of refuge for species and unique plants that served adaptation. Descendants of the Chumash consider the northern Channel Islands a special place, still occasionally paddling these waters in *tomol*s or wooden canoes (McGinnis and Cordero 2004). The first *tomol* to be owned by the Chumash people since the 1880s is the *'Elye'wun* (swordfish), which was built by the Chumash community in 1996–97 under the leadership of the Chumash Maritime Association. The swordfish is symbolized by abalone inlay carved and embedded in the bow of the *tomol*. In this sense, the *tomol* is the swordfish and leads the paddlers to the island. The building of the *'Elye'wun* and the crossing to Santa Cruz Island is a manifestation of a new effort by the Chumash people to reconnect and restore their relationship to the sea and the northern Channel Islands. The ceremonial paddle across the Santa Barbara Channel from the coastal mainland represents the culture's affirmation of the deep connection between the Santa Ynez Mountains, the coastal watersheds, the marine system, and the northern Channel Islands (map 1.1).

Abalone was a staple of the Chumash diet (Erlandson et al. 2011). White abalone (*Haliotis sorenseni*) is a marine snail, a deep-water species found at between 80 and 200 feet on rocky reefs from Point Conception to Punta Abreojos in Baja California, Mexico (Leet 2001). Highly prized for their tender white meat, white abalone were harvested in an intense commercial and recreational fishery that developed during the 1970s, then quickly peaked and crashed as the abalone became increasingly scarce. The biological collapse of white abalone was brought on by changes in sea surface temperature, overfishing by commercial fishers, and withering foot disease. As the abundance of the species declined, its capacity to adapt to the changes brought on by human beings was diminished. The rarity of this species within its historical center of abundance prompted the National Marine Fisheries Service to list it as a candidate species under the Endangered Species Act in 1997. In May 2001, the white abalone became the first marine inver-



MAP 1.1 *Tomol* routes of the Chumash, off south-central California, in 13,000-plus years of inhabitation.

tebrate to receive federal protection as an endangered species in the bioregion (California Department of Fish and Game 2001). The plight of the white abalone is a symptom of a much larger-scale threat to the coastal marine ecosystems of the bioregion. Note that this was the first benthic (bottom-dwelling) species to be federally listed. The listing of such species as threatened is an indication that human activities challenge the adaptive capacity of many species that have historically been able to respond to climate-related events.

BIOREGIONAL INTEGRATION

One fundamental question is whether we have the necessary intuitive and local, place-based knowledge to recognize the multiple dimensions of threats posed by climate change. We need to cultivate a renewed sense of place and community as a first response to the challenge of maintaining biocultural systems in an age of climate change. Without a greater understanding of the particular ecosystems we inhabit, we cannot notice the change in the local ecosystems we depend on. A

place-based approach to climate adaptation requires a more integrative, holistic, and ecologically grounded practice and lifestyle.

Unlike in the past, there are few safe refuge areas to migrate to in this Anthropocene age—we have diminished the life-producing qualities and characteristics of the biosphere to the point that there are few climate refugia remaining for either human beings or other life forms to adapt. There are three interrelated challenges today. First, we no longer have refuge areas to migrate to, to survive the consequences of climate change. Second, the consequences of today's social and ecological crisis brought on by climate change and the overexploitation of resources are much more complex and devastating than the past. Third, we lack a knowledge-based and intuitive understanding of the nature of the crisis we face, and are at present unable to respond and adapt to the wicked nature of climate change.

In response, the formidable task of beginning the long-term process of adaptation includes a fundamental economic challenge to resist the "grinning ghost" of globalization. First, working in the bioregional template requires changing our behavior to respect the productive capacity of local ecosystems. The trade of local-scale resources to global markets ultimately undermines the ecology of the planet. Second, because of the multiple values associated with ecosystems, there are many stakeholders, interests, and user groups that will be in conflict over the access to, use of, and distribution of resources. Consider those that are always present: governments and consumptive users of the sea. In addition, there are activists and would-be investors from outside. These groups have conflicting goals and values. The art of integrative, bioregional, place-based adaptation under these conditions is to integrate conflicting values, at least temporarily, so as to make agreements on resource use and other protective actions that are needed to identify and sustain essential climate refuge areas, and that can better reflect the productive capacity of local ecosystems. Third, there are the challenges of adaptation and resilience, which require new modes of learning and partnership building. We need to stop whittling away at the stick, protect essential ecosystems to serve ecological resilience, and curb the overuse and globalization of resources. Local ecosystems cannot be sustained if they remain traded as commodities in a placeless global market.

