Future Scenarios of Land-Use and Land-Cover Change in the United States—The Marine West Coast Forests Ecoregion

By Tamara S. Wilson, Benjamin M. Sleeter, Terry L. Sohl, Glenn Griffith, William Acevedo, Stacie Bennett, Michelle Bouchard, Ryan Reker, Christy Ryan, Kristi L. Sayler, Rachel Sleeter, and Christopher E. Soulard

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Introduction

Detecting, quantifying, and projecting historical and future changes in land use and land cover (LULC) has emerged as a core research area for the U.S. Geological Survey (USGS) (U.S. Geological Survey, 2007, Burkett and others, 2010). Changes in LULC are important drivers of changes to biogeochemical cycles (Houghton and others, 1999; Casperson and others, 2000), the exchange of energy between the Earth's surface and atmosphere (Sagan and others, 1979; Barnes and Roy, 2008), biodiversity (Ojima and others, 1994; Poudevigne and Baudry, 2003; Wimberly and Ohmann, 2004), water quality (Lowrance and others, 1985; Zampella and others, 2007), and climate change (Nakicenovic and Swart, 2000; Pielke and others, 1999, 2002). To quantify the rates of recent historical LULC change the USGS Land Cover Trends project recently completed a unique ecoregion-based assessment of late 20th century LULC change for the western United States (Sleeter and others, 2012b). To characterize present LULC, the USGS and partners have created the National Land Cover Database (NLCD) for the years 1992 (Vogelmann and others, 2001), 2001 (Homer and others, 2007), and 2006 (Fry and others, 2011). Both Land Cover Trends and NLCD projects continue to evolve in an effort to better characterize historical and present LULC conditions and are the foundation of the data presented in this report.

Projecting future changes in LULC requires an understanding of the rates and patterns of change, the major driving forces, and the socioeconomic and biophysical determinants and capacities of regions. The data presented in this report is the result of an effort by USGS scientists to downscale the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emission Scenarios (SRES) to ecoregions of the conterminous United States as part of the USGS Biological Carbon Sequestration Assessment (Zhu and others, 2010). The USGS biological carbon assessment was mandated by Section 712 of the Energy Independence and Security Act of 2007 (U.S. Government Printing Office, 2007). As part of the legislative mandate, the USGS is required to publish a methodology describing, in detail, the approach to be used for the assessment (Zhu and others, 2010). The development of future LULC scenarios is described in chapter 3.2 and appendix A (Zhu and others, 2010) and in Sleeter and others (2012a). Spatial modeling is described in chapter 3.3.2 and appendix B (Zhu and others, 2010) and in Sohl and others (2011). Below we briefly summarize the major components and methods used to downscale IPCC-SRES scenarios to ecoregions of the conterminous United States, followed by a description of the Marine West Coast Forests Ecoregion, and lastly a description of the data being published as part of this report.

IPCC Special Report on Emission Scenarios

Future changes in LULC, land management practices, and disturbance regimes will influence local ecosystem processes, as well as regional carbon storage capacity and greenhouse gas emissions in the Marine West Coast Forests Ecoregion. A scenario-based framework provides a means to explore uncertainties associated with future LULC conditions and resultant effects on greenhouse gas fluxes.

Scenarios are not intended to be predictive, but rather represent alternative future pathways governed by scenario-specific assumptions in driving forces such as population growth, economic development, technological innovation, energy use, and environmental awareness (Sleeter and others, 2012a).

Projection of future land use and land cover is based on four scenarios developed by the IPCC for the Special Report on Emissions Scenarios (SRES) (Nakicenovic and Swart, 2000). SRES scenarios are grounded in socioeconomics and are widely used by the global environmental change community to understand future environmental conditions resulting from climate change (Arnell and others, 2004; Gaffin and others, 2004; Verburg and others, 2006; Rounsevell and others, 2006; van Vuuren and others 2007). Four SRES storylines (A1B, A2, B1, B2) were selected for the analysis presented in this research. These four scenarios explore a wide range of LULC futures in the United States through the unique combination of a range of scenario assumptions (Sleeter and others, 2012a). The major characteristics of each are described below and summarized in table 1. For a complete description of SRES scenario characteristics, see Nakicenovic and Swart (2000).

