NORTH COAST RESOURCE PARTNERSHIP

NORTH COAST HEALTHY WATERSHEDS & VITAL COMMUNITIES

Economic Analysis

EARTH ECONOMICS

Author:
Earth Economics

April 2018

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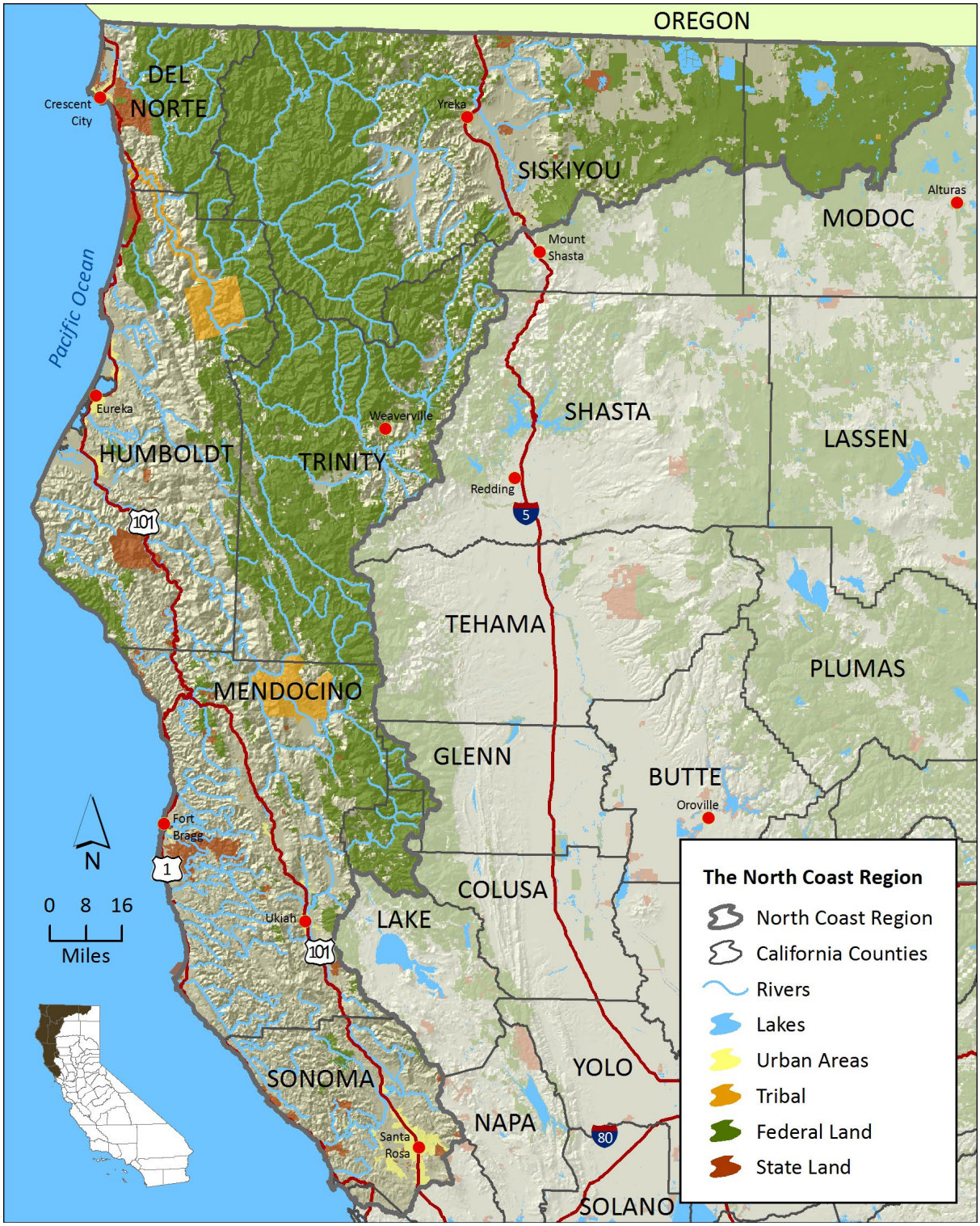
INTRODUCTION

The North Coast of California has a vibrant and diverse economy endowed with skilled, energetic, dedicated people and impressive natural capital assets including towering redwood forests, productive agricultural lands, abundant clean water, productive marine waters, spectacular deserts, stunning coastlines, and mineral and energy production. People have inhabited this region for tens of thousands of years. Despite a history of dispossession, Native Americans in the North Coast continue their proud cultural heritage while also taking a leadership role on innovative advancements.



The North Coast region includes some of the least populated areas of California, such as Modoc County with 9,000 people, and more populated counties, such as Sonoma County with 497,000 people. The region provides food, water, fiber and energy to support the Bay Area and Los Angeles, feeds people across the Pacific, and entertains visitors from around the globe. Most importantly, the region provides a high quality of life for most residents and has the potential for even greater economic prosperity.

Economies constantly transform. Take a look at photos from 100 years ago, and it's clear that every sector of the North Coast economy has transformed. Over the past 100 years, the North Coast evolved from mainly extractive activities (fur, gold, timber, agriculture) to more stewardship-based and service-oriented activities (outdoor recreation, education, sustainable forestry) today. However, at every step along the way, natural capital assets have been foundational to these economic sectors. In addition, human innovation and strong institutions have played an important role. From computer technology to cattle genetics, that dynamism continues. While extractive industries remain, they can now be augmented and influenced by changing market values and opportunities that support local economic health while also ensuring the long term health of the local natural resources. Moving forward, the North Coast economy of the 21st century can further advance value-added goods and services. The diverse economy and ecology that exists across the region requires an economic vision for the future that takes advantage of the value provided across every economic sector.

Today, economists recognize four sectors of capital value that contribute to economic prosperity, ecological health and a high quality of life, and all are present in the North Coast.

- *Built capital* is the stuff we make, such as bridges, electricity, houses, toys, roads, and tables.
- *Human capital* consists of our individual health, education and skills.
- *Social capital* includes our institutions, laws, culture, and how we treat each other.
- Finally, *natural capital* encompasses the natural world that contains all of us and our economy forests, wetlands, deserts, the geology, oceans, atmosphere, biodiversity, abundance of life, climate and ecosystems in general. All of our built capital is derived from natural capital.

