



Making our Facilities
GREENER!

Increasing Sustainable Operations In the Forest Service Pacific Southwest

REDUCING OUR ENVIRONMENTAL FOOTPRINT

December 2006

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Executive Summary / Introduction

For the successful operation of any company, organization, or agency, natural resources must be utilized. All businesses consume electricity and water in their buildings and facilities. Entities with a fleet of vehicles consume gasoline. Most businesses also use paper. Because resources are consumed during regular operations, businesses will necessarily have some impact on the planet. This impact on the natural landscape has been referred to as an ‘environmental footprint’ or ‘ecological footprint.’ A formal footprint analysis calculates the amount of land area required to both support the resource demands and absorb the wastes of an individual, group of individuals, or business.

Though this report does not calculate the land area that is required to support the demands of the Pacific Southwest Region (Region 5) or the Pacific Southwest Research Station (PSW), it does take the first step in quantifying the resources we use in the operation of our offices, facilities, and fleet. As such, this report uses the term environmental footprint in a less formal sense. However, the intent is the same as in a formal footprint analysis. Namely, we are establishing baseline measures of the resources we consume. This will allow us to evaluate successes as we attempt to reduce resource consumption through more sustainable business practices in the future.

Did you know that there are about 4.5 acres of productive land available per person, worldwide? Yet, in the United States, individuals require 24 biologically productive acres per person to support our patterns of consumption and waste production.

Source: Living Planet Report 2006. World Wildlife Fund and Global Footprint Network. www.panda.org/livingplanet.

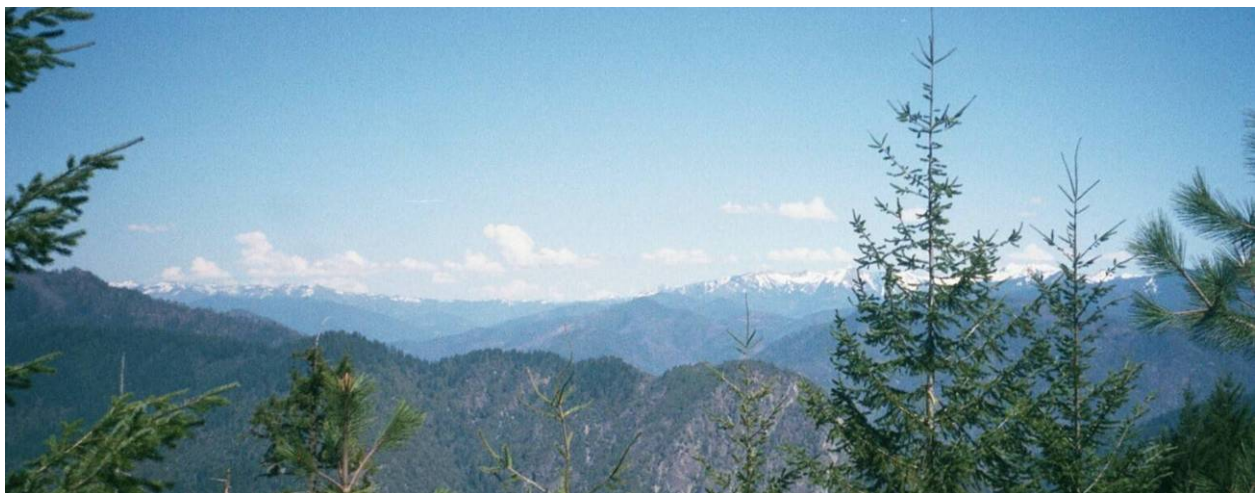
Sustainability has always been the central tenet of the US Forest Service’s mission to manage natural resources in a manner that “sustains the health, diversity, and productivity of the Nation’s forests and grasslands to meet the needs of present and future generations.” Yet, we are embarking on a new era in which we similarly hope to run our business in a more sustainable way that consumes less. This task can be accomplished through a variety of means including taking steps to reduce energy use, water use, and waste production at our buildings and facilities; reducing emissions and increasing fuel efficiency in our fleet; and developing green purchasing and procurement practices. By reducing consumption and waste production, we can ensure that

more natural resources remain in our region to provide essential goods and services like clean water, clean air, carbon storage, wood fiber, biological diversity, and recreational experiences.

This report is designed to be a living document that will evolve and change both as our sustainable efforts grow and as more data are gathered about our resources consumption. For this document, Fiscal Year 2004 (FY04) was chosen as the baseline year for measuring consumption. However, in assessing our successes in reducing consumption, additional data will need to be gathered over multiple years. New data should be added to this document as they become available. Likewise, as new sustainable opportunities arise, they should be included in revised versions of the report.

The existing document is divided into three major sections. The first section provides baseline measures of resource consumption for Region 5 and PSW with regards to energy use, water use, and fleet use. As this was the first effort by Region 5 and PSW to gather footprint data, consumption in other categories (e.g. paper use, electronics use, purchasing and procurement) was not quantified. The second section describes unit-reported current sustainable activities, as well as sustainable wish lists for the future. The third and final section is an ‘idea bank’ containing a number of briefing papers on different activities that might be pilot tested or implemented to reduce resource consumption. As new technologies and opportunities emerge, more briefing papers may be added to this living document.

By carefully evaluating the resources we consume and by thoroughly exploring ideas that may lead to reduced consumption in the future, we hope to embark on a second century of service that couples our sustainable resources management ethic with a sustainable consumption ethic.



Energy Baseline

The Pacific Southwest Region (Region 5) and the Pacific Southwest Research Station (PSW) use three main sources of energy in our facilities: electricity, natural gas, and propane. With just over 5,200 employees in Region 5 and 220 employees at PSW in 2004, electricity use was approximately 4,900 kwh/employee and 6,700 kwh/employee respectively. Electricity use per employee may have been so much higher at PSW because much of the Station's facilities are laboratories that require space for equipment and storage. This space still requires energy to light, heat, and cool, though the number of employees per square foot is generally much lower when compared with similarly sized offices. The electricity consumed by Region 5 and PSW combined in Fiscal Year 2004 (FY04) was enough to power approximately 2,279 average households¹. In 2004, total energy consumption cost the Pacific Southwest Region \$3,290,214 and PSW \$194,174.

FY04 Energy Consumption

	Consumption	Cost	Estimated CO ₂ Emissions (Metric Tons) ^{2, 3}
Electricity	27,347,645 kwh	\$3,173,994	9,980
R5	25,865,373 kwh	\$2,994,302	9,439
PSW	1,482,272 kwh	\$179,692	541
Natural Gas	27,061 Thou Cu Ft	\$241,910	1,480
R5	25,413 Thou Cu Ft	\$227,428	1,390
PSW	1,648 Thou Cu Ft	\$14,482	90
LPG/Propane	67,142 gallons	\$68,484	390
R5	67,142 gallons	\$68,484	390
PSW	0	0	0

Room for Improvement in Data Gathering

The energy use data reported above were derived from FY04 Energy Consumption and Cost Data compiled by the U.S. Department of Agriculture (USDA) for the Forest Service. Raw data are based on payments made to utility companies through the USDA National Finance Center. These data are available for sorting by Region, Station, Forest, Laboratory/Institute, and by energy vendor.

These data almost certainly under-report energy consumption. First, these data don't take into account purchase card payments to utility companies. This may be particularly problematic for reporting on propane purchases. Because local propane companies typically deliver their product

¹ Assuming the average household uses 12,000 kwh/year.

² Estimates for electricity were calculated using CO₂ electricity emissions factors for the California subregion as reported in Table C1 of: *California Climate Action Registry General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions*; Version 2.0; April, 2006.

³ Estimates for Natural Gas and LPG/Propane were calculated using CO₂ fuel and energy emissions coefficients from the DOE, Energy Information Administration: <http://www.eia.doe.gov/oiaf/1605/coefficients.html>

directly to tanks on units, propane purchases using purchase cards are likely. As a result, the propane data above may seriously underestimate actual propane use.

Additionally, the data don't report on energy use in buildings and facilities that are leased by Region 5 or PSW. In buildings and facilities that we lease, energy expenses are commonly paid for by the building/facility owner and are not reported to the USDA or the Forest Service. For Region 5, 1.6% of its 7,698 buildings are leased, whereas 8.3% of PSW's buildings are leased or occupied under a Memorandum of Understanding (MOU). For PSW, leased buildings make up 14.8% of PSW's square footage. Therefore, Region 5 and PSW energy consumption numbers above may significantly under-represent actual energy use. Attempts to gather energy consumption data in the future should address these issues.

Goals and Guidelines for Energy Conservation/Efficiency

2005 Energy Policy Act

- Reduce agency energy consumption 20% by 2015 relative to a Fiscal Year 2003 baseline.
- 3% of energy consumed by the Federal Government must come from renewable energy sources by 2007; 5% by 2010; and 7.5% by 2013.
- When ENERGY STAR or Federal Energy Management Program (FEMP) recommended products are available, only those products may be purchased.
- Sustainable design principles are to be applied to the siting, design, and construction of all new and replacement buildings.

Executive Order 13123

- Each Agency shall reduce its greenhouse gas emissions attributed to facility energy use 30% by 2010 relative to 1990 emission levels.
- Install 20,000 solar energy systems at Federal facilities by 2010.
- Agencies entering into leases (including the renegotiation or extension of existing leases) shall incorporate lease provisions that encourage energy efficiency.
- Agencies shall select ENERGY STAR and other energy efficient products when acquiring and using energy-consuming products.
- Agencies should adopt policies and pursue projects that increase the purchase and use of renewable energy.

Interim Directives on Building Design

- Forest Service Handbook (FSH) Section 7309.11(6)(3) requires that new building construction projects for district offices, supervisor's offices, visitor centers, climate controlled warehouses, and research facilities greater than 2,500 square feet must be registered and certified under the United States Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system at the Silver certification level.

Pacific Southwest Energy Initiative

- On Earth Day, April 22, 2006, the Region 5 Regional Office and PSW announced the beginning of the Pacific Southwest Energy Initiative. This partnership has been developed between Region 5 and PSW to help meet the Agency's energy reduction goals in our region through actions that include driving fewer miles, using more fuel efficient vehicles for

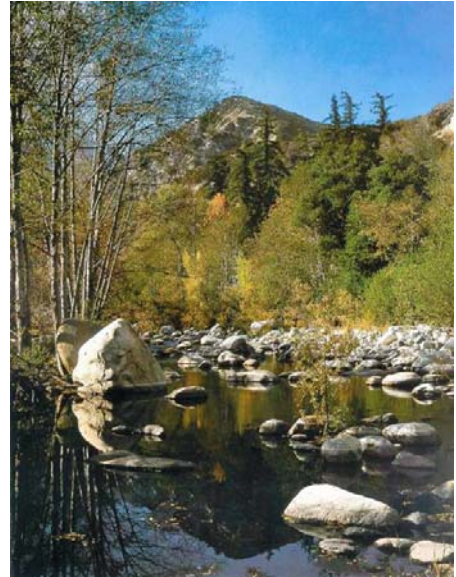
official travel, and working with local utility companies to develop peak load reduction plans.

Additional Resources

- Energy Efficiency and Renewable Energy, U.S. Department of Energy
<http://www.eere.energy.gov/>
- Energy Star Program
<http://www.energystar.gov/>
- U.S. Green Building Council
<http://www.usgbc.org/>
- Federal Network for Sustainability
<http://www.federalsustainability.org/>
- Federal Energy Management Program
<http://www1.eere.energy.gov/femp/>
- Energy & Environment Web Page, U.S. Department of Agriculture
<http://www.usda.gov/energyandenvironment/>
- Official Energy Statistics from the U.S. Government , Energy Information Administration
<http://eia.doe.gov/>
- Sustainable Buildings Web Page , Office of the Federal Environmental Executive
<http://www.ofee.gov/sb/sb.htm>
- Environmental Executive Orders, Office of the Federal Environmental Executive
<http://www.ofee.gov/eo/eo.htm>
- Database of State Incentives for Renewables & Efficiency
<http://www.dsireusa.org/>

Water Baseline

Water is a valued and precious resource in California and the Region’s National Forests are an important point of origin for much of the state’s water supply. Because water from National Forest System lands provides Californians with an estimated 46% of their water⁴, the Forest Service is closely tied to California’s water interests. It is quite important then, that the Forest Service both manages and consumes water resources in California in a responsible manner.



Within California, per capita water use is highly variable with individuals consuming as little as 179 gallons/day in some areas and over 400 gallons/day in other areas⁵. This variability is due in part, to differences in the prevalence of agriculture across the state. Generally speaking, per capita use is higher in largely agricultural areas. The state’s reliance on water for agriculture and for approximately 20% of its electricity in the form of hydropower reinforces the need for Region 5 and PSW to conserve water.

In Fiscal Year 2004 (FY04), the Pacific Southwest Region’s 5,258 employees consumed or otherwise used an average of 22,754 gallons of water per person while on the job. This equates to 87 metered gallons/day per employee during the year’s 261 working days. PSW’s numbers are noticeably lower. At PSW, an average of 2,950 gallons of metered water were used by each of the 220 Station employees during the year. This translates to 11.3 metered gallons of water/working day per employee. One cannot say for certain why the disparity between Region 5 and PSW exists. However Region 5 use may be higher, in part, because of water needed for activities related to fire suppression or because employees reside in a number of Region 5 facilities (e.g. barracks) for part of the year. Lower values for PSW may also reflect the fact that a number of PSW facilities are leased. Water use is not commonly reported by those facility’s lessors (see ‘Room for Improvement in Data Gathering’ below for more information).

FY04 Water Consumption

	Annual Consumption (gallons)	Annual Cost
Total	120,289,836	\$471,413
R5	119,640,619	\$463,148
PSW	649,217	\$8,265

⁴ Brown et al. (2005) *The Source of Water Supply in the United States*. Discussion Paper DP-05-1, RMRS-4851. US Forest Service.

⁵ California Department of Water Resources. (1998). California Water Plan Update Bulletin 160-98, Executive Summary. Table ES4-2.

Room for Improvement in Data Gathering

The water use data reported above were derived from FY04 Water Consumption and Cost Data compiled by the U.S. Department of Agriculture (USDA) for the Forest Service. Raw data are based on payments made to utility companies through the USDA National Finance Center. These data are available for sorting by Region, Station, Forest, Laboratory/Institute, and by energy vendor.

These data almost certainly under-report water use. Because these data were pulled from utility bills, use was only determined for metered water. Water that was drawn from unmetered springs or wells is not included in these data. Along these same lines, water use at campgrounds could not be measured. These data may also under-report water use in the event that water was purchased using purchase cards.

Similarly, the data don't report on water use at leased Region 5 or PSW facilities. In buildings and facilities that we lease, utilities are commonly paid for by the building/facility owner. 1.6% of Region 5's 7,698 buildings are leased. All other facilities are owned by the Forest Service. At PSW, 8.3% of all buildings are leased or occupied under a Memorandum of Understanding (MOU). Attempts to gather water data in the future should attempt to address these issues.

Goals and Guidelines for Water Conservation

Executive Order 13123

- Agencies shall reduce water consumption at their facilities.
- Agencies entering into leases (including the renegotiation or extension of existing leases) shall incorporate lease provisions that encourage water efficiency.

Additional Resources

- California Department of Water Resources, Office of Water Use and Efficiency
<http://www.owue.water.ca.gov/>
- California Urban Water Conservation Council
<http://www.cuwcc.org/home.html>
- University of California: Center for Water Resources
<http://www.waterresources.ucr.edu/>
- Environmental Protection Agency: Cleaner Water Through Conservation
<http://www.epa.gov/water/you/intro.html>
- Environmental Executive Orders, Office of the Federal Environmental Executive
<http://www.ofee.gov/eo/eo.htm>

Fleet Baseline

We use vehicles in virtually every aspect of our work from fighting fire, to surveying wildlife, maintaining recreation sites, performing field research, and managing fuels. In Fiscal Year 2004 (FY04), Region 5 and PSW operated over 4,600 highway legal vehicles. During operation, our vehicles both utilized petroleum products and emitted greenhouse gases and particulate matter into the atmosphere. Because our vehicles play such an integral part in our operations, it is imperative that we consider our fleet in any measure of our environmental footprint.

Region 5 and PSW manage and maintain their fleets in different ways. Region 5 purchases the vast majority of its vehicles outright. However due to PSW's much smaller size, vehicles are instead leased from the General Services Administration (GSA). The data available for the two respective fleets are also different. As a result, the two fleets are analyzed separately below.

Region 5

In FY04, employees in Region 5 drove an average of 6,887 miles per employee in highway legal cars and trucks. This required an estimated 2.47 million gallons of gasoline and an additional 1.17 million gallons of diesel fuel. Region 5's cars and trucks released an estimated 33,534 metric tons of carbon dioxide (CO₂) into the atmosphere.

Region 5 Miles Driven in FY04 (For Highway-Legal Cars and Trucks)

	Miles Driven	Estimated Fuel Used⁶	Estimated CO₂ Emissions⁷ (metric tons)
Total	36,209,866 miles	3,649,667 gallons	33,534 t
Gasoline vehicles	30,640,789 miles	2,477,107 gallons	21,751 t
Diesel vehicles	5,569,077 miles	1,172,560 gallons	11,783 t

Because Forest Service business requires employees to haul goods and equipment, as well as to drive off-highway, we heavily utilize sports utility vehicles (SUVs) and pickup trucks. Unfortunately, Region 5's reliance on these vehicles makes its fleet relatively fuel-inefficient. Using EPA fuel estimates for each vehicle based on their model and year, the average miles per gallon (mpg) for Region 5's entire fleet was calculated. As of October 2004, Region 5's fleet had an average fuel efficiency of 12.7 mpg. Interestingly the fire and emergency response vehicles are not the main drivers of this value. When removing all vehicles specifically purchased for firefighting and/or emergency response, 2004 Region-wide fuel efficiency increases only a small amount, to 14.1 mpg. Though fire and emergency response vehicles are relatively fuel-inefficient (many are large trucks and engines), they make up only a small percentage of the Region's

⁶ Estimated by dividing each vehicle's mileage by the EPA MPG estimate for that model/year.

⁷ Calculated using CO₂ emissions factors for transport fuels as reported in Table C3 of: *California Climate Action Registry General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions*; Version 2.0; April, 2006.

highway-legal vehicles. The fuel efficiency of the Region 5 fleet is, to a greater extent, determined by the SUVs, pickup trucks, and sedans that we drive everyday.

Average Miles per Gallon for Fleet as of October 2004⁸

Unit/ National Forest	All Highway Legal Vehicles	All Non-Fire Highway Legal Vehicles
Regional Office	12.9	13.9
Sequoia	14.0	15.4
Inyo	13.6	14.8
Eldorado	13.7	14.3
Sierra	13.8	15.3
Six Rivers	12.5	14.3
Tahoe	13.3	13.8
Klamath	13.3	14.6
Mendocino	12.7	14.2
Lassen	13.0	14.2
Los Padres	12.1	14.4
LTBMU	12.3	13.1
Stanislaus	12.5	13.5
Shasta-Trinity	12.7	13.9
Modoc	11.6	13.0
Plumas	13.2	14.2
Cleveland	11.9	14.5
San Bernardino	11.6	13.1
Angeles	10.9	12.4

Fuel efficiency in Region 5’s fleet has changed little between October 2004 and July 2006. In July 2006, the Region 5 average miles per gallon for all highway legal vehicles was 12.6 mpg and for non-fire vehicles was 14.1 mpg.



⁸ Average miles per gallon (MPG) have been calculated using the EPA MPG estimates for a vehicle’s given model and year.

Pacific Southwest Research Station

Station-wide, PSW employees drove over 600,000 miles in FY04, or an average of 2,810 miles per employee. Employees drove these miles in the 67 vehicles that were with PSW for the full 2004 Fiscal Year (23 additional vehicles that arrived or left PSW mid-year have not been included here).