It is important to note that the SRES scenarios are in no way intended to represent the complete range of future potential conditions, nor are they intended to be construed as favorable or desirable. Furthermore, for any scenario there exists a wide range of interpretations of the interaction of major driving forces, which could lead to dramatically different future conditions. For this reason, the downscaled SRES scenarios presented here should be considered only as four unique pathways of potential future LULC change.

Table 1. General narrative storyline characteristics of downscaled IPCC Special Report on Emission Scenarios.

Scenario[1]	Characteristics
A1B	The A1B scenario is an economics-oriented, globalization scenario characterized by significant economic expansion, high rates of technological innovation and implementation, high energy demand, and moderate population growth. Global population in this scenario is expected to peak at 8.7 billion in 2055 and then decline to 7.1 billion by 2100. In the United States alone, population will reach 385 to 400 million by 2050 and 460 million by 2100.
A2	The A2 scenario is regional in scope, characterized by very high population growth, low rates of technological innovation and dispersion, intense fossil fuel usage, restricted global trade, locally-driven market solutions and decision making, and a relatively stagnant economy. High rates of immigration are expected to push the U.S. population to between 417 and 460 million people by the year 2050 up to 628 million by 2100.
B1	In the global-scale, environmentally-oriented B1 scenario, the future is characterized by very rapid exchange of technology and green energy resources, high Gross Domestic Product (GDP) and growth in personal income. Global governance and free trade dominate along with increased environmental regulation. Resource friendly lifestyles are adopted and green technologies flourish. This scenario includes the highest demand for biofuels and clean energy resources. Population growth is similar to A1B with projections of 460 million U.S. residents by 2100. Population density will increase yet the footprint of developed land cover will be much lower than in other scenarios.
B2	The future under the B2 scenario is characterized by stronger regulation of the environment, increased local food and energy security, and low population growth globally and for the U.S. (351 million by 2050 and 366 by 2100). Limited international development of alternative fuels technology leads to continued reliance on traditional energy sources yet changes in lifestyle approach lead to lower per capita energy use. Regional solutions are applied to issues of economic, environment, and social sustainability.

Scenario Downscaling

Scenario downscaling is the process of translating coarse-scale scenario data to finer geographic scales, while maintaining consistency with the original dataset and local historical data (van Vuuren and others, 2007, 2010). The data presented in this report are the result of an effort to downscale the IPCC-SRES scenarios to scales suitable for environmental management. We used a global integrated assessment model, the Integrated Model to Assess the Global Environment (IMAGE) 2.2 (IMAGE Team, 2001), to supply future projections of land use at the national scale. An accounting model was developed to refine national-scale projections using LULC histories from the Land Cover Trends project. Expert judgment was used to downscale LULC projections to hierarchically nested ecoregions (discussed in the next section). The final step in scenario downscaling was to convert ecoregion-based projections into spatially explicit maps of annual LULC.

Ecoregion Framework

The U.S. Environmental Protection Agency's (EPA) ecoregion-based spatial framework was used to capture regionally unique processes and landscape potential (Omernik, 1987). Ecoregions represent semicontinuous regions with similar patterns of biotic, abiotic, aquatic, and human land-use characteristics and have proven to be a useful framework for collecting and synthesizing information about LULC change (Gallant and others, 2004). Ecoregions are hierarchical and defined at four spatial scales (Level I, II, III, and IV). We used the 1999 version of Level III ecoregions (U.S. Environmental Protection Agency, 1999) as our base mapping unit. On the basis of this version of the framework, we created a modified version of the Level II ecoregions to serve as our reporting framework. In this report we present results of our effort to downscale IPCC-SRES global scenarios to the Marine West Coast Forests Level II Ecoregion and the three Level III ecoregions contained therein: the Puget Lowland, Willamette Valley, and Coast Range (fig. 1).

Marine West Coast Forests Ecoregion

The Marine West Coast Forests, along Washington, Oregon, and northern California's coastline, are characterized by a cool, maritime, moist climate with dry summers and wet, generally snow-free winters. The low mountains of the Coast Range are covered by highly productive, rain-drenched evergreen forests. The three tallest conifer species in the world grow here and include the coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*), and Sitka spruce (*Picea sitchensis*). Historically, Sitka spruce forests dominated coastal areas in the north, while coast redwoods were the most common species in the fog-laden south. Inland areas were a complex mosaic of western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and Douglas-fir. Today, Douglas-fir plantations are prevalent on the intensively logged and managed landscape. Also in this ecoregion are the drier, flatter, and more populated Willamette Valley and Puget Lowlands, which are in the rain shadow of the Coast Range and Olympic Mountains, respectively. Fertile soils and a temperate climate make the Willamette Valley an extremely productive agricultural area. The Puget Lowland to the north hugs the coastline and is the most densely populated area within the region. The rivers of the Marine West Coast Forests support world-renowned steelhead (*Oncorhynchus mykiss*), Chinook (*Oncorhynchus tshawytscha*), and coho (*Oncorhynchus kisutch*) salmon fisheries.