To strengthen the localization process of economic production and consumption, figure 1.2 includes a depiction of three key values of bioregional integration. Bioregional integration (see box) includes the value of protecting a people's connection and relationship to place, their

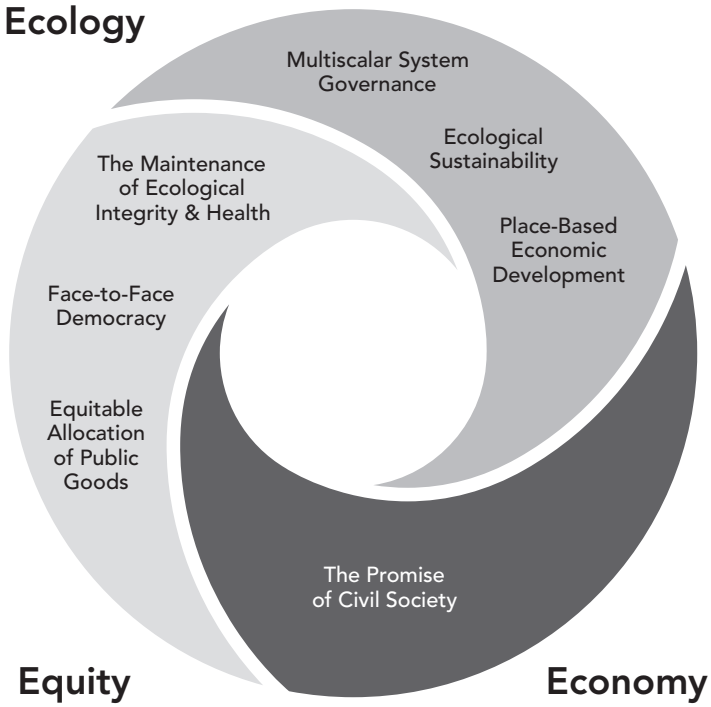


FIGURE 1.2 Three key values of bioregional integration.

specific landscape or seascape (water, food, and air—or collectively, the "commons").

Science and scientists have a role in informing society, but the quest for a "recovery of the commons" (Snyder 1995a) will require a fundamental shift in value orientation and, in some circumstances, the protection of the cultural values that support the "natural contract." We cannot predict or control ecosystems; we can only control human behavior (e.g., our modes of production and consumption) and associated impacts. We influence ecosystem dynamics, but we cannot manage ecosystems.

THE PATH FORWARD

In *Space and Place: The Perspective of Experience* (2001), geographer Yi-Fu Tuan puts forth the equation, "space plus culture equals place." Tuan's equation can appropriately be applied to the landscapes and seascapes we depend on and are irrevocably connected to. Global climate

Principles of Bioregional Integration

A number of principles support bioregional integration, including but not limited to:

- restoring the relationship between place and the economic mode of production and consumption
- protecting rural lands and local agriculture
- establishing biodiversity policies that also support the values of intergenerational equity and environmental justice
- developing regional markets for regionally produced products
- creating value-added programs for sustainably produced resources
- assessing and monitoring economic strategies based on their ability to detect long-term trends in changes to economic security, and with respect to the causes of significant ecosystem change
- emphasizing cooperative, inter-jurisdictional, cross-boundary conservation partnerships that can cultivate the necessary place-based, social, and economic alliances, with potential new roles for government and nongovernment groups.

change has a large-scale spatial and temporal dimensions that are difficult to comprehend. A space has little soul or spirit apart from the interdependent natural features of the places we occupy. Space becomes place and one's region when social identity is influenced and shaped by the vernacular and provincial characteristics of home and community. With respect to the impacts of climate change, we cannot fully understand place without acknowledging the impacts of climate disturbance on the remnant native features and on our respective communities. Space becomes place when we recognize that nature not only provides the sustenance of life but is also the source of ritual, myth, story, and cultural celebration. A return to one's place can also represent an initial step toward adapting and responding to the impacts of climate change on our communities.

Though we have been taught to observe the world objectively, far removed from a natural world, we need to learn to be embedded in the systems we reside in, and relearn the meaningfulness and mindfulness of inhabitation. We need to be more engaged, attached, aware, and attentive to place, not as mere observers of an "environment" or consumers of resources but as participants in the more-than-human community. This book calls for a "recovery of the commons," which requires a fun-

damental shift in values to primarily supporting the life-giving qualities of ecosystems, rather than the short-term values of maximizing financial return and global resource use. Gary Snyder (1995a, 36) recognizes that "we need to make a world-scale 'Natural Contract' with the oceans, the air, the birds in the sky. The challenge is to bring the whole victimized world of the 'common pool resource' into the Mind of the Commons. . . . There is no choice but to call for the recovery of the commons, and this in a modern world which doesn't quite realize what it has lost."

