UROP Project Ideas for Spring 2014
created 1/2014
28 projects, 13 pages

1. Biodiversity Research

Research Description: The island of New Guinea is one of the largest remaining tropical wilderness areas in the world and little is known about its plant, fungal, and insect diversity. We have collected plants, fungi, and insects in New Guinea over many years to describe species new to science and to study genetic diversity. These studies aim to document patterns of biodiversity and understand the ecological and evolutionary processes that lead to the formation of new species. We study the pollination of fig trees by specialized insects as a particular case of coevolution (http://geo.cbs.umn.edu).

UROP Projects: Opportunities for undergraduate research include: (1) the study of plant specimens in the University of Minnesota herbarium (Saint Paul), (2) DNA isolation, gene sequencing, DNA fingerprinting, and phylogenetic or population genetic analysis of plants, fungi, or insects in our laboratory (Saint Paul), (3) experiments with fig trees on display in a rainforest exhibit at the Bell Museum of Natural History (Minneapolis), or (4) digital imaging and databasing to make biodiversity information available on-line (Saint Paul). Beyond tropical rainforest diversity, the latter opportunity could focus on Minnesota flora.

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2. Fungi

Fungi are often classified as microbes, yet the largest organism known on Earth is a wood-degrading root rot fungus in Oregon. It is far larger in diameter than 'Pando' the aspen clone in Utah, it is heavier than an adult blue whale, and it is older than the giant sequoia. Incredibly, we do not fully understand how these fungi metabolize wood, the largest pool of biotic carbon on the planet. Research in Jonathan Schilling's lab is on basic biology of these unique fungi, toward understanding their role in nature and their potential in biotechnology. Our current focus, where an undergraduate student could help, is on the most recently evolved group of wood-degrading fungi - the brown rot fungi. These fungi are not grouped by their evolutionary similarities as a single taxonomic clade (there are at least seven!), but instead are grouped by their effect on wood. Unlike the lignin-targeted strategy of their ancestral white rot fungi, brown rot fungi metabolize wood carbohydrates selectively, without removing significant lignin. We would like to know what underlying physiology led to this ability to circumvent lignin and leads to this similar consequence among such distinct brown rot clades. A UROP project could focus on similarities as well as distinctions among these clades and their effects on wood.

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3. Snow Leopard Summer UROP student
I would like an undergraduate UROP student to participate in a snow leopard occupancy survey in Mongolia. The research will be a part of a citizen participation project to determine current distribution of snow leopards in western Mongolia. The UROP researcher will help train rural sheep, goat and camel herdsmen to use GPS and to record observations and photographic records of snow leopard scrapes and kills. Next summer the project will be centered in the western Gobi Desert. The UROP student will travel with a small team to help instruct rural herdsmen at a series of workshops. After the initial training the team will return to each training locality twice (after 30 days and 60 days). These follow up visits will be to review the data obtained over the previous month and to visit a sample of the sites where snow leopard sign was observed.

After all the participating herdsmen are visited twice, the team will return to Ulaanbaatar to analyze occupancy data and to write a preliminary report that will be used to guide occupancy surveys over the next year. The participating UMN student needs a basic understanding of GIS and preferably will have had either Todd Arnold’s population analysis class or James Forester’s Habitats class. The appropriate time period for this UROP is from early June until the end of July 2014. A student may be able to petition for this project to serve as an alternative for the summer course at Cloquet Biological Station. Students will need to be physically fit and be able to eat the food provided by the Mongolian field team, which given the dry desert conditions will consist of mostly meat and dairy products.

Contact: James L. David Smith, smith017@umn.edu

4. Investigating season extension for organic strawberry production in the Midwest.

Our Project is in the second year of investigating season extension for organic strawberry production in the Midwest. We’re combining new cultivars with different cultural practices, and investigating which combination(s) may be commercially viable. Research includes yield/flower cluster/runner/labor analysis, berry firmness, and possibly other side project including soil health analysis and taste analysis.

Contact: Emily Hoover, hoove001@umn.edu

5. Air pollution measurements and educational outreach

We have an opportunity in our group to build an automated air pollution measurement micro-station. The station will monitor ambient pollutant concentrations and display them in real time on the web. This display will be used to help elementary students learn about weather, air pollution and climate at a local school. As part of this research project, the student will increase their laboratory experience, learn about environmental measurements, and gain some programming skills.

Contact: Dylan Millet, dbm@umn.edu, www.atmoschem.umn.edu

6. Evaluation of the Antimicrobial properties of >100 types of Chili Peppers

Around the world, chili peppers are added to foods to prolong spoilage, and the ancient Mayans used ground chili peppers and chili pepper plant leaves in 100’s of medical remedies to treat human illnesses. Some research has been done testing a handful of chili peppers available in grocery stores for their antimicrobial properties, but 1,000s of types of chili peppers remain untested including the hottest in the world. Professor David Baumler in the Department of Food Science and Nutrition seeks talented undergraduate students to test exotic and rare chili peppers from all over the world for their antimicrobial properties against numerous foodborne microbial pathogens such as Salmonella, E. coli, Listeria, Bacillus, and Clostridia spp.
The Baumler Lab (www.baumlerlab.com) has over 100 types of chili peppers and 130 types of chili pepper leaves ready for examination including the hottest 6 varieties in the world such as the Bhut Jolokia (Ghost Pepper), Trinidad Scorpion, Trinidad Douglah, Trinidad 7-pot, Trinidad Scorpion Moruga, and the Carolina Reaper. Initial work will involve these types of chili peppers, and we are also interested in testing the most effective chili pepper types throughout the growing cycle to determine when the peppers or leaves are most useful. We have all of the world’s hottest, most colorful, sweetest, and ancestral peppers in our lab, and are looking for undergraduate students to embark on this innovative project.

If you are interested in working on a UROP proposal to work on this project, please contact Dr. David Baumler at dbaumler@umn.edu or call Dr. Baumler at (608)-320-4171

7. Improving Pine Regeneration by Reducing Deer Damage

Pines have long been important tree species in Minnesota’s forests. The amount of young pine on the landscape has dropped substantially over the last 30 years. Young pine stands were once much more common because of good natural pine regeneration after forest fires and lower deer populations. Today, regeneration of pines in Minnesota is far less than what it was 20 and 30 years ago. Statewide forest inventories suggest that the number of acres of pine stands in the 0 to 5-year age class is less 1/3 the area in this age class in 1990. Pines are expensive to regenerate, with deer browsing a major problem, especially for white pine.

Areas around and including the forest at the North Central Research and Outreach Center (NCROC) in Grand Rapids have consistently had large deer populations. This helps make the center a good location for studying strategies for controlling deer browsing. NCROC has implemented several white pine reforestation trials in recent years. A UROP student could help identify, compare and evaluate the success of recent deer browsing trials. Results may help refine recommendations regarding deer control strategies and possible directions for future research on deer control. Improved cost effective control strategies could help individual forest landowners as well as society in general; sustaining pine in Minnesota’s forests is a generally accepted long-term management goal for most ecological land types in northern Minnesota.

Howard Hoganson
Professor, Forest Management
Department of Forest Resources
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Grand Rapids, MN 55744

I am seeking an undergraduate student who is interested in learning about the programs and policies that target the state’s 200,000 private forest landowners. To this end, the student will assist me and Minnesota Forest Resources Council staff in developing a private forest management policy reference guide. This reference guide will describe and provide points of contact for additional information on the laws, regulations, financial assistance and property tax programs, and best management practices that are generally applicable to the state’s private forest landowners. The student will be expected to review federal and state statutes, administrative rules, local zoning ordinances, agency policy documents, reports, and websites; prepare concise summaries of relevant laws, rules, local ordinances, and policies affecting the management and use of Minnesota’s private forest land; conceptualize the format and content of the reference guide; and help draft the reference guide.

Interested applicants should contact:

Michael Kilgore
Professor
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9. xNicotunia: CAN YOU MAKE THIS INTERGENERIC HYBRID?

The famous flower breeder, Luther Burbank, once made this cross between a flowering tobacco species and a petunia. The flower breeding lab has research interests in recreating this lost hybrid to determine it potential as a new flower crop. Greenhouse and laboratory research would involve pollination/reproductive biology, embryo rescue in tissue culture, fertility assessments, and other techniques necessary to make wide crosses between plant genera.

Contact: Professor Neil Anderson, Flower Breeding & Genetics, Dept. of Horticultural Science, ander044@umn.edu

10. ASSESSING SEED PRODUCTION IN PYRETHRUM

Chrysanthemum cinerariifolium, Pyrethrum, is a source of a naturally occurring chemical compound used to control greenhouse insects, deer ticks (for Lyme disease avoidance), and bed bugs. The flower breeding program is breeding the crop to increase seed, flower and pyrethrum production. Research for this UROP would involve pollination and reproductive biology experiments to characterize self incompatibility and cross compatibility to maximize seed set across various populations.

Contact: Professor Neil Anderson, Flower Breeding & Genetics, Dept. of Horticultural Science, ander044@umn.edu
11. Project Title: Mapping Quantitative Trait Loci (QTL) for Fusarium Headblight resistance in barley

Research Description: Fusarium head blight (FHB) is one of the most devastating diseases affecting wheat and barley and caused over $3 billion in economic losses to growers over the past 15 years in North America. Losses occur due to yield reductions and also discoloration of the grain caused by the fungus *Fusarium graminearum*. However, another major factor driving economic loss is the presence of mycotoxins such as deoxynivalenol (DON), which make the grain unsuitable for malting/brewing, feed, and food end-uses. Genetic resistance to this disease is the most economical and environmentally friendly method of control; however, genetic resistance is quantitative in nature with individual loci contributing relatively small effects to disease resistance. Diverse germplasm, including wild barley accessions, have been found to show exceptional levels of resistance to FHB. Using two of these unique barley lines, we have developed two populations to genetically map loci that contribute to lower disease severity and reduced DON accumulation. These populations have been genotyped with single nucleotide polymorphism (SNP) markers. The marker and disease data are used to find statistical correlations between specific genetic markers and disease resistance in a process called QTL mapping.

UROP Project: One UROP position is available for work during the summer of 2014. The UROP student will assist with the maintenance of field plots, inoculations of the disease nurseries, and collection of data (assessments of disease as well as various agronomic traits such as heading date, plant height, and spike density). The student will learn how to utilize the disease severity data taken in the field for identifying QTL associated with lower FHB severity and reduced DON accumulation by aid of computer programs and also the process of making superior selections for breeding barley. Research for this project will be based primarily in the field and also in the laboratory using advanced computer programs for QTL mapping.

Contact: Brian Steffenson, Department of Plant Pathology, bsteffen@umn.edu or 612-625-4735.

12. GRAIN BIOPOLYMER RESEARCH

Research Description: Intermediate wheatgrass (IWG) (*Thinopyrum intermedium*) is a perennial crop, whose development as environmentally sound alternative crop for marginal lands has received recent attention amongst agronomists, plant breeders and environmentalists. IWG is well-known to possess resistance to various diseases of common wheat (*Triticum aestivum*), and many desirable agronomic traits, such as high biomass, and drought and frost resistance. The compositional attributes of IWG - high protein and fiber content - make this crop nutritionally attractive. However, the potential use of this crop in the production of baked goods is still unknown and challenging.

What this research is about: Investigating the effects of IWG-enrichment (at various enrichment levels) on the rheological properties of wheat dough and understanding the relation between rheological properties and protein-protein interactions in IWG-enriched wheat dough.

UROP project: 1) Rheological characterization of IWG-wheat blends by conventional (Farinograph) and innovative (GlutopPeak) approaches. 2) Covalent interactions in IWGenriched doughs.

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13. GRAIN POLYMER RESEARCH

**Research Description:** Starch is a biopolymer made up of anhydroglucose units. Starch granules from different botanical sources vary from molecular organization and composition. Its unique molecular structure makes it an important functional ingredient in many food products and many industrial applications. Regular starches contain two principal types of glucan polymers, namely amylose and amylopectin. These polymers primarily differ in molecular size and degree of branching. Starch remains a subject of scientific interest because of the structural complexity; the importance of starch in our diet; and its impact on glycemic index. More importantly, the interplay among these aspects is still not clearly understood.

**What this research is about:** Understanding starch granule architecture and relating the architectural makeup of starch to its functional behavior in multi-component food systems and their consequent impact on human health.

We seek UROP students to work on one of the following projects:

1) Fractionation of glucan polymers (amylose, amylopectin) from mutant maize starches and molecular characterization by gel permeation chromatography (GPC) and high performance anion exchange chromatography (HPAEC).
2) Fractionation of amylose and amylopectin from pulse starches (Velvet Bean, Lablab Bean, Faba bean Black Bean) and molecular characterization by GPC, HPAEC and other lab techniques.
3) Chemical gelatinization and linternerization (acid hydrolysis) of starch granules from different botanical sources to reveal the internal structure of starch
4) Molecular and structural characterization of green house light controlled barley starches

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14. GRAIN BIOPOLYMER RESEARCH

**Research Description:** Starch is a principal source of energy in human diet. How starch is digested has been related to diabetes, prediabetes, cardiovascular disease, and obesity. The relationship between starch molecular structure and evolution of structures during starch digestion is not yet well understood. The knowledge about the nature of branching pattern of glucan chains and the role of biosynthetic enzymes involved in the synthesis of starch granule will help to understand and modulate starch digestion and colonic fermentation. *Brachypodium distachyon* is a model plant for temperate cereals and the first species of the grass subfamily Pooideae with a sequenced genome. This functional genomic model can be used to determine gene function (biological traits for starch biosynthesis) and to study the starch granule development.

**What this research is about:** Understanding the granular architecture of *Brachypodium* starch
**UROP project:** Isolation of starch granules from *Brachypodium* grain, fractionation of glucan polymers (amylose, amylopectin) and molecular and structural characterization by gel permeation chromatography (GPC), high performance anion exchange chromatography (HPAEC), and microscopy

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**15. Soybean Breeding and Genetics project:**

Project would entail phenotyping, (taking measurements) of soybean plants growing in the greenhouse for reaction to Sudden Death Syndrome (SDS). This data along with molecular data will be analyzed to identify quantative trait loci (QTL's) associated with SDS. The phenotyping involves inoculating soybean plants and then taking data about three weeks later.

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**16. Fisheries Research**

Research Description: The number and size of reservoirs has been increasing globally since the 1700s. Today these impoundments are created for a variety of human uses including electricity generation, crop irrigation, and boat navigation. Water level management in reservoirs is important for walleye and other species that spawn in shallow areas that are sensitive to water level changes. In order to manage water levels to the benefit of walleye and other fish, the timing and depth of spawning activity must be well understood.

UROP Projects: Opportunities for undergraduate research include: (1) sampling eggs within known spawning habitat at varying depths to create a model of egg density for lacustrine spawning walleye; (2) comparing the timing of this spawning activity to the established literature and predictions of existing bioenergetics models; (3) utilizing spawning data from previous years to validate existing models of spawning activity. These efforts will require extensive travel and field work within the Namakan Reservoir located in Voyageurs National Park. Applicants will need to be flexible with the timing of their project because walleye spawning is partially dependent on spring climate conditions; however, spawning activity typically occurs during the month of May and continues for 2-4 weeks. The field work itself is demanding and requires surveying littoral habitats in cold-water conditions in both waders and wetsuits. Meals and accommodations will be provided during the field season.

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17. Invasive Species Project

Largemouth and smallmouth bass are invasive species in many areas of the United States and Canada, and in other countries throughout the world. These invasive bass threaten populations of native fishes through predation and competition. Few methods for bass control have been tested, and attempts to reduce population abundance through adult removal are often unsuccessful. Simple population models suggest that methods that target young bass (for example, by inducing nest failure) could be very effective, but this method needs to be tested in the field.

UROP Ideas:

Opportunities for undergraduate researcher stem from an ongoing field experiment that is evaluating induced nest failure as a strategy for controlling invasive bass. Potential projects include:

1. Determining how often bass re-spawn after their nests have failed
2. Relating spawning, hatching, and early development to thermal experience
3. Relating intensity of nest defense to bass size, nest size/health

This work will take place during the second half of May and most of June (exact timing dependent on timing of bass spawning) in lakes throughout Minnesota. The research requires travel, cold-water snorkeling in a wetsuit, operating a boat, and some heavy lifting. Applicants should have flexible schedules, be willing to learn, excited to work in the outdoors, well-organized, and ideally have some fisheries or aquatics background. Travel, food, and lodging will be provided while working in lakes outside of the metro area (June).

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18. Natural and Environmentally-Friendly Approaches for Microbiological Safety of Poultry Foods

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Abstract:
Foodborne outbreaks are a major public health concern in the United States and worldwide. The outbreaks result in human infections caused by pathogenic microorganisms, including bacteria (1). Some of the major bacterial species associated with foodborne infections include Salmonella, Escherichia coli, and Campylobacter (1). These organisms could be present in/on foods such as meat, eggs, fruits, vegetables, and beverages. Among various foods linked to foodborne outbreaks, consumption of contaminated poultry meat and eggs results in significantly higher illness rates (2); researchers are exploring methods to control and/or reduce the aforementioned pathogens associated with poultry and poultry products.

My research focuses on controlling poultry-associated bacteria of significance to human health, including Salmonella and Campylobacter, using natural and environmentally-friendly approach. This involves identification and application of plant-derived antimicrobial compounds to inactivate Salmonella and Campylobacter in poultry and poultry products. This will be accomplished by methods such as in vitro testing (using classical dilution and culturing techniques, cell culture, and/or targeted gene expression profiling), ex vivo standardization (using tissues and organs, and secretions and excretions), and in vivo (live bird) validation. Students will be presented with opportunities in any one or more of the three avenues depending on their time commitment and interest. Once a
project is initiated, the student will be trained in research procedures, including interpreting relevant literature and statistical designs, performing basic or applied experiments, presenting data in conferences, and publishing in peer-reviewed journals. The knowledge gained is expected to improve the scientific efforts to reduce foodborne infections associated with poultry and poultry products, thereby improving human health.

References


19. Title: The use of biochar as an agricultural biofilter material

A number of previous studies have tried to use biofilter materials that were readily available waste materials, such as wood chips, corn cobs, wheat straw and corn stover. However, observations have also been made that chemical modification, like pH adjustment, as well as the chemical alterations of biomass can lead to phenomenal increases in sorption capacities when compared to the unmodified starting material. The goal of this proposed research project is to investigate biomass materials as a potential feedstock for the development of an improved biochar based media for remediating agricultural impacted waters. The research will be focused on biochar material screening. Our overall purpose in this initial phase is to develop an improved material for sorption of N and P from agricultural impacted waters, which could be implemented in a field biofilter. However, this is a complex process. As much as we would like to jump forward to the field scale use, fundamental data and understanding of the interactions involved in removal reactions is needed to properly optimize the capacity of any remediation implementation, particularly in our northern Minnesota climate.

For further information, please contact Kurt Spokas (kspokas@umn.edu or kurt.spokas@ars.usda.gov).

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20. Conservation of Bumblebees by Understanding Systemic Insecticides

Honey bees, bumblebees, and other native bees pollinate 30% of the plants that produce the vegetables, fruits, and nuts that we consume and more than 100 crops in North America require pollinators. The neonicotinyl insecticides, imidacloprid, thiamethoxam, clothianidin, and dinotefuran, were implicated in the decline of bees as they accumulate in pollen and nectar, are systemic, and are expressed for years from a single application. Most genetically modified crops (corn, canola, and soybeans) use seed treatments of imidacloprid (Gaucho), clothianidin (Poncho), or thiamethoxam (Crusier). In the U.S., at least 143 million acres of the total 442 million acres of cropland are treated with over 2 million pounds of imidacloprid, clothianidin, and thiamethoxam. Neonicotinyl insecticides are neurotoxins that affect mechanosensory stimuli, vision, olfaction, learning, and memory. Additionally, neonicotinoids bind to mushroom bodies in bee brains which are particularly large in social bees
compared to other insects, comprising over 40% of the neurons in the honeybee brains and less than 4% in *Drosophila* brains.

Landscape applications of imidacloprid result in much higher levels of residue in nectar and pollen. A homeowner’s formulation of imidacloprid, Bayer Advanced Tree and Shrub, or professional Marathon 1% G permits 270-300 mg to be applied to a 3 gallon pot, resulting in a 400 times higher application rate compared to Gaucho treated corn of 0.675 mg/seed. A soil injection around *Eucalyptus* trees resulted in 660 ppb imidacloprid in nectar. Turf and white clover treated with clothianidin resulted in residues of 171 ppb in clover nectar. Colonies of *B. impatiens* did not avoid foraging on treated clover and showed reduced foraging activity and increased worker mortality in the hives within five days. Colonies showed a trend for fewer workers and males, no queen production, reduced number of wax pots, and reduced colony weight compared to controls. Thus, the potential for neonicotinyl insecticides to impact bee health through chronic exposure may be currently underestimated as residue levels in agricultural and landscape plants are higher than reported for seed treatments.

We will perform research in the greenhouse on the effects of neonicotinyl insecticides in hanging baskets on bumblebee foraging and health.

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21. MARKET RESEARCH: CONSUMER PREFERENCES FOR THERMALLY MODIFIED WOOD

This project idea is well suited for a student interested in Marketing of Biobased Products, or Marketing in general. The product in question is Thermally-Modified-Wood (TMW). TMW is wood that has been exposed to very high temperatures, thus changing the chemical properties of the material and making wood more dimensionally stable and less prone to biological attack. Potential applications are outdoor-furniture, windows, decking, saunas, and others. This product is very successful in Europe but has very little adoption yet in the U.S. Market research is needed to inform entrepreneurs and potential buyers. The research proposed here consists in doing a perceptions study among potential users of TMW. There is more than one potential method to accomplish this, one is to ask study participants to evaluate treated and untreated samples of domestic wood species on several attributes, such as color, appearance, "feel," etc. Another is to conduct a web-survey, where high resolution pictures are shown. Data analysis may include Conjoint Analysis or simple Statistical Inference tests. Skills needed are just basic use of spreadsheet software, and interest in learning market research tools.

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22. TESTING THE MECHANICAL PROPERTIES OF THERMALLY MODIFIED WOOD

This project is well suited for a student interested in Testing of Mechanical Properties of Biobased Products. The product in question is Thermally-Modified-Wood (TMW). TMW is wood that has been exposed to very high temperatures, thus changing its chemical properties and making wood more dimensionally stable and less prone to biological attack. Potential applications are outdoor-furniture, windows, decking, saunas, and others. While this product is very successful in Europe, there is very little adoption in the U.S. One concern in TMW is that high temperatures negatively affect the material’s strength. Research is needed about the mechanical properties of treated material, especially for local/domestic species. In this research, the UROP researcher will test treated and control specimens for mechanical and other properties (i.e., bending strength), according to ASTM standards. The
Kaufert Lab has the necessary equipment to conduct these tests. ALTERNATIVELY, STUDENTS INTERESTED IN RESEARCHING OTHER PROPERTIES OR USING OTHER LAB METHODS, CAN WRITE PROPOSAL TO TEST FOR EXAMPLE, RESISTANCE TO BIOLOGICAL ATTACK (bio-degradability), MACHINABILITY (behavior under cutting tools), GLUING PROPERTIES, FINISHING PROPERTIES.

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23. ENERGY PROFILE OF MINNESOTA INDUSTRIES
This research is suited for students with interest in industrial energy and particularly renewable energy. The research’s purpose is to have a comprehensive profile of Minnesota industries’ use and generation of energy, with particular emphasis on renewable energy. Other items to investigate are current policies/incentives and energy projects. Methods may include researching secondary sources of information, such as the Energy Information Administration, and interview with experts. The UROP researcher will benchmark the state industry’s performance against other states or regions, and also with other countries. The student may decide on the scope of the project, to consider only one industry (e.g., forest products industries) or the entire manufacturing sector.

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24. INTERACTIVE DATABASE OF MINNESOTA FOREST PRODUCTS INDUSTRIES
This project has the objective of providing the forest products industry of Minnesota and its stakeholders with a tool to locate, identify, and classify companies in the sector. Similar efforts have been carried out in other industries (see for example the bioproducts companies map by the BioBusiness Alliance http://www.biobusinessalliance.org/biomap.asp; or the primary forest products map in the South at http://www.forestproductslocator.org/). The map developed is a useful tool for customers to identify and locate wood product companies. Other users are consulting firms, researchers, students, and the public in general. Desirable skills are knowledge of mapping software, such as Google Maps, or ArcGIS.

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25. TESTING THE ACCURACY OF ELECTRIC MOISTURE METERS
One of the most important physical property of biobased materials is moisture content (MC); it affects a number of other properties, such as mechanical strength, resistance to biological attack, and dimensional stability. In the case of forest biomaterials, while the gold standard to determine MC is the “oven-drying” method (ASTM D 4442 – 07), it takes 24 hours, which is a long time in an industrial setting. In response to this, moisture meters have been developed based on the relationship between electrical properties of wood and MC; and are widely used in industry.
However, these meters need to be corrected for both species and temperature, and have a working range outside of which they tend to provide inaccurate readings. In this research, the UROP researcher will test the accuracy of electric moisture meters for different levels of moisture content and wood species. Samples will be placed under controlled conditions of temperature and relative humidity so they attain a desired MC, and then measured using both the oven-drying method and electric MC meters. The differences will be recorded and the accuracy of these meters evaluated.

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26. IMPROVEMENT OF DRYING PROCESSES IN BIOBASED PRODUCTS MANUFACTURING

This research is aimed at students interested in biobased products drying, and doing extensive lab work. These occur in various biobased industrial processes and are a critical component in energy use; thus improvements in drying time or quality can have huge impacts on the environmental performance of industries and on their bottom line. “Kerfing” is a treatment developed to improve the lumber drying process. It has shown to reduce the drying time considerably. However, results have been inconclusive on the treatment’s ability reduce the occurrence of warp, a big problem in structural lumber. Research is needed to evaluate if kerfing significantly reduces warp. The UROP researcher will, following a literature review, decide on an experiment design to test several treatments levels, perform drying tests using the dry kilns at the Kaufert Lab building, and assess the performance of the treatment on different quality attributes.

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27. BioCON (Biodiversity, CO2, and Nitrogen), is an ecological experiment started in 1997 at Cedar Creek Ecosystem Science Reserve in central Minnesota. Its purpose is to explore the ways in which plant communities respond to three major environmental changes: increasing nitrogen deposition, increasing atmospheric carbon dioxide, and decreasing biodiversity. In 2007, water manipulation was added to a subset of plots within the original experiment planted with 9 prairie species. Warming manipulation (2°C) was added to these same plots in 2012, resulting in a CO2 x N x water x temperature factorial experiment (WWCON). The WWCON experiment was designed to determine the direct and interactive effects of these four factors on a suite of responses including plant physiology, NPP, and phenology.

Phenology represents a particularly sensitive ecological response to warming (Inouye et al. 2000; Parmesan & Yohe 2003; Root et al. 2003; Parmesan 2006). In grasslands, the most common phenological response to warming is alteration of onset and duration of flowering (Sherry et al. 2007; Cleland et al. 2006; Hovenden et al. 2008c; Bloor et al. 2010); however, there is also evidence of earlier start of the growing season (Bloor et al. 2010). Fall responses are less pronounced with some evidence of enhanced C4 grass production in fall (Sherry et al. 2008) and earlier senescence (Zavaleta et al. 2003). The interactive effects of warming, CO2, N supply, and water are less clear.

This project will focus on tracking plant phenology throughout the growing season in the WWCON plots to assess warming-induced changes. The student will be measuring reflectance weekly in these plots to track seasonal
changes in leaf area, productivity and plant function. To examine effects of individual species, the student will also census emergence, reproductive phenology, and senescence for a subset of individuals of each species in each plot. Plots will be monitored weekly throughout the growing season.

Rebecca Montgomery (rebeccam@umn.edu) will be the faculty mentor.

Kally Worm (wormx004@umn.edu, 763-434-5131) is the project coordinator.

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28. **Insect Ecology:**

The Urban and Stored product pest lab conducts basic and applied research on insects that infest peoples’ homes and commercial structures that manufacture, sell or serve food. We use a combination of insect behavior, chemistry, physiology to study how these pests take advantage of opportunity to infest structures. Some of the pests we study have a major impact on peoples’ lives and may cause large economic losses when food becomes infested. Such pests include: bed bugs, cockroaches, warehouse beetles, and Indianmeal moths.

Two projects are currently available. One particular project of immediate interest is a study of how insect behavior changes when they are exposed to insecticides, but before the insect dies. Another possible project will study the characteristics of exposure to certain insecticides and quantifying the amount of insecticide that an insect will pick up as they move. In addition to experience in the research process, students will have access to new analytical procedures and equipment used to assess animal behavior, as well as chemical extraction and quantitation techniques. Developing project methods in combination with use of video and / or chromatography equipment will provide the student an appreciation as to how instrumentation fits into the scientific process.

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*document posted online 1/15/2014*