In October 2009, Dr. Han-Sup Han and Dr. Morgan Varner completed the first phase of the study “The effects of mechanical mastication intensity on treatment cost and fuelbed and vegetation response.” They established three treatments (high intensity mastication, low intensity mastication and no-mastication control), replicating each treatment three times across a six-acre site along Car Road at the L.W. Schatz Demonstration Tree Farm.

Mastication involves grinding and shredding potential wildfire fuels, such as standing small trees and downed woody material, and compacting these on the ground (the “fuelbed”). According to Drs. Han and Varner, mastication can create corridors that help “reduce local fire intensity, prevent crown ignition, halt canopy fire spread, and restore ecosystem processes.” Fire managers are ever more frequently using mastication to reduce fire hazard, particularly along the wildland-urban interface (WUI), where traditional fuel management techniques, such as prescribed burning and biomass extraction, are undesirable or not viable.

Despite the increasing popularity of mastication, not much is known about how it impacts fire behavior over time, how masticated materials burn, or how cost effective mastication is, particularly when using small equipment. Drs. Han and Varner are looking to fill this information gap by implementing a range of mastication treatments at the Tree Farm and monitoring the sites for several years. The overarching objective of their study...
Research projects in 2009

Mastication review

Sudden oak death/fire study
Graduate student Howard Kuljian and Dr. Morgan Varner completed research into how sudden oak death affects the crown fire behavior of tanoaks. This study used a healthy tanoak stand at the Tree Farm as a control plot for comparison to an infected tanoak stand in southern Humboldt County (at CalFire’s Eel River Camp near Redway). In December, the journal Forest Ecology and Management accepted a paper describing this research. [Reference: Kuljian, H., and J.M. Varner. 2010. The effects of sudden oak death on foliar moisture content and crown fire potential in tanoak. Forest Ecology and Management 259(10): 2103–2110. doi:10.1016/j.foreco.2010.02.022.]

Biomass/carbon measurement study
Graduate student Ryan Coltrin and Dr. Chris Edgar completed a biomass/carbon measurement study in 2009. During this third and final year of the project, they developed a biomass equation for bay-laurel and an assessment of California Climate Action Registry protocols for measuring forest carbon. In the analysis they used data collected on the Tree Farm in 2007 and 2008, mainly the biomass of 14 bay-laurel trees and an inventory of 65 permanent plots. Bay-laurel is an abundant species for which no mensurational work has been done. The figure below, from Mr. Coltrin’s M.S. thesis, shows the relationship between biomass and diameter at breast height (dbh) of the 14 trees sampled at the Tree Farm. This is the only known figure and equation that predicts bay-laurel biomass and as such is an important contribution in the areas of carbon accounting and woody biomass assessments. Mr. Coltrin successfully defended his M.S. thesis, “Biomass quantification of
Summer operations and maintenance in 2009

Tyler Hulquist and Cody Wright comprised the 2009 summer maintenance crew. Projects they and Gordon Schatz, Tree Farm Manager, worked on:

Tree Farm building
- Replaced old copier, which was a fire hazard.
- Mowed lawns and outer areas to reduce fire hazard.
- Cleaned up inside the building and shop.
- Cleaned gutters and swept walkways.
- Maintained small equipment.
- Took saws and other mechanical equipment to Miller Farms for yearly maintenance.
- Tuned up and sharpened the mower.
- Cancelled the Internet connection in the office, eliminating an underused service.
- Set the weather station to feed data into the computer in the office.

Tree Farm acreage
- Opened and maintained the trail system; cleared poisonoak.
- Established trail locations with a Trimble GPS device.
- Removed brush and pruned trees along roadsides, improving visibility at road corners.
- Filled potholes on roads with rock.
- Cleared culvert inlets and areas around them.

Research projects
- Assisted with mechanical site preparation for the “Tree Farm bio-energy pilot study: Planting five tree species in a replicated test plot.” (Tree Farm summer crew employee Cody Wright.)