A successful economy strikes the right balance of investments in built and natural capital. Conservation lands and National Parks are critical natural capital assets, just like mines and timberlands support the production of critical built infrastructure. Natural and built capital that is complementary (i.e. works together) supports community resilience, equity, and health as well as core "services" that cities and rural communities depend upon, like flood protection, water supply, water quality, and recreation.

To truly succeed economically in the 21st century, the communities of the North Coast region needs to pursue the creation of more integrated economic models. Building the links between sectors and infrastructure is a path toward greater efficiency, productivity, increased employment and rising wages. Wireless technology already enables greater agriculture productivity by reducing over or under irrigating areas of a field. Watershed and forest health provides disaster risk reduction, timber, habitat, and clean water. By identifying the "ecosystem services" provided in the North Coast, as highlighted in the Earth Economics, *Technical Report for the North Coast of California Ecosystem Service Valuation*, 2016, other economic opportunities and funding mechanisms also emerge.

Section 1 below provides a brief economic profile of the North Coast economy, and Section 2 provides some examples of innovative, integrative efforts underway locally and beyond.

SECTION 1. ECONOMIC PROFILE OF THE NORTH COAST

Table 1. Basic economic statistics for counties in the North Coast[1]

County	Population	Median Age	Median Household Income	Median Property Value	Total Employment	Unemployment Rate[2]
Del Norte	27,628	38.8	42,363	183,700	9507	6.0
Humboldt	135,182	37.4	42,685	279,300	73,265	3.6
Mendocino	87,409	42.2	43,510	308,400	52,607	4.2
Modoc	9,033	47.8	41,194	153,100	2,994	8.1
Siskiyou	43,668	47.8	38,524	174,700	20,758.67	8.2
Sonoma	497,776	41.2	66,833	512,100	367,315	2.8
Trinity	13,180	50.3	35,270	263,100	3721	5.7

Table 2. Top 3 industries per county, number employed, and percent of total employment (as of September 2017)[3]

County	Local Government	State Government	Education and Health Services	Trade, Transportation, and Utilities	Natural Resources and Mining	Leisure and Hospitality
Del Norte	**1,922** (23%)	**1,493** (18%)	**1,432** (17%)			
Humboldt	**9,239** (19%)		**8,670** (17%)	**9,762** (20%)		
Mendocino	**5,876** (18%)		**5,817** (18%)	**6,254** (19%)		
Modoc	**845** (33%)			**312** (12%)	**403** (16%)	
Siskiyou	**2,930** (20%)		**2,093** (14%)	**2,037** (14%)		
Sonoma			**34,012** (16%)	**36,393** (17%)		**25,645** (12%)
Trinity	**758** (27%)		**372** (13%)	**452** (13%)		

SECTION 2. REGIONAL SECTOR HIGHLIGHTS

This section describes a few of the critical sectors that support the North Coast economy, along with case study examples from the North Coast and nationally. These areas should be carefully considered in future economic and infrastructure planning:

ECOSYSTEMS

The North Coast economy is housed within and is dependent on healthy landscapes and ecosystems. Just like its roads, buildings, water treatment plants, and levees, the North Coast's ecosystems are important economic assets. The North Coast region produces a multitude of ecosystem goods, such as timber, salmon, wild mushrooms, milk and cheese, wine, and clean water, among others. Many of these products are bought and sold in markets, and they have a known economic value. Natural and working landscapes in the North Coast region also provide a suite of ecosystem services that—although less tangible than the goods outlined above—provide economic value, such as flood risk reduction, carbon sequestration, groundwater recharge, recreation opportunities such as hiking and camping, and the removal of air pollutants. An ecosystem that reduces the risk of flood damage, for example, also provides benefits by protecting local jobs, preventing costs such as infrastructure repairs, reconstruction, and restoration, and by keeping people safe. Box 1 describes an example of a managed ecosystem that enhances habitat while taking advantage of multiple revenue streams that depend on healthy natural capital.

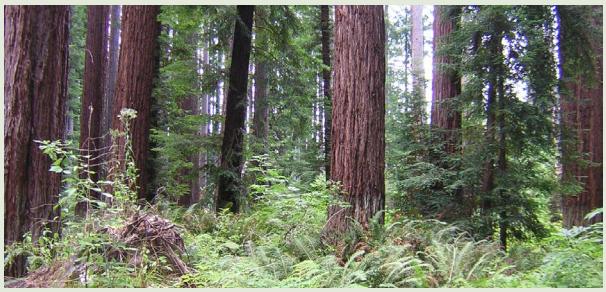
WATER

Water is essential to life, ecosystem health, and virtually all economic activity in California. Water is also unique among everything that is produced and traded in economies: The economy can produce substitutes for energy sources, transportation systems, foods, industrial products and almost every other economic good and service. But there is no substitute for water.

Compared with other parts of California and the world, the North Coast is abundant with this valuable resource. Much of this wealth is diverted and shared with other parts of California through the State Water Project. While this can impact North Coast Watersheds, this may also present opportunities for new funding streams for natural capital investment, as described in Box 2 below. Box 3 then describes a local example of water investment that resulted in multiple benefits and cost savings for a small community. Finally, Box 4 highlights an innovative water conservation program in Sonoma County.

Box 1. Forest of the Future

The Conservation Fund purchased 25 square miles forest in Mendocino County using $40 million in state revolving fund loans and Coastal Conservancy grants. The sections of forest, near the Big River and Salmon Creek, protect stream water quality and provide wildlife habitat for Coho salmon and other riparian species. The forest generates revenue through 'Carbon Offsets' sold in the California Cap-and-Trade market. To date the forest has sold more than $7 million in carbon offsets. The forest follows a sustainable forestry model; timber from the forest is selectively harvested and sold to generate revenue and preserve forest health. The forest generates more than $1.5 million annually from timber sales. In addition to generating revenue, the timber harvesting in the forest supports more than 140 local jobs.