This book includes case studies that explore the role of science and sensibility in how we relate to a river system, watershed, and coastal marine areas in diverse areas across the Pacific Ocean—in California, New Zealand, and the South Pacific. These case studies were chosen because most of us live along a river or a coastal area and are dependent on the ocean for survival. Today, over 50 percent of the world's population lives within 3 km of a surface freshwater body, and only 10 percent lives further away than 10 km (Kummu et al. 2011). In addition, more than half the world's population lives within 60 km of the shoreline, and this could rise to three-quarters by the year 2020. This means that most people depend on coastal marine and/or river systems for their ecological security. As noted earlier, these ecosystems are some of the most threatened in the world (Finlayson, D'Cruz, and Davidson 2005).

I refer to the relationship between science and values as a political process of *negotiating ecology*. The chapters address a number of tenuous relationships that exist today in this Anthropocene age: watersheds and the plight of wild salmon; dairy production and the creation of *wastesheds*; offshore oil rigs and the ecology of fishes; container ships and the killing of whales; and sea level rise and displacement of island peoples, among other issues and concerns. The book also offers a number of responses, including: localizing the primary modes of economic consumption; the protection of marine life; watershed-based activism; and the restoration of the landscape and community.

There are three major parts to the book. The first part focuses on rivers, watersheds, and wastes. In this section, I explore the relationships between science and values in the California watershed movement, coastal adaptation in the islands of the South Pacific, and watershed planning in New Zealand. Part 2 explores the role of science and values in marine systems in offshore California, the Gulf of Mexico, and New Zealand. Part 3 includes chapters on the importance of place and community as an essential prerequisite for cultural adaptation and

ecological resilience. The goal of the last section is to explore ways to recover a sense of place and community—or what Thoreau called in his essay "Economy," in *Walden* (1854), "the nourishing quality of the soil of the soul"—by describing how the cultivation of a place-based ecological sensibility represents an important first step in responding to the many challenges we face.

The case studies and respective chapters are reflections of a personal journey that I draw from as an educator, professional, and academic. One underlying theme is the importance of bioregional thinking and behavior. The book describes a number of principal elements of bioregionalism: homecoming, watershed-based activism, rethinking the mechanical sensibility, place-based consumption and preservation, respecting traditional knowledge, and bioregional restoration.

Homecoming

Chapter 2 is a reflection of my own homecoming and my place. An essential first step to addressing the particular problems we face in society and our treatment of nature is to become more acquainted with the other members of our more-than-human community. We are members of a community and bioregion that includes a circle of animals, plants, and insects. The word *community* derives from Latin *munus*, which has a number of meanings that are relevant here, including service, duty, gift, and sacrifice. A community is an assemblage of individuals bound by a relationship and partnership. This relationship and partnership are based on mutual obligation, exchange of gifts, and shared service. Homecoming is a process whereby one gains a deeper understanding and knowledge of one's place in the world and the needs of other species. I draw from my own experiential knowledge of my own place and region.

Watershed-Based Activism

Re-inhabiting a particular watershed commons represents an ideal place to start the homecoming process. Working with other members of a community is a trait of humanity, even though it seems to have been lost with respect to our globalizing modes of economic consumption and industrial production. Chapter 3 describes the evolution of watershed-based activism in California. A good way to start thinking about your relationship to the greater watershed is to engage and interact with

it. Participate in the river's flow, swim upstream or downstream as if you were a salmon, and cultivate a sensory and olfactory memory of place as if your livelihood (and that of your family and neighborhood) depended on it.

Chapter 4 describes the decline of watershed health across New Zealand. Despite the country's "100% Pure" branding, the watersheds of New Zealand are showing significant signs of degradation. This is, in part, one consequence of a major change in how the land is used and abused in the country. The mechanization and industrialization of New Zealand's watersheds has led to the creation of wastesheds: the watershed becomes a source of source of pollution and wastes. I also explore the importance of cultural heritage and ecological identity as ways to better conserve and restore the watersheds of the country.

Rethinking the Mechanical Sensibility

The mechanization and industrialization of the land is reflected in our poor treatment of marine ecosystems and our continued reliance on fossil fuels. We need to think more critically about the myriad impacts of the mechanization of place, and the impacts of this dependence on fossil fuels on our particular places and regions. An ecologically literate community understands that marine systems are a source of life; they cannot be replicated or replaced. Chapter 5 explores the politics and ecology of the future decommissioning of offshore oil activities in the marine areas of California and the Gulf of Mexico. Hundreds of offshore structures will be decommissioned in the near future. Public policy in these two marine areas is driven by values and diverse interests in the future of these offshore structures, and perceptions of what is "natural" or "artificial."

