Resources and Protocols
for Biology Greenhouse Users

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Contact Information

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## Introduction

The biology greenhouses and their associated equipment were procured at great cost to the University with federal, state, and private financial support. Many plants in the teaching collection are difficult to replace. A functioning greenhouse environment is contingent upon cooperative maintenance by researchers, research assistants, and staff.

Please read this document carefully; every greenhouse user is responsible for understanding and complying with its contents. Principle investigators are responsible for ensuring that research assistants understand and follow the protocols that pertain to their work. A copy of this document is on file in the Headhouse.

If you have any questions or suggestions, please contact greenhouse manager Cameron Hannah-Bick.
Summary of facilities

The Biology Greenhouse comprises facilities devoted to support of the teaching collection, which serves over 1200 students each quarter, and research spanning the plant-based studies of genetics, physiology, phenology, ecology, and evolution. The facility provides a range of environmental parameters in outdoor and indoor research settings. A facility map is included at the end of this document.

Individual greenhouses, their purposes, their building codes assigned by Physical Facilities (PF), and their amenities are described below. Type of entrance, bench dimensions, and interior sensors are listed per bay. Refer to “Protocols for greenhouse research” (Item 1) for information on how to request greenhouse space.

Wooden Teaching/Research Greenhouse & Outdoor Space (PF building 540): Four wooden bays numbered from East to West, and outdoor space in courtyard. City and DI water, roof vents, and swamp coolers are available. Daytime temperatures in summer can surpass 90° F (38°C). None have vestibule entrances. Contact the greenhouse manager for bench dimensions. A recharge of $0.10* square foot/month ($5 minimum) is assessed for use of this bench space.

- **Bay 1** lacks benches. The exterior is corrugated polycarbonate.
- **Bay 2** has wooden benches and solar-powered “attic” fans. The exterior is corrugated polycarbonate. HPS grow lights are present at the time of posting this description but are subject to relocation.
- **Bay 3** has wooden benches and automated drip-line irrigation capabilities. The exterior is glass panes. Not recommended for controlled-pollination studies. HPS grow lights are present at the time of posting this description but are subject to relocation.
- **Bay 4** has rolling-top plastic benches and automated misting capabilities. Temperature and light control is limited. The exterior is polycarbonate.
- **Outdoor space** has stationary tables. Shade clothe is available.

Schuyler Research Greenhouse (PF code #541): Three aluminum-framed bays numbered “1” through “3” from West to East. Each bay contains: Three rolling-top benches per bay; sink with power-washer; LED grow-lights; three types of water (city, DI, and fertilizer-enriched); automated DI misting and drip irrigation capabilities; automated climate controls (four-step cooling, two-step heating, shade/energy cloth with 54% opacity); automated side-wall curtains to block supplemental light from adjoining bays. A recharge of $0.20* square foot/month ($5 minimum) is assessed for use of this bench space.

- **Bay 1** (PF code #1101)
  - Entrance: Vestibule
  - Sensors: Interior temperature and humidity *(no internal PAR)*
  - Bench Dimensions:
    - \(1 = 22' \times 5' \ (6.7m \times 1.5m)\)
    - \(2 = 22' \times 5' \ (6.7m \times 1.5m)\)
    - \(3 = 17' \times 5' \ (5.2m \times 1.5m)\)

- **Bay 2** (PF code #1102)
  - Entrance: No vestibule *(not suitable for GMO research)*
  - Sensors: Interior temperature, humidity, and PAR
  - Bench Dimensions:
1 = 19’ x 5’ (5.8m x 1.5m)  
2 = 21.5’ x 5’ (6.6m x 1.5m)  
3 = 19’ x 5’ (5.8m x 1.5m)

- **Bay 3** (PF code #1103)  
  - Entrance: No vestibule *(not suitable for GMO research)*  
  - Sensors: Interior temperature, humidity, and PAR  
  - Bench Dimensions  
    1 = 19’ x 5’ (5.8m x 1.5m)  
    2 = 21.75’ x 5’ (6.6m x 1.5m)  
    3 = 19’ x 5’ (5.8m x 1.5m)