Other projects in 2009

Tree Farm as outdoor classroom
Forestry and Wildland Resources faculty members used the Tree Farm as a hands-on learning environment for courses such as The Forest Environment (FOR 116), Wildland Fuels Management (FOR 423), Silviculture (FOR 432), and Forest Restoration (FOR 431). For example:
- The Forest Environment (FOR 116): In October 2009, Dr. Fei Pan brought FOR116 students to the site for the project “Tree Farm bio-energy pilot study: Planting five tree species in a replicated test plot.” The students assessed the experiment for survival and growth.
- Silviculture (FOR 432): Dr. Pascal Berrill spent one full Saturday with his students in both spring semester 2009 and fall semester 2009 on the site for the project “Tree Farm bio-energy pilot study: Planting five tree species in a replicated test plot.” In spring, they established the first replicate; in fall, they planted the second replicate and also replanted where mortality had made gaps in the Year 1 portion of the site. Students gained experience with planting spades and an auger, establishing bare-rooted and containerized stock.

Forestry senior term (“capstone”) project
- Forestry students Mark Isaak, Will Livsey and Cody Wright conducted a field day for students at the Tree Farm on Saturday, October 24. They led a forestry-based educational hike centered on the Stewardship area of the Tree Farm and demonstrated forestry techniques and equipment. The broader goal of their project was to set the foundation for future outreach programs based out of the Tree Farm.
Mastication study

Continued from page 1

is to more fully understand how well small-scale mechanical masticators manage fuels on fire-prone forestlands. Specific goals from a forest operations standpoint are to evaluate machine operational efficiency, treatment cost per acre, and work sampling techniques. From a fuels management perspective, specific goals are to evaluate future fuelbed dynamics and the effects of operator intensity (effort per acre) on vegetation recovery.

Because mastication may be a viable option for reducing fuel loads along the WUI, the study site will provide demonstration and learning opportunities for landowners and land managers considering mechanical mastication as a way to reduce fire hazard. The study site will also serve as an outdoor classroom, with students from several forestry classes taking field trips to the Tree Farm during and after the treatment. For instance, Dr. Pascal Berrill’s Forest Restoration class will take several field trips to the Tree Farm to implement restoration work on one treatment site. (See “Other projects planned for 2010: Tree Farm as outdoor classroom, Forest Restoration” on p. 6.)

To bring in aspects of silvicultural strategies, post-treatment erosion, and soil physical and biological response, Drs. Han and Varner have reached out to other faculty members from the Humboldt State University Department of Forestry and Wildland Resources. In 2010, the researchers will continue field data collection and data analysis. Dr. Han and graduate student Brian Vitorelo will present preliminary findings of the research at the 2010 Council on Forest Engineering conference, held June 6–9 in Auburn, AL.

Research projects in 2009

Continued from page 2

live trees in a mixed evergreen forest using diameter-based allometric equations,” in December 2009.

Bio-energy pilot study

Dr. Pascal Berrill initiated the “Tree Farm bio-energy pilot study: Planting five tree species in a replicated test plot.” The study is trying to answer questions of which species have the best survival and growth and highest biomass and energy content upon harvest. Dr. Berrill, along with his students in Silviculture established two replicates, one in spring 2009 and one in fall 2009. (See “Other projects in 2009: Tree Farm as outdoor classroom, Silviculture” on p. 3.) They planted five native tree species on a 33’ x 132’ test plot of gently-sloping, open land under the power lines. The five species are redwood, Douglas-fir, grand fir, red alder and bigleaf maple (replacing cottonwood, planted in spring 2009, but which suffered establishment failures). These species have a potential for bio-energy production, while the test plot is a good example of the type of marginal land (with few other land-use alternatives) that could be acceptable for dedicated biomass production.
Research projects anticipated for 2010

Bio-energy pilot study
Dr. Pascal Berrill will continue work on the “Tree Farm bio-energy pilot study: Planting five tree species in a replicated test plot.” Along with students in the Silviculture course, Dr. Berrill will install the third section of the study site in spring 2010. They will manually weed the two sections planted in 2009 and prepare the third portion before planting ten replications of each species (redwood, Douglas-fir, grand fir, red alder and bigleaf maple). Because the plantings from 2009 experienced considerable competition from weeds on the dry site, the summer work crew will conduct additional mechanical site preparation, using the tree farm mower and brush saws.

Carbon storage
Dr. Pascal Berrill and graduate student Brandon Namm will initiate the study “Below-ground carbon storage in tanoak” at the Tree Farm. The primary aims of this research are to 1) quantify how belowground carbon levels in tanoak are connected to aboveground variables, such as diameter at breast height and basal area, which are easily measured; 2) explore how the allometric relationship between aboveground and belowground biomass and carbon content in tanoak is influenced by canopy position and competition for light and other resources; and 3) use variables that impact this above- and belowground relationship to generate predictive models. The study consists of three segments, starting with a pilot to test methods for excavating and extracting root systems and to assess how stand structure affects the relationship between aboveground variables and root biomass in tanoak. Results from the pilot will shape the subsequent segments: fieldwork and a full study in 2010 and 2011.