Historically, the Marine West Coast Forests Ecoregion has undergone comparatively high rates of LULC change (Sleeter and others, 2012b). Drivers of change have included regional and global timber demand, market competition, population expansion, conversion of forested lands to agriculture, and environmental protection (Daniels, 2005). Modern land use is diverse and includes high-yield timber production in the Coast Range, agricultural production in the Willamette Valley, and extensive developed land uses in the Puget Lowlands. The three subregional economies are distinct from each other and contribute to marked differences in modern and likely future LULC change. While timber harvesting is common throughout the ecoregion, privately held forests in the sparsely populated Coast Range and along the periphery of the Willamette Valley are heavily logged, with much less cutting occurring on public lands, since Federal enactment of species protection by the Northwest Forest Plan (U.S. Department of Agriculture and U.S. Department of the Interior, 1994). According to the U.S. Geological Survey's Land Cover Trends data (Loveland and others, 2002), forest cutting was the highest ranking LULC change throughout this Level II ecoregion with an estimated 15,254 km^2 of forest cleared between 1973 and 2000, representing more than 16 percent of the total land area. Forestry and forest products are major drivers of the region's economy, along with agriculture, high-technology, manufacturing, construction, and service industries. The delivery of goods and services is facilitated by the main north-south and east-west transportation corridors and intercontinental railroad access, two major international airports (Seattle-Tacoma and Portland), as well as major shipping ports located along the entire coast of the Marine West Coast Forests (fig. 1).

Developed lands dominate in the Puget Lowlands and include the major metropolitan areas of Seattle, Tacoma, and Bellevue, home to more than 3.5 million people (U.S. Census Bureau, 2011). The Portland Metropolitan area in the northern Willamette Valley was home to an estimated 2.3 million people. In contrast, the largest cities in the sparsely populated Coast Range include the coastal cities of Aberdeen, Wash. (population 16,461), Coos Bay, Ore. (15,374), and Eureka, Calif. (26,128) (U.S. Census Bureau, 2011).

Agriculture dominates in the Willamette Valley, which produces a large percentage of the grass seed, Christmas trees, and hazelnuts sold in North America. Fruits, nuts, vegetables, and grains, as well as livestock and dairy, are also present; however, greenhouse and nursery stock have become the biggest agricultural commodity in the valley. Agriculture in the Puget Lowlands is a small sector focused on the production of high-value crops such as fruits, vegetables, and greenhouse products. In the Coast Range, agriculture does occur in small pockets along valley bottoms, most notably dairy farming in and surrounding Tillamook, Ore., and hay and pastureland around Humboldt Bay, Calif., and along the Columbia River.