- **NSF Research Greenhouse** (PF code #443): Three aluminum-framed bays numbered “4,” through “6” from West to East. Each bay contains: three rolling-top benches; sink with power-washer; supplementary grow-lights; three types of water (city, DI, and fertilizer-enriched); automated DI misting and drip irrigation capabilities; automated climate controls (four-step cooling, two-step heating, shade/energy cloth with 54% opacity); side-wall curtains to block supplemental light from adjoining bays. *A recharge rate of $0.20*square foot/month ($5 minimum) is assessed for use of this bench space.*
  - **Bay 4** (PF code #1101)  
    - Entrance: Vestibule  
    - Sensors: Interior temperature, humidity, and PAR  
    - Bench Dimensions:  
      1 = 29’ x 5’ (8.8m x 1.5m)  
      2 = 30.5’ x 5’ (9.3m x 1.5m)  
      3 = 28’ x 5’ (8.5m x 1.5m)
  - **Bay 5** (PF code #1102)  
    - Entrance: Vestibule  
    - Sensors: Interior temperature, humidity, and PAR  
    - Bench Dimensions:  
      1 = 27.6’ x 5’ (8.4m x 1.5m)  
      2 = 30.5’ x 5’ (9.3m x 1.5m)  
      3 = 27.6’ x 5’ (8.4m x 1.5m)
  - **Bay 6** (PF code #1103)  
    - Entrance: Vestibule  
    - Sensors: Interior temperature, humidity, and PAR  
    - Bench Dimensions:  
      1 = 30.75’ x 5’ (9.4m x 1.5m)  
      2 = 30.6’ x 5’ (9.3m x 1.5m)  
      3 = 27.75’ x 5’ (8.5m x 1.5m)

- **Alpine Research Greenhouse** (PF building #442, room #1201): One aluminum-framed bay. Contains four chilled benches; a sink with power-washer; supplementary grow-lights; three types of water (city, DI, and fertilizer-enriched); automated DI misting and drip irrigation capabilities; automated climate controls
(four-step cooling, two-step heating, shade/energy cloth with 54% opacity). A recharge rate of $0.20/square foot/month ($5 minimum) is assessed for use of this bench space.

- Entrance: Vestibule
- Sensors: Internal and chilling bench temperatures, humidity, and PAR,
- Bench Dimensions:
  1 = 28' x 3.5' (8.5m x 1.1m)
  2 = 20' x 3.5' (6.1m x 1.5m)
  3 = 20' x 3.5' (6.1m x 1.5m)
  4 = 24' x 3.5' (7.3m x 1.5m)

**Available resources: In the greenhouses**
The following equipment and materials are available to you for research purposes during the period that greenhouse space is allocated to you.

*Denotes availability in Alpine, Schuyler, and Research bays only.
*Denotes limited availability in wooden bays.

- A key assigned to you by the greenhouse manager. Please, do not loan this key to anyone without first consulting with the greenhouse manager. Maintaining key control is critical to the security of these facilities. Extra keys can be checked out from the manager. **Return all greenhouse keys to the greenhouse manager once authorized use terminates.**
- One five-gallon orange pail with lid. Use this pail for temporary storage of discarded materials. Empty it on a daily basis into the appropriate Headhouse receptacle (recycling, garbage, or plant waste—no soil or garbage scraps in the plant waste, please).
- *A sink.** Do not rinse soil down the sink. Turn the water off at the faucet when not using it.
- **Watering hoses.** Do not step on or kink the hoses. Loosely coil hoses when you finish with them so that they are not tripping hazards. Do not let the watering end touch the ground (this can transfer pathogens to research plants). Please turn water off at the valve when it’s not in use.

  The following kinds of water are available and labeled in each bay:
  - De-ionized (DI) water. This water contains no minerals or ions. Use it with caution.
  - Santa Barbara city water. This water is alkaline and contains significant concentrations of calcium, magnesium, and sulfate. Please see the greenhouse manager for more information.
  - *Fertilizer-enriched water.** This is city water mixed with a pre-determined concentration of a balanced fertilizer with acidifying properties to counteract the alkalinity of the city water. Do not attempt to alter the fertilizer injector or its stock fertilizer concentrate. The NPK ratio and ppm nitrogen for the injection rate are displayed on the side of the stock container.
  - **Rolling-top benches.** Take care not to pinch your fingers when you move these benches. Be wary of how weight is distributed on the bench tops. Uneven weight distribution can warp the surface for the long-term or cause difficulty in moving the bench top.
  - **Automated grow lights, irrigation, and other climate controls.** Please contact the greenhouse manager to change the settings for this equipment. **Temperature, humidity, PAR, and**
equipment use data are logged and reproducible in line-graph format with proprietary Wadsworth software.

- Alpine, Schuyler, and Research Greenhouses: Do not try to alter the settings yourself. The programming screens are not intuitive, and multiple components must work together in a precise manner to maintain the environment. Erroneously changing even one aspect of this system can throw off the entire sequence in a way that is time-consuming to identify and correct.
  - Do not open or close cooling pad or irrigation valves without the greenhouse manager’s knowledge.