Pacific Southwest Research Station Miles Driven in FY04 (For Highway-Legal Cars and Trucks)

	Miles Driven
Total	618,113 miles
Gasoline vehicles	602,359 miles
Ethanol/Gasoline vehicles (flex-fuel vehicle)	9,296 miles
CNG/Gasoline vehicles (dual fuel vehicle)	6,458 miles

Room for Improvement in Data Gathering

Region 5 and PSW fleet data reflect information on Forest Service highway-legal cars and trucks. Data were not calculated for other Forest Service equipment, including forklifts, tractors, ATVs, motorcycles, and snowmobiles because miles or hours driven are not regularly recorded for these vehicles. By incorporating data from these other categories of equipment, a more complete picture of the Region and Station fleet use could be developed. Data on travel to meetings using personal occupancy vehicles and using commercial airlines might also be worthwhile to compile.

Goals and Guidelines for Fleet

2005 Energy Policy Act

- By January 1, 2010, the head of any federal agency that uses light-duty or heavy-duty vehicles shall lease or purchase fuel cell vehicles to meet energy savings goals.

Executive Order 13101

- Requires that agencies implement the EPA procurement guidelines for re-refined lubricating oils. This provision does *not* preclude the acquisition of biobased oils.
- Requires that agencies implement the EPA procurement guidelines for retread tires.

Executive Order 13149

- Agencies shall reduce their fleet's annual petroleum consumption by at least 20% by the end of FY2005, compared with FY1999 petroleum consumption levels.
- Agencies shall increase the average EPA fuel economy rating of passenger cars and light trucks by at least 3 mpg by the end of FY2005 when compared to FY1999 acquisitions.

- Agencies are encouraged to use biobased motor vehicle products when those products meet applicable performance standards.

Additional Resources

- Fuel Economy Page, Department of Energy/Environmental Protection Agency
<http://www.fueleconomy.gov/>
- Fuel Economy Guides, Department of Energy/Environmental Protection Agency
<http://www.fueleconomy.gov/feg/download.shtml>
- Alternative Fuels Data Center, DOE, Energy Efficiency and Renewable Energy
<http://www.eere.energy.gov/afdc/>
- FreedomCAR and Vehicle Technologies Program, DOE, Energy Efficiency and Renewable Energy
<http://www1.eere.energy.gov/vehiclesandfuels/>
- California Fuel Cell Partnership
<http://www.fuelcellpartnership.org/>
- West Coast Collaborative: Partnership to Reduce Diesel Emissions
<http://www.westcoastcollaborative.org/>
- Environmental Executive Orders, Office of the Federal Environmental Executive
<http://www.ofee.gov/eo/eo.htm>



Current Sustainable Activities at Units and Wish Lists for the Future

The following pages contain lists that were compiled and submitted by Sustainable Champions across the Pacific Southwest Region (Region 5) and the Pacific Southwest Research Station (PSW).

The first portion of each list describes self-reported current sustainable activities on each National Forest and at each of PSW's facilities.

The second portion contains a wish list of possible sustainable activities that each unit hopes might be implemented at an appropriate time in the future. Some of the activities described in the wish lists cost relatively little and might be implemented quite easily. Other items require a greater initial investment. As a result, funds for those items might not be available immediately. Nevertheless, each wish list demonstrates that employees across the Region and Research Station are interested and committed to making our operations more sustainable. And by disseminating this list to all National Forests and Research Work Units in the Pacific Southwest, individuals will be able to share their own ideas with those at other locations. In doing so, the wish lists for each work location may grow as individuals discover additional sustainable possibilities that might be appropriate at their own units.

Though information was obtained from most units, the following units did not provide information to be included in this report:

Region 5:

Klamath National Forest, Los Padres National Forest, Sierra National Forest, and Stanislaus National Forest

Pacific Southwest Research Station:

Sierra Nevada Research Center (Davis), and the Institute of Pacific Islands Forestry

Angeles National Forest

Current Activities

Recycling:

- *Paper:* Over 200 pounds of paper are recycled each week at the Supervisor's Office.
- *Batteries:* Approximately 500 pounds of batteries are recycled each year.
- *Toner cartridges:* Approximately 50 toner cartridges are recycled each year at the Supervisor's Office.
- *Cellular phones:* Cell phones are recycled.
- *Cans, bottles, and plastic containers:* Recycled at District Offices and Supervisor's Office.
- *Hazardous Waste:* Hazardous waste is recycled.
- Fluorescent tubes are collected at the Supervisor's Office and recycled.
- Aerosol cans are collected and recycled.
- Toilets at the Supervisor's Office are currently being replaced with low volume units.
- Solar powered lighting systems are in use at some recreation facilities.
- Repeater sites are solar powered.
- Timers are used at the Supervisor's Office for lighting, water, and HVAC systems.

Wish List/Possibilities

- Review vehicle purchasing requirements to look at alternative vehicles, replace V-8 engines with V-6, etc.
- Construct a new district office that obtains the LEED silver rating.
- Consider the use of solar power for water system pumps.
- Start recycling programs at district offices.
- Develop a Van Pool program.
- Turn off all printers and computers at night and on weekends.
- Set printers to print double-sided.
- Perform ongoing reviews of utility bills to track usage.
- Replacement of old lighting systems with new electronic ballasts.
- Include presentation/discussion of sustainable operations at new employee orientation.
- Continue to replace toilets at all locations with low volume units.

Cleveland National Forest

Current Activities

Energy Conservation/Efficiency

- All computer monitors are, at a minimum, ENERGY STAR compliant.
 - ENERGY STAR power down features are activated on all monitors.
- Only ENERGY STAR HVAC and large appliances are purchased.
- HVAC at Forest Supervisor’s office is on only during weekdays from 6 am to 6pm. However, a 3 hour override is available for employees working during the weekend.
- Repeater sites are solar power powered.
- All water heaters are blanketed with their thermostat set at 120 degrees.

Water Conservation

- Water meters have been installed on new Forest Service water systems.
- Low flow plumbing fixtures are in place at all District Offices.
- During remodels, remaining fixtures will be converted to low flow.
- At recreation sites, irrigation-dependent plants are not used.
- Irrigation systems have been shut down at some public recreation and administrative sites.
- Where irrigation occurs, it is done at the most effective time of the day.
- For landscaping, the Descanso Ranger District is using plants that are native and consume little water.
- Self-closing water valves are used at recreation sites.
- Vehicle wash rack with re-circulated treated wastewater is used at Oak Grove.
- Descanso Ranger District vehicles are washed at a local car wash which uses reclaimed water.

Recycling/Recycled Materials Use

Product	Supervisor's Office	Descanso Ranger District	Palomar Ranger District	Trabuco Ranger District
Newspapers/magazines/paper	●	●		●
Cardboard	●	●	●	●
Aluminum	●	●	●	●
Plastic (bottles, etc.)	●	●	●	●
Glass			●	
Toner Cartridges		●	●	
Batteries	●			
Cellular Phones and PDAs	●			

- The Palomar Ranger District is starting a program to recycle batteries using “The Big Green Box.”
- The Supervisor’s Office is issuing a letter of direction regarding recycling of fluorescent bulbs.
- Hazmat materials (e.g. wastes and containers) go to a recycler whenever possible.
- 30% recycled paper is used in copiers and plotters.

- Recycled materials are used in new developed recreation sites (e.g. interpretive displays).

Waste Reduction

- Retread tires are purchased for fleet.
- When “junk” advertisement FAXs are received, staff dials the appropriate 1-800 number asking that the phone number be removed from the call list.
- Asphalt is recycled/reused in place on construction projects by pulverizing into aggregate base. This minimizes haul and maximizes the use of onsite materials.

Safe Products and Services

- Low VOC (volatile organic compounds) paint is used.
- Propylene glycol antifreeze that is nontoxic to wildlife is used.
- Tree paint is ecologically friendly, as mandated.

Wish List/Possibilities

- Draft a fire incident recycling plan for blitz teams.
- Incorporate permit specifications, as opportunities arise, requiring on-site recycling and conservation measures for Forest Service facilities managed and operated by Concessionaires.
- New office/janitorial contracts to require green cleaning supplies and ensure services complement Forest Service conservation measures.
- Ensure that all office and cleaning products used in our facilities are environmentally friendly.
- Set printers to print two-sided as the default.
- Work toward establishing baseline water use.

Eldorado National Forest

Current Activities

Energy Conservation/Efficiency

- Energy efficient T8 and T10 fluorescent lights are installed at the Supervisor’s Office, Placerville Ranger District, and at the Fire Cache.
- Lighting occupancy sensors are installed in large rooms at the Supervisor’s Office with additional sensors to be installed soon at the Pacific Ranger District.
- Tankless/On Demand water heaters are in use at the Supervisor’s Office and at the Placerville, Amador, Georgetown, and Pacific Ranger District Offices.

Recycling

Product	Supervisor's Office	Placerville Nursery	Amador Ranger District	Georgetown Ranger District	Pacific Ranger District	Placerville Ranger District	AutoShop	FireCache
Paper	●	●	●	●	●		●	●
Cardboard	●		●	●	●	●	●	●
Cans/Bottles/Plastics	●	●	●	●	●	●		●
Toner Cartridges								
Batteries (dry & wet)	●		●	●	●	●	●	●
Tires							●	
Fluorescent Bulbs			●			●		
Electronic Media	●	●	●	●	●	●	●	●

Wish List/Possibilities

- Set defaults on copiers to duplex.
- Educate employees on the setup and use of duplexing for their computers and associated printers.
- Increase recycling and make recycling more consistent among units. Have units share and coordinate recycling practices.
- Use healthy and environmentally certified cleaning products on all units.
- Install lighting occupancy sensors in frequented rooms like bathrooms and kitchens.
- Add an agenda item to regularly scheduled employee meetings to help identify and review what sustainable activities employees have undertaken.
- Install Solar Tubes at appropriate facilities.
- Replace lighting fixtures and bulbs with energy efficient models where upgrades are needed.

- Start a quarterly objective that will be sanctioned by the Forest Supervisor to achieve sustainable goals.
- Recycle styroblocks at nursery.
- Explore the possibility of telecommuting, based on a merit type system.
- Recycle computer/printer packaging.
- Develop green landscapes at offices and facilities.
- Obtain Leadership in Energy and Environmental Design (LEED)-Existing Building Certification for the Supervisor's Office.

Inyo National Forest

Current Activities

Energy Conservation/Efficiency

- A ground source heat pump has been installed at the Interagency Visitor Center in Lone Pine, California. This system, which is more efficient for summer cooling than for winter heating, reduces energy use for climate control.
- The Inyo uses a Ford Escape hybrid vehicle on the White Mountain Ranger District.
- Solar energy is used at the Schulman Grove Visitor Center to run lighting, cash register, DVD, and TV.
- Ten isolated water systems utilize solar panels to power well pumps at Saddlebag, Aspen, Agnew, Big Pine (3), McGee, Horseshoe, Onion Valley and Greys Campgrounds.
- A solar system is installed at the Mt. Whitney Ranger Station.
- 75% of gas furnaces have been replaced with high efficiency systems.
- In various locations, single pane windows have been replaced with double pane Low-Emittance (Low-E) vinyl windows.
- In various locations, housewrap has been utilized prior to installing new siding.
- T-8 fluorescent bulbs have been installed in Lone Pine and at the Mammoth Lakes Visitor Center.

Recycling/Recycled Materials Use

- White Mountain Ranger Station has two 3-hole recycling bins.
- Mono Lake Visitor Center has recycling bins.
- Supervisor's Office just received recycling bins.

Wish List/Possibilities

- Purchase Kill-A-Watt Electricity Load Meters and Monitors (\$35/unit).
- Install outdoor security lighting (to replace sodium lights).
- Install Solatubes (skylights).
- Purchase new ENERGY STAR refrigerators.
- Install solar attic fans.
- Install dual pane windows.
- Increase ceiling insulation.
- Install T-8 fluorescent light bulbs.

Lassen National Forest

Current Activities

Recycling

Product	Supervisor's Office	Almanor Ranger District	Eagle Lake Ranger District	Hat Creek Ranger District
Offices				
Office paper	●	●		●
Newspapers and magazines		●		
Cardboard		●		
Aluminum Cans	●	●	●	●
Plastic (bottles, etc.)		●		●
Batteries				●
Developed Recreation Sites				
Aluminum Cans			●	●
Plastic (bottles, etc.)			●	

Wish List/Possibilities

- Encourage all Districts and the Supervisor's Office to recycle *all* of the following items: paper (including office paper, newspaper, and magazines), plastics, glass, cardboard, and batteries.
- Encourage all three Districts to recycle aluminum cans, plastics, and glass at all developed campgrounds and recreation sites.
- Minimize use of separator pages when printing. Instruct employees to instead format a header with their name/date/subject/time for e-mail messages.
- Collect advertisement facsimiles at Fax machines and dial 1-800 number to be removed from the list.
- Add hybrid vehicles to the Lassen National Forest Fleet (two hybrid GMC Silverado pickup trucks are scheduled to be added in Fiscal Year 2007, one at Hat Creek Ranger District and one at Eagle Lake Ranger District). Adding more hybrids should be encouraged.
- Install blankets on all water heaters at facilities.
- Lower water heater temperature to 120 degrees Fahrenheit (if not currently set at this temperature).
- Replace all standard incandescent bulbs with compact fluorescent light bulbs.
- Replace ballasts on existing fluorescent fixtures to accommodate T8 fluorescent tubes. Replace current fluorescent tubes w/T8 fluorescent tubes.
- Replace heating filters when needed. Clean furnaces one time per year.

Mendocino National Forest

Current Activities

Energy Conservation/Efficiency

- Double pane windows have been installed in the Front Office at the Covelo District.
- Air conditioning thermostat at the Covelo District Office is set to 78 degrees for summer cooling.
- Repeater sites and Remote Automated Weather Stations are solar powered.
- Some energy efficient compact fluorescent bulbs have been used to replace incandescent bulbs.

Recycling/Recycled Materials Use

- Office paper and cardboard recycling is in place at offices across the Forest.
- Dry cell batteries (alkaline and rechargeable) are collected for recycling.
- 30% recycled content paper is used for printing and copying.
- A recycling box (TechnoTrash) is available for small electronics and media at the Supervisor's Office.
- Mixed recycling of drink containers is available in break rooms.
- Some recycling is done at fire camps.
- Excess computers are auctioned, recycled, or re-used.
- Printer cartridges are returned for recycling.

Wish List/Possibilities

Energy Conservation/Efficiency

- Conduct energy audit to identify the top 10 opportunities for energy efficiency.
- Use only green tipped (low mercury) fluorescent tubes.
- Document energy costs and usage, set efficiency targets, and put activities in place to achieve targets.
- Purchase Kill-a-Watt meters (estimated cost: \$30) to identify potential energy savings at all districts.
- Install occupancy sensors for lighting.
- Replace incandescent light bulbs with energy efficient compact fluorescent bulbs.
- Implement conservation settings for programmable HVAC thermostats (heat to 68 degrees/cool to 78 degrees).
- Install a solar photovoltaic system at a remote or grid-tied location.
- Provide employees with "Personal Energy Calculators" or "Carbon Footprint" calculators to raise awareness of environmental and economic benefits of energy efficiency.
- Perform preventative maintenance on air conditioning filters and other air handling equipment to ensure efficient operation.
- Identify and eliminate phantom loads.
- Purchase electricity from renewable sources.

Fleet/Transportation

- Test and use biodiesel in a government vehicle at the Upper Lake District.
- "Right size" fleet and/or use hybrid vehicles to improve fuel efficiency.

- Encourage and provide incentives for employee carpooling to work
- Remind employees of ways to increase fuel efficiency, including the use of fuel-efficient driving techniques, maintenance, and appropriate tire pressures.
- Maximize efficiency of all vehicle and aircraft trips, use the appropriate vehicle/aircraft and/or eliminate unneeded trips.

Water Conservation

- Install water conserving shower heads.
- Install water heater blankets.
- Set water heater thermostats to 120 degrees.
- Install and test a waterless urinal at one location.
- Plant water conserving or native vegetation to replace water intensive lawns.

Waste Management and Recycling

- Use lawn clippings for mulching instead of disposing of clippings.
- Clean boneyards through the excess property program, auctions, donations, and recycling.
- Reduce hazardous waste generation through improved education, procurement and chemical management.
- Identify additional materials for recycling.
- Purchase additional recycling containers to increase recycling locations, materials, and overall volume.
- Purchase and use an aerosol venting device to properly manage aerosol cans and recycle metal.
- Implement a complete and compliant universal waste management program for: aerosol cans, fluorescent bulbs, and dry cell batteries.

Green Purchasing/Procurement

- Purchase office supplies using green procurement.
- Increase purchasing of non-toxic, recycled content, and biodegradable materials.
- Ensure that everyone with a purchase card understands the intent of Executive Order 13101, "Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition."
- Incorporate environmental considerations into contract language.
- Ensure that Federal Acquisition Regulations (FAR), part 23 on Environmental Requirements are reflected in all contracts.

Buildings and Design

- Plant shade trees to reduce the need for cooling energy use.
- Upgrade aging heating or cooling systems to more efficient ENERGY STAR models.
- Use sustainable building products in construction and maintenance activities (products used could include those with recycled content, low volatile organic compounds, water-based products, or "low-embodied energy" products).
- Identify LEED standards that can be incorporated into design and construction.
- Implement procedures to ensure that unused buildings are winterized in order to avoid unnecessary energy use.
- Where appropriate, use lighter colored roofs to reduce summer cooling requirements.

Electronics

- Set all networked printers to default to duplex printing.
- Set all copiers to default to duplex copying.

- Where possible, replace inventory of paper forms with an electronic library of forms.

Equipment

- Replace solvent-based washer system with an aqueous parts washer.
- Ensure that annual preventative maintenance and cleaning of all heating/cooling equipment is in place.

Chemicals

- Use water-based paints instead of oil-based ones to reduce or eliminate the need for solvents.
- Use (or test) bio-based lubricants such as 2-stroke injection oil, bar oil, and hydraulic fluid.
- Identify and use green janitorial products.

Human Resources

- Establish a "Green Team" to provide for continual improvement of sustainable practices.
- Provide a Sustainability Award for employees who identify or help implement cost saving green programs.
- Add sustainability criteria to position descriptions and performance appraisals.

Education

- Add resources related to our Environmental Footprint and Sustainable Operations to the Forest FSWeb.
- Distribute an annual newsletter to update employees on the Environmental Footprint project.
- Develop an Environmental Footprint interpretive display for office and public events.
- Develop outreach efforts to explain the role of National Forests in providing for carbon sequestration and clean water to the public.
- Provide employees with information to reduce carbon footprint and save energy costs at home through increased awareness.
- Provide training opportunities that minimize transportation needs instead of those that require long distance travel.

Proposals Involving Partners:

- Increase recycling at Mendocino National Forest Fire Camps such that we can achieve 75% waste diversion.
- Reduce use of alkaline batteries in clam shells through increased use of rechargeable battery chargers and/or new technologies at Fire Camps.
- Explore regional or province-wide procurement or contracting opportunities.
- Explore regional or province-wide fleet opportunities.
- Participate in research related to carbon credits as this relates to hazardous fuels reduction generated materials (biomass) used in pilot co-generation projects.
- Seek to maximize the use of locally grown foods for fire camps. Give consideration to maximizing the purchase of organically grown foods.

Modoc National Forest

Current Activities

Energy Conservation/Efficiency

- Building lights are turned off at night.
- Most buildings have fluorescent lighting.
- Most printers and copiers have energy saving features.

Recycling/Recycled Materials Use

- Paper products are recycled to the maximum extent possible (the closest paper recycling center is currently 100 miles away).
- Cans from office vending machines are recycled.
- Printer ink cartridges are recycled to the extent possible.
- Recycled paper is used in printers and copiers.