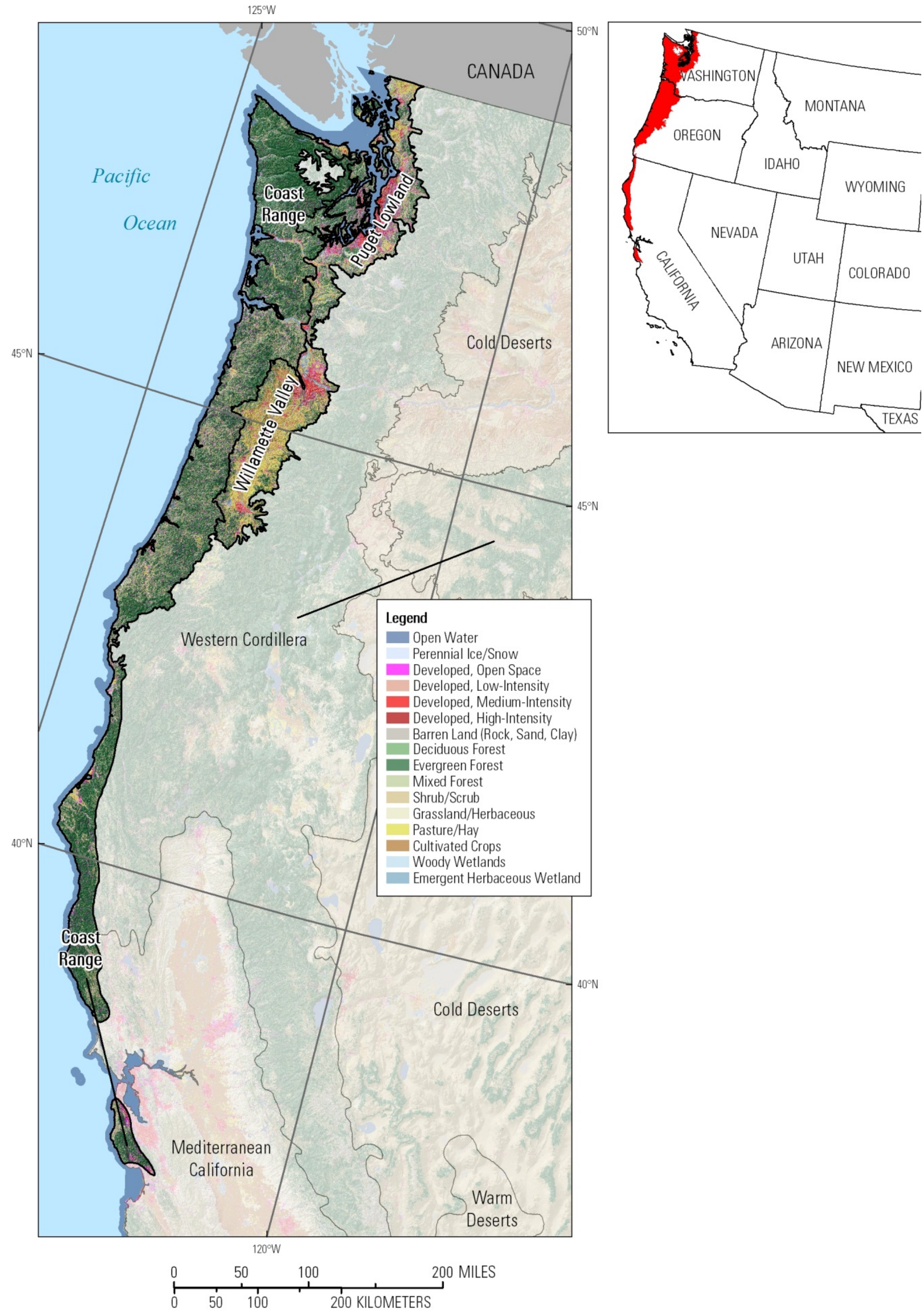

Figure 1. The Marine West Coast Forests Ecoregion (A) land use and land cover map and (B) location map.

Methods

The Forecasting Scenarios Land Use Model

The FOREcasting SCEnarios (FORE-SCE) model (Sohl and others, 2007) was used to produce spatially explicit maps of LULC based on the downscaled Special Report on Emissions Scenarios (SRES) scenarios (fig. 2). The FORE-SCE model incorporates a modular approach to projecting LULC, with a distinct spatial "demand" module and a spatially explicit allocation module. Demand for overall regional proportions of LULC change was modeled independently from the "spatial allocation" process, which places LULC change patches onto the landscape. A LULC accounting model was developed to downscale IPCC-SRES scenarios to the national and ecoregion scales and to provide demand for FORE-SCE. The LULC "demand" is specified ecoregion-by-ecoregion in the form of area for each LULC conversions at 5-year intervals. The FORE-SCE model then allocates demand on the landscape at annual time-steps.