- A digital max/min thermometer, unit interchangeable (°C/°F), in the wooden bays. Please alert the greenhouse manager if the low battery symbol is displayed.

- A door. Invaluable for obstructing hungry pests from accessing your plants. Close every door behind you.
- Emergency contact numbers. Posted at the entry of each bay.

Available resources: In the Headhouse

The Headhouse (PF building #540, room #1001) is the central building with blue doors. It provides work space and houses Greenhouse supplies and climate control equipment. The following equipment and materials are available to you for research purposes during the period that greenhouse space is allocated to you.

- A map of the greenhouse facilities. This is posted on each door of the Headhouse and is included at the end of this document. Many resources below are indicated on the map.
- No restrooms. Nearby restrooms are in Noble Hall (accessible during normal campus operating hours) and the McCloud Lab courtyard (accessible 24/7). Refer to the facility map for their locations.
- A water cooler. Refill your water bottle or use a plastic cup (if available). If you must use a plastic cup, please write your name on it and re-use it.
- A sink. Do not drink water from or rinse soil down this sink. Do not leave dirty items at the sink.
- A campus phone. This phone is intended for staff use and emergency calls only. Please do not use it for private calls. The emergency numbers included at the end of this document are posted above the phone.
- First aid kits. These are located in the left center drawer in the headhouse desk. Please notify the greenhouse manager if you use them.
- A fire extinguisher. Located to the left of the desk. Only use it if you have been trained in its use. Your first responsibility in an emergency is to safely escape and sound the alarm.
- Pesticide and fertilizer application logs and Material Safety Data Sheets (MSDS). These list the application rates and times of horticultural chemicals applied by Greenhouse staff.
- Trash, recycling, and plant waste receptacles. The plant waste receptacle is intended to receive whole, non-GMO* plant matter only. No soil, food scraps, or paper towels, please.
- A stainless steel potting bench. This work surface can be sanitized with 5% acetic acid (located on the bench; use gloves to apply). The brush and pan hanging at the end of the bench should
be used on the bench only, and never on the floor, to prevent the spread of pathogens. Please clean up after your work when you finish.

- **Two carts.** The carts are available to all greenhouse users. Ask before removing either from the greenhouse facility for any reason. Please clean and return them to the Headhouse promptly when you finish with them.

- **Pots, tags, and potting soil components,** as supplies allow. *If you plan to use Headhouse supplies, contact the greenhouse manager to determine what is available to you.*
  - Sunshine #4 potting mix, perlite, vermiculite, sharp washed sand, and peat and/or coconut coir are available for research use. Other potting mix components are for the teaching collection only. Please help prevent the interference of supply shortages with research by reporting deficiencies in Headhouse-stocked materials as they become apparent.
    - **Important safety note:** Certain potting mix amendments (i.e., perlite, vermiculite, and sand) are stored dry and contain fine particles that present respiratory hazards when agitated into the air. Use a dust mask (available on the potting bench in the Headhouse) and handle these components gingerly until they are wetted down.

- **A potting mix storage rack.** If you prepare an excess of potting mix, or prepare it a few days in advance, you may store it short-term in an available bin in the soil storage rack. All stored potting mixes must be labeled with your name and the date of preparation.

**Protocols for All Greenhouse Users**

1. **Respect all posted notices,** particularly those concerning pesticide applications. Notices of pesticide application include the time of application and the federally mandated Restricted Entry Interval (REI). Do not enter a treated greenhouse area until the indicated REI has elapsed.
2. **Wear appropriate footwear to the greenhouse.** Flip flops are strongly discouraged. Bare feet are not permitted.
3. **Treat growing and potting areas as “clean rooms.”** Always wash hands at the Headhouse sink before performing any plant-related work.
4. When not in use, hoses should be turned off at the valve, loosely coiled out of walkways, with the watering end never touching the ground.
5. Do not rinse soil down sinks.
6. **Dispose of waste materials promptly and appropriately.**
7. **Consult the greenhouse manager before attempting to change irrigation or cooling system valves and climate controls.** Closing valves, etc. can result in damage to equipment or plants.
8. **Lock all doors and gates behind you.** It is the responsibility of the last person leaving (even in the middle of a weekday) to confirm that all entry points are secure when you leave. Do not loan your keys to unauthorized persons.
9. **Be conscientious of where electronics, valuables, and other equipment are placed.** Watering routines, pesticide applications, or undiagnosed irrigation leaks may expose adjacent belongings to moisture or chemicals despite the best efforts of greenhouse staff. Other greenhouse users water at their own discretion. The greenhouse facility should not be considered a secure place to store valuable items.
10. Consult the greenhouse manager before storing items on Headhouse grounds. Items approved for storage must be clearly marked with the owner’s name, contact number, and the period of storage. Any items left without permission will be handled according to the greenhouse manager’s discretion.

