



University of Idaho  
CLIMATE ACTION PLAN

2010

University of Idaho  
Sustainability Center  
January 15, 2010

January 6, 2010

Dear Friends,

Climate change, with its long-range and pervasive effects, is a tremendous concern that we all face. While future generations may deal with this change in novel and insightful ways, it is up to our generation to initiate the social, economic and environmental efforts needed now to reduce the effects of climate change and mitigate its future impact.

Universities are uniquely poised to advance research surrounding climate change, to educate students who will become the leaders of those future generations and to model sustainable systems and practices -- in essence, to lead by example and foster the changes needed to address climate change.

Higher education also brings power to the challenge of climate change by developing feasible, scientifically based solutions; this can spell hope for the future when you think about higher education's ability to create a culture of change to help diverse global societies see things in new ways.

With the current level of CO<sub>2</sub> at nearly 388 ppm, we are rapidly getting close to the projected "tipping point" of 450 ppm. Once we get to this tipping point, the effects of sea-level rise due to the resulting global ice sheet melt and other climatologically-induced side effects will have dramatic effects which we have not yet fully realized. No doubt, we are already starting to see these effects in things such as changing weather patterns, increased drought, famine, habitat loss, animal migratory patterns, insect migration, species endangerment and extinction, polar ice melt, sea-level rise and the destruction of coral reefs.

If we take action now, we will have a greater chance to mitigate the impact of global climate change than if we take a 'business as usual' attitude. The University of Idaho is committed to blazing a path of action and serving as a model for other colleges and universities, and the rest of society, across the nation, and to demonstrating what it means to embrace sustainability. To that end, we are committed to achieve carbon-neutrality by 2030.

This report outlines the work that we already have underway toward our institution's carbon-neutral target. Through our vision and our commitment, we aim to curb climate change. Our efforts will draw our community --and our state -- closer together as collectively we work to attain carbon neutral status. I have confidence that the University of Idaho's students, staff and faculty-- along with cooperation from local industry, community stakeholders, and local government -- will be able to achieve this ambitious goal, as outlined in our Climate Action Plan.

Sincerely,



M. Duane Nellis,  
President

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# CLIMATE ACTION PLAN

## INTRODUCTION



This report is the first University of Idaho Climate Action Plan (CAP). The CAP was developed to outline the steps the University of Idaho needs to take to become climate neutral by 2030. The steps towards climate neutrality are also steps towards greater fiscal responsibility. Energy conservation, higher performance buildings, reducing fossil fuel use, and other strategies outlined in this plan are cost-effective, not only reducing our greenhouse gas emissions, but also reducing operational costs and the impacts of future increases in energy and fuel prices.

Part of the motivation for reducing the University's greenhouse gas emissions is to use our campus as a living laboratory. The challenges we face as a campus and university system striving to become carbon neutral provide excellent teaching and research opportunities. At the same time, teaching, research, and outreach provide valuable resources for efforts to address local, regional, and global-scale problems associated with climate change.

A number of the projects identified in this report involve the need for changes in staff, faculty, and student behaviors. We have a tendency to focus on technological solutions to problems, when small changes in behavior can result in significant financial savings and emissions reductions for the university. When we do not change management and personal behaviors we often undermine the effectiveness of technological improvements to our campus. Progress on many issues will require the broad participation of the campus community to be successful.

This report is intended to be a living document with regular updates. Like many long-term, large-scale institutional changes, the effort to become carbon neutral as a campus needs to proceed within an adaptive management framework. We need to continuously collect data on our efforts, evaluate success, and refine our operations based upon our experiences.

For more information about this plan and the University's efforts to reduce greenhouse gas emissions, please contact the University of Idaho Sustainability Center. [www.uidaho.edu/sustainability](http://www.uidaho.edu/sustainability)

## AMERICAN COLLEGES AND UNIVERSITIES PRESIDENTS CLIMATE COMMITMENT

In March 2007, the University of Idaho signed the American Colleges and Universities Presidents Climate Commitment (ACUPCC). As a signatory, the University committed to reduce its greenhouse gas (GHG) emissions significantly in the short-term, and to dramatically reduce GHG emissions and offset the remainder over the long-term. In addition to the long-term goal of climate neutrality, ACUPCC requires the following actions:

1. Develop a comprehensive plan to achieve climate neutrality as soon as possible. This climate action plan is the first iteration of that effort.
2. Initiate two or more tangible actions to reduce GHG emissions in the short-term while a more comprehensive plan is being developed. To meet this obligation, the University implemented the following actions:
  - a. **GREEN BUILDING POLICY:** A policy requiring that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard was established in January 2008.
  - b. **WASTE MINIMIZATION:** A number of efforts were initiated to minimize waste, including joining the national RecycleMania competition, developing tailgate recycling at football games and other sporting events, and expanding e-waste recycling on campus. Additional waste minimization activities are currently being developed as part of the President's Strategic Innovation Initiative and the University's Strategic Action Plan.
3. Make publicly available the University's Climate Action Plan and GHG inventory, including periodic progress reports, through the Association for the Advancement of Sustainability in Higher Education (AASHE). The University of Idaho Greenhouse Gas Assessment was submitted to AASHE in September 2008, followed by this report—the University of Idaho Climate Action Plan—in January 2010.

In Spring 2009, the University of Idaho Sustainability Committee set 2030 as University's target date for climate neutrality. To keep the University on pace for this goal, the committee also set the following intermediate targets: 25% reduction in emissions by 2012, 50% reduction in emissions by 2016, and 82% reduction in emissions by 2023.

## CHICAGO CLIMATE EXCHANGE COMMITMENT

The University of Idaho also joined the Chicago Climate Exchange (CCX) in March 2007. By joining CCX, the University committed to a 6% reduction in GHG emissions by 2010 from a fiscal year 2001 baseline. To reach this target, cumulative annual reduction goals of 1.5% from the baseline must be met starting in 2007. If the university fails to meet annual targets, it will buy carbon credits to make up the shortfall. If the university exceeds reduction targets, it can sell credits on the carbon market. The University has already exceeded its targets for 2007 and 2008, resulting in the banking of 1,200 tons of carbon credits for each of the two years.

## TALLOIRES COMMITMENT

The University of Idaho signed the Talloires Declaration in 2005. The Talloires Declaration begins with a statement of deep concern over the “unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources.” It calls for the higher education community to work together through “education, research, policy formation, and information exchange” to provide leadership in solving this global problem. The declaration concludes with a ten point action plan to which signatories commit. These steps incorporate sustainability and environmental literacy into teaching, administration, research, outreach, and all other aspects of university operations. As a signatory of the Talloires declaration, the University has committed to these standards.

## UNIVERSITY OF IDAHO GREENHOUSE GAS INVENTORY



In September 2008, the University of Idaho published its first greenhouse gas (GHG) inventory. The assessment includes the Moscow Campus and operations within a 15 mile radius of the Moscow Campus. This includes 264 buildings containing 4,100,000 square feet. The operational baseline identifies emissions sources to be included in the assessment. The inventory follows the World Resource Institute and World Business Council for Sustainable Development *Greenhouse Gas Protocol* (2004) by identifying emission sources by scope. Scope 1 emissions include direct GHG emissions from sources owned or controlled by the University of Idaho. Scope 2 accounts for GHG emissions from the generation of purchased electricity. Scope 3 allows for the treatment of other indirect emissions not included in Scopes 1 and 2. Table 1 summarizes the University's emissions sources included in the inventory.

| Scope 1 Emissions | Scope 2 Emissions | Scope 3 Emissions |
|-------------------|-------------------|-------------------|
| Natural Gas       | Electricity       | Waste             |
| Campus Fleet      |                   | Commuter Travel   |
| Refrigerants      |                   | Air Travel        |
|                   |                   | Animals           |

Table 1 Emission sources by scope



Table 2 shows the University’s greenhouse gas emissions from 2005 to 2007. In 2005, total emissions were 39,099 metric tons of carbon dioxide equivalent (MT CO<sub>2</sub>e). During Fall 2008, a commuter survey was completed that enabled a more accurate estimate of emissions from commuter travel. Data from this survey will improve the quality of future evaluations. The complete inventory will be updated every two years, with the next update scheduled for September 2010.

|                                 | 2005          | 2006          | 2007          |
|---------------------------------|---------------|---------------|---------------|
| Natural Gas                     | 4,370         | 4,251         | 5,276         |
| Campus Fleet                    | 2,617         | 2,475         | 2,230         |
| Refrigerants                    | 88            | 88            | 88            |
| Electricity                     | 26,952        | 26,740        | 26,689        |
| Waste                           | 345           | 345           | 345           |
| Commuter Travel                 | 2,050         | 2,037         | 2,044         |
| Air Travel                      | 1,894         | 1,911         | 2,181         |
| Animals                         | 784           | 829           | 787           |
| <b>Total MT CO<sub>2</sub>e</b> | <b>39,099</b> | <b>38,675</b> | <b>39,640</b> |

Table 2 GHG emissions by source

Figure 1 shows that in 2007, electricity and natural gas use resulted in 80% of the University of Idaho’s greenhouse gas emissions, reflecting a profile dominated by building energy use. Consequently, the University should prioritize building efficiency in future reduction efforts. The complete GHG inventory can be found at [www.uidaho.edu/sustainability](http://www.uidaho.edu/sustainability).

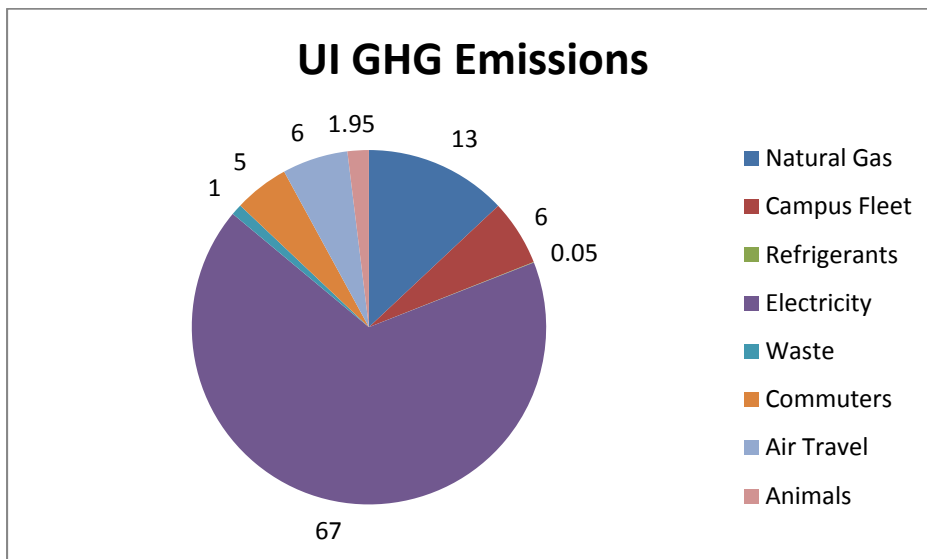


Figure 1 2007 GHG emissions sources in percentages



The first priority of the University of Idaho's Climate Action Plan (CAP) is to reduce GHG emissions. Conservation as a strategy has the highest return on investment, is cost-effective, and reduces vulnerability to future higher energy costs. Many conservation projects involve implementing newer and more efficient technologies. Even though these projects are cost-effective, upfront capitalization is a major obstacle. Other conservation efforts require management changes or broad participation by staff, faculty, and students. These often require little in terms of capitalization cost, but are made difficult by the need for education and participation. It is often easier to change technologies than it is to change attitudes and behaviors.