Waste Reduction

- Employees are encouraged to use two-sided (duplex) printing and copying.

Wish List/Possibilities

- Install occupancy sensors for lighting in bathrooms, copy rooms and, other common rooms.
- Replace T12 fluorescent ballasts/bulbs with T8 ballasts/bulbs.
- Explore the possibility of requiring/promoting the use of green cleaning products by contract custodians.
- Explore the possibility of replacing the lawn at the Supervisor's Office with xeric landscaping to reduce water use.
- Explore the possibility of adding hybrid vehicles to the fleet.
- Explore the possibility of having work-at-home Fridays.
- Replace old outstation heating units with energy efficient units.

Six Rivers National Forest

Current Activities

Energy Conservation/Efficiency:

- Solar powered water treatment systems using MIOX technology are installed at two campgrounds.
- Nine small water systems (recreation & administrative) and a new waste water treatment system (on the Orleans Ranger District) are monitored remotely, reducing fuel use and vehicle wear and tear.

Recycling

Product	Supervisor's Office	Lower Trinity Ranger District	Mad River Ranger District	Orleans Ranger District	Smith River National Recreation Area
Office paper	●	●	●	●	●
Newspapers/Magazines	●	●	●	●	●
Cardboard	●	●	●	●	●
Aluminum	●	●	●	●	●
Plastic (bottles, etc.)	●	●	●	●	●
Glass	●	●	●	●	●
Toner Cartridges	●	●	●	●	●
Batteries	●	●	●	●	●

- Recycling containers are in place at all campgrounds.

Waste Reduction

- Paper that has been printed on one side is cut into tablet size at the Smith River NRA Visitor Center. The backside is used for message memos at the front desk.
- Styrofoam peanuts and other packing materials from incoming packages are stored and later reused for outgoing packages.

Water Conservation

- Sweet Smelling Toilets (SST) are used at all campgrounds and day use areas (with the exception of Panther Flat Campground on the Smith River NRA). No water or electricity is required.
- Coin operated shower facilities are in place at the Panther Flat Campground. Current rate is \$0.50 for 5 minutes.
- Water use is metered at 50% of small drinking water systems.

Wish List/Possibilities

- Reduce mailings of catalogs and magazines.
- Reduce fax advertisements.
- Duplex printing on network printers.
- Reduce electric, natural gas and water use at offices, barracks and residences.
- Install occupancy sensors for lighting in offices & restrooms.

- Replace old fluorescent lighting in offices with new electronic ballast and T8 bulbs.
- Install locking covers over programmable thermostats in offices and barracks to ensure that thermostats remain set at energy-efficient temperatures.
- Turn off personal workstation computers on a nightly basis. Turn off personal workstation computer before weekends, holiday, or vacations.
- Turn off computers that are not being used on a daily basis.
- Have a more systematic approach to replacing mechanical systems at Forest Service facilities.
- Replace old tank type hot water heaters with on-demand/tankless hot heaters.
- Consider using biomass energy at the Orleans District Office.
- Create a Sustainable Operations Information Bulletin Board at the Supervisor's Office and District Units.
 - Post information on Six Rivers fleet fuel consumption.
 - List strategies for reducing fuel use (i.e. parking government vehicles at home to reduce driving of fleet and personal vehicles).
 - Post monthly utility use rates for Supervisors Office and District Units. Post sustainability news and information.
- Install a "Green Activities" suggestion box.
- Raise coin operated shower rate at Panther Flat Campground on the Smith River National Recreation Area. Increase the rate from \$0.50 for 5 minutes to \$1.00 for 5 minutes. Rate increase will reduce water, electricity, and propane use. Septic tank pump frequency will also be reduced.
- Install telemetry in Fiscal Year 2007 at Panther Flat Campground MIOX water treatment system.
- Install water meters on all Forest small drinking water systems.
- Install more user friendly recycling storage/shelter areas at District Units.
- Promote telecommuting.
- Promote carpooling.
- Promote bike riding to work.

Plumas National Forest

Current Activities

Energy Conservation/Efficiency

- All incandescent light bulbs have been replaced with high-efficiency fluorescent bulbs at the Supervisor's Office.

Recycling

Product	Supervisor's Office	Feather River Ranger District	Beckwourth Ranger District	Mt. Hough Ranger District
Paper	●		●	
Cardboard			●	
Aluminum	●		●	
Plastic (bottles, etc.)	●		●	
Glass			●	
Toner Cartridges				
Batteries			●	

- The Supervisor's Office is in the process of developing an alkaline battery recycling plan which will include District Offices.
- The Supervisor's Office will soon ask for employees to set the default on copiers/printers to duplex (two-sided) printing and copying.

Wish List/Possibilities

- New energy efficient heating/cooling system for Supervisor's Office to replace the outdated and poorly functioning system.

San Bernardino National Forest

Current Activities

Energy Conservation/Efficiency

- Ford Escape Hybrid SUV was purchased in 2006 to replace a Ford Expedition.
- Two compressed natural gas vehicles are used on the Forest.
- All outdoor lighting utilizes photo-cell motion sensors to reduce electricity use.
- Energy efficient double pane windows were installed at the Cranston, Keenwild, and Kenworthy Stations during upgrades.
- HVAC units were replaced with more energy efficient units at the Deerlick and Cranston Stations.
- Installing new teleconference system Forestwide to reduce vehicle travel for meetings.
- Barton Flats campground shower building uses solar power.
- Installed solar panel at Heart Bar Fire Station which is now under county lease.

Water Conservation

- Installed low flow toilets in some facilities.
- Utilized native landscaping and drip irrigation at new Supervisor's Office building.

Recycling

Product	Supervisor's Office	Mountaintop Ranger District	San Jacinto Ranger District	Front Country Ranger District
Paper	●	●	●	●
Cardboard				
Aluminum	●	●	●	●
Plastic (bottles, etc.)	●	●	●	●
Glass	●	●	●	●
Toner Cartridges	●	●	●	●
Batteries	●	●	●	●

Sequoia National Forest

Current Activities

Energy Conservation/Efficiency

- Took the lead in securing an agreement to conduct facilities energy surveys/studies with Southern California Edison (SCE) under the Federal Energy Management Program's (FEMP) financing mechanism called Utility Energy Service Contracts (UESC).
- The new Supervisor's Office building, constructed in 2006, uses energy efficient lighting, super insulation, double pane windows, photo electrically controlled exterior lighting, and programmable thermostats.
- Three new barracks (bunk houses) were recently completed with specifications requiring energy saving construction and ENERGY STAR appliances. The Forest anticipates construction of at least two more barracks under the same specifications.
- The TEAMS (Enterprise) organization located on the Sequoia has agreed to conduct a Forest-level baseline environmental footprint study.
- A grant has been obtained to assess the potential for alternative energy use at a remote station that uses over \$12,000 worth of propane per season.

Recycling

- Dumpsters for recycling waste paper with the community recycling program are located at the Supervisor's Office and at the Porterville Work Center.
- Batteries and fluorescent light bulbs are collected and disposed of for eventual recycling under the Environmental Protection Agency's Universal Waste Program.

Shasta-Trinity National Forest

Current Activities

Energy Conservation/Efficiency

- The Forest headquarters office meets the US Green Building Council Leadership in Energy and Environmental Design (LEED) bronze level.
- Motion sensors are used to turn on/off lighting in Forest headquarters.
- Bicycle racks are provided at offices to encourage employees to practice intermittent bicycle commuting.
- Traditional or incandescent light bulbs have been partially replaced by lower energy compact fluorescent light bulbs.
- Thermostats in buildings are set at 68°F in the winter and 78°F in the summer except when specific requirements mandate otherwise.
- Double-paned windows in many facilities have replaced single-paned windows.
- Ultraviolet light reduction coatings have been applied to windows in Forest headquarters.
- Remote Automated Weather Stations (RAWS) and radio repeater sites are solar powered.
- The number of motor vehicles in the Forest fleet has been reduced over the past five years.
- Teleconferencing is used regularly to reduce the number of face-to-face meetings that require travel by motor vehicle or airplane.

Recycling/ Recycled Materials Use and Waste Diversion

- Recycling at the Forest headquarters, district offices, and guard stations includes white paper, colored paper, cardboard, printer cartridges, aluminum cans, plastic bottles, glass containers, newspapers, telephone books, magazines, catalogs, and junk mail.
- Waste diversion of universal waste includes fluorescent light tubes, alkaline batteries, lithium batteries, NiCd batteries, and building materials containing asbestos or lead-based paint.
- Non-confidential shredded paper documents are used as packing material at some locations or recycled with other mixed office materials.
- Motor vehicle recycling and waste diversion includes tires, motor oil, antifreeze, and some parts.
- The Forest is using the 1999 guidelines requires recycling at fire camps. Items recycled include paper, cardboard, newspaper, aluminum, plastic and glass containers, wood scraps, cooking oil, motor oil, and batteries.
- 30% recycled content paper is used for printing and copying.

Waste Reduction

- Where possible, all computer printers default to duplex or two-sided printing.
- New computer printers are ordered with the capability for duplex printing, if possible.
- Forest documents are photocopied on two-sides as the standard practice.
- Computers and related technology waste are disposed of by providing them to schools or other educational institutions or by disposal through approved sources.

Wish List/Possibilities

- Identify the environmental footprint of the Shasta-Trinity National Forest.
- Reduce the environmental footprint of the Forest in the following areas: Building and landscape design; Energy conservation; Water conservation; Waste reduction; Procurement of sustainable products; Environmental restoration.
- Develop a Forest Action Plan that is integrated with other program of work objectives and targets.
- Focus on conservation of resources and socially responsible practices.
- Dispose of all outdated, unneeded, and potentially unsafe items in bone yards.
- Change focus from recycling and waste diversion to a strong emphasis on waste prevention.
- Review all contracts for sustainability criteria.
- Convert all administrative sites to “salmon-safe” government facilities.
- Replace landscape plantings to reduce the need for water, fertilizer, and pesticides.
- Use 30% recycled paper and soy-based ink for printing.
- Use recycled latex paint.
- Increase the use of rechargeable batteries for all applications.
- New buildings meet or exceed LEED silver standard. This is required as of November 2005.
- Purchase or lease hybrid vehicles or biodiesel motor vehicles.
- Replace any non-programmable thermostats with programmable thermostats.
- Explore options for cool roofs or green roofs to reduce energy consumption.
- Replace bathroom fixtures with low water flow fixtures at administrative sites.
- Purchase and use aerosol-venting equipment.
- Document current energy use and develop a plan to minimize energy use.
- Document water use and develop a plan to minimize water use.
- Educate employees on actions they can take at home to reduce their environmental footprint.
- Recognize groups or individuals who contribute to reducing the Forest environmental footprint.

Tahoe National Forest

Current Activities

Energy Conservation/Efficiency

- The Forest utilizes thermostats with timers to reduce HVAC heating and cooling burdens.
- Every other month, the Forest Leadership Team meets via conference call (rather than face-to-face) to save energy by reducing vehicle travel.

Recycling/ Recycled Materials Use

- Paper, plastic cans, etc. are recycled.

Waste Reduction

- Paper grocery bags are collected and given to a nonprofit organization that uses them.

Lake Tahoe Basin Management Unit

Current Activities

Energy Conservation/Efficiency

- Energy efficient lighting ballasts, windows, and appliances have been installed in some buildings.
- Printers and copiers are set to sleep mode during inactive periods.
- Bike racks are provided for employees who want to bike to work.
- Flexible work schedules are permitted to reduce commute days.
- Carpoolers are provided with exclusive parking as an incentive.
- Break room is stocked with high quality coffee to reduce travel to coffee shops.

Waste Reduction

- Re-usable mugs and glasses are provided to employees for coffee, tea and other drinks.

Recycling Materials Use

- 30% post-consumer recycled content paper is purchased for use in printers and copiers.

Landscaping

- Native vegetation is planted and retained.

Wish List/Possibilities

Energy Conservation/Efficiency

- Install monitoring devices to track and make improvements to efficient energy use.
- Turn off lights when not in use – install occupancy sensors or timed lights where appropriate.
- Install daylight sensitive lighting controls to automatically adjust lights based on changing daylight.
- Install energy efficient lighting ballasts, windows, and appliances (where they are not already installed), and ENERGY STAR replacements.
- Purchase “Green” electricity.
- Design and retrofit facilities to utilize natural light.
- Capture natural day light with mirrors and reflecting walls.
- Install solar hot water heaters.
- Install solar panels to generate electricity. Install “reverse” meter.
- Install biomass co-generator for electricity and heat.
- Design buildings to LEED standards.
- Purchase LCD monitors versus CRT monitors.
- Use stairs instead of elevator.
- Set computer monitors to time out or go into sleep mode when not in use.
- Reduce hot water temperature for sinks.
- Purchase solar ovens for heating employee lunches.
- Turn off appliances at the outlet or powerstrip.
- Encourage ready-to-eat employee lunches versus using the microwave.

Heating, Ventilation and Air Conditioning

- Opens windows for cool air instead of using air conditioning.
- Improve HVAC system to heat and cool per Washington Office direction as well as circulate natural air.
- Close windows at the end of the day.
- Use more active and passive solar architecture in new construction.
- Improve insulation and retrofit windows in older buildings.
- “Harvest” heat from computer servers to generate heating for water and HVAC.

Water Use

- Replace older toilets with low flow toilets.
- Install water meters to monitor use and set conservation goals.
- Irrigate landscaping in the evenings and not during the heat of the day.
- Utilize gray water for landscape irrigation.

Recycling

- Develop a unit-wide recycling program and provide recycle bins for all facilities for recycling aluminum, plastic, and glass.
- Contract a recycling service to pick up recyclables on a regular basis.
- Recycle shredded and other paper.
- Purchase rechargeable batteries and chargers.
- Utilize spent paper for memo pads prior to recycling.
- Provide organized storage for re-usable materials and sponsor donation drives for re-use of items. This could be a “free box” of unwanted items.
- Purchase uniforms that contain recycled polyester or organic cotton fibers.
- Purchase re-usable products, e.g. sample bags, as opposed to one-time disposable products.
- Purchase cloth towel dispensing rather than paper towels in restroom and break rooms.
- Hold an inter-departmental recycling contest with prizes.
- Purchase recycled waste aggregates, e.g., crushed glass for re-paving.

Waste Disposal

- Provide drop boxes in the mailroom for spent batteries, cell phones and printer cartridges.
- Purchase biodegradable napkins and utensils for group meetings.
- Monitor volumes of trash for percentages that could be reduced.
- Provide bear-proof composting for food wastes.
- Determine the end sources for our wastes (sewerage, trash).

Product Use

- Centralize filing to reduce duplication of documents.
- Consider more natural fibers over petroleum (plastic) products for building materials, carpet, furniture, etc.
- Order commonly used products in bulk to reduce packaging and shipping.
- Use duplex/double-sided printing and copying, set computer to default to duplex.
- Purchase “Green” cleaning products.
- Purchase Eco-Friendly, natural products from the GSA Advantage catalog.
- Purchase organic foods for employee events.
- Purchase telephone service that contributes to environmental causes.

- Add an accounting tool on printers, plotters and copiers to track use.
- Purchase low Volatile Organic Compound, modular carpet, and replace only high use areas instead of the entire carpet.

Landscaping

- Pave and install Best Management Practice (BMPs) parking at Meyers Work Center.
- Mulch all bare soil areas at facilities.

Partnerships

- Provide information to visitors on ideas for reducing waste and limiting consumption while visiting Lake Tahoe.
- Partner with Basin agencies, organizations and colleges to develop baseline environmental footprint for the entire Basin.

Getting to Work

- Bikes and Feet
 - Encourage bicycling or walking to work.
- Commuting
 - Utilize teleconferencing to reduce travel for meetings.
 - Provide incentives for carpooling, bicycling, or walking to work.
 - Provide shuttle from major Basin gateways to the Supervisor's Office.
 - Provide carpooling for group training sessions.
- Out to lunch
 - Arrange for a "lunch truck" to visit offices at lunchtime to reduce travel to restaurants.
- Fleet Vehicles
 - When scheduled, replace any unnecessary large vehicles with smaller, more fuel efficient ones.
 - Rent size-appropriate fuel efficient vehicles.
 - Identify less expensive gas stations where the fleet gas card can be used.
 - Use hydrogen fuel cell and biodiesel technologies.
 - Provide shuttle between Meyers Work Center and the Supervisor's Office.

At Home

- Wellness
 - Eat salads.
 - Use bicycles and walk more.
 - Exercise to improve circulation and reduce need for higher heating temperatures.

Region 5 Regional Office

Current Activities

Energy Conservation/Efficiency

- HVAC automatically shuts down on weekends and during weekday non-work hours.
- Lighting motion sensors are installed throughout the building.
- T12 fluorescent ballasts were replaced with energy efficient T8 ballasts in 2006.
- Wattage of fluorescent bulbs was reduced to save energy.
- In the parking lot, a number of spaces close to the building are labeled “for carpools only” as an employee incentive.

Recycling/Recycled Materials Use

- All employees have deskside recycling containers for office paper.
- Receptacles for aluminum, glass, and plastic recycling are located throughout the building.
- 30% post-consumer recycled content paper is purchased for use in printers and copiers.

Waste Reduction

- Xerox machines are set to default at duplex (two-sided) copying.

Green Janitorial Practices

- Janitorial contractor’s statement of work stipulates that only green cleaning products will be used.
- Toilet paper and other bathroom paper products are made of recycled materials.

Wish List/Possibilities

- Join the Federal Network for Sustainability to promote and support agency sustainability efforts, from green purchasing to recycling, energy efficiency, etc.
- Implement affirmative procurement with a focus on the supply room, copy center and the folks with purchase cards.
- Implement the federal electronics stewardship Memorandum of Understanding.
- Incorporate pollution prevention and affirmative procurement into the Regional Offices maintenance contracts (landscaping, maintenance, etc.).

Forest Fire Laboratory, PSW – Riverside

Current Activities

Energy Conservation/Efficiency

- The heating and air conditioning systems are run in compliance with federal guidelines for conservation.
- *Turn it off program*-A policy of turning off lights, monitors and other computer accessories, and electrically based equipment has been implemented when employees leave their offices for the day, for lunch breaks, and for lengthy meetings.
- The Lab is examining current electrical usage at key points around the facility in order to identify highest consumption areas to develop a targeted intervention program.
- A number of employees have work at home agreements in place. This reduces gas used for commuting.

Recycling/Recycled Materials Use

Product	Recycled
Office paper	●
Newspapers, magazines, other paper goods	●
Cardboard	●
Aluminum/Tin	●
Plastic (bottles, etc.)	●
Glass	●
Printer/Toner Cartridges	●
Batteries	●
Small Electronics	●
Electronic Media (disks, cds, dvds, etc.)	●
Fluorescent Light Bulbs	●

- Paper used for printing/copying is made of 100% post-consumer content.
- Each office has deskside recycling bins, significantly reducing the Lab’s contribution to the waste stream.

Natural landscapes

- A large greenspace was converted to native plantings a few years ago and that area has remained in its converted state.
- A plan has been provided by a professional architect to convert the front area of the facility from lawn to native plantings and/or plantings that require less water and maintenance. The Lab is working on securing funds for this conversion.

Wish List/Possibilities

- Plans are being drafted (pending budget) to replace current office lighting ballasts with more energy efficient ones. This will facilitate the use of the most energy efficient bulbs.
- Install solar panel arrays over our government employee parking area, allowing us to shade our vehicles and use solar power. Placing solar arrays on roofs is not possible because some roofs are old and in poor condition.

- Lighting occupancy sensors could be installed in conjunction with the updated lighting and ballast installation to gain greater energy efficiency.
- Continue to convert lawns and grass areas to vegetation that uses less water and requires less maintenance.