Box 2. The Value of Water Diverted from the Trinity River

The diversion of water from the Trinity River to the Central Valley in the east and other parts of California has been key to billions of dollars in agricultural, industrial, and residential value for many years. Between 1961 and 1995, for example, an average of 72% of the Trinity River's flow was diverted each year.14 Although this amount was reduced following the Record of Decision in the year 2000, the Trinity River is still a significant source of water and energy for other parts of the state. In 2017, approximately 600,000 acre feet of water were diverted from the Trinity River.[15]

Water diverted from the Trinity River may be some of the most valuable water in the state, in terms of the way it is used. First, the diverted water flows through 5 power plants. Ultimately, the water then enters the Sacramento River, where it comprises about 3% of its total flow.[16] The water is then used for a range of municipal, industrial, and agricultural uses, as well as in-stream flow for endangered fish and recreation. While this water is in many ways "priceless" for the life it supports, it is also has great economic value, which can be measured in a variety of ways. For example, it can be valued in terms of its market price to urban water customers in Sacramento (about $450 per acre foot),[17] its contribution to other commodities like food or Intel processing chips, or Californians' willingness to pay to keep the water instream for habitat or recreational purposes.

The California Water Commission (CWC) provides another approach to valuing this water, which were developed for the purpose of estimating the public benefits of projects funded through the Water Storage Investment Program, a $2.7 billion grant program funded through Proposition 1. Based on a statistical analysis of agricultural water transfer prices from 1992 to 2015, the CWC developed "unit values", representing the alternative cost of obtaining water supplies. The values range from $145 to $354 per acre foot in the Sacramento Valley, depending on the year.[18] Using this approach, the "value" of water from the Trinity River $87–212 million each year.

The CWC notes that these values are likely to increase in many parts of California as the State Groundwater Management Act is implemented, and less water is available for extraction from the ground. Also, it is important to note that alternative water supplies for many communities would cost a lot more, or would be impossible to obtain, so the value of the water they currently receive from the Trinity River is in fact much higher.

Despite the tremendous value of this water, no payments for that water come back to Trinity County and forest assets that capture, filter and produce the water. Were there funding returning to Trinity County, then thinning for fire risk reduction and greater ecological health for the forest would also be providing additional jobs, and further securing a longer term, healthy water supply.

The Pacific Forest Trust has estimated that more than 280,000 acres of forest are in need of restoration in the Trinity River watershed to restore stream quality and improve resilience in the Trinity Watershed. Additionally, more than 625 miles of roads in the watersheds can be improved or decommissions to support stream health.[19]

While the cost of restoring these lands has not yet been calculated, it is likely to be significant, running into the hundreds of millions of dollars. However, for perspective, a $10 per acre foot (or about 2.2% of the amount paid by Sacramento water customers) surcharge on Trinity River water over 30 years would generate approximately $180 million.

Box 3. Newell County Water District: Multiple Benefits of Water Infrastructure Investments[20]

The Newell County Water District, based in Modoc County has prioritized renovations to their water storage, transmission, and distribution system. The town of Newell is home to less than one thousand residents, and has been burdened by water transmissions infrastructure issues for the past several years. Through $1.5 million in funding acquired from the North Coast Resource Partnership via DWR's Integrated Regional Water Management Grant Program the Water District has worked to replace leaking water mains, and reduce the risk of water based contaminants reaching sensitive wildlife in the Tule Lake and Clear Lake National Wildlife Refuges. These improvements are estimated to save more than 100 acre-feet of water per year, which was previously lost through leakage.

The Water District's primary water source comes from three wells outside the town of Newell, however only two were operational when the renovation project began. A 2001 leak assessment found that 60% of water pumped through the groundwater system was lost through leaks and contamination.[21] In addition to leak repair, the grant funding was used to repair the non-operational well, install a new 100,000 storage tank, and install more than 100 water meters. A follow-up leak study showed that these improvements effectively eliminated water loss due to leaks.

The project installed a controls system which reduced system staff workload by 90% and reduced operational costs by $900,000. The renovation project also avoided the need to build $700,000 a water well, and added water supply reliability for the community, valued at $120,000.[22] The water system improvements will return more than $1.7 million in benefits over the life of the installed assets.

Box 4. Russian River "Cash for Grass" Program

Sonoma County, in collaboration with Marin County and more than 10 local municipal utilities and water agencies, formed the Saving Water Partnership in 2010. The partnership emerged through water quality and sustainability concerns about the Russian River in northern California. About 600,000 residents in Sonoma and Marin Counties rely on the watershed for drinking water. The Russian River also plays a crucial role for recreation, wildlife habitat, and agricultural production in the area.[23] The river is highly susceptible to droughts, and has been severely impacted by drought events in 2010 and 2015.[24] In addition, water in the Russian River is currently over-allocated, and is "subsidized" with water diverted from the Eel River, impacting the survival of Chinook, Coho and steelhead in that system.[25]

The Saving Water Partnership focuses on incentivizing water efficient behavior for residential and commercial water customers. This is achieved through incentives and rebates for water utility customers. These programs include toilet replacements, commercial water audits, and K–12 education programs. One of the rebates offered is the "Cash for Grass" program. The Cash for Grass program pays water customers $0.5 per sq. ft. for grass removal and replacement with drought tolerant landscaping. The program has paid for more than 400,000 sq. ft. in turf removal, which is now estimated to save 2.2 million gallons of water per month during irrigation season.[26] Lawn watering comprises 7% of California's total water consumption, the majority of which occurs during seasons of water scarcity.[27] The Saving Water Partnership's Cash-for-Grass program has served as an effective tool to reduce this consumption and curtail peak demand. Similar programs in Los Angeles and Las Vegas have also been very successful.

The turf-removal program has saved an estimated 2,260 acre-feet of water over the life of the program.[28] The Saving Water Partnership has paid approximately $2.4 million in rebates for grass removal. Valued at the rate charged to customers in the city of Santa Rosa[29] the water conserved by the turf removal has saved customers more than $3.8 million.

FOOD

Agriculture is perhaps the only essential industry. Agriculture feeds people. In addition, agriculture has an enormous impact on overall environmental health. Conventional cropping systems often degrade soil health and quality, reducing productivity and creating dependence on synthetic inputs that pollute surrounding ecosystems and negatively impact human health. If managed in a more synergistic way, farmers can reduce their impact and even provide ecosystem services. Natural ecosystems favor diversity, and by mimicking natural systems, land managers can achieve environmental benefits such as reducing air and water pollution, building soil carbon, and sequestering greenhouse gases.