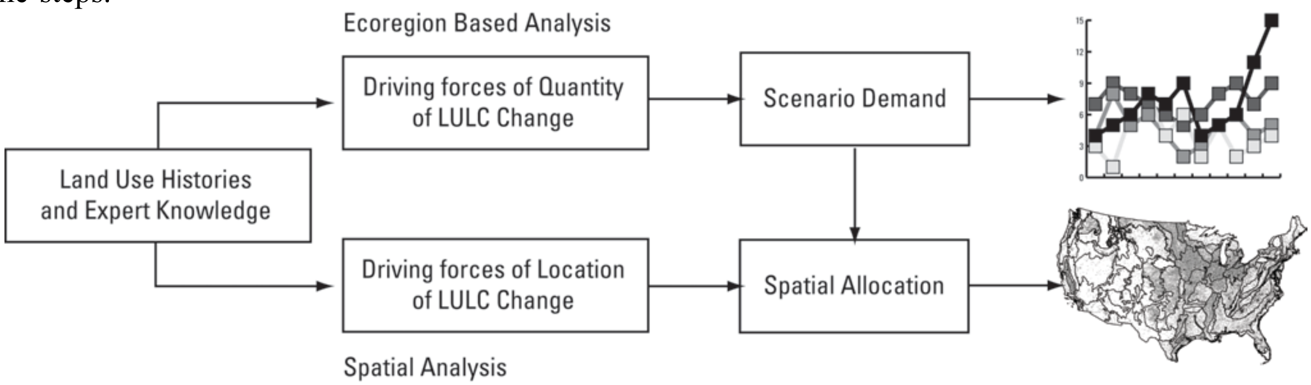

Figure 2. Conceptual diagram of the FORE-SCE modeling framework (demand versus spatial allocation).

Baseline Conditions

Baseline conditions are defined as the period of time from 1992 through 2005 (fig. 3). Starting conditions are initiated using a modified version of the 1992 National Land Cover Dataset (Vogelmann and others, 2001) resampled to 250-meter resolution. For the period 1992 to 2000 LULC is modeled forward using the estimated rates of change from the USGS Land Cover Trends data. For the period 2001–2005 LULC is modeled forward using the rates of change from the 2001–2006 NLCD change product (Xian and others, 2009). Upon completion of baseline modeling, remote sensing data from the LANDFIRE Vegetation Change Tracker (VCT) product (Huang and others, 2010) compiled between 1992 and 2005 are "burned in" to each annual LULC map to represent areas of clearcut logging. A complete description of baseline modeling can be found in Sohl and others (2011).

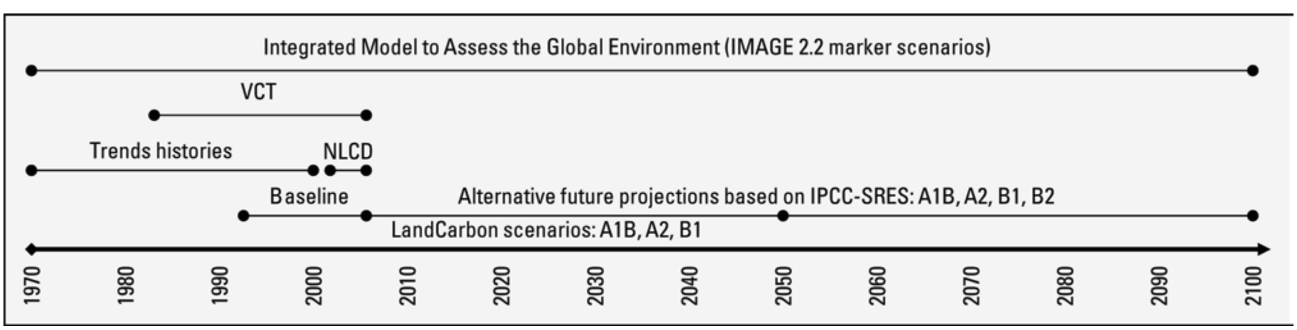

Figure 3. Conceptual diagram describing the development of the modeled baseline.

Table 2. Land use and land cover classes and definitions (modified from the National Land Cover Database 1992; Mechanical Disturbance class derived from a modified version of the LANDFIRE Vegetation Change Tracker).

