In 2010 Dr. Pascal Berril and his graduate student Brandon Namm began work on their study of “Below-ground Carbon Storage in Tanoaks (Notholithocarpus densiflorus)” at the L.W. Schatz Demonstration Tree Farm. Tanoaks are a major component of many forests throughout the West, and can be found throughout the forests at L.W. Schatz Tree Farm. But due to tanoak’s ability to sprout and dominate a stand after disturbance, foresters often view it as a pest and try to remove tanoak from their stands. Tanoaks are an important element of natural ecosystems. In addition to providing structural diversity, tanoaks supply irreplaceable sustenance and habitat to wildlife including birds, mammal, and insects. Despite tanoak’s competition with merchantable species, maintenance of tanoaks can benefit landowners from increased carbon (C) sequestration on their property. As carbon sequestration becomes an ever-increasing interest to land managers, more research has focused on not only growing trees for wood products, but also in accumulating valuable carbon credits that can be bought, sold, and saved in “banks” like any other currency. The objective of Dr. Berrill’s and Namm’s study is to quantify wood density and percent carbon at different locations within tanoak root systems. This will help aid in estimating below ground carbon storage in tanoaks. An assessment of belowground carbon loss due to tanoak removal and Sudden Oak Death will yield valuable information to future tanoak and redwood ecosystem conservation. Sampling work for the research project began at the L.W. Schatz Tree Farm during the summer of 2010 and field work will continue into next year. Excavation work was conducted in 2010, with three tanoaks chosen for excavation. An excavator was used to weaken the selected tanoak root system.
Research projects in 2010

Carbon storage
Dr. Pascal Berrill and graduate student Brandon Namm continued their study on “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.

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.” In the spring of 2010, Dr. Berrill with the help of his Silviculture class planted third section of the study site. Ten replications of each species (redwood, Douglas-fir, grand fir, red alder and bigleaf maple) were planted at the study site. Students from the Forest Restoration class and The Forest Environment class maintained and monitored the plots planted in 2009. Maintenance primarily consisted of weed control as there was considerable competition from weeds on the dry site.

Other projects in 2010

Tree Farm as Educational Tool
In addition to the faculty and graduate research the Tree Farm is a hands-on learning environment for many forestry courses. Forest Health & Protection (FOR 222), Introduction to Forest Operations (FOR 250), Forest Mensuration & Growth (FOR 311), Forest Management (FOR 315), Wildland Fuels Management (FOR 423), and Forest Restoration (FOR 431) all made field trips to the L.W. Schatz Tree Farm as part of the course.

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

• FOR 423 (Wildland Fuels Management) - During the Spring semester Dr. Morgan Varner’s Wildland Fuels Management class focused their term project at the L.W. Schatz Tree Farm. The project areas focusing on fuel management were inter-
Significant maintenance and improvement projects were done over the Summer in 2010. Tyler Hulquist, Jeremy Couch and Ethan Coonen comprised the 2010 summer maintenance crew, along with Gordon Schatz, Tree Farm Manage. Projects completed include:

**Tree Farm building**
- Mowed lawns and outer areas to reduce fire hazard.
- Cleaned walkway and gutters around the building.
- Removed fire pit from behind building.
- Saws and other power equipment brought into town for annual maintenance.
- General landscaping, including weeding, cleanup and mulching.
- Cleaned shop, bathrooms and interior of the building.

**Tree Farm acreage**
- Cleared storm debris and downed trees from roads, trails and culverts.
- Mowed roads, and turnouts as well as brush cut trails.
- Removed brush and pruned trees along roadsides to improve visibility.
- Potholes filled on roads with gravel.
- Cleared culvert inlets and areas around them.
- Cleaned up duck blind at the pond.
- Shaded fuel break enhancement along roads and trails. Included pruning and fire ladder removal 20 to 25 feet on either side of the trails and 8 to 10 feet on either side of roads.
- Removed transformers and power lines from the old hydroelectric station. This included approximately 1 mile of power line, 6 poles and 3 transformers. The old transformers containing PCB were brought to the HSU campus for proper disposal in accordance to hazardous waste regulations. The wire from the power lines was salvaged.
- Trees and slash were removed from PG&E right of way by Erik Schatz and Summer work crew.
- Portable fire pump was repaired.
- Fence repairs were made.
- 75ft clearance under the Tree Farm power line, from PG&E right-of-way to the Tree Farm building were cleared of brush and trees.
- Power boxes clearance were cleared of brush and debris.

**Research projects**
- Tree Farm crew assisted with root excavation for the “Below-ground carbon storage in tanoak” for Dr. Pascal Berrill and graduate student Brandon Namm.
measurements including tree height, live crown ratio, diameter at breast height (dbh), and diameter of the tree at the base of the tree were made prior to excavation. Root wood samples were taken from four locations within the root system: within the lignotuber, the aboveground stump, start of the root (adjacent to the lignotuber) and at the end of the root (near tip). Samples were dried at 65 °C and weighed to obtain dry mass. Wood and carbon density measurements are important and must be established to acquire more accurate biomass and carbon estimates. Wood density and Percent nitrogen (N) and carbon were determined in the lab.