Most terrestrial ecosystems are comprised of diverse perennial plant communities. For many agricultural areas, the land was a native prairie plant community prior to cultivation. Farms that include natural areas, such as river channels, wetlands, and forests, provide habitats, support diversity, and can benefit from increased production. For example, natural areas supply habitat for pollinators such as bees and birds, which in turn pollinate crops, and can save managers money while increasing production. Birds can also prey on pest species that would otherwise harm growing crops. Trees also provide benefits to livestock by providing shade to reduce heat stress during hot weather or provide a windbreak during a cold snap.

People also tend to care about places they find aesthetically pleasing. A synergistic management with native plants can improve farm aesthetics and attract wildlife, adding more reasons for people to take pride in local farmlands.

Healthy soils take many years to develop but can deteriorate quickly with the overuse of fertilizers and pesticides or by being exposed to high erosion from wind and water. Agriculture that mimics historic grasslands and incorporates a diversity of crops contribute soil organic matter, sequesters carbon, and improves water infiltration into the soil. Increased soil moisture can provide a buffer during droughts.

Natural lands and working lands are most productive as complements. Natural lands provide water, flood-risk reduction and other benefits to working lands. Often some of the best habitat, even for endangered species, is still preserved on working lands, which also buffer preservation lands from more intensive development. Box 5 describes the path towards value-added agriculture in Sonoma County, while Box 6 a national effort to better understand, quantify and monetize the co-benefits of farmland conservation practices.

Box 5. Value-added Agriculture in Sonoma County

Milk prices remain historically low. One path is toward the 20,000-cow dairy farm, which brings numerous challenges including water quality, feed, energy and impacts on neighbors. Another path is to pursue "value added" products where possible. For example, the artisanal cheese making industry in Sonoma and Marin Counties is growing rapidly, and today the industry generates nearly $120 million annually and employs more than 330 people across the two counties.[30] The open space agencies in these counties, the Marin Agricultural Land Trust (MALT) and the Sonoma County Agricultural Preservation and Open Space District (SCAPOSD), have worked with dairy farmers and played a key role in supporting the transition from conventional milk production to this value-added product. MALT and SCAPOSD purchase conservation easements from producers, which provide funding in exchange for protecting and preserving their land through sustainable grazing practices. According to a 2011 study by the University of California Cooperative Extension, about 72% of new artisanal cheese producers helped finance their transition by selling agricultural conservation easements.[31] The same study found that 9,000 acres of agricultural conservation easements had been sold by cheese producers in Sonoma and Marin Counties, and that number is likely to be higher today. These agencies have not only sought to catalyze high-value craft cheese production, but also to integrate this production with wine tasting and tourism.

The artisanal cheese industry provides economic and environmental benefits for landowners and community members. Artisanal cheese sells for an average of $15/lbs., far above the price of other milk products.[32] Many artisanal cheese companies provide greater opportunities for full time employment and higher earnings that traditional agriculture businesses.[33] 46% of artisanal cheese makers use organic milk and sustainable grazing practices.[34] These practices has been shown to improve water quality, promote fish health, improve carbon sequestration function, and reduce brush build up and fire risk.[35]

Box 6. Measuring the benefits of farmland through the Conservation Effects Assessment Project

Earth Economics is working with the Conservation Effects Assessment Project (CEAP), a national, multi-agency effort led by the USDA to quantify environmental effects of conservation practices on agricultural land. Practices such as prescribed grazing, appropriate fencing, planting, and habitat management have the potential to produce ecosystem services while saving producers costs. By tying conservation activities to improvements in ecosystem services and ecosystem health, Earth Economics aims to help CEAP form a more holistic view of the benefits of conservation practices. Better understanding of economic benefits will also help to prioritize application of specific practices, and inform the creation of effective financial incentive programs to compensate/reward land managers for taking conservation actions. This project will guide conservation policy and program development and help conservationists, farmers, and ranchers make more informed decisions.

KNOWLEDGE

Education is the largest employer in the ten counties of the North Coast Region. Education is also closely tied to rising incomes. This foundational sector also strengthens advancements in all other areas of employment including agriculture, health, and recreation. It has been established through numerous studies in over 100 countries that formal education has a high return on investment, in the 5–15% range, which is on par with high-grade commercial investments such as stocks and bonds.[4] Studies in the U.S. have found that, on average, each additional year of schooling completed increases an individual's future wages by 10% to 15%.[5,6] The non-income related benefits of schooling are equally important. A quantitative literature review by Oreopoulos and Salvanes, controlling for income, found for example that increased schooling was correlated with improved health (e.g. lower likelihood of receiving health disability payments, greater engagement in healthy activities) and social skills (e.g. greater trust in others, greater social participation).[7]

A growing body of quantitative and qualitative literature also indicates that place-based and nature-based education can supplement traditional classroom education and result in even greater

academic performance. Recent research for example has founds links between nature-based education and higher test scores, enhanced critical thinking skills, increased motivation, and improved attitudes towards the environment.[8] According to Smith and Sobel (2010),[9] the opportunity to apply "...concepts and skills in 'real-world' settings" may be one of the reasons nature-based education has a positive impact on student achievement and engagement.

COMMUNICATION

Communications is an important factor and key to economic development. A 2016 World Bank report "Digital Dividends" by Mike Minges points out the developed nations gain 1.2% in GDP with a 10% increase in broadband extension in communities and rural areas. Considering a development strategy in the North Coast that includes data centers, optic fiber and delivery of services could be a green path to more jobs and higher incomes. A distributed optic fiber system throughout the North Coast could provide a basis for traditional utility delivery, better broadband service for less cost and both expand existing businesses and attract new businesses to the region. Quincy, WA and Chattanooga, TN provide examples of communications development, which are summarized in Box 7.

RECREATION

The North Coast has tremendous outdoor recreational resources, supporting more than 300 recreational activities, including hunting, fishing, hiking, biking, birding, boating, swimming, surfing, sailboarding, rafting, picnicking, and kayaking. The North Coast counties of California provide absolutely world-class recreational experiences. Increasing the recreation economy represents perhaps one of the most rapid routes to increased jobs and income.