Center for Urban Forest Research, PSW – Davis

Current Activities

Energy Conservation/Efficiency

- 12 of 15 employees regularly bicycle or walk to work.
- Two work-at-home agreements are in place to allow employees to telecommute two days each week.
- Climate control thermostats are set to 78° in summer and 68° in winter.
- At close of business day, 50% of lights in offices are turned off for the evening (university requires the remainder of lights to remain on for security reasons).
- Photocopier is ENERGY STAR compliant.

Water Conservation

- *Sustainable Garden*- In the office courtyard, a garden has been installed in which water for irrigation is collected from roof runoff, pavement is pervious to reduce ground water runoff, and materials in construction are recycled and recyclable. This garden serves as an outdoor laboratory for students, faculty, and the community to learn more about sustainable means of gardening.

Recycling/Recycled Materials Use

Product	Recycled
Paper	●
Cardboard	●
Aluminum	●
Plastic (bottles, etc.)	●
Glass	●
Printer Cartridges	●

- Copy paper, folders, etc. are purchased that have post-consumer recycled content.
- Used office furniture is purchased, when available.

Green Purchasing

- Rechargeable batteries are purchased and used.
- New office chairs have been purchased that are made of 40% recycled content.

Wish List/Possibilities

Energy Efficiency/Conservation

- Replace microwave with more energy efficient model.
- Make ENERGY STAR a requirement when available for all new purchases of all appropriate equipment.
- Make it a policy for employees to turn off monitors when leaving desk and power off their computer and monitor when leaving for the day.
- Try to enact policy for all lights in building to be shut off at the end of the day (currently, the university requires that half of the lights be kept on for security purposes).
- Establish more conservative thermostat settings for office and non-office hours.

- Examine current work-at-home agreements for more opportunities to save commuting and consider additional agreements.
- Consider purchasing “office bikes” for short errands around campus and town. This could save time and reduce use of our vehicle.
- Exchange our large SUV for the most sustainable model available to us through the General Services Administration Motor Pool. We are currently on a GSA list to exchange our SUV for a sedan. That exchange will save about \$1,102.00 per year, which could be applied to other sustainable activities.

Water Conservation

- Check office sink filters and install faucet aerator if necessary.

Recycling/Recycled Materials Use

- Add appropriate recycling receptacles to each office and work with UC Davis to add recycling pickup to garbage collection.
- Source 100% post-consumer recycled content, chlorine and chlorine derivative free paper products and better options for other office products.
- Select highest recycled content paper when purchasing printing services. Encourage printer to use soy-based ink. Request that Station renegotiate printing contracts to make this a possibility. Add recycled paper symbols to publications.

Waste Reduction

- Ensure all employees utilize double-sided default printer settings.
- Examine paper consumption and opportunities to reduce consumption.

Green Purchasing

- Close the reduce, reuse, recycle loop by purchasing recycled goods whenever available.
- Develop a ‘green’ acquisition protocol for the Center. Ultimately, the Center would like to design a protocol that is simple for anyone to use, and share progress so that ideas could be compiled into one PSW protocol.
- Purchase green cleaning products for the few we need in our office.
- Submit request to campus that our janitorial service also uses green products.
- Replace office coffee with organic, fair-trade coffee.

Landscaping

- Reinvigorate our Sustainable Demonstration Garden and improve its outreach potential.
- Revise and update the Sustainable Demonstration Garden brochure. Current materials can be found at:
<http://www.fs.fed.us/psw/programs/cufr/search.php?TopicID=&ProductTypeID=&Authors=&Title=garden&OrderBy=&Submit.x=0&Submit.y=0>
- Develop a Sustainable Garden Web page for our Web site to improve online outreach.

Hazardous waste

- Continue current proper disposal and minimize need for any additional hazardous waste.

Office Management

- Include sustainability discussions in staff meetings.
- Add sustainability criteria to job descriptions, KSAs, and performance appraisals.
- Include sustainability clauses in contracts, grants, and agreements, where applicable.
- Join sustainability-related organizations and make their publications available to office.
- Incorporate sustainability into our mission statement.

Other

- Collect and compile product environmental footprint data whenever available. This data could contribute to the Station or Region footprint calculation.
- Use green building design guidelines, where appropriate, to enable us to consider how we might incorporate additional environmental considerations into the facility that we lease from the University of California.
- Participate in sustainability conferences.

Institute of Forest Genetics, PSW – Placerville

Current Activities

Energy Conservation/Efficiency

- Old fluorescent lights have been replaced with new higher-efficiency fluorescent lighting in both the main office and lab buildings.
- An internal shade system has been installed in the greenhouse to reduce cooling and heating costs.
- Old leaking windows on the south side of the building have been replaced.
- At the main office and the Mirov lab, blinds have been installed on some windows to block sunlight in the summer and retain heat in the winter.
- A new HVAC system has been installed in the conference room.
- Old laboratory freezers/refrigerators have been replaced with energy efficient models.
- The Institute of Forest Genetics (IFG) is currently in the process of obtaining a 2 stage solar plan for the site to use solar energy to heat the greenhouse and provide electricity for the whole site.
- IFG is currently tracking energy and water use.

Recycling/Recycled Materials Use

- Recycling bin has been applied for and received.

Hazardous Materials

- Hazardous chemical waste is properly stored and removed.

Wish List/Possibilities

- Install solar panels for the greenhouse and the Institute.
- Install heat reflecting window coverings on lab building and quarters buildings.
- Replace single-paned windows that leak air on the north side of office building and in quarters buildings.
- Replace heating/cooling systems in three quarters buildings.
- Investigate the use of a biomass converter as an alternative energy source.
- Insulate walls and ceilings of all main office, lab, warehouse, and quarters buildings.
- Upgrade old computer monitors with energy efficient models.
- Install occupancy sensors for all restroom lights and fans.
- Remove/recycle metal, old equipment (shop machinery, freezers, refrigerators, incubators), and wood.
- Improve automatic water-timing irrigation on grounds.
- Plant native, drought resistant landscape species.
- Plant shade trees near buildings.
- Install previously-purchased multi-wall polycarbonate siding in the east greenhouse. This siding has an R value of 11.
- Install previously-purchased side-vent manual openers to the greenhouse which allow for greater flexibility in cooling. This will help to reduce cooling use and costs.
- Purchase on-demand/tankless water heaters for main office building, 3 rest-rooms, plus kitchen.

Redwood Sciences Laboratory, PSW – Arcata

Current Activities

Energy Conservation/Efficiency

- Building heater is on a timer so that the building is only heated during weekday working hours.
- Many employees bike or walk to work.
- An indoor bike rack (and shower) has been installed to encourage biking to work.

Recycling/Recycled Materials Use

Products Being Recycled	Recycled
Paper	●
Newspaper	●
Cardboard	●
Aluminum	●
Plastic (bottles, etc.)	●
Glass	●
Styrofoam packing pellets	●
Printer Cartridges	Refilled

- 30% post-consumer recycled content paper is purchased for use in printers and copiers.
- 2 printers are set-up to reuse paper that has been printed on one side.
- Most employees use scrap paper for notes and some make notepads from scrap paper.
- Air-filled packing bags and starch-based packing pellets are saved and reused.

Wish List/Possibilities

- During the summer 2007 remodel, make building more heat-efficient.
- Organize composting on-site.

Forest Sciences Laboratory, PSW- Fresno

Current Activities

Energy Conservation/Efficiency

- Employees reduce travel through teleconferencing.
- Alternative fuel/hybrid vehicles have been ordered.
- Lights that aren't needed are turned off.
- Solar power is used to run some field instruments.
- Fuel hazard control at the San Joaquin Experimental Range is performed using cattle grazing, rather than mechanical equipment.
- Some employees work a 4 day/week-10 hour/day work schedule to save on travel time/mileage to and from the field.

Water Conservation

- Drip irrigation is used to water some of the landscaping at the Lab.

Recycling/Recycled Materials Use

Products Being Recycled	Lab	Field Locations
Paper	●	Some
Aluminum	●	Some
Plastic (bottles, etc.)	●	Some
Glass	●	Some

- Recycled materials products are used.

Waste Reduction

- Printers have been purchased that can print duplex so that less paper is used.
- Rechargeable batteries are used to operate power tools.

Wish List/Possibilities

- Replace all T12 fluorescent lighting with T8 ballasts and tubes.
- Replace HVAC system with a more energy-efficient unit.
- Organize carpooling for employees.
- Place large recycling bin at field sites for pickup by a waste management company. Field sites currently have to bring their recycling to Fresno.
- Replace large trucks with small trucks.
- Arrange for General Services Administration vehicles to be fueled from Working Capital Fund gas tanks at National Forest sites to reduce distances driven to gas stations.

Silviculture Laboratory, PSW– Redding

Current Activities

Energy Conservation/Efficiency

- “Energy conserving” light bulbs are used in the workshop and airport labs.
- The minimum number of required lights is used in hallways and the lunchroom.
- Bicycle racks have been installed to encourage gas free commuting.

Recycling

Product	Recycled
Office Paper	●
Newspapers, magazines, etc.	●
Aluminum/Tin	●
Plastic (bottles, etc.)	●
Glass	●

Other

- When used, boot brushes at building entrance reduce cleaning costs.

Wish List/Possibilities

- Establish a “Green Team” to coordinate our efforts to conserve.
- Put up a bulletin board for sharing sustainable ideas.
- Circulate “green tips”, such as reminders and new information on how to conserve energy and resources. “Green tips” on our list so far:
 - Adopt Microsoft’s guidelines on powering off computers to save energy.
 - Set computer print defaults to duplex print.
 - Turn off common use computers when not in use.
 - Remember to buy items containing recycled materials, if possible.
 - Buy energy efficient equipment as required by current guidelines.
 - Check hot water heater settings and turn to lowest setting appropriate.
 - Do a battery audit and determine if rechargeable batteries are appropriate for use.
 - Check vehicle air filters and tire pressure regularly.
 - Use open windows rather than vehicle air conditioner to keep cool.
 - Encourage full use of the agency’s work at home policy.
 - Encourage co-workers to go to the energy fair.
 - Remember to turn off the lights.
- Determine if the City of Redding might do an energy audit of our facilities.
- Support the Shasta Trinity National Forest’s efforts to change landscaping to more xeric species. Offer to help with the work, if appropriate.
- Determine if reflective film is on the south and west facing windows of the building. If not, have it applied.
- Work with the building manager to change occupancy-sensing light switches that malfunction or are not set appropriately.
- Coordinate with the custodial crew to make sure they turn the lights off when they leave.

Director's Office, PSW–Albany

Current Activities

Energy Conservation/Efficiency

- Lights are turned off at the end of workdays and left off on weekends.
- Some employees have work at home agreements that reduce driving.

Recycling

Product	Recycled
Office Paper	●
Aluminum/Tin	●
Plastic (bottles, etc.)	●
Glass	●
Printer Inkjet/Toner Cartridges	●

Idea Bank

Sustainable activities should be made as easy to implement on the ground as possible. Because it can be difficult and time consuming to research a given sustainable activity, a number of briefing papers have been provided in this section to aid employees in undertaking sustainable projects. Some of the activities described in this Idea Bank are inexpensive and will prove fairly easy to implement at a single office or facility. Other activities are larger in scale, have a more regional focus, and may require long-term planning, funding, and significant up-front expenditures. For more expensive projects, environmental and economic benefits may still be obtained, though the benefits may not be seen for a number of years. Those projects that are less expensive and require less upfront funding might be initiated soon while we simultaneously plan for some of the larger projects that could be implemented in the coming years.

The Idea Bank presented here is, by no means, exhaustive. The ideas contained herein are just some of the creative ways that we can act to reduce our resources consumption and make our operations more sustainable. As new technologies and opportunities for sustainable operations emerge, additional papers might be added to this Idea Bank to provide individuals across Region 5 and PSW with even more options to green their workplace.

Facility Certification by Green Building Programs

A number of the proposed activities described in this document, if implemented, would act to reduce one or more types of resource consumption in the operation of our business. However, it may also be useful to take a more holistic approach to greening our buildings and facilities. For buildings that we own, this can be accomplished through certification in a well-accepted green building program. For leased facilities, this might be accomplished through agreements with our lessors that encourage them to operate their buildings in a manner that takes environmental health into account.

Leadership in Energy and Environmental Design (LEED)

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a nationally accepted benchmark for the design, construction, and operation of green buildings. The system is part of the U.S. Green Building Council's (USGBC) efforts to encourage companies and agencies to undertake building construction that takes human and environmental health into account. The LEED system focuses on five key areas: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. The LEED whole-building approach provides owners and operators with guidance on operation practices that will have a measurable and positive effect on building performance. LEED has specific guidelines for new buildings and for major renovation projects, but also has guidelines for the operation and maintenance of existing buildings and facilities.



Under the LEED Rating System, buildings can currently be certified at 4 different threshold levels: certified level, silver level, gold level, and platinum level. To be certified at higher levels, higher performance and environmental goals are required. Though LEED emphasizes human and environmental health in its certification standards, LEED certified buildings can also provide considerable monetary savings during operations and maintenance. In a study of 33 LEED buildings in California that were built within the past 10 years, data show average bottom line savings of 30% in energy, 30-50% in water use, and 50-97% in waste costs. This will similarly be the case for the LEED certified Bessey Ranger Station, a Forest Service, Rocky Mountain Region facility. The newly constructed facility will use 45% less energy and 50% less water than a similarly sized non-LEED building.

In 2003, Forest Service Engineering in the Washington Office purchased a corporate membership to USGBC. This membership allows all Forest Service staff to benefit from USGBC resources like members-only sections of the USGBC website, discounts on training, and discounts on books.

New Buildings

Effective November 3, 2005, a Forest Service Interim Directive was issued requiring all new Forest Service owned building construction projects for district offices, supervisor's offices,

visitor centers, and research facilities 2,500 square feet or greater in size to be registered and certified under the LEED rating system at the silver certification level. Warehouses 2,500 square feet or greater in size and climate controlled must also be registered and certified at the silver certification level (FSH 7309.11, Section 06(3)(k)).

Retrofitting and Remodeling Existing Buildings

No direction has been issued for existing Forest Service buildings due to be remodeled or retrofitted. However, the LEED program's rating and certification system might similarly be used when buildings are remodeled or retrofitted.

ENERGY STAR Buildings

The U.S. Environmental Protection Agency's ENERGY STAR program began as a voluntary labeling program to promote energy-efficient products and appliances. However, the ENERGY STAR label has been extended to cover new commercial and industrial buildings that promote and demonstrate energy efficiency. Building owners that wish to have the ENERGY STAR label applied to their building use a system called "Portfolio Manager" to help them track and manage their energy use. Facilities entered into the Portfolio Manager are assigned a national energy performance rating on a scale of 1 to 100. Facilities achieving a rating of 75 or better are eligible to apply for the ENERGY STAR. By making the effort to increase a facility's performance rating, energy efficiency can be increased.

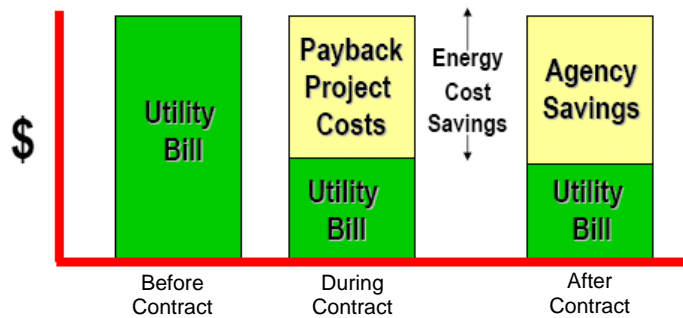


Resources

- U.S. Green Building Council
<http://www.usgbc.org/>
- Forest Service/U.S. Green Building Council Intranet Site
http://fsweb.wo.fs.fed.us/eng/programs/facilities/sus_green/usgbc.htm
- Leadership in Energy and Environmental Design (LEED)
<http://www.usgbc.org/DisplayPage.aspx?CategoryID=19>
- To apply for the ENERGY STAR for a building:
http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager_intro
- To learn about using the ENERGY STAR program for new building design:
http://www.energystar.gov/index.cfm?c=new_bldg_design.new_bldg_design
- ENERGY STAR building manual
http://www.energystar.gov/index.cfm?c=business.bus_upgrade_manual
- To track and improve energy efficiency in your building:
<https://www.energystar.gov/istar/pmpam/>

Financing Mechanisms for Energy Efficiency Improvements

The Federal Energy Management Program (FEMP) of the Department of Energy, Energy Efficiency and Renewable Energy, provides Federal agencies with a mechanism by which agencies can reduce their energy costs without using Congressional appropriations for improvements. By working with FEMP, agencies can implement projects that guarantee energy-related cost savings. Through two of FEMP's programs, improvements can be made to a facility or office without upfront payment for those improvements. Rather, improvements are paid for over a contract term decided upon by the agency using the savings that are generated by the project. Once improvements have been paid for in their entirety, the agency will begin to realize those cost savings.



The two financing mechanisms available from FEMP are Utility Energy Service Contracts (UESC) and Energy Savings Performance Contracts (ESPC).

FEMP Utility Energy Service Contracts (UESC)

UESCs allow Federal agencies to enter into contracts with their franchised or serving utility company to implement energy saving projects at agency offices and facilities. The utility company agrees to provide the agency with services and/or products that are designed to make the agency's facilities more energy efficient. The agency, through a contract with the utility company, agrees to repay the utility company for the services and products over the length of the contract term. Payments to the utility company are made from the cost savings generated by the energy efficiency measures. With this arrangement, agencies can implement energy improvements with no initial capital investment. Region 5 currently has a Master Agreement in place with Southern California Edison. This agreement is in place for projects that would reduce energy consumption at Forest Service offices and facilities that are located in the area served by the utility company.

FEMP Energy Savings Performance Contracts (ESPC)

ESPCs are similar to UESCs in that they allow agencies to implement energy-saving projects at their facilities without up-front capital costs and without special Congressional appropriations to pay for the improvements. However, with an ESPC, agencies enter into a partnership with an energy services company (ESCO), rather than with a utility company. The ESCO, a specialty contractor, conducts a comprehensive energy audit and identifies improvements that will save energy at the facility. In consultation with the agency customer, the ESCO designs and constructs

a project that meets the agency's needs and arranges financing to pay for it. The ESCO guarantees that the improvements will generate cost-savings sufficient to pay for the project over the term of the contract. Contract terms up to 25 years are allowed.

FEMP provides free services through the initial proposal stage without the need for an Interagency Agreement. After the Initial Proposal, FEMP services can be provided on a cost reimbursable basis. An Interagency Agreement spells out tasks and costs of FEMP project facilitation.

Additional Resources

- FEMP Financing Mechanisms
<http://www1.eere.energy.gov/femp/financing/mechanisms.html>
- FEMP Utility Energy Service Contracts
<http://www1.eere.energy.gov/femp/financing/uescs.html>
- FEMP Energy Savings Performance Contracts
<http://www1.eere.energy.gov/femp/financing/superespcs.html>

Biomass Utilization on National Forests

During the past 20 years, there has been an upsurge in the number of biomass (a.k.a. wood-fired) heating systems installed in businesses, schools, hospitals, and government offices. This upsurge stems, in part, from the growing attractiveness of generating heat using a sustainable and economical alternative to non-renewable resources. In addition to biomass being renewable, it is often available for purchase from local businesses. Where installed then, the use of biomass heating systems supports local economies. R5 and PSW might consider the installation of biomass heating systems in our rural offices and facilities just as the “Fuels for Schools” program has aided in the installation of biomass systems in rural schools.

