Southern Oregon Regional Greenhouse Gas Inventory

The carbon footprint of Jackson and Josephine county residents.

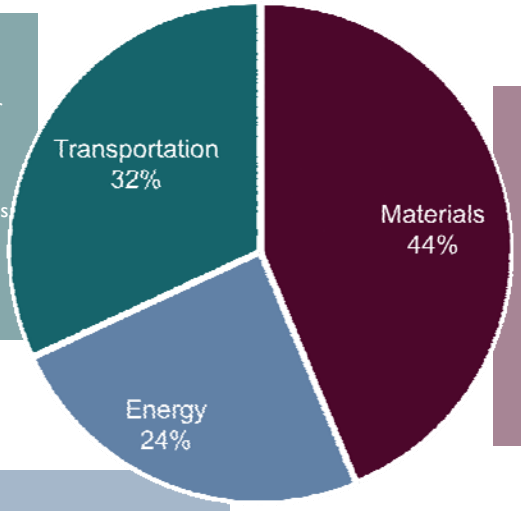
This report summarizes the findings of a greenhouse gas (GHG) inventory conducted on behalf of the Rogue Valley region for emissions generated in 2006. The chart below shows, at the highest level, the "carbon footprint" – that is the GHG emissions from activities of all kinds – of Jackson and Josephine county residents. Emissions stemming from activities within these boundaries are estimated at 5.5 million metric tons carbon dioxide equivalent (MT CO_2e).

This analysis provides a *consumption-based* inventory for southern Oregon. In other words, these are the emissions associated with consumption by Jackson and Josephine county residents – which include emissions that do not occur here, but result from the manufacturing and transportation elsewhere to make and move what we consume. The emissions are in three categories: energy, transportation and materials.

Southern Oregon Greenhouse Gas Emissions

5.5 Million Metric Tons Carbon Dioxide Equivalent (MT CO_2e)

19.6 MT CO_2e per resident



Transportation

Estimated emissions: 1.8 MMT CO_2e

- Vehicle miles traveled by passenger vehicles and light trucks
- Operation of public transportation system
- Local freight movement of materials and goods (commercial delivery trucks)
- Rail, air and other passenger transport methods

Materials (goods and food)

Emissions related to the production, manufacture and disposal of materials, goods and food.

Estimated emissions: 2.4 MMT CO_2e

- Manufacture of products and food (from inside and outside the region) consumed by residents and businesses
- Freight movement of materials, goods and food (heavy truck, rail, air)
- Waste management and recycling system (collection, landfills)

Energy

Estimated emissions: 1.3 MMT CO_2e

- Natural gas consumption from residents and businesses
- Fossil fuel consumption from utilities' generated and imported electricity

As explained in detail in the following pages, these emissions are in some cases:

Direct – emissions that occur here, such as gasoline and natural gas combustion.

Indirect – emissions that occur beyond our community and regional borders, such as electricity imports.

Remote – emissions associated with remote activities that end with final consumption here in the community (such as the production of many goods and much of the region's food).

In 2011, the Rogue Valley Council of Governments (RVCOG) will be convening a public process to identify strategies that not only reduce carbon emissions, but also develop family wage jobs, reduce energy costs, and facilitate the use of the region's as-of-yet relatively untapped renewable energy resources. This GHG emissions inventory supports that process by establishing a baseline carbon footprint of consumption in southern Oregon in order to discover the highest-leverage areas for change and to provide technical support for future project funding.

Methodology: Consumption-Based Carbon Emissions

Currently, there is no standard protocol for conducting a community or regional GHG inventory. Most analyses of the Northwest[1] as a region or of communities and cities in the region focus on *direct* emissions from the use of fossil fuels. However, recent Environmental Protection Agency (EPA) research[2] suggests that those emissions for which we are *indirectly* responsible – especially those resulting from the production of goods and food from outside the regions where they are consumed – are a large share of the total carbon footprint and are ignored by conventional analyses that focus on geographic boundaries. Our methodology aims to include *all* major sources of emissions, direct and indirect.