Box 7. Driving economic development with broadband investments

Quincy is a rural Eastern Washington agricultural town of 7,000 people and a tax base of $3.5 billion, more than most cities of 50,000 residents. Fifteen years ago, the average wage was less than $15/hour and mainly in agriculture. Today, there are 1,500 jobs paying over $25/hour. Less than 15 years ago, Quincy realized the town had a competitive advantage in cheap electricity and promoted data centers. Today, Microsoft has four ten-acre data centers, Yahoo and Dell have multiple data centers and there are co-location data centers as well. While data centers provide few jobs themselves, the tax base enabled by their presence provides many jobs. The School district is currently building a new state-of-the-art high school.

Chattanooga is a gig-city. They provide a gig of data capacity to every resident and business. Businesses told the city they did not want to locate there because the power was unreliable. In planning a transmission up-grade, the Electric Power Board realized they could also string optic fiber throughout the city and provide broadband services. The optic fiber system was built with a distributed infrastructure that enabled a smart-grid, with tremendous power reliability as well as enabling consumers to save on power bills and raise effective real incomes. The infrastructure also allows remote monitoring of power, water, and gas meters and other utility uses. This more fiber intense system enables The Internet of Things and businesses small and large have come to Chattanooga.

While the outdoor recreation economy is significant, the dollar value is not yet tracked in the GDP, as demonstrated in the county economic profiles above in Table 1. Unlike industries like mining or manufacturing, where jobs and income are concentrated by firm and location, the recreation economy is distributed across geographies and cuts across industries, making it difficult to track. However, in 2018 the U.S. Bureau of Economic Analysis will release "satellite accounts", showing the value recreation income and jobs, in the same way that other economic sectors are measured.

However, some studies can provide insights on the scale of the outdoor recreation industry in the North Coast, and the potential for growth. For example, a study by Dean Runyan Associates calculated the economic

impact of travel for each county in California from 1992–2016.[10] As shown in Table 3 below, the North Coast counties collectively support about $3.1 billion in travel expenditures annually. A different study found that the average visitor to Sonoma County spends about $389 per trip.[11] And although it's not broken out in these studies, these economic impacts likely represent both tourism and outdoor recreation, both of which depend on the health of the region's stunning natural capital assets.

Table 3. North Coast Travel Impacts by County

County	2016 Visitor Spending ($ millions)
Del Norte	124
Humboldt	416
Mendocino	386
Modoc	24
Siskiyou	193
Sonoma	1,934
Trinity	52
TOTAL	**3,129**

A 2015 recreation study by Earth Economics in Washington State found that recreation supports over 199,000 jobs and creates over $21 billion in economic activity.[12] Studies in Colorado have found that the outdoor recreation and tourism industries respectively generate $28 billion and $19.7 billion in economic impacts for the state.[13] The economic impact of these industries is $8.52 per capita per year in Colorado, compared with approximately $3.84 per capita per year in the North Coast, suggesting the region has plenty of room for growth in this sector.

A few characteristics make outdoor recreation an industry worthy of significant investment. For one, recreation represents a fundamentally positive economic activity. In contrast to "defensive expenditures" that are required to treat illness or tackle crime, people actually pursue recreational activities to increase their joy and health. Recreation is joyful. Though it may be necessary to have a tooth pulled, it is not something that people seek out, like the experience at a national park or rafting down a river with family and friends.

In addition, though everyone—rural or urban—participates in recreation, recreation predominantly takes place in rural areas. Thus, urbanites spend money in rural areas to enjoy recreational activities in healthy natural ecosystems, such as rivers, forests, coastlines, wetlands, snowy slopes, and agricultural areas. This not only provides jobs for rural areas, but also represents an income stream for reinvesting in the region's natural assets.

RESILIENCE

Disasters will continue to occur. The North Coast has frequently experienced natural events such as floods, wildfires, drought, and landslides for thousands of years. While these events cannot always be predicted or avoided, North Coast communities can make investments that mitigate the potential impacts of disasters when they do happen. Communities can be prepared to take advantage of the pulses of post-disaster funding, which can be used to build greater resilience into the economy moving forward. With the new FEMA policy advancements described in Box 8, communities in the North Coast can build resilience into pre- and post-disaster funding and ensure that a greater proportion of funding is allocated towards green infrastructure and healthy floodplains in urban and rural areas alike.

Box 8. Investing in Resilience: New FEMA funding opportunities for the North Coast

The old approach to disaster funding was to rebuild the same structure in the same place, often leading to repetitive damage when disaster struck a few years later. Today, agencies are shifting their approach to be more proactive and focus on mitigation of future hazards. Agencies are also making better use of natural capital as a cost-effective measure for disaster mitigation or prevention.

The primary source of pre- and post-disaster funding in the U.S. and North Coast is the Federal Emergency Management Agency (FEMA). In 2013, faced with rising natural disaster costs and climate uncertainty, FEMA recognized that it made economic sense to consider the value of natural capital for the flood protection and other ecosystem services it provides. As a result, FEMA approved Mitigation Policy FP-108-024-01[36], which allowed the value of ecosystem services to be considered for floodplain acquisition projects in all 50 states. This meant that the economic benefits of a healthy, restored floodplain could now be recognized in FEMA's benefit-cost analysis, which determines if a project is cost-effective and eligible for federal funding.

In 2016, further recognizing the economic benefits of healthy ecosystems, FEMA expanded this policy to cover other disaster types including wildfire and drought, making new kinds of actions eligible for disaster mitigation. The new policies became immediately valuable following the Northern and Southern California Wildfires. With the new policy, which recognizes the economic value of forest ecosystem services, post-disaster mitigation actions like erosion control, replanting/reforestation, and slope stabilization (e.g. hydroseeding) are now considered immediately cost-effective if they cost less than $5,250 per acre. As a result, local agencies and land trusts have been able to quickly apply for and receive FEMA assistance to take these emergency measures.