From an environmental standpoint, biomass heating systems can prove a beneficial alternative to traditional systems that use non-renewables. Though biomass systems do consume natural resources, the wood they use can be regenerated through sustainable forest management. In contrast, with fossil fuel based systems there is no possibility of regenerating spent resources. Biomass systems can prove especially beneficial when wood comes from fuels reduction projects. By removing fuels from overly-dense forests, forest health will increase and the risk of catastrophic wildfire will decrease. Likewise, fuels removed from forests and used to heat facilities will not use landfill space. Finally, biomass heat generation can be accomplished with no net increase in atmospheric carbon dioxide (CO₂) concentrations, so long as forests are managed sustainably. With sustainable forest management, CO₂ emitted into the atmosphere during combustion will be removed by trees during the subsequent regeneration of forest biomass.

From an economic standpoint, biomass heating systems can offer a cost-effective alternative to heat generated from fossil-fuels. The capital costs associated with the purchase and installation of a biomass heating system are usually greater than those of similarly sized non-renewable systems. However, the costs of operation are significantly lower for biomass systems, primarily because heat from wood-chips and wood-pellets can be generated at a much lower cost per thermal unit. Additionally, biomass obtained from fuels reduction projects does not end up as waste. Because waste transportation and disposal can be costly, utilization of biomass for heating can provide cost savings.

Cost of Fuels per Decatherm

Fuel	Fuel Unit	Price Range Per Unit	Cost per decatherm
Wood Chips	ton	\$30-\$40	\$2.78-\$3.70
Wood Pellets	ton	\$90-\$130	\$5.49-\$7.93
Electricity	kilowatt-hour	\$0.06-\$0.15	\$17.60-\$43.95
Natural Gas	decatherm	\$8.00-\$9.00	\$8.00-\$9.00
Propane	Gallon	\$0.90-\$1.30	\$9.94-\$14.35
Fuel Oil	Gallon	\$1.75-\$2.25	\$12.62-\$16.32

Note: Prices reflect lower 48 states; One Decatherm = 1 MMBTU

Though biomass heating systems are not yet commonplace, they have been demonstrated successfully at a number of locations. For example, Chadron State College, in Chadron, Nebraska, has operated a biomass heating system for 15 years. That system heats 1.2 million cubic feet of space, saving the college 30% when compared with natural gas heating. Since November 2003, Darby Public Schools, in Darby, Montana, has heated an 82,000 square foot space using biomass with an estimated annual savings of \$100,000. And Victor Public Schools, in Victor, Montana has heated a 47,000 square foot space since September, 2004 with an estimated annual savings of \$27,000.

On July 31, 2006, the US Forest Service put its first biomass heating system into operation at the Forest Supervisor's Office on the Apache-Sitgreaves National Forest in Arizona. The Apache-Sitgreaves National Forest, in partnership with Forest Energy Systems, installed two wood pellet-fueled boilers that will use hazardous fuels residues from 10 to 15 acres of forest thinning projects annually. The "whole tree" pellets, made from bark, needles, and white wood, produce clean heat and can even be used on days with poor air quality.

The projects described above demonstrate that under the appropriate circumstances, biomass heating systems can be feasible and economical. In general, the capital costs associated with the purchase and installation of biomass heating systems will be recouped more quickly at:

- *High elevation/colder sites:* Where seasonal temperatures are colder and heaters run more frequently;
- *Sites currently using expensive fuel:* For example, at sites using propane, electricity, or fuel oil;
- *Sites with aging systems or with new construction:* Where an old system is costly to maintain or where a fully functional system is not currently in operation;
- *Sites where a fuel supply is readily available:* This keeps fuel transportation costs low.

When it is determined that a biomass heating system may be appropriate for a given location, a number of associated challenges should be considered and addressed⁹:

- *Biomass systems may require more operator attention than conventional systems:* Smaller biomass systems are more difficult to automate, thus requiring more operator oversight. Additionally, oversized wood chips can jam fuel handling equipment, causing shut downs. Operators will need to watch for jamming and shutdowns.
- *Some biomass systems require more maintenance than conventional fuels systems:* While the best biomass installations don't have higher maintenance costs or personnel needs when compared with facilities that burn oil or gas, some system owners have experienced increased costs for either operator time, or parts replacement and repairs.
- *Wood-chips can be variable in their quality:* Depending on the time of the year and the species of wood being chipped, quality can vary.

⁹ Taken from: Maker, TM (2004). Wood-Chip Heating Systems: A guide for institutional and commercial biomass installations. Biomass Energy Resource Center. p.10.

- *Biomass fuel supply networks may not yet be established:* In many geographic regions, marketable biomass is sold to paper mills and electricity generating plants. In these markets, it may be difficult for suppliers to meet the needs of biomass customers.
- *Public concern that biomass systems are dirty:* Biomass does not burn as cleanly as natural gas. As a result, the public may worry that wood-burning in a biomass installation will be “dirty.” To address this misconception, public education is critically important.

Choosing a Wood Chip vs. Wood Pellet System

There are a number of tradeoffs to consider when choosing between a wood chip and a wood pellet system. First, a wood pellet system’s heating unit is smaller and less expensive when compared with a similarly sized boiler in a wood chip system. Second, the quality of wood pellets is more consistent. Size and moisture content in wood pellets are carefully controlled. This is important because irregularly sized wood chips can cause belts and moving parts in chip heating systems to jam. Similarly, wood that is too moist will not burn, while the increased flammability associated with dry wood can be hazardous. Third, pellet systems allow for cheaper fuel storage in smaller holding containers. In pellet systems, pellets are gravity fed using overhead bins. In contrast, automated wood chip systems are often designed to transport chips from larger bins to the boiler using hydraulic and belted equipment.

There are however two primary disadvantages (one environmental and one economic) to using a wood pellet system. Because pellets are a processed wood product, the energy and natural resources utilized to manufacture the pellets themselves, result in an additional environmental impact. Processing also results in a higher cost for wood-pellets. In fact, wood pellets often cost twice as much as wood chips per thermal unit of heat output. Whether or not a wood chip or a wood pellet system is right for a given application will depend on the local costs of chips and pellets, the required size of the heating system, and the quality consistency of any local chip supplies.

An Emerging Technology: Biomass Cogeneration/Gasification Systems

Cogeneration refers to the generation of two different forms of energy, heat and electricity in the case of biomass cogeneration. Small biomass cogeneration systems are still experimental in nature. Because these first generation systems are expensive to install and operate, they are being utilized only in applications specifically designed for testing and demonstration.

At the time that this publication was written, the US Forest Service, Pacific Southwest Region had provided grants to help test and demonstrate two cogeneration systems that use gasification to generate heat and electricity from biomass. During gasification, high bulk fuels such as wood chips and nut shells are converted to gas and then burned, producing very little smoke or noise. The Community Power Corporation (CPC) has plans to test one 25 kilowatt system at the Siskiyou Opportunity Center in Mount Shasta, California. The system will run for a 1 year trial period, after which CPC will analyze results and work towards commercialization of the system. A second 50 kilowatt system is to be installed on the San Bernardino National Forest at the Big Bear Discovery Center. As this technology emerges and costs decline, there may be increased opportunities to install these systems in additional locations.

Additional Resources

- Region 5, Regional Woody Biomass Utilization Specialist
Bruce Goines (707-562-8910; bgoines@fs.fed.us)
- Fuels for Schools
www.fuelsforschools.org
- Biomass Energy Resource Center
<http://www.biomasscenter.org/>
- FEMP Biomass Energy Savings Performance Contracts (financing mechanism for biomass utilization)
http://www1.eere.energy.gov/femp/financing/superespcs_biomass.html
- Publication
Maker, T. M. (2004) Wood-chip heating systems: A guide for institutional and commercial biomass installations. Biomass Energy Resource Center. 91 p.



Installing Photovoltaics at Offices and Facilities

Solar energy can be utilized by a number of different technologies. Some applications use solar energy to heat water. Other applications use solar energy to create steam that powers turbines, which in turn generate electricity. This briefing paper discusses the possibility of using photovoltaics to power some of our offices and facilities. The term photovoltaics (PV) refers to a technology in which light is converted to electricity. PV arrays are made of silicone modules that generate electrical energy when exposed to light. Often, PV installations also include onsite batteries that can be charged when more solar energy is harvested than is needed. The energy stored in batteries can be used later, when demand exceeds supply, or during cloudy days and evenings.

The PV modules that generate electrical energy are silent and produce no emissions. Because sunlight is an infinite resource, energy generated using sunlight is also completely renewable. As a result, this technology is considered environmentally-friendly. In addition to the environmental benefits of PV utilization, there are a number of associated economic benefits. PV arrays are very durable and reliable and they last at least 20–30 years. They are particularly useful in remote locations where it might be costly to connect to the grid.



One of the largest perceived barriers to PV utilization is the initial cost of installation. PV systems generally have a higher initial cost than alternatives such as generators. However, they are much less expensive to operate and maintain, and they are modular and can grow in the event that a facility's load increases. In fact, when the life-cycle costs (LCCs) of PV systems are compared to alternatives such as generators or long utility line extensions, PV can be an economical option¹⁰. Additionally, if a PV system is connected to the grid using net metering, the system can actually cause a facility's utility meters to roll *backward* when surplus energy is generated.

The installation of renewable energy projects like photovoltaic arrays at Federal facilities, is supported by Executive Order 13123, "Greening the Government Through Efficient Energy Management" and by the Energy Policy Act of 2005 (EPACT). EPACT sets a goal of installing 20,000 solar energy systems in Federal facilities by 2010. As of September 30, 2005, Federal PV arrays have generated nearly 34 gigawatt-hours of electricity. The Forest Service might consider the installation of additional PV arrays at appropriate offices and facilities to support EPACT goals, to save on energy costs, and to support alternative energy utilization.

¹⁰ Department of Energy (1998) Photovoltaics: Federal Technology Alert. DOE/GO-10098-484. http://www.eere.energy.gov/femp/pdfs/FTA_pv.pdf

Currently, a number of financial incentives and mechanisms exist which can help pay for the installation of photovoltaic arrays at Federal facilities. Links to some of those incentives and mechanisms are provided below.

Additional Resources

- FEMP Technology Specific Super Energy Savings Performance Contracts for Photovoltaics
http://www1.eere.energy.gov/femp/financing/superespcs_photovoltaics.html
- FEMP Utility Energy Service Contracts
<http://www1.eere.energy.gov/femp/financing/uescs.html>
- Database of State Incentives for Renewables & Efficiency
<http://www.dsireusa.org/>
- General Photovoltaic Information, U.S. Department of Energy
<http://www1.eere.energy.gov/solar/photovoltaics.html>

Conserving Energy by Using More Efficient Lighting Systems

Good lighting is essential in our offices, facilities, and visitor centers as it provides for pleasant working conditions, a safe work environment, and allows visitors to read interpretive displays. By retrofitting existing lighting systems and installing more energy efficient systems, we will be able to save energy in the long run, improve lighting quality, and reduce maintenance and labor costs. Listed below are a number of possible lighting-related actions that might be taken, each of which has the potential to reduce energy use and resources consumption.

Install Energy Efficient Fluorescents and Ballasts

Replace incandescent bulbs with compact fluorescent lamps (CFL)

Incandescent bulbs, the screw-in light bulbs that we all grew up with, are among the most energy inefficient lighting sources. This is because much of the energy used by those bulbs is emitted as heat instead of light. By replacing a fixture's incandescent bulb with a CFL that will fit in a screw-in socket, energy use from that fixture can be reduced by up to 75%. A standard 100 watt screw-in bulb, left on for 8 hours each day for a year, uses approximately \$23 worth of energy. A CFL with a similar light output uses just under \$6 worth of energy in that same year¹¹. As an added bonus, CFLs have a lamp life of 10,000 hours, compared with the 1,000 hour life of an incandescent bulb. Though the initial cost of a CFL is higher than an equivalent incandescent, the longer lamp life means that costs associated with replacement will be much lower over the life of the bulb.

When purchasing CFLs, take the following into consideration:

- *Wattage Equivalents:* Purchase replacement CFLs with wattages that are approximately one-quarter that of the original incandescent bulb (e.g. when replacing a 100 watt incandescent, purchase a 23 watt CFL). CFLs use less energy so their wattages are lower.
- *Shapes and Size:* In the past few years, manufacturers have produced many new CFL sizes and shapes that can be screwed into light fixture sockets. Make sure replacement bulbs are compatible with the spatial limitations of your lighting fixtures.
- *Color:* Different CFL models produce a variety of different hues or colors of light. Some bulbs emit warmer colors, some cooler colors. Take this into account when making purchases.



Replace T12 tubes and ballasts with more efficient T8 tubes and ballasts

T8 fluorescent tubes use a newer technology than T12 tubes, provide better light quality, last nearly twice as long, and improve efficiency by 30%. All linear fluorescent tubes are categorized by their tube diameter in eighths of an inch. So, T12 tubes are 12/8 or 1.5 inches in diameter

¹¹ Lawrence Berkeley National Laboratory. 2001. Lighting Retrofit Workbook: A Practical "How to" Guide for the National Park Service Visitor Centers. Lawrence Berkeley National Laboratory and the Federal Energy Management Program, Department of Energy. Assumes a utility rate of \$0.08 per kwh.

while T8 tubes are 8/8 or 1 inch in diameter. You can easily determine what types of linear tubes are being used in your office by looking at the markings near the end of the tubes.

To use T8 tubes in lighting fixtures that were originally designed for T12 tubes, the ballast must be replaced. The ballast is an electrical device in the light fixture that controls the current. Older magnetic ballasts are less efficient than the newer T8 electronic ballasts, so ballast replacement will generate energy savings. Fortunately, the tube holders are the same in T12 and T8 fixtures. As a result, T8 tubes can be used in a fluorescent fixture once a T8 electronic ballast has been installed.

Within the line of T8 ballast models, there is variability in energy efficiency. In addition, some electronic ballasts have programmed start or soft start features that prolong the life of tubes without sacrificing performance. In 2006, Region 5 Regional Office (RO) ballasts were replaced with General Electric Ultra Start Ballasts (models GE-232-MV-PS-XL and GE-332-MV-PS-XL) because they allow for a soft start and will reduce replacement costs in the future¹². Take this into account when upgrading.

Remember to dispose of fluorescent bulbs properly:

As of February 8, 2006, all discarded fluorescent bulbs and tubes are considered hazardous waste in California because they contain mercury (California Code of Regulations, Title 22, division 4.5, chapter 11, section 66261.50). Bulbs and tubes must be disposed of appropriately. Recycling is one acceptable means of disposal. Self addressed, postage paid fluorescent recycling mailers can be purchased through the General Services Administration at www.gsaadvantage.gov.

Install Automatic Lighting Controls



Automatic lighting controls can significantly reduce energy use by turning off lights when rooms, hallways, or other areas are left unoccupied.

Automatic controls include time-based and occupancy-based models. Time-based controls are most useful for applications where lighting needs are predictable. For example, in an office regularly occupied between 7 am and 7 pm, a time-based control might be set to turn off lights outside of those working hours. Time-based controls typically include a manual override in the event that lights are needed before or after the pre-programmed hours. In applications where greater flexibility is needed, occupancy sensors (infrared or ultrasonic) can be used to turn off lights when an area is unoccupied.

Infrared sensors require a direct line of sight to activate lights while ultrasonic sensors can detect occupancy, even in rooms where obstructions like furniture block site lines. Both types of technologies, and the locations in which they are mounted, need to be considered carefully prior to installation to ensure that they will be effective in a room. Look for sensors that have both an adjustable sensitivity setting and an adjustable time delay.

Like sensors that turn off room lighting, new products have come on the market that turn off the lights in snack and refrigerated vending machines when no one is near the machine. These products promise to reduce the costs of powering vending machines by over 45% each year.

¹² The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

Different products are available depending on the type of machine. For refrigerated machines, products are available that promise to save energy while still keeping snacks or drinks cool. In 2006, Region 2 purchased 32 VendingMisers and installed them on a number of vending machines in the Region. Those 32 VendingMisers will reduce energy use by an estimated 71,000 kWh each year with an annual savings of \$6,000 (given current energy rates). Region 2 estimates that the VendingMisers will pay for themselves after approximately nine and a half months of use. These products are available from the General Services Administration or at www.gsaadvantage.gov.

Install Light Tubes

Daylighting may offer a great opportunity to reduce energy use from lighting. By using natural sunlight as a part of a lighting system, light fixtures may be dimmed or even turned off for portions of the day. Though skylights have been used to introduce sunlight into building spaces, they can be expensive and time consuming to install. Light Tubes provide an economical alternative. Because light tubes are installed through a much smaller roof hole, they can be installed easily between rafters without any structural modification, often in just a few hours. Yet the tube's internal reflective system captures and channels light much more effectively than a skylight. Lights Tubes can also be installed in small rooms and in hallways where skylights are impractical.

Use LED Exit signs

Replacing exit signs is one of the easiest ways to both reduce lighting costs and save energy due to their long operating hours. Where exit signs are lit using either incandescent or fluorescent bulbs, consider replacing those signs with LED (light emitting diode) signs. Incandescent and CFL exit signs respectively use approximately \$28 and \$10 worth of energy per year to operate. LED Exit signs use only \$3.50 worth of energy to operate¹³. LED exit signs are also inexpensive, cost little to install, and have an extremely long lamp life of 100,000 hours.



Replace Tungsten Halogen bulbs with Tungsten Halogen Infrared (IR) bulbs

When Tungsten halogen lighting is necessary (e.g. for visitor displays where light needs to be whiter), bulbs may be replaced with Tungsten Halogen IR bulbs. Tungsten halogen IR bulbs provide energy savings of up to 30% when compared with standard tungsten halogen bulbs. Tungsten halogen IR bulbs have an infrared coating that lets visible light pass through while reflecting infrared heat back onto the filament in the bulb. Because heat is reflected back onto the filament, less energy is needed to keep the filament at its optimal operating temperature. This results in energy savings.

¹³ Lawrence Berkeley National Laboratory. 2001. Lighting Retrofit Workbook: A Practical "How to" Guide for the National Park Service Visitor Centers. Lawrence Berkeley National Laboratory and the Federal Energy Management Program, Department of Energy. Assumes a utility rate of \$0.08 per kwh.

Additional Resources

- Federal Energy Management Program: Lighting Guidance
http://www.eere.energy.gov/femp/procurement/eep_lighting_guidance.cfm
- New Buildings Institute: Advanced Lighting Guidelines
<http://www.newbuildings.org/ALG.htm>
<http://www.newbuildings.org/lighting.htm>
- Energy Star Lighting Information
http://www.energystar.gov/index.cfm?c=lighting.pr_lighting
- Energy Star Building Manual: Lighting
http://www.energystar.gov/ia/business/BUM_lighting.pdf
- Lighting Retrofit Workbook: A Practical “How to” Guide for the National Park Service Visitor Centers
http://www.eere.energy.gov/femp/pdfs/NPS_guidebook.pdf
- Information on VendingMisers
http://www.usatech.com/energy_management/index.php

Increasing Fleet Fuel Efficiency

Mobility is an important part of Forest Service business. Whether fighting fire, surveying wildlife, performing research, or hauling goods and equipment, Forest Service employees need to be mobile to perform their duties. This requires that both the Pacific Southwest Region (Region 5) and the Pacific Southwest Research Station (PSW) manage and maintain a large fleet of vehicles. In Fiscal Year 2004, the combined fleets of Region 5 and PSW numbered more than 4,600 highway legal vehicles. Much of those two fleets were, and still are, made up of large Sport Utility Vehicles (SUVs) and pickup trucks. This is because our employees often need to both drive in difficult terrain and haul necessary equipment to work sites. However, these same vehicles are relatively fuel inefficient and make for a low overall fleet fuel efficiency.