Because of budget constraints, the University has not built any new buildings on the main campus since 2005. As the university moves forward, new construction needs to treat energy efficiency as a priority. Climate change, peak oil, and increased demand will increase future energy prices. The larger our energy footprint, the more cost and risk we face over the long-term. Eighty percent of the University's GHG emissions result from building energy use. The most important strategy moving forward is to minimize the energy footprint of new buildings while increasing the efficiency of our existing facilities.

Despite its potential, conservation will not be sufficient to achieve carbon neutrality. One option is to generate renewable energy for campus and to offset other energy uses. One proposed renewable energy project is to install a turbine and generator in the steam plant to generate electricity using the biomass that we already burn to heat and cool campus. This project is cost-effective, with a 10 year or less return on investment and a project life of 30 years.

Another strategy is to develop local offsets for several sources of emissions such as commuter and air travel. Small, incremental offset fees over several decades will raise capital for larger, more cost-effective projects that benefit campus and offset emission sources on an ongoing basis. This is preferable to buying certificates or carbon credits on the open market.

## PLAN DEVELOPMENT PROCESS

This plan was written by the Sustainability Director and staff in the University of Idaho Sustainability Center with input and feedback from many individuals across campus.

As a first step towards developing a comprehensive plan, a subcommittee of the Sustainability Committee—the Energy and GHG Reduction Subcommittee—was formed to identify emissions reduction activities. Three working groups were formed out of this subcommittee:

- a. Energy
- b. Transportation
- c. Solid Waste, Purchasing, and Food

These groups were charged with identifying projects that would enable the University to reach its carbon reduction targets. The Climate Action Plan was endorsed by the Sustainability Steering Committee and forwarded to the Climate Leadership Committee. This group endorsed the plan and forwarded it to President Duane Nellis. After receiving presidential endorsement, the plan was submitted to AASHE to fulfill our obligation under ACUPCC. The plan was also posted on the University of Idaho Sustainability Center Web site: [www.uidaho.edu/sustainability](http://www.uidaho.edu/sustainability).

## CURRENT EMISSIONS REDUCTION PROJECTS

University of Idaho is currently implementing large-scale energy efficiency projects to reduce energy costs. These projects are cost effective and reflect sound fiscal and environmental stewardship. The most important energy conservation effort on campus is the implementation of a Performance Contract that includes \$30,000,000 worth of projects. In 2007, McKinstry Essention, Inc., an Energy Service Company (ESCO), performed a technical audit of the University of Idaho, which identified potential energy savings projects with a payback of less than 25 years. Implementations of many of these projects are currently underway and expected to be completed in 2012. These projects are expected to account for significant annual emissions reductions:

- 4,512 MTCO<sub>2</sub>e from avoided Electricity Usage
- 1,040 MTCO<sub>2</sub>e from avoided Natural Gas Usage

These reductions total approximately 1/8 of the 2005 University carbon footprint. Many other carbon reduction projects are also underway. A more comprehensive list of recent and current projects is included in Appendix A.

## ENERGY



In 2007, the University of Idaho emitted 38,981 metric tons of CO<sub>2</sub>e greenhouse gases into the atmosphere, 80% of which resulted from electricity and natural gas usage. To reach our emission reduction targets, considerable decreases in electricity and natural gas use will be required. The following is a list of potential projects and policy measures that will help reduce electricity and natural gas use at the University.

### CAMPUS-WIDE PROJECTS

The central steam system which supports heating and cooling for 75% of campus buildings is more efficient than individual building-level heating and cooling systems. A number of projects are being evaluated or are underway to expand and improve this system:

1. Connect more buildings to the central steam system to eliminate electricity and natural gas use for heating and cooling isolated buildings. As part of the ESCO process, the Menard Law building will be connected to the steam tunnel system, thereby eliminating the current electrical heat system. The challenge with extending the steam system is cost, which is roughly \$5,000 per linear foot.
2. Compare steam pressure supply to actual pressure needed at buildings serviced by steam. If the current delivery pressure is excessive, decrease the pressure to the lowest level required for the delivery of needed downstream pressure. This project is currently underway.
3. Determine if any independent air compressors are still operating in university buildings. If so, remove these compressors and connect the buildings to the central steam system whenever possible. Connecting these air systems to the central air system will allow the one main compressor at the steam plant to handle all air needs more efficiently, using less electricity than small compressors scattered all over campus.
4. Add an additional wood-fired boiler to the steam plant facility. This will eliminate most natural gas use at the steam plant (emergencies or major breakdown backup only).
  - a. Estimated cost of \$26,000,000.
  - b. Yearly Emissions Reduction of 3,412 Metric Tons CO<sub>2</sub>e.

## BUILDING ENERGY USE REDUCTION PROJECTS

The Performance Contract includes large, capital projects (such as steam plant improvements) and campus-wide projects (such as lighting upgrades) with a payback of 25 years or less. Once completed, other efforts will be needed to add smaller projects and projects with longer payback periods:

1. Increase the resolution of building modeling completed by McKinstry. The initial E-Quest modeling provided enough resolution to look at major HVAC projects. A more detailed model will allow planning for additional projects not identified in the first effort.
2. Change the management of buildings to result in additional reductions. This effort could include the following measures:
  - a. Concentrate classes after 5pm into as few buildings as possible, allowing night setback operations to be implemented in all other buildings.
  - b. Add a “space czar” staff position and empower that person to allocate space more efficiently. This position would also develop policies to combine and minimize server rooms needing extra cooling (or locate servers on outside walls to utilize outside air instead of chilled water), and to reduce impacts from labs with fume hoods. Buildings with labs use double to triple the heating energy of other buildings.
  - c. Optimize the use of automated environmental controls. Inefficiencies currently result from how buildings are being managed.
  - d. Firmly enforce State of Idaho standards for managing building temperatures as required by State of Idaho Executive Order 2005-12.
  - e. Select a campus building and pilot the LEED Existing Building Operations and Maintenance process (with a focus on Energy and Atmosphere credits) to assess the practicality of the program for campus-wide implementation.
3. Develop, distribute, and follow up on energy reports for specific campus operations. Develop site-specific energy reduction plans for operations with staff.
4. Fund Energy Efficiency/Conservation Specialists through the Utility Budget. Currently, all funding for electrical, HVAC controls, and maintenance and operations personnel comes from the Facilities budget. Employee priorities are thereby focused on general maintenance and avoidance of occupant complaints. With the many maintenance needs on campus, this often results in little time spent managing and optimizing HVAC and electrical systems for energy efficiency. In addition, a conflict can occur between energy conservation efforts and occupant satisfaction; it is common for maintenance personnel to ignore energy conservation in favor of occupant preferences. If dedicated individuals are not appointed, the University loses out on energy savings developed through the Performance Contract, and will have difficulty capitalizing on future energy-savings opportunities.

- Reduce natural gas usage by the most prevalent users on-campus. The table below shows the top natural gas (NG) users on-campus (excluding the steam plant). Undergo site specific assessments at these facilities to determine ways to significantly reduce natural gas usage.

| Building                         | Yearly NG Usage (Therms) | Yearly Emissions (MT CO <sub>2</sub> e) |
|----------------------------------|--------------------------|---|
| Kibbie Dome                      | 118,851                  | 644                                     |
| Holm Center                      | 94,210                   | 510                                     |
| USDA Research Barn (Incinerator) | 39,812                   | 216                                     |
| Martin Lab                       | 28,239                   | 153                                     |
| Facilities Services Center       | 27,919                   | 151                                     |
| Pf--Forestry Greenhouse #1       | 19,415                   | 105                                     |
| North Campus Center              | 14,869                   | 81                                      |
| Industrial Arts Building         | 14,088                   | 76                                      |
| <b>Total</b>                     | <b>357,403</b>           | <b>1,936</b>                            |

Table 3 Largest energy using buildings on campus

## NEW BUILDINGS

The vast majority of energy use at the University of Idaho is building-related. The current building policy at University is that all new construction and major remodels must attain at least Silver LEED certification. While this is a major step forward, it is not sufficient to meet the University's future needs for new buildings. Every new building that is not net-zero in terms of energy and carbon emissions is creating a larger footprint that will need to be minimized or offset in the future.

An alternative approach to designing and building new buildings allows for considering the total costs of ownership. The current strategy considers the upfront cost of construction in isolation from the maintenance and operations costs of the building over its life-time. This leads to an emphasis on cheaper upfront costs at the expense of long-term operational costs. For example, Kats (2003) studied 40 LEED buildings in California and found that, on average, they cost 2% more in initial construction costs, but save 20% over the life time of the building. Kats concluded that higher performance buildings saved more over time in operation costs, resulting in a lower cost of ownership over the life of the building than for equivalent conventional buildings. Davis Langdon (2009) found no statistically significant cost differences between LEED buildings and non LEED buildings. In some cases, LEED buildings were cheaper on average. Davis Langdon also found that it is important to seek LEED standards from the very start of project planning. Modifying a building later in the design process inflates cost and leads to perceptions of green buildings being more expensive. In fact, many LEED Silver projects are more expensive than Gold because of the cost of redesign. LEED Silver is a common regulatory requirement, and some buildings designed to meet Silver standards were less cost efficient

because the process was one of adding on features to achieve the standard rather than designing the building from the start to achieve the standard. Davis Langdon also found that traditional building costs have gone up by 10% in the last decade as regulations have become more stringent, further improving cost comparisons between green and traditional buildings.

The University of Idaho's current building policy of LEED Silver needs to be progressively strengthened at the pace of advances in building design and construction. We are already at a point where all three structures currently in design are expected to be LEED Platinum. *The baseline standard for new buildings at the University should be strengthened to Gold in the near-term and to Platinum by 2012.* The goal should be net zero as soon as is practical. Otherwise, every new building will make the task of achieving carbon neutrality more difficult and expensive.

## ELECTRICITY PLUG-LOAD REDUCTION

A number of steps can be taken to reduce energy used by plugged-in equipment in buildings. This equipment not only uses electricity, but also generates heat while it operates. Using less electricity as part of plug-load also results in lower cooling demand for campus and building systems, resulting in additional energy savings.

1. Implement an Energy Star™ office equipment purchasing policy to reduce plug loads during and between office equipment operations.
2. Turn off all electronic equipment when not in use, particularly as people exit their offices at the end of the day and week.
3. Change energy settings on computers. Changing power settings to reduce electricity use by computers also reduces HVAC energy use associated with cooling computer labs and servers. The University's Information Technology Department (ITS) is willing to implement a network-wide change in the computer lab computers, but is blocked by software issues. Their current software is unable to wake the machines up for virus protection updates. They hope that the next Windows operating system will enable them to address this problem.
4. Change to laptops for as much of computer use on-campus as possible. Laptops use a fraction of the energy of desktops and require less cooling. Energy savings from using a laptop instead of a desktop are estimated to be between 50% and 80% ([http://www.energystar.org/en/en\\_022p.shtml](http://www.energystar.org/en/en_022p.shtml)).
5. Analyze the current and optimum locations of servers in terms of HVAC requirements. The University needs to inventory all servers on-campus, and needs to determine efficiency in terms of electricity use and heating and cooling needs. The goal is to reduce heating and cooling loads caused by computer labs and servers.
6. Determine opportunities to switch to centralized printers and minimize the use of personal printers. This will reduce plug load and background power use, enable the purchase of duplexing machines that save paper, and reduce the overall cost of printing on-campus, which is affected by purchases, electricity use, heating and cooling loads, and recycling.

## RENEWABLE ENERGY SOURCES



University of Idaho has a number of options for developing renewable energy sources. Using renewable energy on campus reduces the amount of electricity and natural gas that the University needs to purchase and use, thereby reducing our GHG footprint.