LULC Class	Description
Water	Areas of open water, generally with less than 25 percent vegetation/land cover.
Developed	Areas characterized by a high percentage (20 percent or greater) of constructed material (concrete, asphalt, buildings, etc.)
Mechanical Disturbance	Areas of forest physically cleared by logging activity or thinning.
Mining	Areas of extractive mining activities with surface expressions
Barren	Areas characterized by bare rock, gravel, sand, silt, clay, or other earthen material, with little or no "green" vegetation present regardless of its inherent ability to support life. Vegetation, if present, is more widely spaced and scrubby than that in the green vegetated categories; lichen cover may be extensive.
Deciduous Forest	Areas dominated by trees where 75 percent or more of the tree species shed foliage simultaneously in response to seasonal change.
Evergreen Forest	Areas dominated by trees where 75 percent or more of the tree species maintain their leaves all year. Canopy is never without green foliage.
Mixed Forest	Areas dominated by trees where neither deciduous nor evergreen species represent more than 75 percent of the cover present.
Grassland	Areas dominated by grasses and forbs. In rare cases, herbaceous cover is less than 25 percent, but exceeds the combined cover of the woody species present. These areas are not subject to intensive management, but they are often utilized for grazing.
Shrubland	Areas dominated by shrubs; shrub canopy accounts for 25 to 100 percent of the cover. Shrub cover is generally greater than 25 percent when tree cover is less than 25 percent. Shrub cover may be less than 25percent in cases when the cover of other life forms (e.g. herbaceous or tree) is less than 25 percent and shrubs cover exceeds the cover of the other life forms.
Agriculture	Areas dominated by vegetation that has been planted or is intensively managed for the production of food, feed, or fiber; or is maintained in developed settings for specific purposes. Includes cultivated crops, row crops, small grains, and fallow fields.
Hay/Pasture	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.
Herbaceous Wetland	Areas where perennial herbaceous vegetation accounts for 75 percent to 100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.
Woody Wetland	Areas where forest or shrubland vegetation accounts for 25 percent to 100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.

Scenario Demand

Future scenario-based projections were developed for the period 2005 to 2100 for four IPCC-SRES scenarios. Projections of LULC from the Integrated Model to Assess the Global Environment (IMAGE) were incorporated into a land use accounting model to project conversions between LULC classes, at five-year intervals, for the conterminous United States. National-scale LULC conversions were then downscaled to each successive, hierarchically nested Level I, Level II, and Level III ecoregion using historical, ecoregion-based LULC change data from the Land Cover Trends project (Sleeter and others, 2012b; or see *http://landcovertrends.usgs.gov*). Land Cover Trends data were used to provide a point of departure for initializing LULC projections, also serving as a consistency check for future change. Scenario projections with large departures from the historical ranges were screened for logical consistency, ensuring projections were plausible and consistent with scenario characteristics. Throughout the LULC scenario development and downscaling process experts were consulted in a series of workshops and ad-hoc consultations. Figure 4 is a conceptual diagram depicting the multistage scenario development process. A complete description of the scenario development and downscaling process can be found in Sleeter and others (2012a) and Zhu and others (2010).

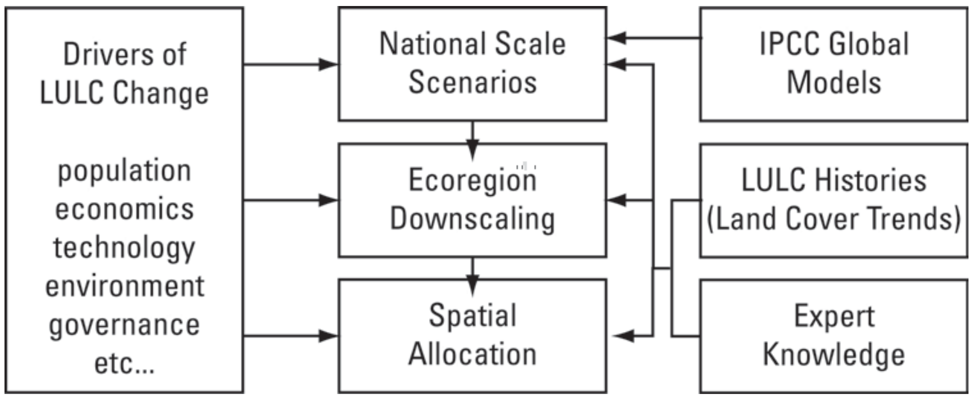

Figure 4. Conceptual diagram describing the scenario development process and components.

Spatial Allocation

Land use and land cover was modeled using a modified version of the FOREcasting SCEnarios (FORE-SCE) modeling framework (Sohl and others, 2011, 2007; Sohl and Sayler, 2008) for 2006 to 2100. The FORE-SCE model is spatially explicit, capable of placing LULC change onto the landscape. Guided by LULC demand, FORE-SCE's patch-by-patch allocation methodology generated realistic patterns of local and regional scale LULC change.