In October 2004, Region 5's highway-legal fleet had an average fuel efficiency of 12.7 miles per gallon (mpg). Average fuel efficiency on each of the Region's National Forests ranged from 10.9 - 14.0 mpg. Interestingly, fire and emergency response vehicles were not the main drivers of these low values. When removing all vehicles specifically purchased for firefighting and emergency response, the Region-wide fuel efficiency increased to only 14.1 mpg. Though fire and emergency response vehicles are relatively fuel-inefficient (many are large trucks and engines), they make up only a small percentage of the Region's highway-legal vehicles. The fleet's fuel efficiency is, to a greater extent, determined by the SUVs, pickup trucks, and sedans that employees drive everyday. In October 2006, fleet fuel efficiency was no different. The Region-wide average for all highway-legal vehicles was 12.6 mpg. For non-fire highway-legal vehicles, the average remained at 14.1 mpg.



Fortunately, there are a number of possible ways for both Region 5 and PSW to increase fuel efficiency in their respective fleets, reduce petroleum use, decrease their environmental footprint, and simultaneously save money. A number of those means are described below.

“Right Sizing” the Fleet

National Forests and Research Work Units will have to maintain a number of full-size trucks and SUVs in order to haul goods and equipment for some job applications. However, some locations may have more large vehicles than are necessary to perform all of those applications. Where this is the case, a unit might “right size” its fleet by replacing a number of large vehicles with mid-sized SUVs, small SUVs, or even sedans. This would increase fuel efficiency, reduce fuel consumption, and save significant costs. For example, a 2007 Chevrolet 1500 Suburban (4WD) gets 14 mpg city and 18 mpg highway. The estimated annual fuel cost for the Suburban is

\$2,484¹⁴. On the other hand, a 2007 Ford Escape (4WD) gets 21 mpg city and 24 mpg highway with an annual estimated fuel cost of \$1,809. Replacing a single Suburban with an Escape would likely save a unit over \$600/year in fuel alone. Replacing full-size pickup trucks with compact pickups or full-size sedans with compacts could provide similar savings. This would simultaneously reduce our resources consumption.

Buying Hybrid Vehicles or Alternative Fuel Vehicles (AFVs)

Hybrid Electric Vehicles: Hybrid electric vehicles (or simply ‘hybrids’) contain both a conventional internal combustion engine and a large set of batteries and electric motor. The vehicle’s computers automatically switch power between the electric motor and the internal combustion engine to obtain the best mix of fuel economy and vehicle performance. With this technology, vehicles can obtain twice the fuel economy of conventional vehicles with lower emissions. Current hybrid models never need to be plugged in so they can be used in the same way as a conventional vehicle.



Region 5 currently operates 8 Hybrid Ford Escapes, an SUV, and 2 Hybrid Honda Civics, a compact sedan. These vehicles demonstrate the Region’s increasing commitment to making its fleet more fuel efficient. In the future, Region 5 and PSW might consider adding more hybrids to their fleets. This would both increase overall fleet fuel efficiency and serve as a visible reminder of the value that the Forest Service places on conserving natural resources.

Hybrids are more fuel efficient than conventional vehicles. However, the benefits that the Forest Service obtains by driving hybrids may be diminished as a result of our driving applications. Because the electric motors on hybrids operate most at lower speeds, some hybrid models get their best gas mileage during city driving. In contrast, much of our driving takes place in rural areas. Though Forest Service hybrids do obtain better gas mileage than their conventional equivalents, their actual fuel economy has been less than EPA estimates. For example, EPA rates the 2005 Ford Hybrid Escape at between 33-36 mpg in city driving, a significant improvement over the 20-25 mpg rating of the conventional Escape. Yet, the Hybrid Escape on the Inyo National Forest obtains an average of 28 mpg. Still, one must remember that there are other benefits associated with driving hybrids besides increased fuel economy. Hybrids pollute less and emit less carbon dioxide. The EPA estimates that each 2007 Hybrid Ford Escape (4WD) will emit 6.0 tons of carbon dioxide/year whereas the conventional 2007 Ford Escape (4WD) will emit 8.3 tons/year and the 2007 Chevrolet 1500 Suburban (4WD) will emit 11.3 tons/year¹⁵. The Hybrid Escape similarly produces less air pollution. Ultimately, our decision to buy more hybrids is dependent not only on economic considerations, but on a commitment to environmental considerations, as well.

¹⁴ 2007 Fuel Economy Guide; US Department of Energy, Office of Energy Efficiency and Renewable Energy, and the Environmental Protection Agency; <http://www.fueleconomy.gov/feg/download.shtml>. Assumes that vehicles travel 15,000 miles per year (55% in city/45% on highway) and that regular unleaded gasoline costs \$2.65/gallon.

¹⁵ Side-by-side vehicle comparison at: <http://www.fueleconomy.gov/feg/sbs.htm>. Assumes that vehicles travel 15,000 miles per year (55% in city/45% on highway).

Propane Vehicles¹⁶: Today, propane (also known as liquefied petroleum gas or LPG) is used in cars and trucks, as well as in off-road vehicles like forklifts and loaders. Vehicles can be equipped solely with propane fueling systems, or with bi-fuel systems that enable drivers to switch between propane and gasoline use. Propane vehicles can generate 60% fewer ozone-forming emissions than vehicles powered by gasoline. Additionally, tests on light-duty bi-fuel vehicles running on propane have demonstrated a 98% reduction in the emissions of toxics like benzene, formaldehyde, and acetaldehyde. Using propane in our fleet not only reduces the impact of our fleet on the environment, but also reduces our dependence on foreign petroleum since 85% of the propane used in the U.S. comes from domestic natural gas processing and petroleum refining.

Propane is the most accessible of the liquid and gaseous alternative fuels. Approximately 3,000 documented fueling stations are located nationwide. The cost of a gasoline-gallon equivalent of propane is generally less than that of gasoline, but varies depending on location. However, the more limited range on dedicated propane vehicles and the extra cost (about \$2,500/vehicle) may prevent the purchase of propane vehicles for some applications.

Ethanol Flexible-Fuel Vehicles (FFVs): FFVs are designed to operate with gasoline or with a mixture of ethanol and gasoline. Ethanol can be made from any biological feedstock that contains appreciable amounts of sugar or materials that can be converted into sugar. As such, ethanol is a renewable resource. By using ethanol to fuel vehicles then, the use of non-renewable petroleum resources will decline. All major domestic and foreign automakers already approve of the use of E10 (10% ethanol, 90% gasoline) in their vehicles. However, higher concentrations of ethanol, like E85 (85% ethanol, 15% gasoline) can only be used in FFVs. FFVs both contain special parts that don't corrode when used with high-concentration blends and contain engines that burn at a higher compression ratio that is necessary when using high-concentration blends. In FY06, the PSW fleet included eight FFVs.

Changing Driving Habits

Perhaps the easiest and most economical way to increase fuel efficiency in our fleet is to changing driving habits. Here are a number of tips to help individuals reduce fuel consumption at absolutely no cost¹⁷.

Plan ahead to consolidate trips: Instead of making a number of trips throughout the day, try to plan multiple tasks in a single trip.

Share Vehicles/Carpool: When more than one employee is traveling to a meeting or needs to drive to a remote location, drive together. This reduces the total number of vehicles in operation so that less gas is used.

Take the smallest vehicle necessary to get the job done: Some Forest Service work requires employees to navigate rough roads in poor weather. In those cases, large 4-wheel drive vehicles

¹⁶ Information obtained from: http://www.eere.energy.gov/afdc/afv/prop_vehicles.html.

¹⁷ Information modified from: <http://www.ford.com/en/company/about/publicpolicy/ecodriving.htm>

are often the safest option. However in many cases (e.g. when driving to meetings), smaller, more fuel efficient vehicles can be used.

Remove excess weight: Unneeded items in trunks or in the beds of trucks make a vehicle's engine work harder. This causes the vehicle to consume more fuel.

Avoid excess idling: When parked or sitting at a drive-through, it is best to shut off a vehicle. In fact, it is more fuel efficient to turn a vehicle off and then restart it, rather than letting a parked vehicle idle for more than a few seconds.

Accelerate and decelerate smoothly: By doing this, a vehicle is able to make more efficient use of its power and obtain better gas mileage.

Maintain a steady speed: The use of cruise control on the highway is ideal because it decreases gas pedal activity.

Observe posted speed limits: The EPA estimates a 10-15% improvement in gas mileage by driving 55 mph instead of 65 mph.

Keep tires properly inflated to the recommended pressure: This alone can reduce the average fuel that a vehicle uses by 3-4%.

Air conditioning should be used selectively: Air conditioning reduces fuel economy. Use it only when it is necessary.

Avoid "topping-off": Overfilling a vehicle's gas tank when refueling can cause gasoline to spill. Spilled gasoline contributes to air pollution as it evaporates.

Additional Resources

- Alternative Fueling Infrastructure, DOE, Energy Efficiency and Renewable Energy
http://www.eere.energy.gov/afdc/infrastructure/fuel_inf.html
- Alternative Fuel Vehicles, DOE, Energy Efficiency and Renewable Energy
<http://www.eere.energy.gov/afdc/afv/afvehicles.html>
- Hybrid Electric Vehicle Information
<http://www.eere.energy.gov/cleancities/hev/>
- Alternative Fuel Vehicle Leasing, General Services Administration
<http://www.gsa.gov/Portal/gsa/ep/channelView.do?pageTypeId=8211&channelPage=%2Fep%2Fchannel%2FgsaOverview.jsp&channelId=-13037>
- Incentive Program for Alternative Fuels, California Air Resources Board
<http://www.arb.ca.gov/fuels/altfuels/incentives/incentives.htm#altfuels>

Using Biodiesel in Our Fleet

Biodiesel is a diesel replacement fuel that is manufactured using vegetable oils, animal fats, or recycled cooking greases or oils¹⁸. Though diesel engines can run on oils and greases obtained directly from sources like restaurants or fast food joints, engine problems can occur when using raw or unrefined oils and greases that have not been processed into biodiesel. When considering alternatives to diesel for the Forest Service fleet then, only *manufactured* biodiesel should be used.

Different blends of biodiesel can be customized for use in different fueling applications. The biodiesel blend is typically reported using the letter ‘B,’ followed by a number. That number indicates the percentage of biodiesel in that fuel with the remaining percentage usually petroleum-based diesel. For example, B100 is 100% biodiesel. B20 is 20% biodiesel and 80% petroleum diesel. Generally, any blend of biodiesel can be purchased when ordering wholesale. However when buying from a retail pump, purchases may be limited to the blend on hand. Today, B20 is the most common biodiesel blend in the United States because it balances property differences between biodiesel and conventional diesel, as well as differences in performance, emission benefits, and costs. At this time, most original equipment manufacturers (OEMs) do not recommend using high blend levels (with a high biodiesel content). However, OEMs do generally support the use of blends up to B20.

The Pacific Southwest Research Station (PSW) does not regularly use diesel vehicles. However a number of Region 5’s larger trucks and engines are fueled with diesel. Region 5 might test biodiesel in a small number of diesel vehicles to determine whether or not it would be appropriate in a larger percentage of the Region’s fleet. If initial testing and demonstration is successful, it might also be worthwhile to encourage our contractors to use biodiesel in their own vehicles. That might be accomplished by inserting language about biodiesel into fleet-related contracts.

To ensure that only high-quality biodiesel is purchased, any biodiesel that the Forest Service buys, or requires contractors to buy, should meet ASTM D6751-03 specifications (commonly referred to simply as ASTM specifications). ASTM International is a consensus based standards group comprised of engine and fuel injection equipment companies, fuel producers, and fuel users that has developed biodiesel quality specifications.

Benefits Associated with Biodiesel¹⁹

Biodiesel is Easy to Use: In blends of B20 or less (e.g. B20, B10 or B5), biodiesel is literally a “drop in” technology. No new equipment or equipment modifications are necessary. B20 can be stored in diesel fuel tanks and pumped with diesel equipment. There are some challenges associated with the use of biodiesel (see below). But by and large, those challenges can be addressed and obstacles can be overcome.

¹⁸During the manufacturing process, oils and fats are converted to long chain mono-alkyl esters.

¹⁹ Information obtained from: Tyson, K.S. and McCormick, R.L. (2006). 2006 Biodiesel handling and use guidelines. Second Edition. Technical Report, NREL/TP-540-38836. National Renewable Energy Laboratory.

Biodiesel has lubricating properties: With a biodiesel blend as low as B1 or B2, you can use biodiesel as a lubricity additive. This can be particularly useful in applications where biodiesel is blended with ultra low sulfur diesel fuels which may have poor lubricating properties.

Using biodiesel reduces carbon dioxide (CO₂) emissions: Biodiesel does produce CO₂ emissions during combustion. However to produce biodiesel, plants like soybeans must be grown. During growth, these plants actually remove CO₂ from the air to make stems, roots, leaves, and seeds. As a result, substituting B20 for petroleum diesel reduces life-cycle CO₂ emissions by 15.66%.

Biodiesel use reduces emitted pollutants: Biodiesel reduces tailpipe particulate matter (PM), hydrocarbon (HC), and carbon monoxide (CO) emissions from most modern four-stroke engines. Testing has shown that PM, HC, and CO reductions are independent of the plant material used to make biodiesel. Substituting B20 for petroleum diesel reduces air toxics by 20% to 40%.

Challenges Associated with Biodiesel

Cold flow impacts²⁰: One of the greatest concerns regarding biodiesel relates to its potential to cloud or gel at low temperatures. This is more of an issue in fuels with higher blended concentrations of biodiesel. In B20 blends, with biodiesel made of soy methyl esters, biodiesel has a cloud point of approximately 7° F, compared with a cloud point of 3° F for Number 2 diesel. Because this 4 degree difference is relatively minor, B20 can generally be used just as successfully as No. 2 diesel, so long as the same cold-weather precautions are taken. Namely, in cold conditions biodiesel can be blended with kerosene, cold flow enhancing additives can be added, fuel filter or fuel line heaters can be used, or vehicles can be stored in or near buildings.

Though cold flow impacts may be a concern, biodiesel has been used successfully in a number of cold locations. For example, Yellowstone National Park uses a canola-based B20 blend in *all* of the park's diesel vehicles. In Cedar Rapids, Iowa, Five Seasons Transportation drove their bus fleet over 1.4 million miles with B20 during one of the coldest winters on record (temperatures were below -20° F for almost a week). Still, accurately determining how B20 will perform in Region 5's fleet during winter months will require testing the biodiesel/winter diesel mix that is typically delivered to the Pacific Southwest.

Solvent effect of biodiesel: Petroleum-based diesel causes deposits to accumulate on tank walls. Because biodiesel has a solvent effect, these deposits will be shed off when biodiesel is first used. In some vehicles, this has caused fuel filters to clog when vehicles were first switched to biodiesel. During this initial period of transition, fuel filters may need to be replaced frequently. However, after going through a few tanks of biodiesel, tank deposits should be fully shed and this should no longer be a problem.

Higher concentration blends are not compatible with some equipment: B100 may soften and degrade certain types of rubber compounds found in hoses and gaskets (i.e. buna N, nitrile, natural rubber). This could cause hoses to leak and crumble. However with lower concentration biodiesel blends like B20, this problem generally does not occur. In addition, B100 can cause

²⁰ Taken from: Cold flow impacts. Fact sheet from the National Biodiesel Board.
http://www.biodiesel.org/pdf_files/fuel/factsheets/Cold%20Flow.PDF

sedimentation if left in contact with some copper containing metals, lead, tin, or zinc. Fortunately, these metals are not regularly used in diesel equipment.

Shelf life of biodiesel: Biodiesel has a shelf life of 6 months, as compared to No. 2 diesel's twelve-month shelf life. This can be a challenge if vehicles are parked throughout the winter or if diesel is kept in a tank for long periods of time. There are two remedies to this issue. First, when it is anticipated that a vehicle or tank will be unused or parked for a long period of time, tanks may be filled with 100% petroleum based diesel. Second, additives expected to be available for distribution in early 2007, could be added to extend shelf life.

Biodiesel and energy per gallon: Biodiesel produces 8% less energy per gallon than typical No. 2 diesel. This difference can be noticeable when using B100. However with B20, the difference in power, torque, and fuel economy should be between 1% and 2%. Fortunately, most users report little noticeable difference between B20 and No. 2 diesel fuel.

Pros and Cons to Retail vs. Wholesale Purchasing

In some locations, biodiesel blends may be available at a local gas station for purchase. Purchasing biodiesel blends from a retailer promises to be the easiest means of obtaining fuel. By purchasing biodiesel blends at the pump, the Forest Service will not have to assume any of the costs or responsibilities associated with the maintenance of pumps or tanks nor the risks associated with the storage of a hazardous material on National Forest land. However, there are a number of limitations associated with purchasing biodiesel at the pump. First, retailers may offer only one blend of biodiesel, thus limiting our ability to customize the fuel blend. If that retail blend has a higher biodiesel content than B20, it may not be appropriate for the Forest Service fleet. The second limitation is location. More and more biodiesel pumps are being installed throughout the state. Yet finding a retail pump far from urban centers may be difficult.

Instead, wholesale biodiesel should be considered as an alternative because of the unique advantages associated with its purchase and delivery. First and foremost, with wholesale purchases, the customer has the ability to decide what biodiesel blend they wish to have pumped into storage tanks. If fleet managers decide that B20 (or any other blend for that matter) is appropriate for their fleet, then this blend can be delivered. The second advantage is cost. Wholesale biodiesel purchases are less expensive than retail ones. Cost can be further reduced by adjusting the percentage of biodiesel in the blend (biodiesel typically costs about \$0.25 more per gallon than petroleum based diesel). Wholesale purchase and delivery of biodiesel also allows for its use in fleet located far from retail pumps.

Making the Switch: An Irreversible Decision?

Because the use of B20 requires no modification to diesel vehicle equipment, making the switch to biodiesel is *not* an irreversible decision. In the event that a Forest designates a vehicle for biodiesel use and needs to drive it far from a biodiesel pump, the vehicle may be filled with petroleum-based diesel with no adverse impact. In that case, both fuels will simply mix in the tank, creating a blend with a lower 'B' level (e.g. biodiesel that was initially B20 would be diluted to a blend less than B20). When the vehicle is returned to its home unit, it can be refilled with the appropriate biodiesel blend. This is an important point to note since many of our diesel

vehicles are emergency response vehicles. If a Forest decides to use biodiesel in an emergency response vehicle and that truck is dispatched to a distant incident, the truck can be filled with diesel while on that incident without any anticipated problems. It should be noted though that just as biodiesel could be delivered to storage tanks on National Forests, so too could it be delivered and dispensed to fires or other incidents.

Additional Resources

- National Biodiesel Board
www.biodiesel.org
- West Coast Collaborative
<http://www.westcoastcollaborative.org>
- Federal Network for Sustainability (FNS), Biodiesel Page
<http://www.federalsustainability.org/initiatives/biodiesel.htm>
- Publication
Tyson, K.S. and McCormick, R.L. (2006). 2006 Biodiesel handling and use guidelines. Second Edition. Technical Report, NREL/TP-540-38836. National Renewable Energy Laboratory.

Testing and Demonstrating a Hydrogen Fuel Cell Vehicle

Emerging hydrogen fuel cell technologies promise to reduce petroleum consumption and improve air quality. Fuel cell vehicles produce no air pollutants and few greenhouse gases. If fueled with pure hydrogen, fuel cell vehicles emit only heat and water. Currently, the Department of Energy is focusing on developing cost-effective hydrogen production technologies that simultaneously produce clean energy with little net greenhouse gas emissions. Once those technologies are developed, both the production of hydrogen for fuel and its use in vehicles will prove to be a green alternative to fossil fuel vehicles. Because fuel cell vehicles are considered a much greener transportation alternative than vehicles powered with gasoline, the Forest Service might consider using some of these vehicles in the coming years.



Though hydrogen fuel cell vehicles are not yet commercially available, a national hydrogen infrastructure is being developed. As a result, possibilities for leasing or owning a fuel cell vehicle will likely increase in the near future. In the meantime, a small fleet of fuel cell vehicles is being tested and demonstrated throughout the country. Automakers are leasing this small fleet of prototype vehicles in areas where hydrogen fueling stations have been installed.