Place-Based Consumption and Preservation

Chapters 6, 7, and 8 focus on the need to protect marine life across the Pacific Ocean. The human impacts on marine ecosystems are a sign of the Anthropocene age, which is an informal geologic chronological term that marks the impacts of human activities on the earth's ecosystems. The term was coined in the 1980s by ecologist Eugene Stoermer and popularized by a Nobel Prize–winning atmospheric chemist, Paul Crutzen. The oceans are threatened by a combination of two modes of globalization: the global impacts of climate disturbance and the global

scale of economic consumption of marine resources. Coastal marine management should take into account the large-scale impacts of climate disturbance on coastal marine ecosystems that are being driven by the rise in sea surface temperature, changes in salinity, increasing acidification (changes in oceanic pH), and general declines in primary and secondary levels of productivity of the world's oceans (Schubert et al. 2006). Yet, as these chapters argue, human beings cannot control or manage the ecological processes that influence the productivity of the sea, we can only control human behavior, our consumption of marine life and associated impacts.

Without substantive change in value orientations and the approaches used to address the human impacts on coastal marine ecosystems, we will become more vulnerable and less secure in the face of climate change. Chapter 6 describes the politics and science that have influenced the designation of marine protected areas in California. Chapter 7 describes the challenge of marine governance in New Zealand. Chapter 8 describes the tenuous relationship between our reliance on container ships in our global economy and the whales of the California Current. Ultimately, the protection of the world's ocean requires the cultivation of place-based ocean constituencies that can support a renewed maritime sensibility and ethos—one that embraces not just the economic or instrumental use of marine resources that are traded in a global economy but recognition of the intrinsic place-based values of healthy coastal marine systems. Maritime communities should be recognized as distinct places worth protecting. Protecting maritime place requires the preservation of marine ecosystems. In a context of global climate change and global economy, a more ecologically integrative and holistic approach to resource allocation and biodiversity preservation is needed that can support particular maritime places and communities. Policies that support the up-scaling of marine life protection should be combined with down-scaling of the economic use of marine species in global markets to ensure that maritime communities can adapt and be sustained.

Respecting Traditional Knowledge

Chapter 9 focuses on the challenges faced by island peoples in this age of climate change and rising sea levels. With rising sea levels, islands are being lost and indigenous peoples forced to migrate, often to distant places. The climate refugee is placeless, a passenger on a sinking ship without a lifeboat. There is a need for a broader theory of justice that can

embrace other forms of knowledge and life in an age of climate change, and one that can address the plight of climate refugees. With the loss of these cultures and communities, we also lose the place-based knowledge systems that have long played a key role in supporting adaptation to previous climate-related changes. I propose a theory of biocultural justice that respects the diversity of epistemologies of maritime place, and links alternative knowledge systems (both traditional forms of ecological knowledge and scientific knowledge) with principles of sustaining ecological security. Biocultural justice represents a shift from "shallow," anthropocentric theories of social justice to a "deep" practice of an ecologically based theory of justice. Schlosberg (2012) and others support a spatial expansion of an epistemology of justice, horizontally into a broader ecological range of social issues and vertically into examinations of the global nature of injustices that are associated with food, energy, and water insecurity. This conceptual shift underscores the need to support a theory of justice that represents a deeper realm of human relationship with the more-than-human world, where protecting marine ecosystem health and integrity are understood as essential principles and conditions that can support a practice of justice. A concerted effort at the international level is needed that can support a theory of blue justice. For those who receive the burden of the socio-ecological costs and risks from climate change, international agreements and conventions are needed that can encourage the protection of people who will need to be relocated in the future.

Bioregional Restoration

Restoring place is the focus of chapter 10. The imagination plays a critical role in the path toward bioregional restoration. Bioregional restoration requires not only the act of replanting native plants along a creek's bank, digging out and removing invasive species, or restoring a river's flow to bring back wild salmon. Bioregional restoration also includes storytelling, theater, art, and ceremony that strengthen the connection between people with place. For many years, I dressed up as a salmon and gave presentations to children about the values of salmon. I told stories of the salmons' migration upstream, and discussed the ecology of salmon along the south coast of California. We also discussed the differences between the role of native habitat in the salmons' return, and what role our community has in restoring wild salmon to our creeks and rivers. Wearing the mask of the salmon was one way to strengthen the

connection to and awareness of the wonder of the natural world. The hope was that children would identify with the salmon, and perhaps teach their parents about how we can restore the species to our neighborhood creeks.

. . .

In the bright white and yellow glow of this day,
we turn to the mountains and think of the sea.
Today we can begin the hard work of community building—to
celebrate our connection to a creek, to the greater watershed,
to the bioregion—to celebrate our gift from the blue islands on our
horizon.
We are grateful for the gifts of this place and region.
It is the breath of our song, our clear winter breeze.
Let's celebrate this place with renewed partnerships, and a renewed
sense of community and continuity with others.
We should be grateful to the wild beings, their secrets, freedoms,
and ways.
We should be grateful to the sun-facing, light-changing sycamores.
We depend on this earthhousehold by the sea, this amphitheater by
the sea.
There are shadows of wild southern steelhead in this creek.
We should cherish the springtime bloom of ceanothus and Chinese
houses, monkey flower,
and the interface between the land, fresh and saltwater.