The study found that root wood density did not change with size or distance from the stem. Percent carbon was highest at the sample farthest from the lignotuber, while samples from the other locations were not statistically different. Root carbon also varied among root systems sampled. The increase in carbon and lack of change in wood density with distance from the lignotuber is contrary to aboveground findings that wood density decreases with increasing stem height.

Understanding how different tree components allocate carbon is important for accurate stand-level carbon estimates. Larger diameter roots containing more biomass did not have greater wood density or percent carbon. The study concluded that accounting for carbon and wood density at different locations in the root system allows for more accurate estimation of belowground carbon. Root systems may allocate carbon differently than aboveground stems. Because roots, branches and stems have different mechanical and physiological functions, it is not safe to assume that above- and belowground components allocate carbon in the same way. Patterns of carbon and root wood density contrast studies in aboveground components, demonstrating that assumptions about belowground biomass need to be studied in greater depth. Further research will focus on whether stand-level variables have similar effect on belowground and aboveground C wood density. This research project will be continued next year with additional sampling at the L.W. Schatz Tree Farm.
Other projects in 2010

Continued from page 2

spersed throughout the tree farm property. A total of 18 students from FOR 423 participated in these projects. The goal of these projects was to focus on the potential treatments to reduce fire hazards in the areas.

- As part of FOR 425, the Wildland Fire Management Capstone, three students evaluated the potential fire hazard of the East and North perimeter of the Tree Farm. The students, Names go here, names go here, used filed collected data for modeling potential fire behavior under extreme weather.

- In the spring 2010, Dr. Pascal Berrill's Forest Restoration (FOR431) class made several trips to the L.W. Schatz Tree Farm for their applied restoration project "Restoring biodiversity and wildlife habitat on degraded forest sites at the L.W.Schatz Tree Farm". The students planned, implemented, and monitored their restoration projects. The project consisted of planting various species of trees and forage shrub species on degraded sites. The student in FOR 431 made a total of three visits to the Schatz Tree Farm over the course of the spring semester. In addition to the plantings, the work included surveying and mapping the degraded site. The site map was developed in GIS and was an integral part of their restoration plan. Using GIS technologies, allowed the students to calculate area and the number of seedlings needed to achieve their desired density and composition. After planting, the GIS map was updated to show seedling locations, and then used to develop a monitoring prescription tailored to the specific site and new forest. FOR 116 and FOR 431 students have performed maintenance (primarily weed control) and monitoring during field trips to the Tree Farm. Tree Farm Manager, Gordon Schatz, oversaw the FOR 431 planting operations. Gordon Schatz plays an integral part in the process, sharing his experience and knowledge of the site and the unique challenges it presents for forest establishment. Schatz also provides hands-on experience demonstrating hand planting techniques, supervising the planting, and answering questions about site history and the local flora and fauna.

Summer operations and maintenance planned for 2011

- Coordinate with Summer crew to update Tree Farm GIS database with mapping. GPS units will be used to map the trails and many streams throughout the Tree Farm property.

- Install a solar fan in the garage.

- Continue the vigilance over cleanliness, which has reduced the mice problem.

Tree Farm Manager Gordon Schatz overseeing the FOR 431 planting operations.
#### Research projects anticipated for 2011

**Below-ground carbon storage in tanoak**

Dr. Pascal Berrill and his graduate student Brandon Namm will continue their project assessing the below ground biomass. The pilot study was conducted last year with excavation of three tanoaks on the Tree Farm property. Additional tanoaks will be sampled in 2011 to expand the study as well as further research focusing on whether stand-level variables have similar effect on belowground and aboveground carbon wood density.

**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.” Dr. Berrill along with students from his Silviculture (FOR 432) and Forest Restoration (FOR 431) class will continue to monitor and maintain the plots through hand weeding.

#### Other projects planned for 2011

**Tree Farm as outdoor classroom**

The Tree Farm will continue to be used for many forestry classes, there are many field trips already planned for 2011:

- Forest and The Environment (FOR 116): In fall semester 2011, students in the Forest and The Environment class will visit the Tree Farm.
- Forest Restoration (FOR 431): Dr. Pascal Berrill and his Forest Restoration students will continue to maintain and monitor restoration sites at the Tree Farm.
- Wildland Fuels Management (FOR 423): Dr. Morgan Varner’s Wildland Fuels Management will visit the Tree Farm and discuss fuel management and fuel treatments.

**Nonindustrial Timber Management Plan**

Establish an NTMP for the Tree Farm by putting out a statewide call for bids to write a plan.

**Geographic Information System**

Continue improvements on the Tree Farm GIS database, including additional mapping of trails, streams and research projects at the Tree Farm.

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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.