Sudden oak death/fire study
Graduate student Howard Kuljian and Dr. Morgan Varner will conduct further laboratory analysis to evaluate foliar ignition of tanoak. The Humboldt State University Wildland Fire Laboratory also received funding from the UC-CSU Collaborative Research Program to continue laboratory fire research using fuel from the Tree Farm to predict changes in fire following the loss of tanoak from regional forests. Mr. Kuljian and Dr. Varner plan to submit results for publication in peer-reviewed journals.

Summer operations and maintenance planned for 2010

- Work with Tom Manoli, HSU Environmental Health and Safety Coordinator, to conduct a hazardous materials assessment of the powerhouse transformers to determine the level of PCBs in them and plan for appropriate use or disposal. This is the top maintenance priority for 2010.

- Pull aluminum power line from the powerhouse; investigate options for selling the aluminum line and transformers.

- Replace rotten wood in beam over the entrance. Humboldt State University Plant Operations had not done the work in 2009.

- Work with Erik Schatz to clear under power lines.

- Install a solar fan in the garage.

- Continue the vigilance over cleanliness, which has reduced the mice problem.
Other projects planned for 2010

**Tree Farm as outdoor classroom**
Forest Restoration (FOR 431): In spring semester 2010, Dr. Pascal Berrill will make three visits to the Tree Farm with his Forest Restoration class. The students will get hands-on experience by restoring biodiversity and forest cover to one area masticated in 2009 as part of the mastication study run by Drs. Han Sup-Han and Morgan Varner. (See “Mastication Study” on p. 1.) The restoration project will be monitored by current and future Forest Restoration classes.

Silviculture (FOR 432): In fall semester 2010, Dr. Pascal Berrill and his Silviculture students will establish the third section of the bioenergy study plantation and weed the two sections planted in 2009. (See “Bio-energy pilot study” on p. 4.)

Forest Management (FOR 315): Dr. Chris Edgar will take his Forest Management class to the Tree Farm in spring 2010. On this field trip they will cover the role of school forests in forest research, silviculture of mixed-evergreen forests, tree farms, and non-industrial private forestlands.

**Forestry capstone project**
In spring 2010 a three student capstone group will conduct short-term monitoring on the mastication project site along with HSU Wildland Fire Laboratory personnel. (See “Mastication study” on p. 1.)

**Collaboration with Schatz Energy Research Center**
Dr. Han will continue to work with the Schatz Energy Research Center to procure funding to work on research projects in utilization of woody biomass for energy production.

**Fire use plan**
Dr. Morgan Varner will finalize a fire use plan for the Tree Farm.

**Weather data**
Humboldt State University undergraduate student Anthony Valdez, working under the direction of Dr. Andy Stubblefield, will retrofit the weather station at the Tree Farm so that the station uploads weather data in real time to a Web site (http://nrs.isa.humboldt.edu/gdmet/content/data_gdmet_realtime2.php). This data will be compiled with that from four other weather stations Dr. Stubblefield and undergraduates Nick Schroeter and Adam Heck have installed on Green Diamond property from Eureka to Crescent City.

**Nonindustrial Timber Management Plan**
Establish an NTMP for the Tree Farm by putting out a statewide call for bids to write a plan.

**Energy audit**
Conduct an energy audit (with the Humboldt State University Schatz Energy Research Center). Explore options for and benefits of installing solar panels on the roof of the main building, with the possibility of power buy back through Pacific Gas and Electric Company, the current utilities provider for the Tree Farm.

**Geographic Information System**
Bring the Tree Farm GIS up to date by adding current projects and identifying management compartments.

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L.W. Schatz Demonstration Tree Farm
The L.W. Schatz Demonstration Tree Farm’s mission is to provide a demonstration tree farm operation for the benefit of the instructional and research needs of the students and faculty of Humboldt State University and as an example for owners of small timberland parcels. The Tree Farm enables experimentation and research regarding the growing, harvesting, and replacement of trees on timberland. The Tree Farm aims to utilize as many square feet as practical for production of commercial wood crops. The Tree Farm serves as an outdoor classroom for educational purposes and also enables public educational assistance to landowners through publications, photos, lectures, symposia, and tours.