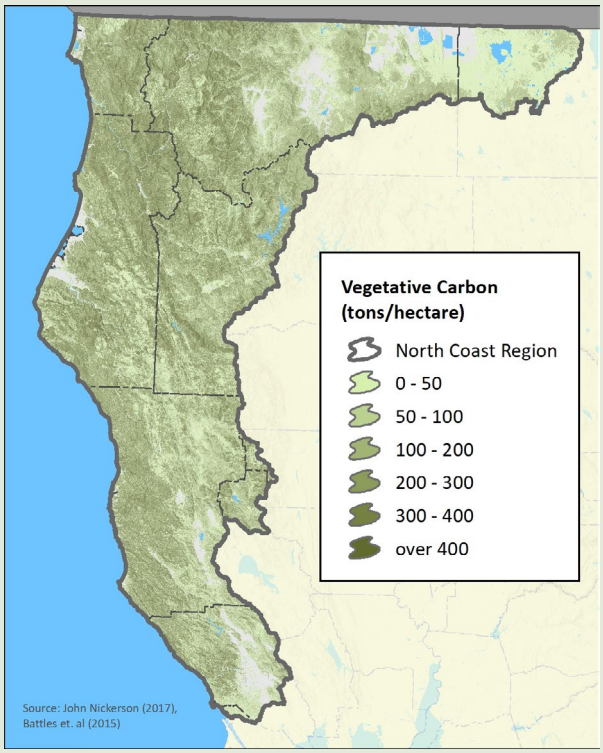
Finally, in 2018, recognizing the cost-effectiveness of preventative measures, Congress more than doubled FEMA's pre-disaster mitigation budget, to $250 million for the fiscal year. This increases the opportunity for North Coast communities to apply for pre-disaster funding, which can be used for a range of innovative projects including hazardous fuels reduction, open space acquisition and protection, riparian restoration, and aquifer storage and recovery.

Other federal agencies are also shifting their focus and funding towards preventative—rather than reactive—measures, acknowledging this approach is far cheaper in the long run. For example, Wildfire Disaster Funding Act, passed by Congress in early 2018, will allow the U.S. Forest Service to use disaster relief funds to fight fires, rather than pulling funding from other parts of their budget, which are often important for preventative actions like hazardous fuels reduction.

CLIMATE

Box 9. Climate Mitigation Revenue Opportunities: Carbon Offsets

Carbon trading seeks to control pollution by providing market-based economic incentives for reducing greenhouse gases. The California Air Resources Board issues carbon offset credits to projects meeting requirements in its Cap-and-Trade Regulation. In the counties that make up the North Coast of California, eight offset projects have been completed which registered over $5 million in offset credits. Another 24 projects are planned, for another $12 million in registered offset credits. For example, a project in Trinity County sought to improve forest management on almost 12 thousand acres of fir, pine, and hardwood forest. The project registered for more than $800,000 in credits and is expected to yield about $30,000 credits every year after completion. Existing carbon credits sold in the North Coast are just a fraction of the total carbon sequestration assets in the region. The North Coast Resource Partnership has inventoried carbon sequestration by land cover in the region and found that 4.2 gigatons (4.2 billion tons) of CO2 are stored in forest, grassland, farmland, and wetlands across the North Coast region.[37] Of that total, 3.5 billion tons are stored in forested land alone.



TRANSPORTATION

Box 10. Del Norte Transportation Commission Climate Resilience Plan[38]

Del Norte County's Transportation Commission included Climate Change resilience strategies in their 2016 Regional Transportation plan. The County commissioned an analysis of the Climate Change risks facing the county through 2100. Rising sea levels and increased flood events present a threat to the County's transportation grid. This analysis assessed threats to roadways in the county, and identified critical roadways under threat (such as tsunami evacuation routes). The Transportation Commission has identified adaptation options that will mitigate the risk of climate change to transportation infrastructure. These options include floodwalls, levees, bridge and drainage modification, and even asset relocation and retreat.

The estimated cost of these adaptation measures is $30 million just to modify the 'critical' roadways. A full spectrum mitigation strategy would incur a cost between $70[39] and $330 million, depending on the methods chosen.[40] Del Norte County anticipates a summer temperate increase of 3°F by 2050, and as much as 6°F by 2100. As Del Norte County braces for these changes, the Transportation Commission will use their Climate Change resilience analysis to prioritize resilience projects and allocate funding to protect critical infrastructure.

ENERGY

Box 11. Humboldt RCEA[41]

Local government agencies in Humboldt County—including the Cities of Arcata, Blue Lake, Eureka, and the Humboldt Bay Municipal Water District—formed the Redwood Coast Energy Authority (RCEA), a Joint Powers Agency. The RCEA's purpose is to provide a sustainable and cost comparable alternative to traditional energy utilities in the Humboldt County.[42] RCEA works in partnership with PG&E, the current primary energy supplier for the area. PG&E maintains the powerlines and deliver electricity to customers, while the RCEA coordinates energy sourcing.

Compared to PG&E, the RCEA's power generation mix contains more wind, biomass, and hydroelectric power than PG&E and contains no coal, natural gas, or nuclear generated power.[43] The RCEA is 2–3% cheaper for residential customers, and 1–2% cheaper for commercial customers. The RCEA is an example of a Community Choice Energy program, which are becoming more common in local governments. Community Choice Energy program in California are structured as an 'opt-out' program, in accordance with state legislation. When a Community Choice Energy program becomes available, customers are automatically enrolled in this program. Due to the opt-out nature of the program, as well as the economic and environmental benefits it provides, RCEA has developed a large customer base and positive reception.[44]

The RCEA's power mix does not include coal or natural gas sources, whereas PG&E's power mix includes 17% natural gas.[45] Households that switch to the RCEA from PG&E will conserve approximately 1,200 lbs of CO2 per year, on average.[46,47] A county-wide switch of all Humboldt county households to the RCEA from PG&E will save 30,300 metric tons of CO2 per year.[48] Valued using the EPA's Social Cost of Carbon,[49] a county-wide switch will generate $1.3 million in CO2 emissions savings. In addition to emissions savings, switching to RCEA from PG&E will provide an average of $18 a year in rate based savings per year, per household. A county-wide switch from the RCEA and PG&E would result in $1 million rate-based customer savings. The potential emissions and rate-based savings provided by the RCEA exceed these estimates, because many customers in adjacent counties are also eligible to enroll in the RCEA program. The RCEA also creates jobs within the Humboldt community, more than 30 positions within the Energy Authority have been filled to date.