In South Lake Tahoe, a company called Air Products is planning to install a mobile hydrogen fueling station in 2007 or 2008. Because of the Lake Tahoe Basin Management Unit's (LTBMU) proximity to that mobile fueling station, the LTBMU is in a unique position to test and demonstrate a fuel cell vehicle. The Region 5 Regional Office is engaging in a dialogue with Air Products to explore this possibility further.

Additional Resources

- Alternative Fuels Data Center, DOE, Energy Efficiency and Renewable Energy
<http://www.eere.energy.gov/afdc/>
- Department of Energy, Hydrogen Vehicles Web Page
http://www.eere.energy.gov/afdc/afv/hydr_vehicles.html
- FreedomCAR and Vehicle Technologies Program, DOE, Energy Efficiency and Renewable Energy
<http://www1.eere.energy.gov/vehiclesandfuels/>
- California Fuel Cell Partnership
<http://www.fuelcellpartnership.org/>

Registering Carbon Emissions with the California Climate Action Registry

There is now broad scientific consensus that increasing greenhouse gas (GHG) concentrations in the atmosphere are leading to climate change. GHGs like carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are emitted during most forms of energy production. Currently in the United States, efforts to reduce GHG emissions are voluntary. However, recent legislation in the state of California will create mandatory carbon dioxide caps in the future.



For entities that operate within the state of California, the California State Legislature established the California Climate Action Registry (Registry) in 2000, with technical modifications in 2001. The Registry is a non-profit public/private partnership that enables members to both establish greenhouse gas (GHG) emissions baselines, and track current and future emissions, in an effort to reduce overall GHG emissions.

Reporting Non-Biological Emissions

Using the Registry's General Reporting Protocol (GRP)²¹, participants agree to calculate both their direct and indirect GHG emissions from non-biological sources. Direct emissions include those from onsite combustion, manufacturing processes, and from transportation fleets. Emissions associated with electricity and steam consumption are the only indirect emissions required to be reported by the Registry, though participants are encouraged to report additional indirect emissions. An entity's emissions totals from five emissions sources (indirect electricity and cogeneration, direct mobile combustion, direct stationary combustion, direct process emissions, and direct fugitive emissions) become publicly available after certification and Registry approval. No other kinds of emission totals are provided to the public by the Registry.

Reporting Sector-Specific Biological Emissions

All participants are required to use the GRP to complete their emissions inventories. However, the Registry also offers voluntary industry-specific protocols to give further guidance to certain sectors, including the Forestry sector. The Forest Protocols allow an entity to report its biological forest carbon stocks and emissions as well as project-level emissions reductions activities.

Some Challenges to Overcome

1) *Completeness in Electricity/Heating Accounting*

The Registry requires that entities report at least 95% of their emissions and that reporting accuracy be certified by a third-party (GRP, Section III.5.1). However,

²¹ *California Climate Action Registry General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions*; Version 2.0; April, 2006.

electricity and heating at some of our facilities is purchased using purchase cards. Forest Service data on electricity/heating purchased using purchase cards is not readily and systematically available. If Region 5 and the Pacific Southwest Research Station (PSW) can confirm that less than 5% of our energy is purchased by purchase cards, the Region and Station may still be able to comply with Registry requirements. Yet, this is still a significant challenge.

2) *Timeliness in Reporting Emissions*

The Registry requires that members report emissions no later than August 31 of the year following the emissions year. Certification must be completed by December 31 of that same year (GRP, Section IV.14.7). However, the energy data that USDA generates for the Forest Service has recently taken two years to obtain. For example, the Forest Service did not receive energy data from USDA for Fiscal Year 2005 (FY05) until fall, 2007. Had Region 5 and PSW been members of the Registry, we would have been required to report FY05 energy data by August 31, 2006, over a year before the data was actually obtained. To become members of the Registry, Region 5 and PSW will have to obtain our energy use data more rapidly.

3) *Reporting Emissions from Leased Facilities*

In some leased facilities, we don't have access to data pertaining to energy use. The leasor pays energy bills which Region 5/PSW never sees. This poses some challenges for GHG reporting. It may be possible for Region 5/PSW to use the "financial control criterion under the Management Control Approach" for emissions reporting. Participants that use this criterion only report emissions from those facilities over which they have financial control (GRP, Section II.2.8). With a lease, we don't maintain financial control. The means by which we report emissions at our leased facilities would need to be discussed further with the Registry to clarify what method would work best for us. See GRP Sections II.2.2, II.2.3, and II.2.8 for further guidance.

Joining the Federal Network for Sustainability

The Federal Network for Sustainability (FNS) is a voluntary, collaborative network of Federal agencies in the western United States that strives to promote sustainable environmental stewardship and implement the President's "Greening the Government" Executive Orders. The FNS was started in 2000 and now contains multiple signatories from across more than 15 federal agencies.



The FNS' core values are to showcase sustainable programs and projects, act as a catalyst for change, create and manage an information-sharing clearinghouse, develop and deliver training for network members, and communicate ideas through conferences and meetings.

During the week of July 17, 2006, the Forest Service's Rocky Mountain Region (Region 2) became an official member of the FNS. By following in Region 2's footsteps, the Pacific Southwest Region (Region 5) and the Pacific Southwest Research Station (PSW) can demonstrate a more national Forest Service commitment to operating in a sustainable manner.

Some of the FNS Initiatives

Since 2000, FNS has created a number of sustainable initiatives in an effort to help member agencies green their operations. These initiatives include:

Copier Paper Initiative: The goal of the Copier Paper Initiative is to help member agencies move beyond the Executive Order 13101 requirement mandating that agencies use copier/printer paper with 30% post-consumer recycled content. The initiative is an effort to encourage agencies to use paper with even higher post-consumer content, encourage a reduction in paper use, and ensure proper recycling of paper.

Electronics Products Stewardship Initiative: FNS Supports the Federal Electronics Challenge (FEC), jointly developed by the Environmental Protection Agency and the White House Task Force on Recycling. The FEC is a partnership program that encourages Federal agencies to purchase greener desktop and laptop computers, monitors, printers, fax machines, and copy machines. The FEC also encourages agencies to recycle obsolete electronics in an environmentally safe way.

Environmental Management System (EMS) Initiative: Executive Order 13148 requires Federal facilities to implement EMSs. This initiative provides assistance to agencies in developing their EMS. Assistance is primarily given in the form of training.

Sustainable Buildings Initiative: Federal agencies are required to apply sustainable design principles to the siting, design, and construction of new facilities (Executive Order 13123). This

initiative is designed to educate agency staff about the concepts that are an important part of constructing sustainable buildings.

Biodiesel Initiative: This initiative represents a partnership with the West Coast Collaborative and the Far West Regional Laboratory Consortium. Through this partnership, FNS is identifying promising Federal biodiesel projects so as to increase the use of biodiesel among agencies along the west coast.

Additional Resources

- Federal Network for Sustainability Website
<http://www.federalsustainability.org/>
- Federal Network for Sustainability Initiatives
<http://www.federalsustainability.org/initiatives/initiatives.htm>
- Greening the Environment Executive Orders
<http://www.ofee.gov/eo/eo.htm>
- Federal Electronics Challenge
<http://www.federalelectronicschallenge.net>
- West Coast Collaborative
<http://www.westcoastdiesel.org/>

Reducing Paper Use in Offices and Facilities

Executive Order 13101 requires federal agencies to print and copy using paper that contains at least 30% post-consumer recycled content. This encourages more sustainable printing/copying practices in offices and facilities. Yet our offices and facilities can be more sustainable in our paper consumption by reducing the amount of paper that we use. Below are two easy ways that offices can reduce paper use with little to no additional cost or effort.

Setting Printers/Copiers to Duplex by Default

Over the last several years, Region 5 and PSW have procured printers and copiers that allow users to duplex (two-sided) print and copy. Region 5 and PSW purchased these machines, in part, with the hopes that users would increase the extent to which they generated two-sided documents. Unfortunately, to duplex print/copy, users often have to navigate and click through additional computer and copier windows, prompts, or menus to select two-sided printing/copying. For employees who are in a rush to complete print jobs or for those who are not computer savvy, these additional steps may deter the more systematic use of duplexing. By making it easier to duplex, the frequency of duplex printing/copying should increase.



Currently, most menu driven copy machines are set to copy simplex (single-sided) by default. The printer drivers on personal computers are also set to print simplex by default. Users who wish to duplex must choose to do so. By simply switching these settings so that machines and drivers default to duplex printing and copying, double-sided printing/copying should increase. Users would still be able to perform single-sided printing/copying if an application demanded it, but would have to choose that option. This could cut paper use by up to half.

The Region 5 Regional Office (RO) changed the default copy settings on its Xerox Work Centre Pro 40 copy machines to duplex copying in August, 2006. The defaults on those machines are now set to perform single-sided to double-sided (1 → 2 sided) copying. Users still have the option of copying single-sided (1 → 1 sided) if necessary. However, they must now choose this option. As a result of this simple change, the percentage of duplex copying increased from 14% to 27% during the first 4 months after the change was made. Duplex copying almost doubled in that time! As employees become more comfortable with using 2-sided copying for their daily copy applications, the frequency of duplex copying may increase even more.

Duplex Printing/Copying on Regional Office Xerox Work Centre Pro Machines

	Baseline*	Aug 2006	Sep 2006	Oct-Nov 2006
2-sided Copied Pages	226,924	10,012	12,349	34,645
Total Copied Pages	1,646,471	54,694	56,629	127,280
% Copied 2-sided	14%	18%	22%	27%
2-sided Printed Pages	21,4805	19,156	38,413	33,173
Total Printed Pages	176,0859	95,803	155,423	210,192
% Printed 2-sided	12%	20%	25%	16%

*Baseline data includes *all* prints/copies made between machine installation and August, 1, 2006. As such, it provides an historical baseline against which all paper reduction efforts can be compared.

Because the RO's copy machines are networked, employees can also print from their work computers directly to the Xerox Work Centre Pro machines. Though the RO looked into changing the default *print* settings on Xerox machines to duplex, the RO discovered that this would require every employee to change the print driver defaults on their work computer. It was decided that this was not feasible. Interestingly, without any modification to print settings, duplex printing more than doubled by September 2006 when compared with baseline data. This strongly suggests that employees changed their printing practices because they were made aware of the environmental footprint/sustainable operations effort. The fact that 2-sided printing declined in October/November indicates that employees may need to be reminded more than once about the importance of reducing paper use.

In the RO, there was some concern that duplex printing and copying would increase the number of paper jams in machines. This concern stems from employee experiences in which older copiers and printers jammed when duplexing. However, employees have been encouraged to provide feedback if problems arose after machine defaults were changed. To date, not a single complaint has been made regarding increased jams on Xerox Work Centre Pro machines.

Separator Pages are Good-On-One-Side (GOOS) Paper

Many employees across Region 5 and PSW have complained about the separator pages (a.k.a. cover sheets) that print at the start of every print job they send to networked printers. While users can disable this feature, printers are located far from employee desks in many offices. This makes separator pages necessary in order to separate multiple print jobs until a time when employees can get to their nearby printer.

By recycling separator pages, employees can reduce waste. However, to reduce waste even further, employees should re-use this Good-on-One-Side (GOOS) paper. Because the back side of GOOS paper is blank, that side can be used for draft print jobs, scratch paper, or notepaper. Once both sides are used, the paper can then be recycled. By using the backside of GOOS paper, each piece of paper is used an additional time before it enters the waste stream.



Expanding Recycling Efforts

Recycling has become a part of everyday life in many communities. In larger urban areas and in many more rural areas, residents and companies are often provided with recycling receptacles by their waste management companies. Recyclables are removed, sorted, and processed at facilities where everything from paper to plastics to aluminum cans is recycled. In more remote locations, recycling programs may not have been formally established because of small population densities or lack of demand. However, even at remote locations, some forms of recycling can be practiced. For example, recycling mailers can be purchased that allow recyclables to be packaged and shipped-off for processing. Below are some of the opportunities available for recycling materials that we commonly use in our everyday business operations.



Paper, cardboard, glass, aluminum, and plastics

More often than ever before, waste management companies are recycling collected paper, cardboard, glass, aluminum, and plastics. If you have the option of contracting with a number of waste management companies, consider contracting with a company that offers recycling. If this isn't possible, locate the nearest recycling center to determine if paper, cardboard, glass, aluminum, and plastics might be stored on site and periodically driven to that center by an employee.

Batteries

Self-addressed, postage paid mailers and boxes can be ordered from companies that recycle batteries. Recycling is even free, in some cases. The cost of the recycling mailer will depend on the type of batteries that you wish to recycle.

For rechargeable batteries: Free mailers can be ordered from the Rechargeable Battery Recycling Corporation (RBRC) (<http://www.rbrc.org>). For no charge, RBRC will mail you self-addressed, postage paid boxes. You simply place your used rechargeable batteries in the box, then seal and ship the box to RBRC when it is full. RBRC pays for shipping and recycles the batteries that they receive.

For all other battery types (alkaline, lead, etc.): Mailers and boxes can be purchased for recycling all types of batteries. Mailers that are purchased will be sent to you with a prepaid, self-addressed label. Once the mailer/box is filled, users simply seal the box and schedule a pickup. The batteries are then shipped away for recycling. Log on to the General Services Administration's (GSA) purchasing website at www.gsadvantage.gov and search for 'battery recycling.' A number of products are available.

Fluorescent bulbs

As of February 8, 2006, all fluorescent bulbs and tubes are considered hazardous waste in California when discarded because they contain mercury (California Code of Regulations, Title 22, division 4.5, chapter 11, section 66261.50). Bulbs and tubes must be disposed of accordingly. Recycling is one acceptable means of disposal. Prepaid, self-addressed, fluorescent bulb recycling boxes/mailers can be purchased through the General Services Administration at www.gsaadvantage.gov. Log on to the GSA purchasing website and type "fluorescent recycle" in the search field. A number of mailers are available for purchase. Once a mailer is filled, users simply seal the box and schedule a pickup. The bulbs are then shipped away for recycling.

Electronic media, small electronic appliances, etc.

Similar to the battery and fluorescent bulb mailers above, you can also purchase prepaid, self-addressed boxes/mailers that allow you to recycle disks, compact discs, videotapes, cell phones, pagers, etc. One such product is called Technotrash and is produced from a company called GreenDisk. Technotrash boxes/mailers can be purchased from GreenDisk at their website, www.greendisk.com. Another company called Ecodisk accepts all electronic data storage products. Though they do not sell prepaid mailers, one can simply pack data storage materials in a box and ship them to the company for destruction and recycling. For more information, go to www.ecodisk.com.



Printer cartridges

Many printer cartridges, be they inkjet or toner cartridges, come with postage paid, self-addressed mailers that allow users to return empty cartridges for recycling. In the event that your cartridge did not come with one of these mailers, many office supply stores will accept empty cartridges from customers. Alternatively mailers can often be ordered free of charge from many printer manufacturers. Most of the printers in our offices and facilities are Lexmark or Hewlett-Packard printers and links to request their mailers are provided below.

Hewlett Packard Product Recycling:

<http://www.hp.com/hpinfo/globalcitizenship/environment/recycle/index.html>

Lexmark Recycling Programs:

http://www.lexmark.com/lexmark/site/home/0,7085,682506091_0_0_en,00.html

Purchasing and Procuring Green Products

The Forest Service is required to use environmentally preferable products and services in order to comply with federally mandated programs and USDA's Agriculture Acquisition Regulations (AGAR 423.703). This includes the use of recovered material products; energy and water efficient products; alternative fuels and fuel efficiency, bio-based products; non-ozone depleting substances; priority chemicals; and environmentally preferable products. These products are described on the Office of the Federal Environment Executive website (<http://www.ofee.gov/gp/gp.htm>).

The programs below are designed to make it easier to regularly purchase green, environmentally-friendly products.

Purchasing ENERGY STAR Compliant Products

ENERGY STAR is a voluntary labeling program that identifies and promotes energy-efficient products. ENERGY STAR is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy. In 2005 alone, ENERGY STAR saved businesses, organizations, and consumers about \$12 billion. Major appliances, computers, monitors, office equipment, lighting, heating, cooling, and new commercial and industrial buildings, are listed as being ENERGY STAR compliant if they meet certain energy-efficient standards. Simply look for the ENERGY STAR label when purchasing these kinds of products or visit the ENERGY STAR website (<http://www.energystar.gov/>) for more information.



Purchasing Recycled Products

The Comprehensive Procurement Guidelines (CPG) are part of the EPA's efforts to promote the use of materials that are recovered from solid waste. EPA is required to designate products that are or can be made with recovered materials, and to recommend practices for buying these products. Once a product is designated under CPG, agencies are required to purchase it with the highest recovered material content level practicable. For general information about the CPG program, visit (<http://www.epa.gov/cpg/>). For a list of products and for guidance on which products to purchase, see (<http://www.epa.gov/epaoswer/non-hw/procure/products.htm#construct>).

Purchasing Green Cleaning Products

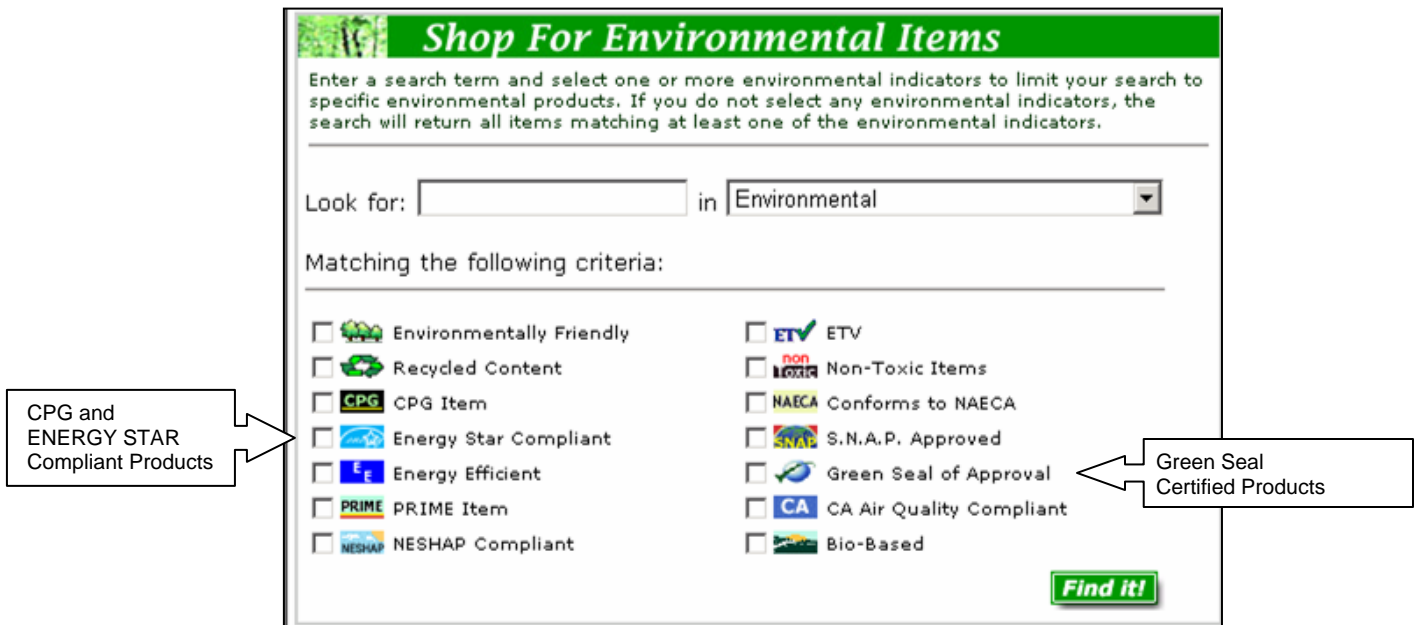
The federal government does not certify green janitorial products. However, many government contracts for green cleaning products and services reference the Green Seal list of products. Green Seal is a nonprofit organization that provides science-based environmental certification standards to help manufacturers and purchasers make environmentally responsible choices about the products they make or buy. Green Seal has standards that are applicable for all-purpose, bathroom, and glass cleaners (GS-37). Green Seal also has standards that apply to all-floor care products (GS-40), degreasers (GS-34), and hand



cleaners (GS-41). A list of Green Seal certified cleaning products can be found at the following website (<http://www.green seal.org/findaproduct/index.cfm#cleaners>). The Center for a New American Dream also keeps an updated list of products that meet their nationwide purchasing criteria which are based on the Green Seal GS-37 standard (<http://www.newdream.org/procure/products/approved.php>).

Using GSA Advantage to identify and/or purchase green products

The General Services Administration’s purchasing website (www.gsaadvantage.gov) provides a one-stop web location for federal employees to procure products. Purchasers can use GSA Advantage either to purchase products directly or as a useful resource to determine products that meet the ‘green’ requirements listed above (ENERGY STAR compliant, CPG compliant, or Green Seal Certified). The “Environmental Aisle” of the GSA Advantage website is dedicated to identifying green products. This portion of the website can be accessed at www.gsaadvantage.gov, by clicking “Environmental” under the list of “Special Categories” on the website’s home page. From there users will see the following window:



Using the window above, users can shop for ‘green’ products that match certain criteria.

Additional Resources

- New American Dream, Approved Cleaning Products List
<http://www.newdream.org/procure/products/approved.php>
- USDA Energy and Environment Web Page
<http://www.usda.gov/energyandenvironment/>
- USDA Green Purchasing Affirmative Procurement Web Page
<http://www.usda.gov/procurement/>

- USDA Federal Biobased Products Preferred Procurement Program
<http://www.usda.gov/procurement/biobased/>
- Alternatives to Ozone Depleting Substances:
<http://www.epa.gov/ozone/snap/lists/index.html>
<http://www.ofee.gov/gp/snap.html>
- Office of the Federal Environmental Executive, Green Purchasing Training
<http://www.ofee.gov/gp/training.html>

Green Language in Janitorial Products

In April 2006, two Region 5, Regional Office (RO) Forest Service employees became ill, complaining of nausea and headaches as a result of the janitorial staff's use of an industrial carpet cleaner to remove a carpet stain in the RO. Unfortunately, this incident is not unique. In fact, many common commercial and consumer cleaning products contain chemicals that, depending on dose and exposure, can be harmful to both chemically sensitive individuals and janitorial employees.

There is growing evidence that some chemicals in cleaners can aggravate or cause asthma. For example, an occupational lung disease bulletin issued by the Massachusetts Department of Public Health in April, 1998, reported that more than 10% of the reported work-related asthma cases list cleaning agents as the suspected cause. These cleaning agents included bleach, chlorine, floor stripper, ammonia, sodium hydroxide, hydrochloric acid, detergents and disinfectants. Similarly, the Consumer Product Safety Commission's (CPSC) National Electronic Injury Surveillance System (NEISS) estimates that in 2005 alone, over 31,000 injuries resulting in emergency room visits, occurred due to exposure to non-cosmetic bleaches, spot removers or cleaning fluids, and other general purpose household cleaners²². These and other chemicals in cleaning products can also have adverse effects on the environment.

Today, more than ever, federal facility managers are working with the acquisition community to encourage the use of cleaning agents with a reduced impact on employee health and on the environment. Many federal agencies have switched from the use of conventional cleaning products to green cleaning products and services. For example, the Department of the Interior is working to green their janitorial services:

<http://greeninginterior.doi.gov/sustain/ch5.html>

and the EPA has undertaken green cleaning pilot projects:

<http://www.epa.gov/opptintr/epp/pubs/cleaner.pdf>.

The implementation of green cleaning practices is even more important for the janitorial staffs at our offices and facilities, because those staffs have little ability to provide input into the decision-making process. Yet, those same individuals are chronically exposed to cleaning chemicals as a part of their work. As a result, it is the health of the janitorial staff that likely suffers most as a result of such exposure.

Because much of our janitorial services are currently contracted out, the Forest Service procures janitorial products less often than in the past. To ensure the safety of our own employees and contracted individuals, and to minimize the impact of cleaning products on the environment, the Forest Service can require contractors to purchase green janitorial products for cleaning at our facilities. The sample language below has been modified from a green Statement of Work for custodial services, issued in April 2005, by the Fairchild Air Force Base in Washington State (<http://www.ofee.gov/gp/custodialsow.pdf>). In the fall of 2006, the language below was incorporated into the RO janitorial contract Statement of Work. This language or similar language might be incorporated into other Forest Service contracts with janitorial contractors.

²² Consumer Product Safety Commission, National Electronic Injury Surveillance System (<http://www.cpsc.gov/library/neiss.html>)

Sample Green Language for Janitorial Contracts²³

The <<**State Unit Here**>>, of the US Forest Service requires the use of environmentally preferable products and services in order to comply with federally mandated programs and USDA's Agriculture Acquisition Regulations (AGAR 423.703) that direct USDA agencies to actively promote a preference for Environmentally Preferable Products. This includes the use of: recovered material products; energy and water efficient products; alternative fuels and fuel efficiency, bio-based products; non-ozone depleting substances; priority chemicals; and environmentally preferable products. These products are described on the Office of the Federal Environment Executive website (<http://www.ofee.gov/gp/gp.htm>).

Products and Materials:

Custodial cleaning products required in the performance of this SOW shall meet as a minimum, Green Seal Product Standards (<http://www.green seal.org/certification/environmental.cfm>). If it is determined that a product does not meet Government performance requirements, the contractor shall submit a proposed alternative that would meet the performance requirements with the lowest environmental impact for evaluation and acceptance.

Products that fall under the Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg>) shall meet the minimum recovered (recycled) content.

Bio-based products shall be used upon issuance of the bio-based product listing from the United States Department of Agriculture (USDA) (<http://www.usda.gov>).

The contractor shall purchase and use Energy Star or other energy-efficient items listed on the Department of Energy's Federal Energy Management Program (FEMP) Product Energy Efficiency Recommendations product list.

Supplements or amendments to listed publications from any organizational level may be issued during the life of the contract.

Before implementing any change that will result in a change to the contract price, the contractor shall submit to the Contracting Officer a price proposal within 30 calendar days following receipt of the change. An equitable adjustment (increase or decrease) will be negotiated, if applicable, under the "Changes" clause of the contract.

²³ Adapted from Section 4.7 and 4.7.1 of the April, 2005, Fairchild Air Force Base 'green' statement of work for custodial services. (<http://www.ofee.gov/gp/custodialsow.pdf>)

Landscaping and the Use of Sustainable Gardens

When employees or the public approach our buildings, offices, and visitor centers, it is our landscape design that individuals see first. Through ecologically-responsible design, we have the opportunity to both visually demonstrate our commitment to sustainability and to educate the public about the importance of designing environmentally-friendly landscapes.

When designing landscaping, native plants that are known to have high levels of pest- and disease-resistance should be used to reduce the use of pesticides and herbicides. Drought tolerant plants should be used in dry regions to reduce water consumption. When possible, waste should be composted on-site or sent to a facility for composting and both rainwater and runoff should be stored or reclaimed for irrigation.

To encourage the design of environmentally-friendly landscaping, the Pacific Southwest Research Station's (PSW), Center for Urban Forest Research (CUFR) has been testing and demonstrating a "sustainable garden" since 1999. This 1,000 square foot garden is located outside the entrance to CUFR, on land that was once a parking lot. The garden employs a variety of mechanisms that reduce water use and energy use. Similarly, CUFR designed the garden to utilize recycled content. Among the sustainable features:

- Drought tolerant vegetation has been planted.
- Installed paving is pervious to reduce runoff and a dry swale and vegetated filter strip treat any residual surface runoff.
- Concrete rubble, plastic, rice hulls, and green waste from the project have been recycled.
- To mitigate the urban heat island effect, light-colored paving and trees are utilized.
- Trees have been planted strategically to assist in energy savings, air pollutant uptake, and carbon dioxide sequestration.
- CUFR's pitched roof provides 3,000 sq. ft. of catchment area to harvest rainwater for irrigation. Steel gutters convey water to barrels and cisterns for storage.
- Over-sized galvanized steel gutters (5" depth) in the Center's roof gutter system reduce water loss during intense storms in order to maximize harvested water.
- Water from gutters is conveyed to tanks through 2.25" diameter aluminum pipes and filters that treat the 'first flush' of roof runoff to capture pollutants.
- Particles and debris are filtered by metal grates, gravel, and rice hulls in three filters.
- Four solar panels mounted on a pole in the garden's courtyard convert light into electricity to pump stored water from cisterns to the irrigation system. The solar panels face southeast because plants are irrigated early in the morning when evaporative loss is low. A linear current booster permits pumping at low light levels.

As an added benefit, Greg McPherson, the project's coordinator and the CUFR director, undertook the project in partnership with the Environmental Horticulture Department at the University of California at Davis, thus strengthening PSW's relationship with the University of California.

The project is also visible to the university community. The local Davis city newspaper featured the sustainable garden in a favorable article. Campus students commonly maintain the garden,

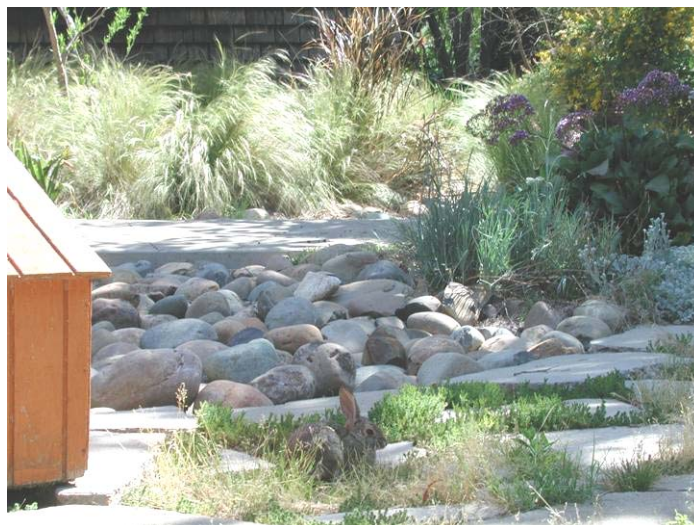
and in doing so learn firsthand about sustainability. The visibility of the solar panels in the garden's courtyard serve to spark inquiries about the project from those unaware of the project's scope. And brochures located at CUFR's entrance explain the garden's features in detail. The sustainable garden continues to serve as an outdoor laboratory for students, faculty, home gardeners, and landscape professionals to learn more about effective multipurpose solutions to regulating the flow of water, energy, and materials through urban ecosystems.

Contact

- Director, Center for Urban Forest Research, Pacific Southwest Research Station
Greg McPherson (530-752-5897, egmcperson@ucdavis.edu)



Sustainable Garden Soon After Installation



Current Growth at Sustainable Garden

Funding Green Microgrants

Sustainable activities and projects have a history of being place-based, grassroots efforts. In fact, the movement to increase sustainable, renewable, or otherwise ‘green’ practices in the United States originated from enthusiastic *individuals* who shared a vision to reduce our patterns of resources consumption in unique ways.



It is in this spirit that both the Pacific Southwest Region (Region 5) and the Pacific Southwest Research Station (PSW) first established a ‘green’ microgrant program in 2006. Green microgrants are fairly modest Forest Service funds that are awarded to stimulate grassroots sustainable efforts on the ground. The microgrant approach enables Forest Service employees to decide which sustainable activities are most needed at their unit and apply for funding for those activities. Green microgrants also provide a mechanism for intra-unit collaboration and brainstorming related to developing sustainable business practices. Finally, this approach instills a sense of pride and ownership in the sustainable activities taking place on the ground. Though the funded activities may be local in scope, those same activities may be transferable to other Districts, Forests, and Labs.

In 2006, PSW funded 7 microgrants, each at a maximum of \$2,000. Region 5 funded 13 microgrants, each at a maximum of \$1,500. The funds available for these microgrants were quite modest. However, a number of high-quality proposals were submitted and funded which indicates that worthwhile sustainable activities can be developed and implemented at little to no cost. Because many of those projects are still being implemented, their outcomes cannot be reported here. However, a description of the funded projects is provided below.

Microgrants Funded by PSW in 2006

Native Plant Restoration at the New Institute of Pacific Islands Forestry Facility: Invasive species will be cleared using established techniques and native lowland forest plants that have been grown in the Institute of Pacific Islands Forestry (IPIF) greenhouse will be outplanted in front of IPIF in a 100 meter border surrounding the facility. Volunteers will take part in the activity and outreach will be performed.

Green Seating: At the Center for Urban Forest Research, microgrant funds will subsidize the cost of replacing employees’ current office chairs that are outdated and in disrepair with environmentally sustainable models that are made of 40% recycled materials and are fully recyclable.

Paving the Way for Recycling: At the Forest Fire Laboratory (RFL) in Riverside, California, 150 deskside recycling containers were purchased to allow for deskside disposal of recyclable

materials. Additionally, ‘Big Green Box’ battery and ‘Technotrash’ electronic device recycling mailers were purchased and are now being used by RFL.

A Bicycle Shelter to Promote Fossil-Fuel-Free Commuting and Employee Fitness: IPIF will purchase and install a bicycle shelter to shield bicycles from the rain, encourage biking to work and increased fitness among employees, reduce clutter of bikes under eaves and building gutters, etc.

Juice, Juice, Who’s Using All the Juice?: RFL will purchase and install industrial electrical submeters to measure power usage by equipment, labs, and buildings. These will allow RFL to determine which areas are most energy inefficient and concentrate energy saving efforts there.

A Solar Energy Plan for a Forest Research Facility: To move towards a ‘greener future’ with a solar panel array, the Institute of Forest Genetics needs a solar panel plan from professionals in the power generating industry. This microgrant will contribute towards obtaining that professional plan.

Voluntary Carpool Coordinating System: Funds will be used to develop an online system to efficiently find carpoolers and to schedule carpooling within the units at the Redwood Sciences Lab in Arcata.

Microgrants Funded by Region 5 in 2006

Pine Hills Fire Station Solar Power Conversion (Cleveland NF): Funds will subsidize the planned installation of new solar panels, batteries, electrical accessories, an inverter, and a storage enclosure at the Pine Hills Fire Station barracks.

Placerville Nursery Visitor Display Lighting (Eldorado NF): Track and other lighting in the nursery visitor area will be replaced with “solar tubes” and will be supplemented by energy-efficient lighting, if needed.

Sky Lights (Inyo NF): The Inyo NF will purchase and install six tubular skylights in hallways and a windowless office. Tubular skylights will daylight these areas and allow employees to leave lights off.

Eagle Lake Ranger District ENERGY STAR Commercial Washing Machines for Crew Barracks (Lassen NF): The Lassen NF will replace two outdated/inefficient washing machines with ENERGY STAR commercial washing machines at the District crew barracks.

Energy Efficiency Supplies and Energy Awareness (Mendocino NF): The Mendocino NF will purchase energy-efficient supplies for use in facilities, including compact fluorescent bulbs, lighting occupancy sensors, water heater blankets, kill-a-watt meters, etc. To raise energy-efficiency awareness, a “Personal Energy Calculator” will be provided to employees along with information about how to save energy and dollars.

Occupancy Sensing Light Switches or Sensors (Modoc NF): Occupancy sensors will be installed in the Supervisor’s Office to turn off lights in areas when they are unoccupied. Sensors will be installed in lightly used areas like restrooms, copy rooms, conference rooms, and storerooms.

Biomass Heating, Conversion Feasibility – Orleans Ranger District Office (Six Rivers NF): The Six Rivers NF will perform an assessment to determine the feasibility of installing a biomass heating system at the Orleans Ranger District Office. If installed, this system would dramatically reduce costs when compared with the current propane system.

Lighting the Way – Wind Up LED Flashlights for Forest Fleet (San Bernardino NF): The San Bernardino NF will replace existing disposable battery flashlights in forest vehicles with flashlights that use a hand crank to generate a charge. One minute of winding produces up to an hour of continuous light. This will decrease the Forest’s use of disposable batteries.

Blackrock Work Center Generator Controls (Sequoia NF): The Sequoia NF will research, design, purchase, and install controls to automatically shut off the generator at Blackrock Work Center each night for six to eight hours. This will reduce propane consumption and generator maintenance by 25 to 33 percent.

Solar Energy Augmentation at Billy Chute Communication Site (Shasta Trinity NF): The current solar installation at the communication site is inefficient. The Shasta Trinity NF will use funds to replace and augment the existing system.

Keeping Forest Service Safety Green (Tahoe NF): The Tahoe NF will produce a short safety video for distribution across the Forest Service Intranet that demonstrates “green” alternatives to common practices. The film will address alternatives to petroleum based solvents for cleaning mechanical tools; the proper method of HAZMAT storage; the correct method of battery, paint, and solvent disposal; the use of non lead-based paint; and proper disposal of fluorescent bulbs and tubes.

Recycling Needs a Home (Lake Tahoe Basin Management Unit): The LTBMU will purchase recycling collection containers to be distributed within office work areas and will construct a shelter for recycled goods to provide storage and protection from rain and snow. The volume of recycled materials will be tracked, as well.

Regional Office Battery and Fluorescent Lamp Recycling (RO): Funds will be used to 1) purchase equipment and services from Battery Solutions, Inc., for non-rechargeable battery recycling; and 2) recycle the stockpile of over 350 spent fluorescent tubes that were removed when the RO installed more energy efficient lighting.

Communication and Incentives to Encourage Sustainable Operations

Ultimately, our ability to make changes to our patterns of consumption is dependent on the individuals in our workforce. The business operations of the Pacific Southwest Region (Region 5) and the Pacific Southwest Research Station (PSW) will only become more sustainable if a large percentage of our employees embrace practices that will act to reduce energy use, water use, and waste production; reduce emissions and increase fuel efficiency in our fleet; and increase green purchasing and procurement practices. It is very important then, that employees are made aware of the importance of acting sustainably in the workplace and are given the tools they need that will allow them to participate in sustainable practices. A few means by which this may be accomplished are to:

Add sustainable operations items to the agenda of regularly scheduled employee meetings:

This will educate and remind employees about the Region and Station's commitment to sustainable operations. This will also provide employees with a setting in which they can ask questions and hear about successful sustainable accomplishments.

Provide additional opportunities for communication about sustainable operations: By sharing ideas and successes, sustainable activities on one unit can be transferred to other units. Region 2 currently hosts an annual Sustainable Operations Summit that allows individuals from across the Region to share their sustainable successes. Similar summits might be held at a variety of different scales in the Pacific Southwest (e.g. at the District, Forest, Research Work Unit, Station, or Regional level).

Help units to develop 'green teams': Employees might be given time to form 'green teams' which could attempt to address sustainable operations issues and implement activities at their unit. Green teams would provide a setting for enthusiastic employees to brainstorm, share information with one another, and generate new ideas.

Award those employees who demonstrate green leadership: Recognition makes people proud of the work they do. Region 5 or PSW might establish a small awards program that recognizes those who have lead sustainable efforts and/or projects. By formally recognizing individuals or teams of individuals, their activities also become visible to a larger audience.

Present new employees with sustainability information at new employee orientations: By emphasizing sustainable operations when employees first come on board, a new generation of employees will be trained who will incorporate a sustainable consumption ethic into the Agency's organization behavior.

Install 'green suggestion boxes' to collect sustainable operations ideas: Suggestions that are collected might then be reviewed and discussed at regularly scheduled meetings to determine which suggestions would be appropriate to implement.