It is important to stress that some of the data presented here are *estimates*, not actual measurements. This analysis builds on the EPA's work to assemble a new kind of inventory methodology. However, it is an evolving process based on available data and current understanding of the major sources of GHG emissions. In order to provide the truest and fullest accounting of the region's GHG emissions, a hybrid inventory approach was used in which actual data was collected when available (energy, local transport, solid waste) and national averages with regional adjustments were used as estimates when it was not (goods and food production and transportation, air travel, etc.). The Rogue Valley region, however, is not so different from national averages[3] and the methodology provides an estimate with a clear message: consumption matters as much as energy and transportation.

The International Council for Local Environmental Initiatives (ICLEI) recently released a draft Community-Scale Protocol Framework, which includes the consumption-based methodology.[4] While the methodology is still being refined, a growing number of communities are conducting the consumption-based inventories, including Portland Metro[5], Lane County, King County, Washington[6], the State of Oregon[7], and the State of California[8].

There are two major exclusions to this inventory that are not consistent with the methodology:

1. **Carbon sequestration by forests:** The Rogue Valley region is home to vast forestlands that sequester and store carbon. Carbon storage is not "consumed" and therefore not included.

2. **Emissions from energy used in local production:** Emissions from Rogue Valley production are generated on behalf of those consuming the goods and food. While a portion of local production is consumed locally, the majority is consumed outside of the region; therefore, we attempt to include only those emissions attributable to that share of local production that is consumed here.

Energy (natural gas and electricity)

Energy used in buildings is the source of 24% of our region's GHG emissions.

Lighting, heating, and cooling buildings, and the operation of appliances by residences, commercial establishments, and industrial buildings account for 1.3 million metric tons of carbon dioxide equivalent. Emissions from electricity generation make up 77% of the total energy emissions, while combustion of natural gas and other fuels make up the remaining 23%.

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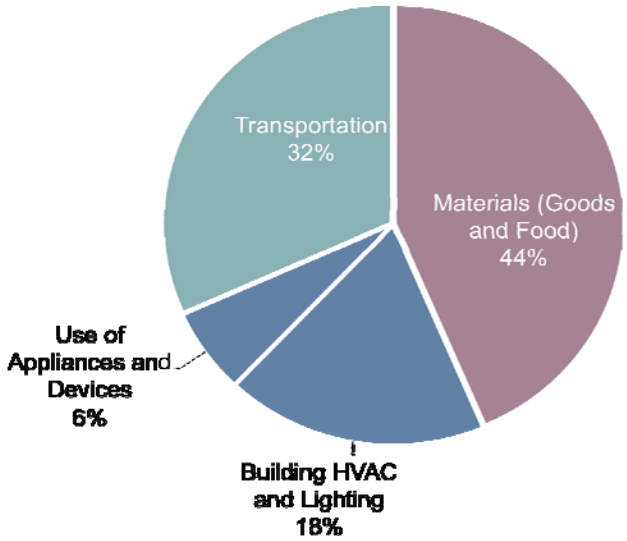
[1] For example, see "2008 Seattle Community Greenhouse Gas Inventory," City of Seattle, (http://www.seattle.gov/climate/docs/2008-community-summary.pdf) or "CO2 Emissions from Fossil Fuels by Sector," Sightline Institute (http://www.sightline.org/maps/charts/Climate-EmBySector).
[2] "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices," EPA (2009), http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf.
[3] Oregon Economic & Community Deveopment Department's Regional Analysis of Jackson, Josephine, Klamath and Lake Counties. Downloaded online at http://www.oregon4biz.com/assets/docs/holzgang.pdf.
[4] ICLEI's Draft Community-Scale GHG Emissions Accounting Protocol Framework may be downloaded at http://www.icleiusa.org/library/documents/Community_Protocol_Draft_Framework.pdf
[5] For details see library.oregonmetro.gov/regional_greenhouse_gas_inventory.pdf
[6] For details see http://www.kingcounty.gov/environment/dnrp/newsroom/newsreleases/2010/april/0420Greenhouse-gas.aspx
[7] For details see http://yosemite.epa.gov/R10/ECOCOMM.NSF/2. Oregon DEQ Climate Materials Research Projects.pdf
[8] For details see http://www.climatechange.ca.gov/research/.

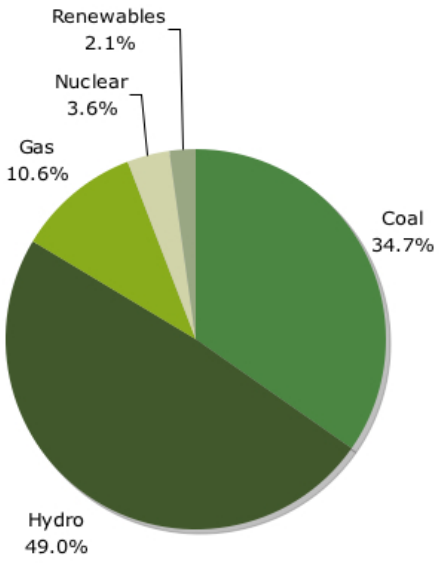
Considering the history of hydropower in the region, it may come as a surprise to many long-time residents of the Northwest to learn that electricity consumption is responsible for such a large portion of the carbon footprint. This is because as the region's economy and population have grown, the hydroelectric system has been unable to keep up with the expanding region's electricity needs. For the most part, coal and gas have filled this gap.

Rogue Valley Region Greenhouse Gas Emissions with Energy Split



Regional Sources of Electricity

Northwest Power Pool (NWPP)



There are many efforts to reduce the region's dependency on coal and gas. The electric utilities serving southern Oregon (Pacific Power and City of Ashland Utilities) have made investments in renewable energy and energy efficiency, and a state-mandated Renewable Portfolio Standard (RPS) will require specific steps in that direction over the coming years. In large part due to public policy and citizen commitment, Oregon has become a leader in renewable energy, including solar and wind power. Renewable energy sources are still a small share of total electricity generation (2.1%) though it is growing rapidly.[9]

The pie chart above shows the current mix of energy for the Northwest Power Pool, which is the section of the national grid from which we draw our power. The State has mandated renewable energy goals for large utilities of 25% of the electricity supply by 2025. Implementation of the standards will result in reductions in GHG emissions from Northwest electricity supplies.

Energy emissions for southern Oregon residents are lower than the national average, primarily due to the high proportion of hydropower generation, which amounts to roughly half of electricity generation in the region. The region's reliance on fossil fuels is further lessened by the high percentage of southern Oregon households that use wood as a primary fuel for space heating. Since carbon dioxide released from wood burning has only recently been sequestered from the atmosphere by the photosynthetic process of the tree, its return to the atmosphere, per GHG inventory protocol does not count as an addition of carbon. Therefore, we note the important role of wood in space heating, but it is not included as an emissions source in the inventory. [10]

The energy use documented in this section happens almost entirely in buildings, but the distinction between building energy and transportation energy will blur with the adoption of electric vehicles (EV). This is because building electrical outlets will likely charge the batteries in EVs. While EV technology promises to lower transportation-related emissions substantially, accommodating this new power demand will require deliberate steps by the utilities.

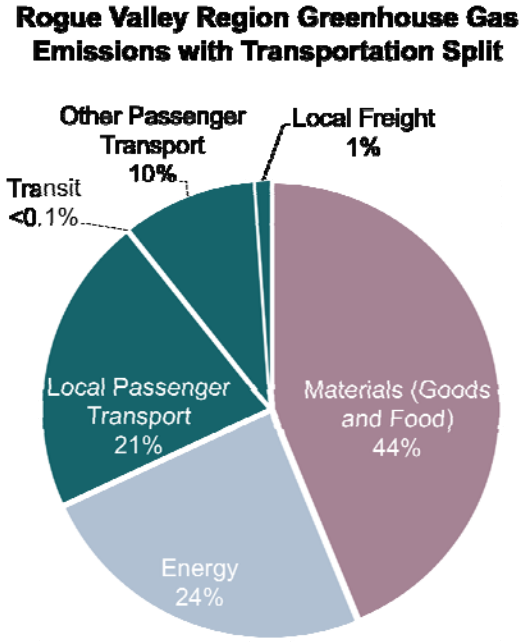
[9] The discussion of the regional electric grid draws on the most recent eGRID data from EPA , which reflects the electric power industry's structure as of December 31, 2007. For more see EPA's eGRID online at http://cfpub.epa.gov/egridweb/

[10] Residential wood burning is makes up about 18% of the Rogue Valley's space heating needs. Following U.S. GHG Inventory methodology based on Intergovernmental Panel on Climate Change guidelines these emissions have been excluded from this analysis.