11. Report potential plant concerns and maintenance issues. All observations of pest problems, etc. are valuable. Leaks, raccoon or skunk sightings, odd noises or smells, access concerns, etc. should be promptly reported to the greenhouse manager or to Physical Facilities as warranted. Relevant phone numbers can be found at the end of this document.

12. Check out all equipment and materials from the greenhouse manager before removing them from the facility. (Funding is allocated to the greenhouse’s operation based on its demonstrated use.) Both carts are available to all greenhouse users. Please return them to the Headhouse promptly.

Greenhouse protocols for research use

To promote the best research experience possible for you, your fellow researchers, and future greenhouse users, please observe the following protocols.

1. Request greenhouse space and extensions online at: https://www.eemb.ucsb.edu/content/greenhouse-request-form. This Greenhouse Request Form is located on the EEMB website under “Support Services: Greenhouse”. If research is off to a slow start, talk to the greenhouse manager and submit a subsequent space request change to ensure that your space is not reserved by other researchers before you finish.

2. A recharge rate, or “bench fee,” of $0.20*square foot/month ($5 minimum) is assessed for use of the NSF, Alpine, and Schuyler greenhouses and $.10 square foot/month ($5 minimum) is assessed for use for the wooden greenhouse and outdoor space. This rate was approved by the Greenhouse Committee for all use of these facilities beginning in 2017. It helps 1) support facility upkeep and 2) replace greenhouse materials used for research. Please budget for this fee in relevant grant applications.
   a. Recharges are due on the 15th of each month. When requesting greenhouse space, please provide the 4-digit EEMB recharge number assigned to your funding source. Request a recharge number through the financial person from the department that administers your funds. They can provide the PI’s name, the account/fund/sub numbers, and the project code to EEMB Accounting (x2427).
   b. Planned experiments for which sufficient recharge funding does not exist must be brought to the Greenhouse Committee’s attention for consideration. Contact the Greenhouse Manager for more information.

3. Please notify the greenhouse manager of any anticipated changes, additions, etc. to pre-approved use of research space. These changes must be approved prior to their initiation, as maintenance activities and greenhouse space are assigned according to the known needs of each greenhouse project.

4. Be considerate of other greenhouse users. Please, use only the space allocated to you and keep it clean. Desired changes to environmental controls should be discussed with others whose plants may be affected before a request is submitted to the greenhouse manager.

5. Be proactive about pest prevention and control. Pest control is multi-faceted, time-consuming, and very rarely 100% effective. In addition to the physical destruction they cause, many common greenhouse pests carry disease. Promote effective pest exclusion and control with the following steps:
a. Always close the door behind you.
b. Promptly remove and dispose of weeds and unhealthy or dead plant matter. (In addition to reducing pest habitat, this practice allows topical pesticides to be applied to parts of the plant that most need them.)
c. Allow sufficient space between plants so pests cannot easily crawl from one plant to another and fungal growth is inhibited. If necessary, remove excess growth from plants to encourage airflow among foliage.
d. Maintain a clean work environment. Remove discarded pots, “research scraps,” etc. promptly.
e. Provide or arrange for sufficient water, an appropriate fertilizer regime, and adequate ventilation (via spacing) for your plants. A plant’s vitality strongly influences its ability to withstand or defend against attacks, and appropriate ventilation reduces the spread of pests and pathogens.
f. If possible, quarantine new plants before bringing them into your research population. If you rely on pesticide applications to control pest populations, please alert the greenhouse manager to new plant introductions.
g. Promptly notify the greenhouse manager of any signs of pathogen or pest infestation.
h. Do not apply pesticides, fungicides, or herbicides of any kind without the knowledge of the greenhouse manager. Failure to do so may result in a violation of safety protocols and state and/or federal law. It is important that the greenhouse manager know of all chemicals applied at the greenhouse, as well as the qualifications of the person conducting applications.

6. Label all plants and materials. Each plant should be identifiable in the event that it is moved from its location for pest control or other purposes. Plastic tags and pencils are available for labeling plants in the Headhouse. (Ink fades with exposure to sunlight and should not be used.)

   a. Storage space is very limited at the greenhouse facility. Please do not leave supplies or equipment in the Headhouse without first asking the greenhouse manager. Your supplies may be assumed to be greenhouse property if this step is not followed. See Item 9 under Protocols for All Greenhouse Users.
b. Plants, materials, etc. that are considered abandoned by greenhouse users may be discarded.