### BIOMASS

The most viable option for generating renewable energy beyond a pilot scale is to add a steam turbine and generator to the current University steam plant. The current system would support a 450 KW system generating an estimated 2,571 mWh per year. This would generate electricity from biomass already burned to produce steam for campus. University Facilities has explored the feasibility of the project, but has not located a source of funding to capitalize it. Costs for equipment and installation are estimated at \$750,000, with a return on investment of 10 years or less. The project would generate annual emissions reductions of 1,074 MT CO<sub>2</sub>e.

### WIND

The University of Idaho Moscow campus has limited potential to develop wind as a meaningful source of energy. The technology is important to our region, and pilot and demonstration projects should be developed for education and outreach efforts, but the technology is not currently part of the University's emissions reduction strategy for the Moscow campus. However, there has been no feasibility assessment of wind projects on other University properties around the state. As a first step, a GIS layer needs to be developed that includes all University properties in the state. The properties need to be assessed for their potential for renewable energy production, including wind and geothermal.

In addition to building its own wind projects, another option is to buy equity in a wind project and sell the electricity. The generated electricity would offset the University emissions profile while paying back the initial investment. This option needs to be further explored as an investment and offsetting strategy.

### SOLAR

Large-scale solar projects are still not cost effective when compared to other renewable energy options for the university. Initial calculations put solar electric generation systems in the 32-50 year payback range, depending on future electricity prices. Small pilot projects that meet educational and outreach



objectives have value, but the technology needs to become more cost-effective before widespread adoption.

University Facilities is currently piloting solar powered outdoor lights near the Student Recreation Center. The lights are performing well, although they have only been installed for one year. Questions concerning battery life and durability of other components of the lighting systems cannot be answered yet. The installation of additional solar outdoor lights will be considered in locations on the edges of campus not readily served by a power source, or in places where the installations will be temporary. Regardless of the outcome of the pilot, the technology still has problems that limit wide-scale deployment, such as batteries that must be periodically replaced.

University Facilities is also currently investigating light emitting diode (LED) lamp arrays that can be retrofitted for existing exterior lighting fixtures, replacing the existing lamps and ballasts with a screw-in LED array. If Facilities determines that this is a reasonable course of action, it will be a cost-effective way to significantly reduce electricity use on campus with a minimal capital investment.

## SOLID WASTE



The University of Idaho produces approximately 1,500 tons of waste per year, resulting in the release of 242 metric tons of CO<sub>2</sub>e into the atmosphere from the decomposition and transportation of waste. To reduce waste-related emissions, UI must minimize the amount of overall waste produced and recycled. UI has set a goal of reducing waste by 20% and increasing recycling by 60% by 2013. In Spring 2009, the University's Sustainability Center presented a Request for Innovation (RFI) proposal to meet its 2013 goal. The proposal addresses waste management issues including purchasing, handling, and disposal. This project was accepted as part of the President's Strategic Innovation Initiative in the fall of 2009.

Projects include the following:

- Paper reduction – Increase duplex copying on campus. ITS will start a pilot program using duplex mode as the default printing option for several University computer labs this spring. Many departments are already shifting to an electronic-only format for documents. This practice needs to be encouraged and accelerated.
- Office furnishings – Move to standardized office furnishings made of durable wood or metal that will be kept or re-sold back to campus users at a reduced price. Eliminate the use of inexpensive particle board furniture that breaks apart and cannot be reused.
- Education and Outreach – Expand educational and service-learning projects concerning recycling. This includes offering a free waste audit and consulting program to help offices and departments reduce waste, implementing and advertising a recycling program at sporting events, and other measures. Tailgate recycling at football games was launched this year, and recycling inside Kibbie Dome was piloted during the last game of the 2009 football season.
- Food Waste – Compost all food waste from campus. The University began composting food waste from campus dining operations and from the Commons in January 2010. Several other coffee shops and food vendor locations generate small amounts of food waste. Composting services will be extended to these smaller locations once the two larger food waste stream operations are well established.
- Minimum Waste Catering – Starting in Fall 2009, University Catering moved to a minimum waste catering system using reusable or compostable plates, flatware, and other serving utensils.
- Recycled Paper – The University of Idaho is in the process of developing a policy requiring the use of a minimum 30% recycled-content paper for on-campus multipurpose paper purchases, and the policy will also encourage the purchase and use of 100% post-consumer, recycled-content paper.

- Bottled Water – Reduce the use of disposable water bottles. A reusable water bottle campaign was launched in Fall 2009. UISC and the Office of the Dean of Students gave stainless steel water bottles to every incoming freshman and graduate student.
- Electronics and E-waste – Starting in 2010, E-waste will be banned from the landfill in Oregon where we ship our waste. E-waste is now recycled through University Surplus. E-waste is defined as anything with a plug, battery, or microchip. Containers for small electronics have already been distributed by the University's Sustainability Center, and Surplus already processes approximately 25 tons of computers and monitors per year. These efforts will be expanded in 2010. The leasing of electronic equipment should be evaluated in terms of the total cost of ownership of equipment in comparison to our current purchase and recycle practice.

## ANIMALS AND FARM OPERATIONS



The University of Idaho has a small, local population of livestock used for research and educational purposes through the Palouse Research, Extension, and Education Center (PREEC). PREEC includes the dairy center, beef cattle center, and sheep center, with a total herd of 400-500 animals. This number is expected to remain constant for at least the next five years. With the creation of the Environmental Livestock Center in southern Idaho, some research currently conducted at the Moscow campus may shift south in the next 10-15 years, reducing local herd size by 20-25%. As these animals digest food and excrete waste they release methane ( $\text{CH}_4$ ), so a reduced herd size will result in lower emissions in Moscow while increasing cattle-associated emissions in southern Idaho. Another potent greenhouse gas, nitrous oxide ( $\text{N}_2\text{O}$ ), is released through the management of animal waste.

In 2005, emissions from livestock at the University amounted to 784 MT  $\text{CO}_2\text{e}$ . To reduce these emissions, animal waste should be composted before being distributed. Composting stabilizes carbon so that less is released into the atmosphere. The composted material will be used as animal bedding or applied to rangelands. Composting has the potential to reduce manure-related emissions by 30-40%.

The University is also studying carbon sequestration through land management techniques such as no-till farming and re-vegetation of non-seeded areas. PREEC has already converted one-third of its crop land to a direct seed (no till) system, and plans to convert half to no-till by 2012-2013. No-till farming increases carbon sequestered in the soil rather than allowing it to escape into the atmosphere as carbon dioxide. The University will continue to use multiple tillage systems on the remaining lands to meet faculty research needs.

## TRANSPORTATION



Transportation is the fastest growing energy use in the world. It is also a major source of greenhouse gas emissions, accounting for more than half of the world's oil use. In the United States, transportation patterns are dominated by the personal automobile, accounting for 81% of our transportation energy use, 96% of which comes from oil. Furthermore, transportation produces one-third of US carbon emissions.

In 2007, the University of Idaho released 6,455 metric tons of CO<sub>2</sub>e emissions related to transportation: 2,044 metric tons from commuting, 2,230 metric tons from the campus fleet, and 2,181 from air travel. These three sources constituted 16% of total emissions at the University in 2007.

## COMMUTING

Moscow is a relatively small community in size and population. Ninety-three percent of off-campus students live within the Moscow city limits with a median commute of 1 mile. For faculty and staff, 75% live in Moscow, with a median commute of 1.6 miles. Despite this, motor vehicle commuting is popular, including 32% of off-campus students and 75% of faculty and staff.

Strategies for reducing commuter emissions include encouraging alternative modes of transportation, encouraging carpooling and ride sharing, and adding a small fee to the parking pass to build a fund for projects that mitigate and offset commuter impacts.

## PROMOTE ALTERNATIVE MODES OF TRANSPORTATION

- Create a University of Idaho Commuter Club (CC), offering special parking passes for students and faculty who agree to carpool to campus. Joining the UICC would allow commuters better parking opportunities. For example, a single carpool pass could allow access to a blue lot. A two person carpool, with two passes in the car, would allow access to a red lot, while three passes or more would allow access to a gold lot, and so on. More people in the carpool results in better access to parking. Blue passes should be priced with this club in mind. Cost studies could determine what is feasible and effective. The result is a reduction in vehicles traveling to campus, and a reduction in GHG emissions. Meanwhile, benefits are incentivized for the consumer by saving them time and money (compared to cost of a gold permit or inconvenience of remote parking).
- Include a "Carpool Finder" on the University of Idaho Transportation Web site to assist individuals who are looking for a carpool.

- Launch “Leave Your Car at Home Day” once a year, once a semester, once a month, or once a week. Launching a work from home day to avoid the commute entirely for those who do not need to work from campus is an even better option.
- Install traffic control devices such as speed tables to slow traffic in and around campus. Bike lanes and well-labeled driving lanes are also a deterrent to speeding and reckless driving.
- Encourage the use of public transit by working with transit officials to reduce student, faculty, and staff ridership cost.
- Start a Staff Car Loaner program—a stumbling block for many staff and faculty wanting to use alternative transportation is being unable to respond to an emergency involving their children due to the lack of a car. A loaner program for emergencies takes care of this problem. This could be modeled after Portland, Oregon’s ZipCar™ program.
- Facilitate safe bicycle commuting by creating bike lanes on campus. Prohibiting parking along some streets on campus would promote a more friendly and healthy environment for pedestrians and bicyclists. It would also make space for much needed bike lanes, reducing dangerous bike/vehicle interactions without needing to rebuild roads on campus.
- Develop the bike lanes along 6<sup>th</sup> Street that run directly from campus to downtown Moscow. Currently, these routes are incomplete and segmented. Routes should also extend along the eastern edge of campus and have a more visible and direct connection with the Latah County trail system.
- Add more bike parking, including covered spaces, to increase convenience. Make lockers available to bike commuters.
- Promote bicycling by including information on local bike shops and a “Best Bike Routes” map on University's Transportation Web site. Additionally, bike maintenance classes should continue to be hosted on campus in conjunction with local bike shops.
- Expand the Parking and Transit website to include information on transit alternatives on campus and within Moscow. Use it to support and educate the campus community on public transit options, bike clinics, and pedestrian improvements.
- Develop an orientation packet to inform new students, faculty, and staff of transportation information and alternatives. Include Best Routes and other information from the Parking & Transportation Web site.
- Work with local groups to set up quarterly bike repair discounts and consultations.

## INCREASE MANAGEMENT EMPHASIS ON A PEDESTRIAN-ORIENTED CAMPUS

- Potential traffic control projects that would benefit alternative transportation and increase the pedestrian-oriented management of campus include the following:
  - Close 6<sup>th</sup> Street from Rayburn to Line Street.
  - Make 6<sup>th</sup> Street one-way West from Rayburn to Stadium.
  - Make Idaho Ave Ext. one-way going west (already planned).
  - Make Rayburn and Stadium one-way going north.
- Collect traffic count data for pedestrians, bikes, and cars on campus streets.
- Increase visibility of major pedestrian crosswalks. Eliminate confusion and conflict with proper lighting and signage or traffic flow control.

## DEVELOP OFFSETS THAT BENEFIT CAMPUS AND REDUCE EMISSIONS-RELATED IMPACTS

1. Add a “carbon fee” to parking passes sold. The fee should be sufficient to fund on-campus offset projects to reduce commuter emissions. The goal is carbon neutrality by 2030. This means that the fee can be structured to develop conservation or renewable energy infrastructure over a 20 year period capable of offsetting annual emissions from commuter travel.
2. Do not allow (or charge a premium for) freshman parking passes. Access to Grey and Purple lots could be further limited with these rules, creating space for carpool lots and alternative transit infrastructure. If deemed necessary, there could be a policy that only allows freshman to buy Blue Parking passes. This policy would allow a car for trips home, while still relieving parking congestion and discouraging driving. This measure would be further aided by a comprehensive ride-share program.

## CAMPUS FLEET

The University of Idaho maintains a variety of vehicles to ensure the safety and viability of our campus community, and for faculty and staff travel throughout the state. The current Moscow campus vehicle fleet is shown in Table 4.

|  |     |
|--|-----|
| Passenger car, excluding police car                  | 31  |
| Passenger Van, up to 15 passengers                   | 44  |
| Pickup / Van, Cargo or Delivery (1 ton & under)      | 201 |
| Trailer: small utility, etc. (1 ton & under)         | 26  |
| Bus / Van, over 15 passenger                         | 2   |
| Motor Home   | 1   |
| Trailer: large flat bed, enclosed, etc. (over 1 ton) | 2   |
| Truck (over 1 ton) excluding 5 above                 | 14  |
| Semi Tractor   | 2   |
| ATV, Cushman, or off-road Motorcycle                 | 1   |
| Other  | 4   |

Table 4 University-owned vehicles on Moscow Campus

While many of these vehicles are a necessary part of the campus community, opportunities exist to reduce GHG emissions from use and maintenance of the University fleet:

- Purchase new vehicles with highest possible mileage per gallon for the intended use.
- Continue the pilot program using electric vehicles for on-campus use.
- Analyze the feasibility of a biodiesel program to produce fuel for the campus fleet. Although there are problems with biodiesel feasibility, including the food-versus-fuel conflict, net-energy gain, and cost-effectiveness, University faculty have considerable expertise in the field. Drawing on this expertise could stimulate new investment and research opportunities at the university while also reducing emissions.
- Explore federal, state, and local incentives for purchasing low- or zero-emission vehicles.
- Explore federal, state, and local incentives for the installation of Electric Vehicle (EV) Charging Stations both on-campus and in the community.



## FACULTY AND STAFF AIR TRAVEL

Air travel is a necessary part of university operations. Other than encouraging more video conferencing, few alternatives exist to air travel. Offsetting emissions with meaningful investment in other GHG reduction or renewable energy projects is another option.

- Develop an air travel offset fund for on-campus emissions reductions projects or renewable energy projects.
- When University faculty travel for guest lectures, strongly encourage a carbon offset to be purchased as part of visiting expenses.
- Encourage the use of carpooling to and from airports by faculty and staff. The carpool finder services outlined in the commuter section could serve faculty and staff travel as well.

## NEXT STEPS



This report is a first attempt to assemble strategies and projects to reduce the University of Idaho's GHG footprint. It falls short of developing an overall strategy for reaching carbon neutrality. Many more strategies and projects will have to be identified and implemented to reach that goal over the next couple decades.

After the formal submission of the University's Climate Action Plan (CAP) to AASHE in January of 2010 we will continue these efforts. The UI GHG inventory will be updated in September 2010. The University's Climate Action Plan needs to be updated every two years.

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## APPENDIX A – RECENT AND CURRENT CLIMATE CHANGE EFFORTS



This section inventories recently completed projects or those that are currently being implemented at the University of Idaho to support reductions in GHG emissions.

### 1. 2007 ESCO Technical Audit Projects:

- a. **Conversion of HVAC Control Systems** – Convert systems in many buildings from the old, inefficient pneumatic control systems to the centrally-controlled Siemens Direct Digital Control (DDC) system. These upgrades improve the operational efficiency of the HVAC systems by reducing energy waste from out-of-adjustment/calibration issues, and they allow temperatures to be reduced during non-operational hours.
- b. **Lighting Retrofits** – Nearly all incandescent lights on campus were replaced with efficient fluorescent lamps, and many older fluorescent lighting fixtures were retrofitted with more efficient lamps and ballasts. In addition, photocell, occupancy sensors, and timed switches were installed at various locations to reduce unnecessary hours of operation of existing lighting. The lighting initiatives provide an annual savings of over 5 million kWh of electricity, which translates to over \$200,000 per year in cost savings.
- c. **Variable Frequency Drives (VFD)** – VFDs were installed to control the speed of many pumps and fan motors for various Heating, Ventilation, and Air Conditioning (HVAC) systems. Typically, these motors run at a constant speed needed to provide the maximum flow and therefore waste energy during partial load operation. Significant energy savings result from controlling speed to provide only the flow needed. The VFD initiatives provide an annual savings of over 1.6 million kWh of electricity, which translates to over \$63,000 per year in cost savings. Variable Frequency Drives are an element of the University of Idaho Design and Construction Standards and are included where appropriate in all new construction and renovation efforts.
- d. **Unoccupied Building HVAC Control** – For a variety of reasons, many University buildings are unnecessarily heated, cooled, and ventilated as if they were occupied 24 hours-per-day. In order to implement an unoccupied setback sequence, it is typically necessary to upgrade the existing HVAC controls, and it is often necessary to provide a supplementary cooling system for specific areas that require constant cooling (such as computer server rooms). The Unoccupied Mode initiatives provide annual savings of over 1.6 million kWh of electricity, 11,900 million Btu of heating energy, and 500 million Btu of cooling energy, which translates to over \$150,000 per year in utility cost savings.

- e. **Steam Plant Woodchip Storage and Drying Facility** – Completed during Summer 2009. A storage facility to keep the supply of wood chips out of the weather was built, and an on-going research/pilot program was established to study the drying out of wet or moist wood chips using heat or by using low humidity ambient outside air.
  - f. **Adoption of the Governor of Idaho’s Executive Order 2005-12** – “Energy Conservation Considerations in State Buildings.” More information available at <http://adm.idaho.gov/adminrules/bulletin/bul/nov00.pdf> .
  - g. **Implementation of the University Administrative Procedures Manual 40.04 New and Major Renovation Building Policy** – This policy requires that all new construction and major renovation projects on the University of Idaho campus adhere to the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) for New Construction certification standards at least at the Silver level. Attainment of the higher levels of Gold or Platinum certification is highly encouraged. More information is available at <http://www.uihome.uidaho.edu/default.aspx?pid=105677> .
  - h. **Using Wood Rather than Natural Gas** – This practice has saved more than \$600,000 in energy costs per year, even though steam production has increased to meet University’s needs. Natural gas use has decreased, significant costs have been avoided, and efficient operation of the steam boilers has resulted from wood-fuel use.
  - i. **Development of a Central Campus Chilled-water Production and Distribution System** – This initiative has reduced the duplication of efforts around campus and improved energy efficiency. An efficient, double-effect steam absorption chiller and a new large, efficient electric chiller were recently installed at the North Campus Chilled Water Plant. The new electric chiller will become operational in the summer of 2010. The absorption chiller uses steam produced primarily from less-expensive wood fuel instead of electricity, and helps defer the need for additional electrical system infrastructure (specifically a third substation). These units increase the central chilled water system capacity, allowing the decommissioning of old and inefficient chillers and smaller, multiple air conditioning units in individual buildings.
  - j. **Building HVAC Systems Commissioning** – An on-going program which analyzes, tests, and makes improvements to control sequences in building HVAC systems. The University has completed 6 buildings to date, with 9 more currently in-process.
2. **Metering of Building Energy Use** – Since energy usage cannot be managed unless it is measured, the University of Idaho has initiated a building utility sub-metering program with the goal of metering and recording all utility usage for every building on the University campus. Well over 100 meters have been added or replaced in the last several years, which completes Phase 1 and nearly completes Phase 2 of our Building Sub-metering program. When Phase 2 is complete, all major University campus buildings will be fully sub-metered for energy usage. University has partnered with Avista, the local power utility, who is providing over \$75,000 in equipment, software, and installation reimbursement, to enable the university to electronically read the sub-meters at all University buildings. The major advantage of electronic over manual reading is that the meters are read much more frequently (for University’s system,

on a 5 minute interval). This detailed data is available for savings analysis and building system troubleshooting. Phase 3 involves metering energy for minor buildings such as farm facilities and temporary buildings, and metering water usage for all major buildings. Phase 3 will add the capability for electronic meter reading of University steam condensate and water sub-meters in all major buildings.

3. **Installation of Occupancy Sensor Lights** – These were installed in three large classrooms of the Menard Law Building. The project will reduce energy consumption and costs by keeping lights off when the classrooms are not occupied – this initiative is funded by the UISC and will be completed by June 2010.
4. **Installation of Solar-powered LED Path Lighting** – This installation along Paradise Creek bicycle path will be completed in 2009. Eleven luminaires (light fixtures) were installed; each uses two 600 lumen LED lamps for a total of 17 watts per luminaire. This installation saves 1,021 kWh per year. In addition to saving energy, the lamp life is also greatly increased by using LED lamps (50,000 hour lamp life) instead of standard metal halide lamps (10,000 hour lamp life); LED lamps also have a higher color rendering index (CRI) than metal halide lamps, which is an added bonus for exterior walkway lighting.
5. **Installation of Solar-powered Ventilation Fans at Hoop House** – This mini-grant should be completed by June 2009.
6. **Energy Efficiency Installations for University Housing and Greek Sororities and Fraternities** – UISC facilitated the entry of 17 Greek houses, Wallace, Towers, and Family Housing into an Avista program for energy upgrades in multi-family housing. Avista paid to install lighting retrofits, insulation upgrades, and water conservation measures for these residences. This program was completed in 2009.
7. **Sustainability Revolving Loan Fund** – This fund was mandated in Spring 2009 for various sustainability projects. Although the policy was established, no funding has been identified to start the fund.

## APPENDIX B – CURRICULUM RELEVANT TO CLIMATE CHANGE



The University of Idaho is committed to teaching climate change science across many disciplines. The following tables identify efforts in both curriculum and research.

| FACULTY MEMBER/<br>INSTRUCTOR | COURSE ID/<br>TITLE                               | COURSE DESCRIPTION/<br>RELEVANCE TO CLIMATE CHANGE   |
|-------------------------------|---|--|
| Frank Jacobus                 | ARCH 151<br>Intro to Built Environment            | Introduces concern for climate change across the design disciplines.   |
| Diane Arm Priest              | ARCH 266<br>Materials and Methods of Construction | Introduces sustainability issues in material selection and construction technique.   |
| Phil Mead                     | ARCH 463 ECS I                                    | Thermal principles in the built environment. Teaches passive methods for heating and cooling.  |
| Bruce Haglund                 | ARCH 464 ECS II                                   | Topics include day lighting and electric lighting design, sustainability, rating systems, site energy generation, and economics of green architecture. |
| Wendy McClure                 | ARCH 483<br>Urban Issues                          | Urban planning effects on energy use and sustainability are presented.   |
| Wendy McClure                 | ARCH 504<br>Sustainable Development Seminar       | Students explore the issue of sustainable development.   |
| Sherry McKibben               | ARCH 504<br>Eco Urban Design                      | Land Use, Transportation, and Environmental connection to CO2 emissions reduction.   |
| Sherry McKibben               | ARCH 504<br>Housing Typologies and Issues         | Building design and configuration related to climate change and CO2 reduction.   |
| Bruce Haglund                 | ARCH 510<br>Graduate Seminar                      | Prepares students to design a sustainable building or site.  |
| Bruce Haglund                 | ARCH 553<br>Comprehensive Design                  | Use of interdisciplinary integrated design as a tool toward attaining sustainable design.  |

| FACULTY MEMBER/<br>INSTRUCTOR | COURSE ID/<br>TITLE                             | COURSE DESCRIPTION/<br>RELEVANCE TO CLIMATE CHANGE   |
|-------------------------------|---|--|
| Bruce Haglund                 | ARCH 554<br>Research Studio: London & UK        | Student research and design of green architecture in London and the UK. Studies abroad offering.   |
| Sherry McKibben               | ARCH 554<br>Arch Studio (Urban Design)          | Land Use, Transportation, and Environmental connection to CO2 emissions reduction.   |
| Bruce Haglund                 | ARCH 556<br>Graduate Project Studio             | Students design a self-articulated sustainable design project.   |
| Bruce Haglund                 | ARCH 570<br>Natural Lighting                    | Hands-on analysis and design of day lit spaces.  |
| Bruce Haglund                 | ARCH 571<br>Building Performance                | Hands-on analysis of building performance - focused on energy efficiency and user satisfaction.  |
| Bruce Haglund                 | ARCH 581<br>English Green Architecture          | Preparatory seminar for studies abroad in England focused on green architecture.   |
| Tracie Lee                    | BUS341<br>Business Systems                      | This module has 2 hours of class (in a 4 credit module) focused on ethics and sustainability. Students are given an exam question covering one or the other. They are also asked to discuss macro-environmental factors such as weather and natural resources in a presentation. |
| Tracie Lee                    | BUS378<br>Project Management                    | Student teams work on real-world projects (often provided by University departments, including the Sustainability Center). We have had at least 2 projects each semester focused on sustainability-related issues.   |
| Eric Stuen                    | ECON 201<br>Principles of Economics             | This course introduces topics in macroeconomics, a central issue of which is economic growth. Economic growth is relevant to climate change - I discuss how economic growth can, but doesn't necessarily, exacerbate climate change by increasing carbon dioxide emissions.      |
| Eric Stuen                    | ECON 447<br>International Development Economics | This course involves theory and evidence for how and why economies develop. Climate change is an important topic in development as measures taken to reduce carbon dioxide emissions can impose costs on economies that may inhibit their development.                           |



| FACULTY MEMBER/<br>INSTRUCTOR         | COURSE ID/<br>TITLE  | COURSE DESCRIPTION/<br>RELEVANCE TO CLIMATE CHANGE   |
|---------------------------------------|--|--|
| Grindley, Brown,<br>Burton, & Browder | HPRD 201<br>Physical Activity, Wellness, &<br>Behavior Change            | One week in the course discusses Environmental Health (e.g., basics of climate change, water supply, population, and recycling). We went out and planted trees this year too for our lab with the sustainability center.   |
| Grindley                              | HPRD 351<br>Social & Environmental Aspects of<br>PA and Wellness         | Several classes look at sustainability - how to get people into healthy active lifestyles for the sake of sustaining health and reducing waste and reducing our footprint (e.g., less medicine = less medicine bottles= less waste= less production= less pollution, and walking instead of driving).  |
| Goc Karp, Brown, &<br>Goetz           | HPRD 429<br>Leadership, Pedagogy and<br>Programming in Physical Activity | Students develop healthy active lifestyle programs- these tie into sustaining healthy living. For example, one group looked at bike safety and bike parking. Darin Saul did a guest lecture also.  |
| L. Vierling,<br>Walden, & Hicke       | REM/GEOG 450<br>Global Environmental Change                              | Major global environmental changes addressed using an interdisciplinary approach. Topics may include processes and principles of ecosystems, biogeochemical cycles, impacts and mitigation of climatic change, atmospheric chemistry, feedbacks between climate and various earth system processes, and trends in global biodiversity.   |
| FACULTY MEMBER/<br>INSTRUCTOR         | COURSE ID/<br>TITLE  | COURSE DESCRIPTION/<br>RELEVANCE TO CLIMATE CHANGE   |
| L. Vierling                           | CORE 125<br>The Earth and Our Place On It                                | Through class discussion, writing, field trips, community service-learning opportunities, music, art, readings, and film, students in this course explore how residents of the planet are connected to each other and the environment. For this course, the earth is viewed as a system impacted by human and natural forces and shaped by public policies and the acts of ordinary citizens. Central questions of the course concern the sustainability of the earth system, major threats to the system, and each individual's role in maintaining its health. |
| Bruce Mobarrry                        | BIOL 116<br>Organisms and Environments                                   | This course teaches the evolutionary history, distribution, and ecology of organisms on Earth, including the effects of humans (e.g. climate change).  |

|                  |   |   |
|------------------|---|---|
| Eva Top          | BIOL 411<br>Senior Capstone                                 | The primary objective of the course is to provide the students with an opportunity to apply their scientific knowledge to the "real world" that they will enter upon graduation. They critically read, consider, discuss, and write about specific critical issues that society is facing today. One of the regular topics is climate change. |
| Armando McDonald | FORP 436/536<br>Wood Composites                             | Raw material, processes, properties, and their applications for a number of natural fiber and wood composites made of veneers, particles, and fibers. Additional project assignments required for graduate course. Two half day field trips. Two lectures and one 3-hr lab a week.  |
| Armando McDonald | FORP 438/538<br>Wood Chemistry                              | The chemistry of lignocellulosic fiber (natural fiber and wood) formation, agricultural/natural fiber and wood structure and reactions of lignocellulosic compounds. Additional projects and assignments required for graduate course. Two lectures and one 3 hour lab per week.  |
| Armando McDonald | FORP 491<br>Biomaterial Product and Process Development Lab | Lab to accompany FORP 495 Product and Process Development and Commercialization.  |

| FACULTY MEMBER/<br>INSTRUCTOR | COURSE ID/<br>TITLE                                 | COURSE DESCRIPTION/<br>RELEVANCE TO CLIMATE CHANGE  |
|-------------------------------|---|---|
| Coleman & O'Laughlin          | FOR501<br>Grad student seminar on Forest Bio-Energy | Sustainable Forest Biomass Production for Renewable Energy and Climate Change Mitigation Invited speakers will cover technology, policy, biomass feedstock availability, and related issues regarding forest management and woody cropping systems.     |
| Judy Parrish                  | GEOL 417/517<br>Paleoclimatology                    | Examination of how climate in the past 600 million years is studied.  |
| Judy Parrish                  | GEOL 407/507<br>Basin analysis                      | The study of how sedimentary basins are formed and what controls the fill. One of the largest influences on basin fill is climate, so this is a critical part of the course.  |
| Judy Parrish                  | GEOL 102<br>Historical Geology                      | The history of the Earth, including climate change.   |
| Brooke Roberts                | PHIL 452/552/ENVS 552<br>Environmental Philosophy   | Environmental responsibility.   |
| Jodi Johnson-Maynard          | SOIL 205<br>The Soil Ecosystem                      | Lectures on soil organic matter and carbon sequestration; touched on in soil and hydrologic cycle lecture.  |
| Craig                         | PSY 317<br>Environmental Psychology                 | Discussing psychological responses to natural disasters and conservation efforts. In addition, the course discusses at some length the ways in which world views (and gender) impact the use of the environment.  |
| Craig                         | PSY 320<br>Social Psychology                        | Includes a chapter on Environmental Psychology and in particular research on effective and ineffective strategies to promote pro-environment behaviors. Includes a chapter on Consumer Behavior in which "green consumers" are addressed in some depth. |
| Adam Sowards                  | HIST 424/524<br>American Environmental History      | Examines the history of human-environment mutual influences over the past few centuries, including political and social movements related to nature.  |
| Jeff Hicke                    | GEOG 100  | Physical Geography, covers introduction to climate change   |
| Jeff Hicke                    | GEOG 310  | Biogeography covers climate change impacts to plant and animal species and their ranges.  |

| FACULTY MEMBER/<br>INSTRUCTOR | COURSE ID/<br>TITLE                      | COURSE DESCRIPTION/<br>RELEVANCE TO CLIMATE CHANGE   |
|-------------------------------|--|--|
| Jeff Hicke                    | GEOG/RNGE 450                            | Global environmental change; a large portion of the class is devoted to climate change.  |
| Jeff Hicke                    | GEOG/ENVS 501                            | Grand Challenges of Environmental Sciences; a portion of the class is devoted to climate change.   |
| Joseph Kuhl                   | PISc 401<br>Plant Growth and Development | Application of physiological principles to the management of plants in agronomic, horticultural, and forest systems. The same physiological principles are applicable to the changing environment related to climate change. |

## APPENDIX C – RESEARCH RELEVANT TO CLIMATE CHANGE



| DEPARTMENT   | FACULTY MEMBER/<br>INSTRUCTOR | RESEARCH ACTIVITIES RELEVANT TO CLIMATE CHANGE   |
|--|-------------------------------|--|
| ARCHITECTURE   | Phillip Mead                  | Health and Design Issues.  |
| HEALTH, PHYSICAL EDUCATION, RECREATION AND DANCE (HPERD) | Goc Karp & Helen Brown        | A number of research projects look at physical activity. For example, Karp and Brown are involved with Safe Routes to Schools. It encourages walking and biking to schools. Not only can it help with physical and mental health but it also would cut down on driving and reduce environmental impact.  |
| RANGELAND ECOLOGY AND MANAGEMENT                         | Lee Vierling                  | Carbon sequestration assessment of Moscow Mountain forests (DOE funded); Forest photosynthesis rate estimation from satellite data (NSF and ARS funded); Carbon and erosion estimates of soils (BLM funded); various other past projects involving climate and carbon sequestration  |
| DEPT. OF FORESTRY PRODUCTS                               | Armando McDonald              | Development of bio-based products from sustainable natural resources and waste streams. These include: bio-energy, liquid bio-fuels, bio-plastics, natural fiber composites, bio-derived chemicals, value added waste management. These research activities help displace fossil fuel derived fuels and materials by substituting with a bio-derived products that helps sequester carbon and reduce the carbon footprint. |

| DEPARTMENT   | FACULTY MEMBER/<br>INSTRUCTOR | RESEARCH ACTIVITIES RELEVANT TO CLIMATE CHANGE  |
|--|-------------------------------|---|
| DEPT. OF FORESTRY<br>RESOURCES                           | Coleman &<br>Page-Dumroese    | Two MS students research projects on Carbon Negative bio-energy systems where the char byproduct is amended to soil as a natural energy extraction that includes carbon capture and storage.<br><br>This research is focused on climate change mitigation.  |
| DEPT. OF FORESTRY<br>RESOURCES                           | Coleman & Gessler             | One MS student and staff scientists are working to define static and dynamic factors that define forest site quality. Dynamic factors can then be used to predict changes in potential forest type and growth potential.<br><br>This research can be used to predict forest responses to climate change.  |
| DEPT. OF GEOLOGICAL<br>SCIENCES                          | Judy Parrish                  | Current projects: Stratigraphy, sedimentation, climate, and paleobotany of the Eocene Chuckanut Basin, western Washington (climate in W WA around 40 million years ago); carbonate spring mounds of the Navajo Sandstone (climate and hydrology about 155 million years ago); lateritic paleosols (ancient soils) in the Columbia River Basalts, Idaho, Oregon, and Washington, and their relationship to climate (climate about 15 million years ago). |
| DEPT. OF PLANT, SOIL<br>AND<br>ENTOMOLOGICAL<br>SCIENCES | Glenn Shewmaker               | Switchgrass variety trial at Kimberly, multi-state with Ceres and Noble Foundation.   |
| DEPT. OF<br>PSYCHOLOGY                                   | Craig                         | The use of nuclear energy and the ways in which persuasive techniques are used effectively to change attitudes.   |
| DEPT. OF<br>PSYCHOLOGY                                   | Craig                         | In addition, I have a pre-post survey design to determine the effectiveness of the PSY 317 Environmental course on changing attitudes on a variety of Environmental Attitude measures. The control group is students who are not in the course over the same time period.   |
| DEPT. OF RANGELAND<br>ECOLOGY AND<br>MANAGEMENT          | Eva Strand                    | I am serving on a committee in the North American Carbon program. This particular committee is synthesizing current knowledge and proposing new research to quantify the impact of woody encroachment in western semiarid rangelands on the global carbon budget.   |

| DEPARTMENT                                    | FACULTY MEMBER/<br>INSTRUCTOR | RESEARCH ACTIVITIES RELEVANT TO CLIMATE CHANGE   |
|---|-------------------------------|--|
| INSTITUTE FOR<br>PACIFIC NORTHWEST<br>STUDIES | Adam Sowards                  | Research of Arctic scientific exploration from a century ago, which includes observations of climate and its relationship to other scientific factors. Also, co-authoring a textbook on North American Environmental History that will incorporate climate influences on human-nature interactions and include recent debates over climate change. |
| DEPT. OF GEOGRAPHY                            | Jeff Hicke                    | Changes in insect outbreaks in response to climate change.   |
| DEPT. OF GEOGRAPHY                            | Jeff Hicke                    | Carbon exchanges between atmosphere and ecosystems.  |
| DEPT. OF GEOGRAPHY                            | Jeff Hicke                    | Changes in Pacific Northwest animal species in response to climate change.   |
| DEPT. OF GEOGRAPHY                            | Jeff Hicke                    | Climate change impacts to mountain ecosystems.   |

**APPENDIX D – OUTREACH RELEVANT TO CLIMATE CHANGE**



The University of Idaho is highly involved in teaching about methods to reduce carbon emissions and curb climate change to the local, state and regional communities through many efforts. The table below reflects both recent and current efforts by department.

| FACULTY MEMBER/<br>INSTRUCTOR | DEPARTMENT               | OUTREACH PROGRAM/<br>PROJECT NAME   | RELEVANCE TO CLIMATE CHANGE  |
|-------------------------------|--------------------------|---|--|
| Thomas F. Hess                | Dept. of Agriculture     | Engineering Capstone Design: Composting project for UI food wastes, dairy wastes, animal mortalities. | Mitigation of food waste to landfill disposal; results in substantial lessening of greenhouse gas emissions (CH <sub>4</sub> ) from anaerobic breakdown in landfill.   |
| Frank Jacobus & Bruce Haglund | Dept. of Architecture    | McCall Field Campus Project   | A series of design studios and design build studios aimed at building a carbon-neutral campus one building at a time. We began in 2006 and still have a decade of work ahead.  |
| Bruce Haglund & Jay McCormick | Dept. of Architecture    | Engineering Innovation Lab Project  | An integrated architecture/engineering design studio aimed at developing a net zero energy building for campus. Students worked with the project architect throughout the semester. Funding is being sought for the building.  |
| Coleman                       | Dept. of Forest Products | Mobile pyrolysis demonstrations.  | Forest slash is currently flared as a nuisance. The portable pyrolyzer takes conversion technology to the slash pile and converts biomass into a liquid crude oil and biochar. Biochar is charcoal (80% carbon), which has thousand-year residence times when applied back to the managed forest site. So this is a "carbon-negative" energy production system that solves forest management problems. Web site is:<br><a href="http://www.fs.fed.us/r6/umpqua/projects/fast-pyrolysis/index.shtml">http://www.fs.fed.us/r6/umpqua/projects/fast-pyrolysis/index.shtml</a> |



| FACULTY MEMBER/<br>INSTRUCTOR | DEPARTMENT  | OUTREACH PROGRAM/<br>PROJECT NAME  | RELEVANCE TO CLIMATE CHANGE  |
|-------------------------------|---|------------------------------------|--|
| Helen Brown                   | Dept. of Health, Physical Ed., Recreation and Dance                       | Safe Routes to School              | Support walking and biking to school and work with 7 local schools to decrease auto use.   |
| Helen Brown                   | Dept. of Health, Physical Ed., Recreation and Dance                       | Sustainability Food Committee      | Support local, organic food in University food system-outcome, lower carbon footprint from food.   |
| Helen Brown                   | Dept. of Health, Physical Ed., Recreation and Dance (HPERD)               | Greening the Curriculum            | Working with HPERD faculty to integrate issues of sustainability into CORE HPERD courses.  |
| Jean McIntire and Bob Kesler  | Dept. of Sociology and Anthropology and UI Student Financial Aid Services | PCEI Van Pool - Lewiston/Moscow    | The Van Pool reduces commuter traffic between Moscow and Lewiston. In one year, this volunteer-driven van saved 4,000 gallons of fuel by reducing vehicle miles traveled of 10 University of Idaho employees. We also have one City of Moscow employee riding the van.   |
| Donn Thill and Josh Peak      | Dept. of Weed Science   | Composting animal and food waste.  | Reduce materials transported to landfill.  |
| Barry Willis                  | Dept. of Engineering  | Linked UI - WSU Classroom (EP 205) | Students and faculty who were driving between Moscow and Pullman to attend jointly offered courses and meetings between the University of Idaho and WSU are now able to view selected meetings and courses in web linked classrooms developed especially for this purpose. Engineering Outreach developed and funded the College of Engineering's classroom (EP205). A similar room was designated for this purpose at WSU. The rooms are linked using excess bandwidth provided to Idaho and WSU by Qwest. The connected rooms will reduce the need for transportation between the campuses, reducing carbon emissions into the atmosphere. |

| FACULTY MEMBER/<br>INSTRUCTOR | DEPARTMENT | OUTREACH PROGRAM/<br>PROJECT NAME | RELEVANCE TO CLIMATE CHANGE   |
|-------------------------------|------------|-----------------------------------|---|
| Cheyney, Charles              | Extension  | Lost Rivers Grazing Academy       | Well-managed irrigated pastures sequester 30% more carbon than annual irrigated crop land and utilize much lower levels of manufactured inputs requiring fuel for manufacture and transportation. Irrigated pastures in the Pacific NW are expected to sequester 33,000 lbs more carbon over their life time than annual irrigated crops. |

## APPENDIX E – UNIVERSITY OF IDAHO CAMPUS BUILDINGS



| SITE | SITE DESCRIPTION    | BLDG NO | DESCRIPTION                        |
|------|---------------------|---------|------------------------------------|
| MOSC | MOSCOW              | 96      | PRITCHARD GALLERY                  |
| MOSC | MOSCOW              | 667     | LETTERS ARTS SOCIAL SCIENCES ANNEX |
| MOSC | MOSCOW              | 686     | TWIN LARCH SANCTUARY               |
| NFAR | MOSCOW - NORTH FARM | 70      | PUMPHOUSE 3                        |
| NFAR | MOSCOW - NORTH FARM | 89      | PUMPHOUSE 4                        |
| NFAR | MOSCOW - NORTH FARM | 92      | MILKING PARLOR                     |
| NFAR | MOSCOW - NORTH FARM | 113     | MANIS ENTOMOLOGY RESEARCH LAB      |
| NFAR | MOSCOW - NORTH FARM | 120     | SHEEP BARN #1                      |
| NFAR | MOSCOW - NORTH FARM | 330     | FARM RESIDENCE - DAIRY             |
| NFAR | MOSCOW - NORTH FARM | 331     | SCALE HOUSE                        |
| NFAR | MOSCOW - NORTH FARM | 332     | MILLING ROOM                       |
| NFAR | MOSCOW - NORTH FARM | 333     | MIXING ROOM                        |
| NFAR | MOSCOW - NORTH FARM | 334     | FEED STORAGE                       |
| NFAR | MOSCOW - NORTH FARM | 335     | CALF BARN                          |
| NFAR | MOSCOW - NORTH FARM | 336     | LOAFING BARN                       |
| NFAR | MOSCOW - NORTH FARM | 337     | DRY COW SHELTER                    |
| NFAR | MOSCOW - NORTH FARM | 338     | HAY SHED                           |
| NFAR | MOSCOW - NORTH FARM | 339     | HEIFER BARN                        |
| NFAR | MOSCOW - NORTH FARM | 340     | COMMODITY BUILDING                 |
| NFAR | MOSCOW - NORTH FARM | 341     | MATERNITY/RESEARCH BARN            |
| NFAR | MOSCOW - NORTH FARM | 342     | FEEDING BARN #1                    |
| NFAR | MOSCOW - NORTH FARM | 343     | FEEDING BARN #2                    |
| NFAR | MOSCOW - NORTH FARM | 344     | FEEDING BARN #3                    |
| NFAR | MOSCOW - NORTH FARM | 345     | UPRIGHT SILO                       |
| NFAR | MOSCOW - NORTH FARM | 346     | DAIRY PUMPHOUSE                    |
| NFAR | MOSCOW - NORTH FARM | 350     | SHEEP SHELTER 301                  |
| NFAR | MOSCOW - NORTH FARM | 351     | SHEEP SHELTER 302                  |

| SITE | SITE DESCRIPTION    | BLDG NO | DESCRIPTION                     |
|------|---------------------|---------|---------------------------------|
| NFAR | MOSCOW - NORTH FARM | 352     | SHEEP SHELTER 304               |
| NFAR | MOSCOW - NORTH FARM | 353     | SHEEP SHELTER 305A              |
| NFAR | MOSCOW - NORTH FARM | 354     | SHEEP SHELTER 306               |
| NFAR | MOSCOW - NORTH FARM | 355     | SHEEP SHELTER 307               |
| NFAR | MOSCOW - NORTH FARM | 356     | SHEEP SHELTER 308               |
| NFAR | MOSCOW - NORTH FARM | 357     | LAMBING BARN                    |
| NFAR | MOSCOW - NORTH FARM | 358     | SHEEP BARN #2                   |
| NFAR | MOSCOW - NORTH FARM | 359     | FARM RESIDENCE - SHEEP          |
| NFAR | MOSCOW - NORTH FARM | 360     | FARM STORAGE BUILDING #3        |
| NFAR | MOSCOW - NORTH FARM | 361     | SHEEP WORKING FACILITY          |
| NFAR | MOSCOW - NORTH FARM | 362     | FUEL STORAGE SCALE HOUSE        |
| NFAR | MOSCOW - NORTH FARM | 363     | MANIS LAB GARAGE                |
| NFAR | MOSCOW - NORTH FARM | 364     | MANIS LAB STORAGE BUILDING      |
| NFAR | MOSCOW - NORTH FARM | 366     | MANIS LAB STORAGE SHED 1        |
| NFAR | MOSCOW - NORTH FARM | 367     | MANIS LAB STORAGE SHED 2        |
| NFAR | MOSCOW - NORTH FARM | 368     | MANIS LAB STORAGE SHED 3        |
| NFAR | MOSCOW - NORTH FARM | 369     | MANIS LAB STORAGE SHED 4        |
| NFAR | MOSCOW - NORTH FARM | 370     | MANIS LAB STORAGE SHED 5        |
| NFAR | MOSCOW - NORTH FARM | 398     | MANIS LAB STORAGE SHED 6        |
| OCAM | MOSCOW - ON CAMPUS  | 1       | ADMINISTRATION BUILDING         |
| OCAM | MOSCOW - ON CAMPUS  | 3       | ART & ARCHITECTURE NORTH        |
| OCAM | MOSCOW - ON CAMPUS  | 4       | ARCHIE PHINNEY HALL (FOCW)      |
| OCAM | MOSCOW - ON CAMPUS  | 5       | FOOD RESEARCH CENTER            |
| OCAM | MOSCOW - ON CAMPUS  | 6       | GRADUATE ART STUDIO (GAS HOUSE) |
| OCAM | MOSCOW - ON CAMPUS  | 7       | CONTINUING EDUCATION BLDG       |
| OCAM | MOSCOW - ON CAMPUS  | 9       | GIBB HALL                       |
| OCAM | MOSCOW - ON CAMPUS  | 10      | ALUMNI CENTER                   |
| OCAM | MOSCOW - ON CAMPUS  | 11      | POWER PLANT                     |
| OCAM | MOSCOW - ON CAMPUS  | 12      | STUDENT HEALTH CENTER           |
| OCAM | MOSCOW - ON CAMPUS  | 14      | MENARD LAW BUILDING             |
| OCAM | MOSCOW - ON CAMPUS  | 15      | MEMORIAL GYM                    |
| OCAM | MOSCOW - ON CAMPUS  | 16      | ART & ARCHITECTURE BUILDING     |
| OCAM | MOSCOW - ON CAMPUS  | 17      | MORRILL HALL                    |
| OCAM | MOSCOW - ON CAMPUS  | 18      | RIDENBAUGH HALL                 |
| OCAM | MOSCOW - ON CAMPUS  | 19      | LIFE SCIENCES SOUTH             |

| SITE | SITE DESCRIPTION   | BLDG NO | DESCRIPTION                       |
|------|--------------------|---------|-----------------------------------|
| OCAM | MOSCOW - ON CAMPUS | 20      | STUDENT UNION & FINANCIAL AID     |
| OCAM | MOSCOW - ON CAMPUS | 21      | CAROL RYRIE BRINK HALL (FOCE)     |
| OCAM | MOSCOW - ON CAMPUS | 22      | ART & ARCHITECTURE SOUTH          |
| OCAM | MOSCOW - ON CAMPUS | 25      | AG SCIENCE (INCLUDING NEW WING)   |
| OCAM | MOSCOW - ON CAMPUS | 26      | HAMPTON MUSIC BUILDING            |
| OCAM | MOSCOW - ON CAMPUS | 28      | JANSSEN ENGR CLASSROOM BLDG       |
| OCAM | MOSCOW - ON CAMPUS | 30      | NICCOLLS HOME ECONOMICS BLDG      |
| OCAM | MOSCOW - ON CAMPUS | 32      | LIBRARY                           |
| OCAM | MOSCOW - ON CAMPUS | 34      | STEEL HOUSE                       |
| OCAM | MOSCOW - ON CAMPUS | 35      | J.W. MARTIN LAB                   |
| OCAM | MOSCOW - ON CAMPUS | 36      | RADIO-TV CENTER                   |
| OCAM | MOSCOW - ON CAMPUS | 38      | MINES BUILDING                    |
| OCAM | MOSCOW - ON CAMPUS | 39      | MCCONNELL HALL                    |
| OCAM | MOSCOW - ON CAMPUS | 41      | SHOUP HALL                        |
| OCAM | MOSCOW - ON CAMPUS | 42      | TARGHEE HALL                      |
| OCAM | MOSCOW - ON CAMPUS | 43      | COLLEGE OF EDUCATION BUILDING     |
| OCAM | MOSCOW - ON CAMPUS | 44      | INDUSTRIAL ARTS BUILDING          |
| OCAM | MOSCOW - ON CAMPUS | 46      | CAMPUS POLICE SUBSTATION          |
| OCAM | MOSCOW - ON CAMPUS | 47      | RENFREW HALL (PHYS SC)            |
| OCAM | MOSCOW - ON CAMPUS | 48      | OFFICE OF DEVELOPMENT             |
| OCAM | MOSCOW - ON CAMPUS | 49      | ENGINEERING ANNEX                 |
| OCAM | MOSCOW - ON CAMPUS | 50      | EXECUTIVE RESIDENCE               |
| OCAM | MOSCOW - ON CAMPUS | 52      | THEOPHILUS TOWER                  |
| OCAM | MOSCOW - ON CAMPUS | 53      | SWIMMING CENTER                   |
| OCAM | MOSCOW - ON CAMPUS | 54      | BUCHANAN ENGINEERING LAB          |
| OCAM | MOSCOW - ON CAMPUS | 55      | COLLEGE OF NATURAL RESOURCES BLDG |
| OCAM | MOSCOW - ON CAMPUS | 56      | PHYSICAL EDUCATION BLDG           |
| OCAM | MOSCOW - ON CAMPUS | 59      | GOLF CART STORAGE SHED            |
| OCAM | MOSCOW - ON CAMPUS | 60      | HUMAN RESOURCES & PURCHASING      |
| OCAM | MOSCOW - ON CAMPUS | 61      | ENVIRONMENTAL HEALTH & SAFETY     |
| OCAM | MOSCOW - ON CAMPUS | 62      | SOUTH HILL COMMUNITY CENTER       |
| OCAM | MOSCOW - ON CAMPUS | 65      | HARTUNG THEATRE                   |
| OCAM | MOSCOW - ON CAMPUS | 66      | PUMPHOUSE 2                       |
| OCAM | MOSCOW - ON CAMPUS | 81      | AQUACULTURE INSTITUTE             |
| OCAM | MOSCOW - ON CAMPUS | 82      | FEED & STORAGE POULTRY 1          |

| SITE | SITE DESCRIPTION   | BLDG NO | DESCRIPTION                         |
|------|--------------------|---------|-------------------------------------|
| OCAM | MOSCOW - ON CAMPUS | 83      | LONGHOUSE                           |
| OCAM | MOSCOW - ON CAMPUS | 84      | CAGE HOUSE                          |
| OCAM | MOSCOW - ON CAMPUS | 85      | ARBORETUM BARN                      |
| OCAM | MOSCOW - ON CAMPUS | 86      | EXP SOLAR LAYING HOUSE POULT 5      |
| OCAM | MOSCOW - ON CAMPUS | 87      | POULTRY-BREEDER                     |
| OCAM | MOSCOW - ON CAMPUS | 88      | ROCK LAB - GEOLOGY                  |
| OCAM | MOSCOW - ON CAMPUS | 90      | AGRICULTURAL PUBLICATIONS           |
| OCAM | MOSCOW - ON CAMPUS | 93      | BUSINESS TECHNOLOGY INCUBATOR       |
| OCAM | MOSCOW - ON CAMPUS | 94      | EARLY CHILDHOOD LRNG CENTER         |
| OCAM | MOSCOW - ON CAMPUS | 97      | IDAHO COMMONS                       |
| OCAM | MOSCOW - ON CAMPUS | 99      | GREENHOUSE (W 6TH STR) 4 UNITS      |
| OCAM | MOSCOW - ON CAMPUS | 100     | GOLF CLUBHOUSE                      |
| OCAM | MOSCOW - ON CAMPUS | 104     | NATIVE AMERICAN/MIGRANT ED CTR      |
| OCAM | MOSCOW - ON CAMPUS | 106     | ART & ARCHITECTURE INTERIOR DESIGN  |
| OCAM | MOSCOW - ON CAMPUS | 107     | NAVY BUILDING                       |
| OCAM | MOSCOW - ON CAMPUS | 110     | MCCLURE HALL                        |
| OCAM | MOSCOW - ON CAMPUS | 111     | ENGINEERING/PHYSICS BLDG            |
| OCAM | MOSCOW - ON CAMPUS | 114     | ASUI-KIBBIE ACTIVITY CENTER         |
| OCAM | MOSCOW - ON CAMPUS | 115     | TRACK STORAGE & RESTROOMS           |
| OCAM | MOSCOW - ON CAMPUS | 116     | WICKS FIELD STORAGE & RESTROOM      |
| OCAM | MOSCOW - ON CAMPUS | 118     | NORTH CAMPUS CENTER                 |
| OCAM | MOSCOW - ON CAMPUS | 119     | GOLF COURSE STORAGE BLDG            |
| OCAM | MOSCOW - WEST FARM | 126     | OBSERVATORY                         |
| OCAM | MOSCOW - ON CAMPUS | 143     | STUDENT RECREATION CENTER           |
| OCAM | MOSCOW - ON CAMPUS | 147     | AG EXTENSION & ED BUILDING          |
| OCAM | MOSCOW - ON CAMPUS | 275     | BOOKSTORE/US POST OFFICE            |
| OCAM | MOSCOW - ON CAMPUS | 403     | UNIVERSITY RECYCLING                |
| OCAM | MOSCOW - ON CAMPUS | 404     | FACILITIES GARAGE                   |
| OCAM | MOSCOW - ON CAMPUS | 405     | LES SMALL ENGINE SHOP               |
| OCAM | MOSCOW - ON CAMPUS | 406     | UNIVERSITY VEHICLE STORAGE          |
| OCAM | MOSCOW - ON CAMPUS | 407     | PUMPHOUSE 9                         |
| OCAM | MOSCOW - ON CAMPUS | 420     | RECYCLING / SURPLUS                 |
| OCAM | MOSCOW - ON CAMPUS | 421     | ART & ARCHITECTURE EAST             |
| OCAM | MOSCOW - ON CAMPUS | 422     | AGRICULTURAL BIOTECHNOLOGY BUILDING |
| OCAM | MOSCOW - ON CAMPUS | 423     | GAUSS-JOHNSON ENGINEERING LAB       |

| SITE | SITE DESCRIPTION   | BLDG NO | DESCRIPTION                       |
|------|--------------------|---------|-----------------------------------|
| OCAM | MOSCOW - ON CAMPUS | 424     | J. A. ALBERTSON                   |
| OCAM | MOSCOW - ON CAMPUS | 500     | SOUTH HILL TERRACE- 418 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 501     | SOUTH HILL TERRACE- 426 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 502     | SOUTH HILL TERRACE- 430 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 503     | SOUTH HILL TERRACE- 458 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 504     | SOUTH HILL TERRACE- 464 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 505     | SOUTH HILL TERRACE- 470 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 506     | SOUTH HILL TERRACE- 486 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 507     | SOUTH HILL TERRACE- 492 TAYLO     |
| OCAM | MOSCOW - ON CAMPUS | 508     | SOUTH HILL APTS - 506 TAYLOR      |
| OCAM | MOSCOW - ON CAMPUS | 509     | SOUTH HILL APTS - 510 TAYLOR      |
| OCAM | MOSCOW - ON CAMPUS | 510     | SOUTH HILL APTS - 528 TAYLOR      |
| OCAM | MOSCOW - ON CAMPUS | 511     | SOUTH HILL APTS - 524 TAYLOR      |
| OCAM | MOSCOW - ON CAMPUS | 512     | SOUTH HILL APTS - 514 TAYLOR      |
| OCAM | MOSCOW - ON CAMPUS | 513     | SOUTH HILL APTS - 518 TAYLOR      |
| OCAM | MOSCOW - ON CAMPUS | 514     | SOUTH HILL APTS - 1020 DEAKIN     |
| OCAM | MOSCOW - ON CAMPUS | 515     | SOUTH HILL APTS - 1011 DEAKIN     |
| OCAM | MOSCOW - ON CAMPUS | 516     | SOUTH HILL APTS - 1012 DEAKIN     |
| OCAM | MOSCOW - ON CAMPUS | 517     | SOUTH HILL APTS - 1016 DEAKIN     |
| OCAM | MOSCOW - ON CAMPUS | 518     | SOUTH HILL APTS - 1010 DEAKIN     |
| OCAM | MOSCOW - ON CAMPUS | 519     | SOUTH HILL APTS - 1006 DEAKIN     |
| OCAM | MOSCOW - ON CAMPUS | 520     | SOUTH HILL APTS - 425 SWEET       |
| OCAM | MOSCOW - ON CAMPUS | 530     | SOUTH HILL VISTA - 301 SWEET      |
| OCAM | MOSCOW - ON CAMPUS | 531     | SOUTH HILL VISTA - 303 SWEET      |
| OCAM | MOSCOW - ON CAMPUS | 532     | SOUTH HILL VISTA - 307 SWEET      |
| OCAM | MOSCOW - ON CAMPUS | 533     | SOUTH HILL VISTA - 311 SWEET      |
| OCAM | MOSCOW - ON CAMPUS | 534     | SOUTH HILL VISTA - 315 SWEET      |
| OCAM | MOSCOW - ON CAMPUS | 535     | SOUTH HILL VISTA - 319 SWEET      |
| OCAM | MOSCOW - ON CAMPUS | 536     | SOUTH HILL VISTA - 380 TAYLOR     |
| OCAM | MOSCOW - ON CAMPUS | 537     | SOUTH HILL VISTA - 374 TAYLOR     |
| OCAM | MOSCOW - ON CAMPUS | 538     | SOUTH HILL VISTA - 354 TAYLOR     |
| OCAM | MOSCOW - ON CAMPUS | 539     | SOUTH HILL VISTA - 350 TAYLOR     |
| OCAM | MOSCOW - ON CAMPUS | 540     | SOUTH HILL VISTA - 342 TAYLOR     |
| OCAM | MOSCOW - ON CAMPUS | 541     | SOUTH HILL VISTA - 334 TAYLOR     |
| OCAM | MOSCOW - ON CAMPUS | 542     | LIVING LEARNING COMMUNITY BLDG #1 |

| SITE | SITE DESCRIPTION     | BLDG NO | DESCRIPTION                         |
|------|----------------------|---------|-------------------------------------|
| OCAM | MOSCOW - ON CAMPUS   | 543     | LIVING LEARNING COMMUNITY BLDG #2   |
| OCAM | MOSCOW - ON CAMPUS   | 544     | LIVING LEARNING COMMUNITY BLDG #3   |
| OCAM | MOSCOW - ON CAMPUS   | 545     | LIVING LEARNING COMMUNITY BLDG #4   |
| OCAM | MOSCOW - ON CAMPUS   | 546     | LIVING LEARNING COMMUNITY BLDG #5   |
| OCAM | MOSCOW - ON CAMPUS   | 547     | LIVING LEARNING COMMUNITY BLDG #6   |
| OCAM | MOSCOW - ON CAMPUS   | 548     | LIVING LEARNING COMMUNITY BLDG #7   |
| OCAM | MOSCOW - ON CAMPUS   | 549     | LIVING LEARNING COMMUNITY BLDG #8   |
| OCAM | MOSCOW - ON CAMPUS   | 550     | WALLACE RESIDENCE- COMMON           |
| OCAM | MOSCOW - ON CAMPUS   | 551     | WALLACE RESIDENCE- STEVENSON        |
| OCAM | MOSCOW - ON CAMPUS   | 552     | WALLACE RESIDENCE- BALLARD          |
| OCAM | MOSCOW - ON CAMPUS   | 553     | WALLACE RESIDENCE- WILLEY           |
| OCAM | MOSCOW - ON CAMPUS   | 554     | WALLACE RESIDENCE- GOODING          |
| OCAM | MOSCOW - ON CAMPUS   | 569     | ELMWOOD APARTMENTS                  |
| OCAM | MOSCOW - ON CAMPUS   | 570     | GRADUATE STDT RESIDENCE             |
| OCAM | MOSCOW - ON CAMPUS   | 678     | TEACHING & LEARNING CENTER          |
| OCAM | MOSCOW - ON CAMPUS   | 680     | POULTRY HILL WAREHOUSE              |
| OCAM | MOSCOW - ON CAMPUS   | 687     | NIATT CCVT STORAGE BUILDING         |
| OCAM | MOSCOW - ON CAMPUS   | 688     | CHEMICAL STORAGE                    |
| OCAM | MOSCOW - ON CAMPUS   | 689     | FACILITIES SERVICES                 |
| OCAM | MOSCOW - ON CAMPUS   | 690     | FACILITIES LATHHOUSE/GREENHOUSE     |
| OCAM | MOSCOW - ON CAMPUS   | 691     | FACILITIES STORAGE                  |
| OCAM | MOSCOW - ON CAMPUS   | 695     | CAMPUS STORAGE #1                   |
| OCAM | MOSCOW - ON CAMPUS   | 771     | RECLAIM WATER CHLORINATION BLD      |
| PARK | MOSCOW - PARKER FARM | 133     | PF--PLANT SCIENCE AGRONOMY SEED ST  |
| PARK | MOSCOW - PARKER FARM | 134     | PF--PLANT SCIENCE GREENHOUSE #1     |
| PARK | MOSCOW - PARKER FARM | 135     | PF--PLANT SCIENCE SEED HOUSE        |
| PARK | MOSCOW - PARKER FARM | 136     | NATURAL RESOURCES MICROPROP. LAB    |
| PARK | MOSCOW - PARKER FARM | 137     | PF--NATURAL RESOURCES GREENHOUSE #1 |
| PARK | MOSCOW - PARKER FARM | 138     | PF--PCF PUMPHOUSE                   |
| PARK | MOSCOW - PARKER FARM | 139     | PF--PLANT SCIENCE FARM HOUSE        |
| PARK | MOSCOW - PARKER FARM | 141     | PF--PLANT SCI AGRONOMY STOR/GARAGE  |
| PARK | MOSCOW - PARKER FARM | 145     | PF--PLANT SCIENCE FARM SHOP         |
| PARK | MOSCOW - PARKER FARM | 146     | PF--PLANT SCIENCE MACHINE SHED      |
| PARK | MOSCOW - PARKER FARM | 347     | NATURAL RESOURCES STOR/COLD STORAGE |
| PARK | MOSCOW - PARKER FARM | 348     | NATURAL RES. MICROPROP. GREENHOUSE  |



| SITE | SITE DESCRIPTION      | BLDG NO | DESCRIPTION                         |
|------|-----------------------|---------|-------------------------------------|
| PARK | MOSCOW - PARKER FARM  | 349     | NATURAL RESOURCES GREENHOUSE #2     |
| PARK | MOSCOW - PARKER FARM  | 371     | NATURAL RESOURCES OFFICE/RES LAB    |
| PARK | MOSCOW - PARKER FARM  | 372     | PF--NATR'L RESOURCES GREENHOUSE #3  |
| PARK | MOSCOW - PARKER FARM  | 373     | PF--PLANT SCIENCE SEED STORAGE      |
| PARK | MOSCOW - PARKER FARM  | 374     | PF--NATURAL RES. VEHICLE COMPOUND   |
| PARK | MOSCOW - PARKER FARM  | 394     | PF--PLANT SCIENCE GREENHOUSE #2     |
| PARK | MOSCOW - PARKER FARM  | 395     | PF--PLANT SCIENCE GREENHOUSE #3     |
| PARK | MOSCOW - PARKER FARM  | 396     | PF--PLANT SCIENCE GREENHOUSE #4     |
| PARK | MOSCOW - PARKER FARM  | 413     | FISH & WILDLIFE STORAGE FACILITY    |
| PARK | MOSCOW - PARKER FARM  | 414     | NATURAL RESOURCES GENERAL STORAGE   |
| SFAR | GENESEEE - SOUTH FARM | 470     | KAMBITSCH FARMHOUSE                 |
| SFAR | GENESEEE - SOUTH FARM | 471     | GARAGE (N)                          |
| SFAR | GENESEEE - SOUTH FARM | 472     | GARAGE (S)                          |
| SFAR | GENESEEE - SOUTH FARM | 474     | PUMPHOUSE                           |
| SFAR | GENESEEE - SOUTH FARM | 571     | GENESEEE PESTICIDE STORAGE          |
| SFAR | GENESEEE - SOUTH FARM | 679     | KAMBITSCH METAL SHOP BUILDING       |
| WFAR | MOSCOW - WEST FARM    | 33      | HOLM CENTER                         |
| WFAR | MOSCOW - WEST FARM    | 58      | ANIMAL PAVILION & MEATS LAB         |
| WFAR | MOSCOW - WEST FARM    | 63      | AQUACULTURE WET LAB                 |
| WFAR | MOSCOW - WEST FARM    | 64      | PUMPHOUSE 5                         |
| WFAR | MOSCOW - WEST FARM    | 72      | FARM RESIDENCE - BEEF               |
| WFAR | MOSCOW - WEST FARM    | 73      | FARM OPERATIONS SHOP                |
| WFAR | MOSCOW - WEST FARM    | 74      | BEEF BARN 1                         |
| WFAR | MOSCOW - WEST FARM    | 75      | BEEF BARN 2                         |
| WFAR | MOSCOW - WEST FARM    | 76      | BEEF SHELTER 212                    |
| WFAR | MOSCOW - WEST FARM    | 77      | BEEF SHELTER 214A / DRY HEIFER SHED |
| WFAR | MOSCOW - WEST FARM    | 78      | FARM STORAGE BUILDING #1            |
| WFAR | MOSCOW - WEST FARM    | 79      | USDA RESEARCH BARN                  |
| WFAR | MOSCOW - WEST FARM    | 80      | FARM STORAGE BUILDING #2            |
| WFAR | MOSCOW - WEST FARM    | 91      | JACOB MONSON MEMORIAL BARN          |
| WFAR | MOSCOW - WEST FARM    | 122     | BEEF BARN 3                         |
| WFAR | MOSCOW - WEST FARM    | 123     | VT. SCI. RESEARCH BARN/CATTLE ISOLA |
| WFAR | MOSCOW - WEST FARM    | 124     | SHAVINGS SHED                       |
| WFAR | MOSCOW - WEST FARM    | 125     | HAZARDOUS MATERIALS STORAGE         |
| WFAR | MOSCOW - WEST FARM    | 129     | BEEF WORKING FACILITY               |

| SITE | SITE DESCRIPTION   | BLDG NO | DESCRIPTION                        |
|------|--------------------|---------|------------------------------------|
| WFAR | MOSCOW - WEST FARM | 130     | METABOLISM/SURGERY BUILDING        |
| WFAR | MOSCOW - WEST FARM | 132     | PESTICIDE STORAGE                  |
| WFAR | MOSCOW - WEST FARM | 144     | IRRIGATION SYSTEM PUMPHOUSE        |
| WFAR | MOSCOW - WEST FARM | 375     | BEEF SHELTER 215                   |
| WFAR | MOSCOW - WEST FARM | 376     | BEEF SHELTER 214B                  |
| WFAR | MOSCOW - WEST FARM | 377     | BEEF SHELTER 216                   |
| WFAR | MOSCOW - WEST FARM | 378     | BEEF SHELTER 213                   |
| WFAR | MOSCOW - WEST FARM | 379     | TRUCK SHED                         |
| WFAR | MOSCOW - WEST FARM | 380     | SEED ROOM                          |
| WFAR | MOSCOW - WEST FARM | 381     | MACHINE SHED                       |
| WFAR | MOSCOW - WEST FARM | 382     | RODEO TEAM HORSE SHELTER #1        |
| WFAR | MOSCOW - WEST FARM | 383     | RODEO TEAM HORSE SHELTER #2        |
| WFAR | MOSCOW - WEST FARM | 384     | ISOLATION BARN                     |
| WFAR | MOSCOW - WEST FARM | 385     | ISOLATION HOUSE #1                 |
| WFAR | MOSCOW - WEST FARM | 386     | ISOLATION HOUSE #2                 |
| WFAR | MOSCOW - WEST FARM | 387     | ISOLATION HOUSE #3                 |
| WFAR | MOSCOW - WEST FARM | 388     | ISOLATION HOUSE #4                 |
| WFAR | MOSCOW - WEST FARM | 389     | MONSON WORKING FACILITY            |
| WFAR | MOSCOW - WEST FARM | 390     | USDA INCINERATOR                   |
| WFAR | MOSCOW - WEST FARM | 391     | USDA SHAVINGS SHED                 |
| WFAR | MOSCOW - WEST FARM | 392     | HORSE SHELTER #2                   |
| WFAR | MOSCOW - WEST FARM | 393     | HORSE SHELTER #1                   |
| WFAR | MOSCOW - WEST FARM | 399     | ANIMAL & VET SCIENCE RESEARCH BARN |
| WFAR | MOSCOW - WEST FARM | 408     | WHITE PINE OFFICE SHED             |
| WFAR | MOSCOW - WEST FARM | 409     | WHITE PINE WORK SHED               |
| WFAR | MOSCOW - WEST FARM | 681     | RADIATION STORAGE BUILDING         |
| WFAR | MOSCOW - WEST FARM | 685     | AVS RESEARCH HAY BARN              |