Transportation

Transportation is responsible for about 32% of the region's GHG emissions. These emissions come mainly from on-road private vehicles, commercial vehicles, and air travel, with small shares from transit and recreational boating.

In southern Oregon, per-capita local passenger transport emissions are higher than the national average. This finding is not surprising given the region is largely a rural setting with fewer opportunities for alternative transportation (walking, biking, transit, etc.) compared to a higher density, more urban environment.



Transportation, which looms large as a local emissions source, represents roughly half of the GHG emissions *that happen in the region itself*. However, when we include all of the emissions resulting from local consumption – those that happen inside *and* outside the region – transportation makes up just 32% of the total carbon footprint. The 10% share labeled "Other Passenger Transport" consists of air travel and long-distance ground transportation (inter-city bus).[11] Transit buses account for less than 0.1% of the Rogue Valley's total emissions.

While local freight is accounted for in this transportation analysis (a 1% share), most of our freight need is long-distance transportation of goods from far beyond the region's borders. The emissions from the long-distance freight movement of these goods are included in the emissions associated with materials, goods and food, and not within the transportation section.

It warrants mention that the process under SB 1059 is a distinct, state-wide effort with an emphasis on MPOs, and is focused solely on emissions reductions from light duty vehicles[12]. To avoid any general inconsistencies with that state process, this project has employed the same methodology and modeling software the state is using for its statewide estimates. To avoid specific inconsistencies with the later phases of SB 1059, which entail scenario planning and the generation of emissions reduction strategies for light duty vehicles, ClimateWise II will defer to the RVMPO for identifying the appropriate transportation and land use strategies in southern Oregon's MPO area.

Materials, Goods and Food (production, movement and disposal)

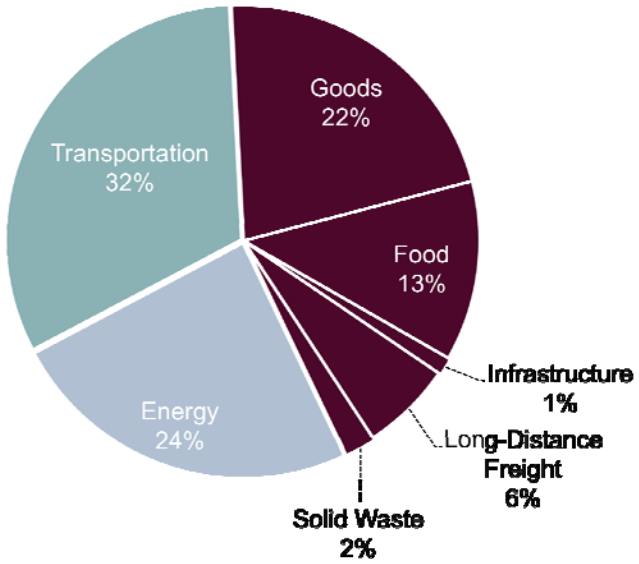
Slightly less than 44% of the region's GHG emissions result from the consumption of goods and food by Rogue Valley citizens. These embodied emissions are GHG emissions emitted from the energy consumption and industrial processes associated with the production of goods and food that are produced elsewhere and shipped to the Rogue Valley for consumption. For goods, these emissions are generated during extraction of raw materials, manufacturing and transport. For food, these emissions include growing, processing and distribution. A small component of this category is emissions associated with the disposal of food and products in the landfill. These life-cycle stages of manufacturing and distribution, which are generally invisible to consumers, are a large and important part of our carbon footprint.

[11] This analysis uses national per capita averages from the EPA report previously cited, in the absence of local data or explicit guidance from any widely accepted protocol or methodology.
[12] The legislation specifies that the emissions goal apply to only vehicles weighing less than 10,000 pounds.

"Goods" (22%) and "food" (13%), shown in the figure to the right, include the life-cycle GHG emissions of items such as clothing, furniture, cars, food and beverages. It also includes packaging of products and single-use items that are quickly relegated to the waste stream.

The movement of goods and food (6%) from distant United States production sites to the Rogue Valley area are quantified as long-distance freight. This long-distance movement of materials often looms large in our perception, but depending on the item, may in fact be a small share of the item's total carbon footprint. For example, freight-related emissions contribute only one-eighth of the total emissions related to the provision of food. Most food-related emissions result from the growing of food (especially feed for animals and the use of fertilizers) and, to a lesser extent, food processing.

Rogue Valley Region Greenhouse Gas Emissions with Materials Split



The relatively small solid waste slice (~2%) represents the emissions associated with the end-of-life disposal of goods and foods. While this emissions source is a small share of total emissions, several things should be noted. First, the success of regional waste reduction programs in keeping this slice small should not be underestimated. Reuse and recycling that diverts materials from disposal and back into use has significant net carbon reduction impacts compared with use of virgin materials – even when transportation impacts of material collection and hauling are counted. Second, the management of the more upstream portion of material flows offers many potential GHG-reducing opportunities promoting new green purchasing strategies for businesses and consumers, reducing energy use and supporting the internalization of the life-cycle carbon costs of goods into their market price. Finally, the region does generate renewable energy through landfill gas collection, an industry best practice that lowers the overall carbon intensity of our regional electricity grid by capturing landfill methane (a powerful GHG) and displaces the fossil fuels that would be required to generate the equivalent electricity if this resource were not being utilized.

The infrastructure section of the figure above represents the emissions associated with the construction and maintenance of highways, streets, bridges, tunnels, sewers and pipelines. Most of this slice is in the manufacture, distribution and installation of materials into the built environment.

The aggregate estimate for this entire section does not attempt to include international trade. Estimates of our imported carbon footprint suggest that the consumption slice could in fact be significantly larger, increasing our national carbon footprint by as much as 20%.[13]

Current Emissions and Future Reductions

Gases that trap heat in the atmosphere are referred to as greenhouse gases (GHGs) or simply as "carbon" in a carbon footprint. Repeated scientific investigation has shown that these gases are being emitted faster than they can be removed by earth's natural systems. While there is still no consensus on the degree to which these GHGs are contributing to the phenomenon of worldwide shifts in climate, longitudinal climatic information does support the contention that we are in a period of unusually rapid, worldwide climate change. This climatic shift, should it continue as predicted, will result in significant changes in long-term temperature and precipitation

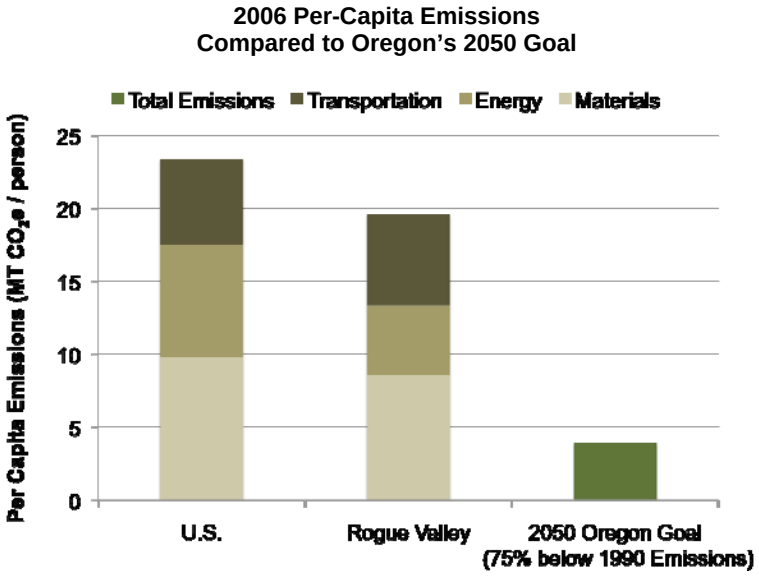
[13] See "Embodied Environmental Emissions in U.S. International Trade, 1997−2004," Christopher L. Weber and H. Scott Matthews (2007).

patterns, and disruptions of weather patterns causing events such as heat waves, droughts and more frequent severe weather events[14].

A recent analysis of the potential impact of climate change in the Rogue Valley[15] suggested that annual average temperatures are likely to increase from one to three degrees Fahrenheit by 2040 and four to eight degrees by 2080 with seasonal differences as follows: summer temperatures increasing seven to15 degrees and winter temperatures increasing by three to eight degrees by 2080. Rising temperatures will likely cause snow to fall as rain at lower elevations. A decreased January snowpack is consequently expected with a decline in runoff and stream flow. The basin is likely to experience more severe storm events incorporating more variable weather, with higher and flashier winter and spring runoff events and increased flooding. Additionally, wet and dry weather cycles are expected to last longer and become more extreme, posing threats from both drought and flooding. Finally, wildfires are likely to consume more vegetation. That report includes more specific information on the major threats posed to natural and human systems in southern Oregon. In the face of the evidence, it would seem a prudent step to both devise strategies to adjust future practices to meet these changes, and to look at ways to reduce the impact of the region's carbon emissions while also increasing its economic security and self-reliance.

As stated previously, the residents of the Rogue Valley region have a smaller per-capita carbon footprint than the average U.S. resident. This difference is primarily due to two factors. The region's abundant sources of clean electricity from hydropower combined with lower average incomes, resulting in lower rates of consumption and long-distance travel.

Ultimately, the per-capita comparison is not useful in determining how the region's current emissions compare to the reductions needed to avoid the most catastrophic effects of climate change and Oregon's stated goals for 2050.[16] See the figure to the right.



This GHG inventory is a first step in responding to and potentially mitigating the impacts of climate change by reducing GHG emissions. The baseline information about the carbon footprint from Jackson and Josephine counties will be presented at workshops to local leaders and experts. Workshop participants will contribute their recommendations for moving forward with carbon reduction strategies to a regional steering committee. These recommendations will be available for decision-makers to consider, although they are not tied to any regulatory mandates.

In addition to this project, the following efforts in southern Oregon to reduce energy consumption and GHG emissions, while also fostering economic benefits, are also underway:

- The **Southern Oregon Green Jobs Council** is a consortium of private and public stakeholders committed to the coordination and development of alternative energy and efficiency projects that increase the number of living-wage jobs in the southern Oregon.

[14] Oregon Climate Change Research Institute (2010). *Oregon Climate Assessment Report*. Accessed online at http://occri.net/wp-content/uploads/2011/01/OCAR2010_v1.2.pdf.
[15] Climate leadership Initiative, Geos Institute (2008). *Preparing for Climate Change in the Rogue River Basin of Southwest Oregon.* Available for download online at http://www.geosinstitute.org/images/stories/pdfs/Publications/ClimateWise/ROGUEWORKSHOP_FINALsinglewebsite.pdf
[16] State of Oregon House Bill 3543 sets greenhouse gas reduction goals: namely by 2010 to begin to reduce greenhouse gas emissions, by 2020 to achieve greenhouse gas levels 10% less than 1990 levels and by 2050 to achieve greenhouse gas levels 75% below 1990 levels. For more detail visit http://www.oregon.gov/ENERGY/GBLWRM/HB3543.shtml.

- **Southern Oregon Clean Energy Alliance** is working to evaluate and foster regional collaboration on renewable energy and energy efficiency projects that also develop local career opportunities.
- **Rogue Valley Clean Cities Coalition** is made up of businesses and public agencies working together to encourage the use of alternative fuels.

There are also a number of initiatives being pursued by the State of Oregon, including:

- Setting a statewide GHG emission reduction goal of a 75% reduction below 1990 levels by 2050.
- Developing a low-carbon fuel standard and adapting low-emission vehicle rules. The goal of the low-carbon fuel standard is to reduce the carbon intensity of Oregon's transportation fuel mix by 10% over the next 10 years, by increasing the use of low-carbon fuels such as waste-grease biodiesel.
- Establishing a statewide transportation GHG reduction strategy.
- Adopting GHG reporting rules for certain industries emitting more than 2,500 MT CO_2e per year including electrical utilities, fuel distributers and landfills.

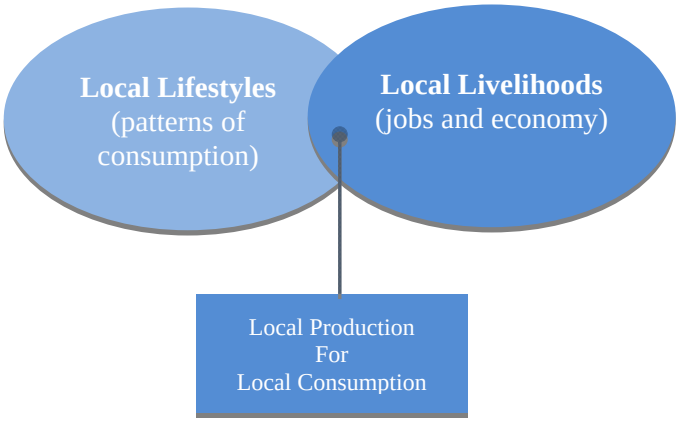
Climate Change, Carbon Footprints and Local Natural Resource Economies

This report is overwhelmingly about the carbon footprint of the daily lives of residents in southern Oregon – their transportation habits, consumption of food and goods, and use of energy to heat, cool and operate buildings. One observation is that this carbon footprint looks a lot like carbon footprints elsewhere in Oregon and in the U.S. This similarity makes sense: consumption patterns have a lot in common from one place to another in the U.S. because we are all part of the same fossil fuel-based economy.

This similarity means that many of the climate actions eventually taken in southern Oregon will be the same as elsewhere. Among those include fuel-efficient vehicles and low-carbon fuels, more effective building weatherization, and energy-efficient lighting, heating, and appliances and equipment in homes and businesses. These actions will probably also include careful stewardship of material flows to streamline consumption, reduce and reuse wastes and make the most of the wastes we do generate, for recycling, energy recovery and composting. This list is the same everywhere, albeit with local twists.

Local Lifestyles Vs Local Economy

This analysis focuses on consumption, not production. While the forestry and agriculture industries may be a source of local emissions and carbon sinks in the Rogue Valley - neither are the focus of this inventory. As the graphic to the right depicts there is overlap between the emissions associated with consumption by the area's residents and what they produce, but the scale of the overlap is relatively small.



Emissions are either being generated elsewhere (producing goods consumed in the Rogue Valley) to support local lifestyles or for elsewhere (generating emissions producing goods for consumptions outside the Rogue Valley) to support local livelihoods.

Forestry and agriculture have important roles in our collective carbon footprint nationally – indeed, with the right stewardship, they hold promise for addressing some of our biggest carbon challenges. The following section discusses a few of the key issues in this arena.

Carbon Opportunities in Resource Based Economies

Rural economies and the resources they manage offer unique opportunities not available to urban economies in a low-carbon economy. There are three main areas for there is potential for carbon reductions by altering, enhancing or relying on rural production.

- Agricultural practices: In general, agriculture (including animal husbandry) is a net emitter of CO_2 and other GHGs, notably methane (CH_4) and nitrous oxide (N_2O). However, the management of animal wastes, changes in fertilizer selection and use, and tilling practices to build soils can all significantly reduce emissions.
- Forestry practices: Forests, including trees, other plants and soils, are major stocks of carbon globally. However, we typically manage them mainly for timber production or for recreational or watershed purposes. Changing practices to enhance soils, reduce fire risk, and increase the stock of plant-based carbon can *increase* those stocks, perhaps significantly, for certain forests.
- Energy from biological feedstock: Forest biomass and certain crops can be utilized to generate electricity and heat or as the feedstock for liquid fuels.

These opportunities are potentially enormous and economically beneficial – indeed, in some cases, the carbon benefits may dwarf the carbon footprints of the day-to-day lives of people working in these rural sectors. In other words, national and international climate action could translate into vast, long-term economic development and steady jobs to many rural communities that can put the pieces together.

However, there is still great uncertainty around the realization of this opportunity for a variety of reasons spelled out below.

Policy Uncertainty, Lingering Technical Questions and the Road Ahead

We are early in our understanding of the GHG life cycles of bio-based fuels compared to fossil fuel based fuels. The issues have become regrettably politicized at the early stages, but if we pull back, the reasons for confusion are understandable and genuine: the underlying technical issues are complicated, many parties sense that they have "skin in the game", and our current regulatory frameworks are still playing catch-up. This is a recipe for conflict: jockeying for position, rather than asking the hard questions about what a viable low-carbon economy really means.

First and foremost, we should expect an increasing demand for technologies that are low-carbon or carbon neutral from a "life-cycle" perspective. Virtually no process is *exactly* carbon neutral; rather, for any technology and feedstock – such as energy from woody biomass – there is a spectrum of outcomes that depends on specific circumstances.

Luckily, we have some examples to follow. The low-carbon fuel standard (LCFS) efforts in California and Oregon have made slow but steady progress toward an understanding of biologically based energy sources and their juxtaposition with the fossil fuel sources. Just as we have had to learn to think differently about corn ethanol and soy biodiesel – and their relationship to petroleum energy sources – we will need new and better tools to compare biomass energy with its alternatives. The U.S. EPA recently announced it would take three additional years (2011-2014) to study biomass energy issues in detail; this is good news.

An important point to consider in any effort focused on mitigating climate change and reducing GHG gases is the need to devise strategies that are both socially and economically viable. Relying on punitive measures that place a region at a competitive disadvantage are not sustainable and will not be embraced by the population or the economy, and therefore will not lead to long term solutions that become a positive and permanent part of society.

Summary of Inventory Method and Assumptions

The technical appendix should be referenced for additional information on any of the following.

Energy

Assumptions for natural gas emissions:

- Per-capita emissions are based on retail sales in Jackson and Josephine counties.

Assumptions for electricity emissions:

- Per-capita emissions are based on retail sales in Jackson and Josephine counties.
- Emissions are calculated based on the carbon intensity of the regional electricity grid, the Northwest Power Pool (NWPP).

Other details:

- The regional split between heating, ventilating and air condition (HVAC) / lighting and appliances / devices was assumed to be the same as the national split.
- Industrial energy use is the energy used only for the operation of industrial buildings, not for the local manufacture of goods and services. The split of industrial energy (separating building operation from product manufacture) comes from the EPA (2009).
- Wood is assumed to be carbon neutral; therefore the emissions are not included.

Transportation

Assumptions for local passenger transportation:

- Light-duty vehicle emissions were estimated using Oregon Department of Transportation's GreenSTEP model. This model was developed as part of the Statewide Transportation Strategy and Senate Bill 1059. This analysis uses data provided by the State of Oregon and is consistent with SB1059 efforts to date.
- Transit emissions were calculated based on data received from local transit agencies.

Assumptions for freight:

- A fixed share (15%) of freight emissions associated with goods and food was assigned to transportation inside the Rogue Valley boundary.

Assumptions for transit:

- Emissions were calculated from Rogue Valley Transit District and Josephine County data on fuel consumption for the operation of buses.

Assumptions for long distance/other:

- Per-capita assumptions from EPA's analysis were adjusted by the ratio of local per-capita income to national per-capita income.

Materials, Goods and Food (production, movement and disposal)

Per-capita emissions from material goods and food for the U.S. were attributed to the Rogue Valley region, with a few adjustments.

Assumptions:

- A certain share (20%) of goods and food production was assigned to the region. Emissions from electricity for that share were adjusted by the region's lower carbon intensity (for the electricity component of production).
- Median household income for the Rogue Valley region is less than the national average. It is assumed that this difference results in fewer purchased goods by residents.
- The estimates do not account for international trade due to lack of information on foreign production and supply chains, which would, according to several studies, raise the GHG emissions related to material consumption

For additional details on this report, please contact:
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Good Company performed this analysis and generated this report, with detailed comments and assistance from Rogue Valley Council of Governments staff.