SECTION 3. LOOKING AHEAD: AN ECONOMIC VISION FOR THE NORTH COAST

Perhaps the most pronounced transformation in modern economies, including the North Coast, is the integration of economic sectors. 20th century infrastructure was all about one good or service and one infrastructure to provide it. Levees provided flood risk reduction. Wires and telephones provided communications, and nothing else. Today, a cell phone is more than a telephone. You can talk, text, tweet, or video-chat on it. And, your phone takes pictures, provides direction, counts your steps, facilitates games, and gives you access to the Library of Congress. Infrastructure that you can hold in your hand provides a grand multitude of benefits. That is the essence of the 21st Century economy.

Though tomorrow's economy will not be identically yesterday's, the best path is to build on economic sectors that are strong in the North Coast, and retain valuable historic and cultural value while better integrating existing and new infrastructure. For example, integrating traditional recreation and agricultural tourism. There is not only one formula for economic success, and the North Coast is well positioned to forge its own path.

Improving built capital (transportation, energy, water) while minimizing negative impacts on natural and cultural capital increases the potential value. For example, power generation from forest thinning biomass contributes to greater energy independence, jobs and ecological benefits, while reducing the catastrophic risk of forest fire and the follow-on threats of flood, slide, loss of water quality and healthy forest associated cultural values.

Integration of multiple sectors, while presenting upfront challenges, will be integral to success for the North Coast. For example, energy efficiency and production is essential to any economy. Information technology, from the device (computer, phone), wireless, optic fiber to data center and back, is also an essential infrastructure. And so is agriculture, which feeds us all. Consider this: data centers require inexpensive energy, which means the North Coast with wind, hydro and wood biomass provides a natural teaming location for data centers. In addition, data centers also produce waste heat, and must maintain standby generators and a vast bank of batteries in case of a power failure. The chillers, generators, diesel and batteries typically account for half of the cost of the data center. Could Siskiyou and other North Coast Counties have a competitive advantage where data centers are teamed with power production, green house farmers are paid to take waste heat from the data centers in the winter, reducing data center cooling costs, and agricultural culls are used to produce ethanol or biodiesel to fuel data center generators?

Economies are dynamic. Competition, technological advancement, and changes in consumer tastes mean that economies are in motion. Cattle ranching is transformed from a generation ago with breeding, genetics, tracking and handling. Fishing, recreation, health care, and other industries are similar. Fortunately, the North Coast has been a leader and early adopter in many of these advancements across industries. It is also why knowledge is at the core of economic and ecological success.

At the same time, clearly better management of natural and built capital bolsters the viability and rate of return of private within the region and that calls investment.

The natural capital of the North Coast also provides a vast multitude of benefits and is a driver of a stronger economy. Forests, provide food, water, timber, habitat, flood risk reduction, recreation, carbon sequestration (which provides greater climate stability), and biodiversity. These area multiple benefits from a single natural capital asset, like a cell phone.

A successful economy requires an integrated approach that considers watershed health, forest health, human and social capital, and built infrastructure. The outcome of success is increased happiness, health, employment, income and quality of life for communities in the North Coast.

The North Coast has vast assets and has built an economy suitable to this place and this community. The region can maintain its rural, small community nature while ensuring quality of life for its people and a path to rising incomes without becoming a copy of San Francisco or other California regions. The natural infrastructure is in place, with tremendous water, forests, ecosystems and other resources for a prosperous 21st Century economy.

REFERENCES

1 U.S. Census Bureau, 2012-2016 American Community Survey 1-Year Estimates

2 U.S. Bureau of Labor Statistics. Local Area Unemployment Statistics Information and Analysis

3 U.S. Bureau of Labor Statistics. Quarterly Census of Employment and Wages. Available at: https://www.bls.gov/cew/datatoc.htm

4 Polacheck, S.W., 2007. Earnings Over the Lifecycle: The Mincer Earnings Function and Its Applications. State University of New York at Binghamton and the Institute for the Study of Labor.

5 Rouse, C. E., 1999. Further estimates of the economic return to schooling from a new sample of twins. Economics of Education Review 18(2), 149-157. Available at: http://www.sciencedirect.com/science/article/pii/S0272775798000387; Ashenfelter, O., Krueger, A., 1994. Estimates of the Economic Return to Schooling from a New Sample of Twins. The American Economic Review 84(5), 1157-1173. Available at: http://www.uh.edu/~adkugler/Ashenfelter&Krueger.pdf

6 A 10% return means that for two people who are the same in every other way, if one of those people were to receive an additional year of education, their future annual earnings would be 10% higher. The studies cited here compared up to 450 sets of identical twins (who are presumably as close as possible in terms of mental and physical ability) with varying levels of education in order to isolate the impact of a year of education on their wages.

7 Oreopoulos, P., Salvanes, K. G., 2009. Journal of Economic Perspectives 25(1), 159-184. Available at: http://www.nber.org/papers/w15339

8 Chawla, L., Escalante, M., 2012. Student Gains From Place-Based Education. University of Colorado. Available at: http://regionalchange.ucdavis.edu/ourwork/projects/other-files/place-based-education-fact-sheet

9 Smith, G. A., Sobel, D., 2010. Place- and community-based education in schools. Routledge, New York, NY. Available at: http://uwashington.worldcat.org/title/place-and-community-based-education-in-schools/oclc/609651924&referer=brief_results

10 Dean Runyan Associates, 2015. California Travel Impacts by County,

1992-2016p. Retrieved from: https://industry.visitcalifornia.com/Research/Report/Economic-Impact-by-State-Region-County-1992-2016p

11 Destination Analysts, 2014. Sonoma County Tourism: Sonoma County Visitor Profile Study. Report of Findings prepared for Sonoma County Tourism by Destination Analysts, Inc.

12 Briceno, T., Schundler, G., 2015. Economic Analysis of Outdoor Recreation in Washington State. Earth Economics, Tacoma, WA.

13 The Denver Post, 2017. Colorado's outdoors creates economic powerhouses out of recreation and tourism industries. Retrieved from: https://www.denverpost.com/2017/06/27/colorado-outdoor-recreation-tourism-consumer-spending/

14 Summary of Volume and Diversion of Trinity River Water. (1995) California Bay-Delta Program. Retrieved from: http://www.calwater.ca.gov/Admin_Record/E-006927.pdf

15 USGS, 2018. https://waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=217221&wys_water_yr=2017&site_no=11525430&agency_cd=USGS&adr_water_years=2006%2C2007%2C2008%2C2009%2C2010%2C2011%2C2012%2C2013%2C2014%2C2015%2C2016%2C2017&referred_module=

16 California Water Plan Update: Chapter 6- Sacramento River Hydrologic Region (2005) California Department of Water Resources. Retrieved from: https://www.water.ca.gov/LegacyFiles/waterplan/docs/cwpu2005/vol3/v3ch06.pdf

17 "Water Service Fees and Charges" (2014) City of Sacramento. Retrieved from: https://www.cityofsacramento.org/-/media/Corporate/Files/DOU/Services-Rates/201220132014WATER.pdf?la=en

18 California Water Commission, 2016. Water Storage Investment Program: Technical Reference. Available at: https://cwc.ca.gov/Documents/2017/WSIP/TechnicalReference.pdf

19 Remucal, J., Wayburn, L., Bachmann, S. (2017) A Risk Assessment of California's Key Source Watershed Infrastructure: Repair and Maintenance Needs for the Feather, Pit, McCloud, Upper Sacramento, and Upper Trinity River Watersheds. Pacific Forest Trust. Retrieved from: https://www.pacificforest.org/california-water-security-source-watershed-report/

20 http://www.northcoastresourcepartnership.org/app_pages/view/7875

21 "Newell Water System Renovation" (n.d.) North Coast Resource Partnership. Retrieved from: http://www.northcoastresourcepartnership.org/files/managed/Document/9552/NCRP_Prop50_Project-Modoc-Newell.pdf

22 Ibid

23 http://www.savingwaterpartnership.org/wp-content/uploads/smswp-10-11%20Annual%20Report%20FINAL%20DRAFT%20web.pdf

24 Ibid

25 https://eelriver.org/2016/07/21/balancing-the-russian-river-on-the-back-of-the-eel-river/

26 Metzger, S. (2016) Water Wise Lawn Alternatives. University of California. Retrieved from: http://ucanr.edu/sites/scmg/Lawn_Replacement/Water-Wise_Lawn_Alternatives/

27 Pittenger, D. (2014) Keeping Landscapes Green with Less Green. University of California. Retrieved from: https://www.green-technology.org/gcschools/images/Keeping_Landscapes_Green.pdf

28 Addink, S. (2006) "Cash for Grass" – A Cost Effective Method to Conserve Landscape Water? University of California Riverside. Retrieved from: https://agops.ucr.edu/turf/topics/Cash-for-Grass.pdf

29 "Rate Table: City of Santa Rosa" (2017) City of Santa Rosa. Retrieved from: https://srcity.org/DocumentCenter/View/15958

30 Rilla, E. (2011) Coming of Age: The Status of North Bay Artisan Cheesemaking. University of California Cooperative Extension

31 Ibid

32 Ibid

33 Ibid

34 "Artisanal Cheese and Land Conservation in the Milkshed of Sonoma and Marin Counties" (2016) Conservation Strategy Fund. Retrieved from: http://www.sonomaopenspace.org/wp-content/uploads/DRAFT-Case-Study-Artisanal-Cheese-and-Conservation-For-Review.pdf

35 Ibid

36 https://www.fema.gov/media-library/assets/documents/33295

37 Nickerson, J. (2017) Carbon Inventory for the North Coast Region Partnership. Dogwood Spring Forestry.

38 http://www.dot.ca.gov/hq/tpp/grant_files/final-products/2_2016-Del-Norte-RTP-Body-and-Appendices.pdf

39 "2016 Regional Transportation Plan" (2016) Del Norte Local Transportation Commission. Retrieved from: http://static1.squarespace.com/static/57f8232ce58c6208092f73fa/57fb356c5fd63ba74383b28f/57fb355d5fd63ba74383b1b8/1476080989961/2016-Draft-Del-Norte-Regional-Transportation-Plan-9-9-16-1.pdf?format=original

40 "Del Norte Climate Change Adaptation Study on Transportation Infrastructure" (2016) Green DOT Transportation Solutions. Retrieved from: http://greendottransportation.com/del-norte-climate-change-adaptation-study-on-transportation-infrastructure/#prettyPhoto

41 http://www.times-standard.com/opinion/20170414/community-choice-energy-great-idea-for-humboldt-county

42 "About RCEA" (n.d.) Redwood Energy. Retrieved from: https://redwood-energy.org/community-choice-energy/about-community-choice/

43 PG&E – RCEA Comparison. (2017) PG&E. Retrieved from: https://www.pge.com/pge_global/common/pdfs/customer-service/other-services/alternative-energy-providers/community-choice-aggregation/RCEA_ElectricPowerGenerationMix.pdf

44 "CCE Options" (n.d) Redwood Energy. Retrieved from: https://redwoodenergy.org/community-choice-energy/about-community-choice/about-cce/qa/#1502718183862-d714c66f-ef5e

45 PG&E – RCEA Comparison. (2017) PG&E. Retrieved from: https://www.pge.com/pge_global/common/pdfs/customer-service/other-services/alternative-energy-providers/community-choice-aggregation/RCEA_ElectricPowerGenerationMix.pdf

46 "Table A.3. Carbon Dioxide Uncontrolled Emission Factors" (n.d.) Energy Information Administration. Retrieved from: https://www.eia.gov/electricity/annual/html/epa_a_03.html

47 "Household Energy Use in California" (2009) Energy Information Administration. Retrieved from: https://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/ca.pdf

48 "Humboldt County, CA" (2016) Census Reporter. Retrieved from: https://censusreporter.org/profiles/05000US06023-humboldt-county-ca/

49 "Social Cost of C02, 2015-2050" (2016) United States Environmental Protection Agency. Retrieved from: https://www.epa.gov/sites/production/files/2016-12/documents/social_cost_of_carbon_fact_sheet.pdf