Essential to spatially modeling future land cover is developing an understanding of the underlying variables determining why LULC occurs where it occurs, and thus landscape potential to support a specific land use or land cover. To identify LULC determinants, we randomly sampled data points from the 1992 National Land Cover Dataset (NLCD, Vogelmann and others, 2001) for 13 different land-cover classes (excluding mechanically disturbed and snow/ice) for each Level III ecoregion (table 2). The mechanically disturbed class was created using disturbed forest patches captured by the LANDFIRE Vegetation Change Tracker (VCT) product between 1986 and 1992 (Huang and others, 2010). To minimize inclusion of non-harvest related forest disturbance in the VCT data, wildfires were masked out using spatially explicit data from the Monitoring Trends in Burn Severity (MTBS) project (Eidenshink and others, 2007). The final VCT-derived mechanically disturbed forest patches represent logging activity alone. Each of the final 14 land-cover classes was sampled at the 250-meter pixel size (table 2).

We performed stepwise logistic regression analysis of individual land cover classes against 24 different biogeophysical and cultural parameters (table 3), also sampled at 250-meter pixel resolution, to reveal dominant land-cover predictors for each Level III ecoregion within the Marine West Coast Forests. Only variables meeting a significance level between 0.05 and 0.001 were used. Logistic regression-based probability surfaces were then generated for each land-cover class, providing spatial reference of areas most likely supporting or capable of supporting the given land-cover type. Table 4 lists the determinant variables and associated sign (+/-) influence on LULC presence for each Level III ecoregion.

These probability-of-occurrence surfaces are fed into the FORE-SCE model to guide the spatial allocation of LULC change occurrence. The FORE-SCE model used a modified version of the 1992 National Land Cover Dataset to initiate model runs. Changes in LULC were modeled forward from 1992 through 2006 using rates of change from Land Cover Trends for the period 1992–2000, and rates of change from the 2001–2006 NLCD (Homer and others, 2004; Xian and others, 2009). Vegetation Change Tracker data was used to provide annual areas of forest harvest which was “burned in” on the

Table 3. Independent variables used in the logistic regression analysis to produce probability of land use and land cover occurrence, organized by biophysical and cultural categories.

Category	Variable
Topographic	Elevation (NED)[1] Slope[1*] National Compound Topographic Index (CTI) [1*]
Geographic	Latitude (XCOORD) Longitude (YCOORD)
Cultural	Population Density (POPDEN)[2] Housing Density (HOUSEDEN)[2] Distance to City (DISTCITY)[2+] Distance to City with Population > 100,000 (DSTCTY100K)[2+] Distance to City with Population < 25,000 (DSTCTY25K)[2+] Urban Window Count (URBAN)[2++] Distance to Road (DISTROAD) [3+] Distance to Railroad (DISTRAIL)[3+] Distance to Protected Areas (DISTGAP1_2) [4]
Biophysical	Available Water Content (AWC) [5] Soil Organic Carbon (SOC) [5] Crop Capability (CROPCAP)[5] Hydric Soils (HYDRIC)[5] Distance to Water (DSTWATER)[2+] Distance to Stream (DISTSTREAM)[2+]
Climate	Maximum July Temperature (MAXTEMP)[6] Minimum January Temperature (MINTEMP) [6] Average Temperature (30 year average, AVETEMP) [6] Average Precipitation(30 year average, AVEPRECIP) [6]

[1]U.S. Geological Survey, 2006.
[2]U.S. Census Bureau, 2000.
[3]U.S. Geological Survey, 2012.
[4]U.S. Geological Survey, 2011. Only GAP Level 1 and 2 protected areas (highest level of protection) were used.
[5]Natural Resources Conservation Service, 2011.
[6]Maurerand others, 2007. Based on the IPCC-SRES A1B scenario.
[*]Derived from the U.S. Geological Survey’s National Elevation Dataset, more information available at: *http://edna.usgs.gov/Edna/edna.asp*.
[+]Distance to variables calculated in ArcGIS environment in meters away from feature line or boundary.
[++]Calculated as average density per concentric 50 pixel radius values based on U.S. Census population density.

modeled LULC. A protected area database (PAD-US, 2010) is used to restrict the placement of LULC change on certain types of protected lands. The spatial modeling proceeds with individual patches of LULC change placed on the landscape until scenario demand is met. Qualitative storylines accompanying the quantitative scenarios are also used to inform the spatial modeling, as patch size characteristics, parameters on patch dispersion, or lands protected from change, varied depending upon characteristics of the underlying scenario storylines.

Table 4. Land cover classes and logistic regression results.

[Only variables between the 0.5 and 0.001 significance level were captured and listed from highest to lowest predictive power. The sign (+/-) preceding each variable indicates the numerical direction of variable influence.]

Determinant Variables of Land Use and Land Cover for the (1) Coast Range, (2) Puget Lowlands, and (3) Willamette Valley

	Water			Developed			Mechanical Disturbance			Mining			Barren			Deciduous Forest			Evergreen Forest			Mixed Forest			Shrub			Grass			Agriculture			Hay Pasture			Herbaceous Wetland			Woody Wetland		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
ELEVATION	-	-	-	-	-	+	+	+	+			-	-			-			+	+	+				+	-		+			-	-		-	-	-	-	-		-	-	-
SLOPE				-		-	-	-	+					-			+	+			+			+	+				-	+	-	-	-		-	-			-	-		
CTI	+	+	+	-	-		-	-			-	-	-			-	-		-	-		-	-			-		-			-				-	-	-	+		-		
LATITUDE								-			+							+					+																		-	
LONGITUDE																		+												-			+			-		-	-			
POPDEN			-																					-	-			-				-	-				-				-	
HOUSEDEN																		-																		-						
DISTCITY	+			-	-	-					-	-		+					+		+		-			-							-									
DSTCTY100K		-		+				-	+	-				+		+				-			-			-			-				-	+							-	
DSTCTY25K							+			-			+											-	-			-									+					
URBAN				+	+	+	-	-		-			-				-		-	-		-	-		+		+	-			-	+	-	-		-		-	-			-
DISTROADS		+			-	-			+					-			-	+		+			+				+	+			-		-	-	-			-				
DISTRAIL										-			-	-	-	+								+			-		-	-		-	+		+		-					
DISTGAP1_2							+			-	+		-	-	+	+			-												+		-	+			-					-
AWC	-		-			+	+			-	-	-		-	-	+	+	+				+	+		-		+				+	+	+	+	+	+	+	+	-		+	
SOC													-															-							-							-
CROPCAP			-	+	+		+	+	+	+		+		+		+	+	+	+	+	+	+	+	+	+			+	+			+	-	-		-				+		
HYDRIC	+				-		-	-	-		-			+		-	-		-	-	-	-	-	-								+		+	+	+			+	+	+	+
DISTWATER		-	-						-				-	-				-							+		-	+			+	+	+			+	-	-				-
DISTSTREAM		+	-					+					-	-		+		+			+			+											+	+					+	
MAXTEMP	-																			-							-			-	+			+								
MINTEMP		-						+								-		+	-							-		+											+	-		
AVETEMP										+		+													+																	
AVEPRECIP					-			+				-				+		+						+							-	-		-				+		+	+	

Data Summary

Appendix A contains 14 baseline maps for the period 1992 to 2005 for the Marine West Coast Forests. The 1992 map represents LULC from the modified 1992 NLCD, with the subsequent maps (1993-2005) modeled by FORE-SCE and guided by historic LULC change rates estimated by the USGS Land Cover Trends data for the period 1992 to 2000. The map files are in IMG file format and compatible with most geographic information system (GIS) and remote sensing software applications.

Appendix B is the LULC demand-accounting model for the Marine West Coast Forests presented in spreadsheet format. The workbook contains 12 individual worksheets with scenario-based demand values by Level III ecoregion (Coast Range, Puget Lowlands, Willamette Valley) for each of the four IPCC scenarios (A1B, A2, B1, B2).

Appendix C contains 380 individual maps of projected annual LULC in the Marine West Coast Forests for the period 2006–2100 for each of the four IPCC scenarios (A1B, A2, B1, B2). The map files are in IMG file format and are compatible with most GIS and remote sensing software applications.

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Appendixes

[linked online]

Appendix A. Baseline Maps for the Period 1992–2005

Appendix B. Demand Tables

Appendix C. Projected Land Use and Land Cover Maps for the Period 2006–2100

C1. A1B Scenario
C2. A2 Scenario
C3. B1 Scenario
C4. B2 Scenario