7. Publication acknowledgments: If a publication results from research conducted in the Alpine, Schuyler, or Research Greenhouses (Buildings 441, 541, and 442, respectively), authors should acknowledge the generous support for their construction and, if applicable, their provision of LED grow lights accordingly. Example citations are:

   a. Schuyler Greenhouse: The authors gratefully acknowledge use of the Schuyler Greenhouse at the University of California-Santa Barbara, whose construction was funded by Dr. A.H. Schuyler and NSF Grant OIA-0963547.
b. Alpine and Research Greenhouses: The authors gratefully acknowledge use of the Alpine or Research Greenhouse at the University of California-Santa Barbara, whose construction was funded by NSF Grant OIA-0963547.
c. LED grow light use: The authors gratefully acknowledge use of LED grow lights at the University of California-Santa Barbara Biology Greenhouse, whose acquisition was enabled by the UCSB student-funded The Green Initiative Fund and NSF Grant OIA-0963547
8. **Handling and disposal of GMO materials**: It is solely the researcher’s responsibility to handle and dispose of genetically modified plant matter in compliance with USDA/APHIS and EPA requirements. See the Greenhouse Website (https://www.eemb.ucsb.edu/services/greenhouse) for links to resources.

**Greenhouse protocols for teaching use:**

To allow the best circumstances for teaching needs to be met, please observe the following protocols:

1. **Inform the greenhouse manager of all plant needs in advance of their scheduled use by at least two weeks.** Lab sections increase in size, and plants that have been used in the past may no longer be immediately available in the quantity required. It takes time to locate additional specimens. Plants may also benefit from some preparation so that they better demonstrate their trait of interest. *The more advance notice given, the more likely teaching needs will be fulfilled.*

2. **Check out all plants from the greenhouse manager.** The plants used, the date of their collection, and the date of their return must be recorded in the “Teaching Collection Use Log.” This log is located in the Headhouse. Verbally acknowledging intentions for plants to a greenhouse assistant, volunteer, or intern is not a suitable substitute. *Do not simply walk away with plants for a class or lab section. Missing plants suggest unauthorized access, and valuable plants can be (and have been) lost due to unfamiliarity with the plant’s needs. The greenhouse manager must know what is being taken, when, and for how long it will be used.*

3. **Please follow the recommendations for plant care given by the greenhouse manager.** Whoever checks out the plants is ultimately responsible for their welfare. Please ensure that any student assistants who are tasked with watering and/or transporting the plants are familiar with such recommendations.

4. **Return all plants to the greenhouse by 4:30PM Friday unless other arrangements are approved by the greenhouse manager beforehand.** Please talk to the greenhouse manager if you have questions.

**Important phone numbers:**

*Dial “9” before calling off-campus numbers from a campus phone to exit the campus network.*

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<th>To</th>
<th>Call</th>
<th>From a personal phone</th>
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<tr>
<td>Report an <strong>EMERGENCY</strong></td>
<td>Emergency Response</td>
<td>911</td>
<td>9-911</td>
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<tr>
<td>Report a <strong>SECURITY</strong> concern</td>
<td>UCSB Police (non-emergency)</td>
<td>(805) 893-3446</td>
<td>3446</td>
</tr>
<tr>
<td>Report a <strong>MAINTENANCE</strong> concern</td>
<td>Physical Facilities</td>
<td>(805) 893-8300</td>
<td>8300</td>
</tr>
<tr>
<td>Report a <strong>MAINTENANCE</strong> concern</td>
<td>UCSB Police (non-emergency)</td>
<td>(805) 893-3446</td>
<td>3446</td>
</tr>
<tr>
<td>Request an <strong>ESCORT</strong></td>
<td>CSO Escort</td>
<td>(805) 893-2000</td>
<td>2000</td>
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<tr>
<td>Report a <strong>WORKER’S COMP</strong> claim</td>
<td>Worker’s Compensation</td>
<td>1-877-682-7778</td>
<td>9-1-877-682-7778</td>
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<tr>
<td>Contact the <strong>GREENHOUSE MANAGER</strong></td>
<td>Cameron Hannah-Bick</td>
<td>Office: (805) 893-2867</td>
<td>2867</td>
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<td>Cell: (707) 495-4386</td>
<td>9-1-707-495-4386</td>
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Map of Greenhouse Facility: