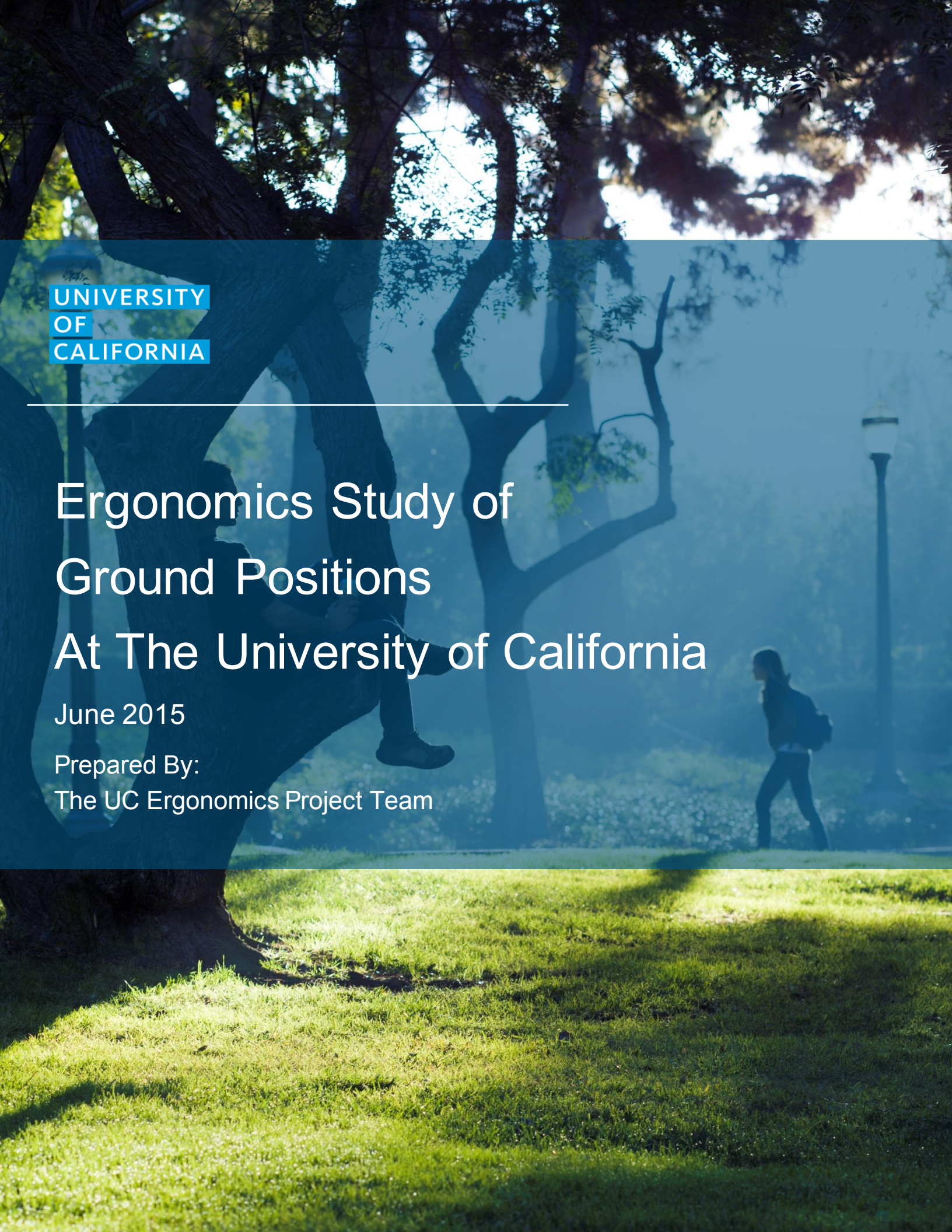

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Ergonomics Study of Ground Positions At The University of California

June 2015

Prepared By:
The UC Ergonomics Project Team

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Environment, Health, and Safety
The Office of the President
1111 Franklin Street, 10th floor
Oakland, California 94607-5200

Executive Summary

At the University of California, grounds employees play a critical role in maintaining the landscape and hardscape throughout each location. To perform these job functions, workers are exposed to risk factors such as repetitive motion, strain and awkward postures. During fiscal years 2009-2014, musculoskeletal injuries involving grounds staff accounted for 246 workers' compensation claims, with an actuarial estimated ultimate direct cost of $1,968,328 *(loss data was valued as of June 30, 2014).*

At the request of University of California, Office of the President (UCOP) Risk Services, the UC Ergonomics Work Group conducted a study of the grounds staff to identify the top five areas of musculoskeletal risk and develop strategies to address these issues. A project team comprised of five ergonomists from various UC locations was formed.

Various approaches were used to meet the project objectives, including:

- Workers' Compensation data analysis
- Literature review
- Task analysis
- Direct observation and front line experiences at participating campuses

The top 5 high-risk tasks identified and addressed in this project include:

1. Manual Material Handling
2. Hedge Trimming
3. Tree Trimming
4. Debris Maintenance
5. Digging, Shoveling, Trenching and Irrigation

From the compiled data, a set of reference documents was developed, including:

- Best Practices Bulletins
- Product Recommendation Sheets
- Ergonomics Design Guidelines for Landscape Design, Construction and Maintenance

The *Best Practices Bulletins* provide work practice recommendations to reduce musculoskeletal risk factors. Each bulletin also includes information on equipment selection, training concepts, body mechanics, and work and staffing guidelines. The *Product Recommendation Sheets* offer equipment recommendations that have proven successful at one or more UC locations. The *Ergonomics Design Guidelines for* Landscape Design, Construction and Maintenance offer valuable ergonomic considerations to implement in the design phase of construction projects.

UCOP Risk Services will provide funding, up to $5,000 per location, to facilitate implementation of ergonomic interventions to address one or more of the high-risk tasks. The application and brief evaluation tool for this process are included in this report.

Project documents are available on the UC EH&S website at: http://www.ucop.edu/environment-health-safety/groups-and-programs/workgroups/ergonomics-projects.html . Content will be updated as pilot projects are implemented and data changes.

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Office of the President
1111 Franklin Street. 10th Floor
Oakland, California 94607-5200

Project Sponsors

Cheryl Lloyd, Chief Risk Officer, *Office of the President*
Ken Smith, Executive Director, Environment, Health and Safety, *Office of the President*

Project Team

Ergonomics Study of Grounds Positions at the University of California

Team Members	Location	Email
Kristie Elton	UC, Office of the President	kristie.elton@ucop.edu
Mallory Lynch	UC, Berkeley	mlynch@berkeley.edu
Brian MacDonald	UC, Santa Cruz	Bmacdon1@ucsc.edu
Greg Ryan	UC, Berkeley	gryan@berkeley.edu
Ginnie Thomas	UC, Santa Barbara	gthomas@housing.ucsb.edu

Participating UC Locations

Thank you to those who contributed to this project:

- UC Berkeley
- UC Davis Medical Center
- UC Irvine
- UC Los Angeles
- UC Riverside
- UC San Diego
- UC Santa Barbara
- UC Santa Cruz
- Lawrence Berkeley National Laboratory

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Ergonomics Study of Grounds Positions at the University of California

Project Objective

At the request of University of California, Office of the President (UCOP) Risk Services, the UC Ergonomics Work Group conducted a study of the risk factors associated with grounds positions. The objective of the study was to develop system-wide strategies that reduce these ergonomic risks.

Project Scope

The scope of the project involved identifying the top five at-risk tasks within these positions and developing strategies to reduce injuries and decrease workers' compensation costs. This was achieved by developing:

- **Best Practices Bulletins** to provide resources and guidelines for improving work practices
- **Product Recommendation Sheets** to provide information on equipment with proven success
- **Ergonomics Design Guidelines** for landscape design, construction and maintenance
- **Pilot Project Guidelines** to assist each location in developing and implementing location-specific interventions to address one or more of the high-risk tasks
- **Evaluation Tool** and metrics for effectiveness

Project Methodology

Injury and risk data was collected from each participating location using multiple means:

- Questionnaire (*Appendix A- Initial Questionnaire*)
- Recorded claims data

- Interviews with management and frontline employees
- Information provided by onsite ergonomists

After review and analysis of the data, the top five at-risk tasks were identified by the project team, as follows:

1. Manual Material Handling
2. Hedge Trimming
3. Tree Trimming
4. Debris Maintenance
5. Digging, Shoveling, Trenching and Irrigation

Other at-risk tasks reported (but not included in this study) are pulling starter cords on powered tools, riding or pushing a mower, raking, hammering and removing stakes and wearing provided work boots.

A second questionnaire was then developed by the project team and distributed to the ergonomists at participating locations (*Appendix B- Task Information Questionnaire*). Responses to this questionnaire provided the project team with the necessary information to develop the Best Practices Bulletins, Product Recommendation Sheets and Ergonomics Design Guidelines.

Findings and Recommendations

A set of recommended strategies to reduce the risk factors associated with the five at-risk tasks was developed. Please refer to the **Best Practices Bulletins**, **Product Recommendation Sheets** and **Ergonomics Design Guidelines** in this report for recommendation details.

Project Metrics

The goal of the project is to provide information, tools and resources to each UC location in order to implement specific and effective actions that will result in the reduction in the frequency and severity of injuries related to these top five at-risk job tasks.

Success measurements include:

- Completion and distribution of Best Practices Bulletins for each UC location to use as a resource to improve work practices
- Completion and distribution of Product Recommendation Sheets to provide equipment information that will assist with injury reduction strategies
- Completion and distribution of Design Guidelines for Landscape Design, Construction and Maintenance and providing guidelines to campus partners during the design phase of construction
- Ongoing system-wide support to implement recommended design guidelines
- Implementation of a one-year pilot project at participating locations, including an evaluation tool
- Integration of pilot project evaluation outcomes and lessons learned into work practices

Long-term success of the project will be assessed by reviewing university workers' compensation claim data. Following achievement of the above short-term measures, a decline in injury rates and cost is anticipated.

Next Steps

University of California grounds departments interested in participating in a UCOP-sponsored pilot project should work directly with the campus ergonomics program to complete the Ergonomics Pilot Project Application (*see appendix E*). Instructions are included in the application. Upon completion of the pilot, grounds employees and managers are expected to provide feedback to share with other participating UC locations. The Pilot Project Survey (*see appendix F*) should be used to collect the feedback.

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Ergonomics Design Guidelines

For Landscape Design, Construction and Maintenance

FOREWORD: The campuses and medical centers are rich in history with landscape designs from many significant landscape design movements. Landscaping involves many different jobs and includes creating beds, planting, terracing, and landscape maintenance such as tree service, hedge trimming, lawn maintenance, seasonal clean up, gardening and irrigation. The grounds staff helps keep these landscapes looking beautiful which, unfortunately, makes them one of the top high risk occupations. The following guidelines are intended to reduce the risks associated with musculoskeletal injuries for grounds staff while supporting the beauty of the landscape.

Effective planning and design should actively engage all stakeholders. It should include input from grounds, maintenance, landscape contractor(s), landscape architect(s), experienced facilities personnel, management, Environment, Health & Safety (EH&S) and campus ergonomists.

Process Considerations

- Design and planning meetings should include representatives from real estate, facilities (irrigation specialist, sheet metal and painting experts), EH&S, campus ergonomists and grounds care staff throughout the entire planning and building process
- Include all representatives in “value-engineering” decisions

Architectural Considerations

- Provide a centrally-located grounds department storage area and design satellite storage areas throughout the campus to reduce driving time for access. Adequately stock the satellite storage areas with appropriate quantity and type of grounds maintenance tools for the number of groundskeepers assigned to that area.

- The design of the storage areas should also include:
    - parking, utilities, communication systems and security
    - power outlets to charge battery operated equipment and electric carts
    - shelved storage

  - work benches for maintenance of tools and equipment
  - safe fuel storage for gasoline powered equipment
  - safe storage for fertilizers
  - hot/cold water valves

- When designing the overall landscape, allow for easy service vehicle access for maintenance (i.e. tall trees require a bucket truck, hedges and lawn grass (turf) require electric carts and mowers); provide removable and lightweight bollards

- Provide at least 24 inches of unplanted area (such as bark mulch, gravel, or decomposed granite) along any vertical wall for easier maintenance access

- Install irrigation valve boxes where they can be safely accessed (such as in the 24 inch unplanted area mentioned above), but also screened for aesthetic purposes

- Utilize non-corrosive, non-painted steel and metals instead of painted railings or metal work to greatly reduce the maintenance time and costs associated with repainting and/or refinishing surfaces

- Specify outdoor furniture and site furnishings that do not require regular maintenance

Flora Considerations

- Use drought-tolerant plants to reduce irrigation water use and maintenance efforts

- Use low-volume high-efficiency irrigation sprinklers to reduce irrigation water use; use in-line drip irrigation to reduce time associated with repair of faulty drip emitters and to reduce irrigation water use

- Use artificial turf or low water use, no-mow turf, that does not require regular mowing

- Avoid growing vines on buildings because they are difficult and dangerous to access for maintenance and are difficult to remove from buildings for repainting

- Avoid high maintenance plantings on terraces, ledges and other areas that do not provide safe and easy access

- For maintenance accessibility, provide access without stairways, when designing the landscape in courtyards.

- Plant hedges with a minimum of 24 inches for maintenance access on all sides; do not plant hedges flush against an obstacle or building

- Select plants that have slow growth rates, require less pruning, trimming or dead flower removal. In general, woody shrubs should only be used in locations where they will be allowed to grow to their full size without pruning.

- Avoid using annuals due to labor intensity and water usage; the use of succulent plantings is encouraged due to their low maintenance requirements and low water use

References

http://www.lni.wa.gov/safety/SprainsStrains/demofnl/landscaping-fnl.pdf
http://www.canadiangardening.com/how-to/lawn-care/separate-your-lawn-and-garden-with-mowing-strips/a/35951
www.wbdg.org/ccb/AF/AFDG/aerospacegroundequipment.pdf
www.wbdg.org/ccb/AF/AFDG/landscape.pdf
http://www.cp.berkeley.edu/lhp/guidelines/components.html

Manual Material Handling

- Green Waste, Brush, Tree Limbs and Tree Trunks
- Materials, Tools and Equipment

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Best Practices Bulletin: *Manual Material Handling*

Green Waste, Brush, Tree Limbs and Trunks; Materials, Tools and Equipment

Presented by Office of the President Risk Services- June 2015

Green waste, brush, tree limbs and trunks

The light material is consolidated with tools and blowers and placed in a variety of containers. Heavier material is often handled by outside contractors or trimmed and cut down to size. Some material is dragged or carried to the transport vehicle but most material is manually loaded nearby. Wheeled bins, automatic lifters and heavy equipment are used to place material inside transport vehicles. Some wood chipping is performed onsite. At the waste site, material is dumped on the ground or placed in tall dumpsters by manually lifting or using tools. Towable containers, automatic tippers, larger equipment and use of a subterranean dumpster help reduce manual material handling.

Materials, tools and equipment

Items are moved, transported and used at various locations throughout the campuses. To the extent possible, mechanical aids are used to assist in moving, lifting and positioning the items. Individual or 2-3 person lift teams are used when device aids are not available or cannot be used due to surrounding conditions. Planning ahead, using the right equipment and practicing safe handling techniques are beneficial to reducing the risk of injury.

Some of the risk factors for these job tasks include:

- Awkward postures when picking up consolidated debris from the ground
- Awkward postures and use of excessive force when handling heavy tree limbs and trunks
- Repetitive lifting and moving heavy material and equipment

Best Practices

The best way to reduce the risks associated with manual material handling and improve efficiency is to eliminate the manual material handling by automation and utilization of equipment and/or tools. Since automation is not always feasible, the information below includes additional best practices that can be implemented to achieve the same goals of risk reduction and efficiency improvement.

Green Waste and Brush - *Collecting Cut Material*

- Use a tractor with a frontend load attachment to consolidate large amounts of debris *(refer to Industrial Equipment Matrix)*
- Mulch all grass, do not collect clippings (unless there is a special event on campus). Mulching mowers are optimal for this. If clippings are collected, utilize equipment equipped with a grass catcher or a turf vacuum. *(refer to Industrial Equipment Matrix)*
- Recycle leaf litter in place to increase the organic matter in soil; use it as mulch to help with water retention and decrease manual material handling

Placing Materials Into Transport Vehicles

- Keep the load as light as possible when lifting material into container or transport vehicle
- Place material into a towable container that can be automatically tipped at the dump site to reduce additional manual material handling *(refer to Industrial Equipment Matrix)*
- Place green waste in wheeled bins, with mechanical tipping capability, and roll on and off trailers or vehicle beds *(refer to Product Recommendation Sheet and Industrial Equipment Matrix)*

Removing Materials From Transport Vehicles

- Provide vehicles with automatic lifts and dump/tilt features to reduce manual material handling associated with debris transport and disposal *(refer to Industrial Equipment Matrix)*
- Automatically dump collected green waste directly into subterranean dumpster containers to reduce lifting and reaching overhead *(refer to Product Recommendation Sheet)*

Placing Material Into a Wood Chipper and Moving Large Limbs

- Use motorized winches and grapples to reduce dragging, lifting and carrying tree debris to feed into chippers *(refer to Industrial Equipment Matrix)*

- Use light weight safety helmets with mesh visors to reduce neck/upper body muscle tension and improve visibility while working *(refer to Product Recommendation Sheet)*
- Chipping may produce a high amount of fine air-born particulate matter; use a PAPR respirator for further protection *(refer to Product Recommendation Sheet)*
- Utilize industrial landscaping equipment to load chipped material into dump truck and consolidate and transport larger materials such as tree trunks and tree limbs *(refer to Industrial Equipment Matrix)*
- Where necessary, utilize towable chippers to place them close to the job site and purchase chippers that can dispense directly into transport vehicles or blow chipped material directly onto landscape as mulch/ground cover *(refer to Industrial Equipment Matrix)*

Removing Green Waste - *From Living Roof or Inaccessible Planting Area**

- Use a bucket truck to provide access for pruning *(refer to Industrial Equipment Matrix)*
- If proper equipment is not available to provide safe access, contract out the job to reduce the risk of injury

**Where standard equipment cannot be used*

Materials, Tools and Equipment - *Lifting, Moving or Transporting*

- Use mechanical aids (e.g. hoists, forklifts, pallet jacks, hand or truck dollies, tractors, back hoes and carts) when moving and/or lifting heavy or awkward items; use additional staff to provide extra visual guidance or assist with keeping doors open etc. (*refer to Product Recommendation Sheet and Industrial Equipment Matrix)*
- When mechanical aids are not available, ask your supervisor to have the job evaluated by the campus ergonomist or Environment, Health and Safety specialist to develop administrative and engineering controls
- Place pivoting handle grips on the end of wheel barrows to reduce awkward postures when dumping contents (*refer to Product Recommendation Sheet)*
- Use lift gates to load and unload items *(refer to Industrial Equipment Matrix)*
- Utilize trailers, with ramps, for all large equipment that cannot be driven to work site *(refer to Industrial Equipment Matrix)*
- Modify the trailer gate, if needed, to reduce manually lifting the gate (*refer to Product Recommendation Sheet)*
- Retrofit hard to move items, such as bleachers on the athletic field, with wheels to make them easier to move around for various events *(refer to Product Recommendation Sheet)*

Temperature

- To reduce heat stress provide the following:

  - Have and maintain one area of shade (use a portable, stand up umbrella or canopy as needed) when the temperature exceeds 80 degrees
  - Provide access to drinking water
- Dress appropriately when working in cold and/or wet environments to improve muscle flexibility, dexterity and grip strength

Equipment

Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two–week trial period

During the pilot period, consider the following:

- Vibration levels
- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

Training

Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury.

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective

equipment (PPE) as required

- Instructions on ergonomic practices focusing on the following:
  - practicing neutral postures
  - safe lifting, carrying, and pushing techniques
  - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

Body mechanics

Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
  - Appropriate equipment is not available ***and***
    - The load is too heavy for one person, ***or***
    - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
  - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
  - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
  - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.

Work and staffing guidelines

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue

- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

References

https://www.dir.ca.gov/dosh/dosh_publications/Erg_Landscaping.pdf
http://www.lni.wa.gov/safety/SprainsStrains/demofnl/landscaping-fnl.pdf
http://safety.ucanr.edu/Programs/Heat_Illness_Prevention/

Product Recommendation Sheet

Manual Material Handling – Green Waste, Brush, Tree Limbs and Trunks; Materials, Tools and Equipment

Grounds Product Recommendations

Task: Picking up, transporting, and dumping green waste, brush, tree limbs and trunks; transporting materials, tools and equipment

Criteria: Use small and large equipment to reduce manual material handling and effectively maintain grounds

Wheeled Containers

Application: Collecting trash/recycle and compost materials

Make	Model	Cost *(approximate)*	Comment *(Pros and Cons)*	
			Pro:	**Con:**
Toter and Schaefer	32-96 gallon containers	Varies on size of container	• 2 or 4 wheels • Allows for easier transport to dump site • Fit on electric or battery tippers at dump site for automated dumping	• Containers can get heavy when full

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website:
http://www.toter.com/products/category-list.cfm/category/carts
http://www.ssi-schaefer-asia.com/waste-management/products-for-the-collection-of-waste-and-recyclable-materials/2-wheel-containers.html

Subterranean Dumpster for Green Waste

Application: Dumping green waste directly into larger waste container

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
MarBorg Waste Disposal	Custom Construction Service	$5000.00	• Vehicle can back up and dump directly into dumpster • Vendor services unit	• Cost

For More Information: Julie McAbee, UC Santa Barbara
Julie.mcabee@ehs.ucsb.edu

Website: www.marborg.com/greenwastecollection

Forestry Helmet System

Application: Head and hearing protection

Make	Model	Cost *(approximate)*	Comment *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	Pro-Mark	$100.00	• Lightweight and very sturdy • Mesh face cover stay cool on hot days • Integrated hearing protection for chainsaw use	• Some users have issues with proper fit of ear muffs

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/protective-and-work-wear/head-and-face-protection/pmfh/

Heavy Industry PAPR Kit

Application: Protection for wood chipping

Make	Model	Cost *(approximate)*	Comment *(Pros and Cons)*	
3M	TR-300	$1500.00	**Pro:** • Lightweight • Integrated helmet • Integrates with hearing protection and wireless comm. system	**Con:** • None mentioned

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.pksafety.com/3m-versaflo-hi-papr-kit-tr-300-hik.html?gclid=CPnu2ZLjlMUCFRNafgodh4MAVg

Forklift

Application: Transporting containers/pots, green waste and pallets

Make	Model	Cost *(approximate)*	Comment *(Pros and Cons)*	
Toyota	8FGU20	$29,000	**Pro:** • Excellent for getting up to high places • Reduces manual material handling • Quick lift speed	**Con:** • Requires initial certification training • Recertification every 3 years • Cost

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu

Website: http://www.forkliftaction.com/equipment/specifications.asp?itid=3894

Leonard Nursery Truck Extended Lift Tree Dolly

Application: Transporting containers/pots, green waste and pallets

Make	Model	Cost *(approximate)*	Comment *(Pros and Cons)*
A.M. Leonard	Model #F22GP	$419.99	**Pro:** • Wide tires make it easier to roll across turf • Double vertical frame tubes on each side **Con:** • Manual aid requires a 2 person team

For More Information: Yvonne Ybarra, UC Riverside
yvonne.ybarra@ucr.edu

Website: http://www.amleo.com/leonard-nursery-truck-extended-lift-1600lb%2c-flat-free-tires/p/f22gp

EZ Haul Utility Jumbo Cart

Application: Transporting lightweight material

Make	Model	Cost *(approximate)*	Comment *(Pros and Cons)*
EZ Haul	Model # CT411 or CT412	$369.00	**Pro:** • Helps transport green waste in hilly terrain • Large wheels makes pushing easier • Lightweight **Con:** • None provided

For More Information: Mallory Lynch, UC Berkeley
mlynch@berkeley.edu

Website: http://shop.ezhaulcart.com/index.php?main_page=product_info&cPath=26&products_id=3

Pivoting Wheelbarrow Handles

Application: Use safer hand/wrist postures when dumping loads

Make	Model	Cost *(approximate)*	Comment *(Pros and Cons)*
Simply Dump It	N/A	$25.00	**Pro:** • Attaches easily to end of wheelbarrow • Comfortable **Con:** • None provided

grips
- Easier to dump load

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu
Website: www.simplydumpit.com

2 Sided Assist for Trailer Lift Gate

Application: To reduce lifting and lowering of trailer gate

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Gorilla	40101042G	$180.00	**Pro:** • Counterbalance technology requires no lifting/lowering of gate	**Con:** • None mentioned

For More Information: Randy Sauser, UC Los Angeles
rsauser@ehs.ucla.edu
Website: http://www.northerntool.com/shop/tools/product_200316067_200316067

Modification of Bleachers – Installation of wheels

Application: Moving bleachers

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
UCSC in-house project (Fleet Services)	Not applicable	$2500.00	**Pro:** • Eliminates lifting of heavy bleachers	**Con:** • Possibly cost • Not an off the shelf product

For More Information: Michael Smith, Head of Maintenance, UCSC, mipsmith@ucsc.edu
Jose Medrano, Fleet Manager, UCSC jmedrano@ucsc.edu
Brian MacDonald, Campus Ergonomist, UCSC bmacdon1@ucsc.edu
Website: N/A (custom project)

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Best Practices Bulletin: *Manual Material Handling*

Trash and Recycle

Presented by Office of the President Risk Services- June 2015

Trash and recycle

The design of the collection bins is critical for gaining access, maneuverability, weight of contents and ease of transfer to larger waste management bins. Some collections bins have been redesigned to deter rain water and rodents, and some collection trucks have been modified or purchased to automate more of the process. These innovations are reducing manual material handling and influencing the reduction of injuries.

Some of the risk factors for these job tasks include:

- Repetitive and awkward postures when lifting waste and recycle bags from receptacles
- Awkward and forceful postures when lifting bags above shoulder height to place in larger transport vehicles

Best Practices

Automate these work processes in order to reduce the risk of injury and improve efficiency. Since automation is not always feasible, the information below includes additional best practices that can be implemented to achieve the same goals of risk reduction and efficiency improvement.

Lifting or Moving Trash and Recycle Containers Filled with Material

- Select waste and recycle receptacles with rain hoods to reduce content weight and with side access to reduce lifting bags above shoulder height *(refer to Product Recommendation Sheet)*

- Select receptacles where the liners slide out of unit without lifting; choose liners with handles to promote safe gripping *(refer to Product Recommendation Sheet)*
- Attach custom stand to existing trash containers to reduce lifting bags above shoulder height *(refer to Product Recommendation Sheet)*
- Utilize solar-powered waste and recycle compacting systems in high traffic areas *(refer to Product Recommendation Sheet)*
- To reduce the weight being lifted empty waste containers at 50% capacity

Emptying Contents into Larger Containers and Transport Vehicles

- After manually placing trash/recycle into wheeled container (toter), automate dumping waste contents directly into transport vehicle; provide vehicles with automatic tippers for the dump site *(refer to Product Recommendation Sheet)*
- Customize transport vehicles to provide lower access for loading *(refer to Product Recommendation Sheet)*
- After manually lifting contents from liner from stationary outside receptacles, place bags inside vehicles with lower beds that *can* automatically dump at waste site *(refer to Product Recommendation Sheet and Industrial Equipment Matrix)*

Transporting Wheeled Containers to Pick-Up Area

- Use trucks with lift gates to load and transport large wheeled containers *(refer to Industrial Equipment Matrix)*
- Use small electric vehicle with trailer and spring loaded ramp to load and transport wheeled containers *(refer to Industrial Equipment Matrix)*

Transporting Trash and Recycle to Collection Site

- Use transport vehicles with automatic dumpers to transport collected material to towable container or main dump site *(refer to Product Recommendation Sheet and Industrial Equipment Matrix)*
- Position multiple large waste collection sites throughout the campus to reduce transport time

Dumping Trash and Recycle at Final Collection Site

- Use mechanized lifts to automatically dump all free standing containers at final collection site *(refer to Product Recommendation Sheet)*
- Provide trailer to move large (3 & 5 yard) towable containers to final collection location *(refer to Product Recommendation Sheet and Industrial Equipment Matrix)*

Temperature

- To reduce heat stress provide the following:
    - Have and maintain one area of shade (use a portable, stand up umbrella or canopy as needed) when the temperature exceeds 80 degrees
    - Provide access to drinking water
- Dress appropriately when working in cold and/or wet environments to improve muscle flexibility, dexterity and grip strength

Equipment

Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two–week trial period

During the pilot period, consider the following:

- Vibration levels
- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

Training

Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury.

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
    - practicing neutral postures
    - safe lifting, carrying, and pushing techniques
    - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

Body mechanics

Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
    - Appropriate equipment is not available ***and***
        - The load is too heavy for one person, ***or***
        - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
    - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
    - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
    - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.

Work and staffing guidelines

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

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Product Recommendation Sheet: *Manual Material Handling of Trash/ Recycle Receptacles and Systems*

Grounds Product Recommendations

Task: Collect, transport and dump trash/recycle

Criteria: Reduce weight and frequency of manual material handling and automate the process where possible

Outdoor Receptacle with Rain Hood and Side Access Door

Application: Trash, recycle and compost containers

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Fabritech	No model #	$900.00	**Pro:** • Easy to open • Keeps out rain and rodents • Side access for removal of liner • Easy to cluster in diff. shapes • Aperture can be changed for different waste streams and are color coded **Con:** • Flat sides can attract graffiti • Not an off the shelf solution • Must be manufactured (30 day delivery)

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: Brien Angelo fabritech.us@gmail.com 510-367-1858

Pivoting Elevated Waste Container

Application: Improve access for existing trash cans

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Victor Stanley Trash Can Custom Stand – UCLA Sheet metal Shop	S-42	Existing cans Custom Stand - $800-$1000	**Pro:** • Elevates waste container • 42” height meets ADA requirements • Keeps out rodents • Container rotates 90 degrees on stand for sideways removal of liner • Reduces shoulder and arm elevation **Con:** • Not an off the shelf solution • Expensive • Lidless design exposes trash to rain

For More Information: Cindy Burt, UC Los Angeles burt@ehs.ucla.edu

Website: N/A

Big Belly Solar Compactor

Application: Solar trash, recycle and compost containers

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Big Belly	Trash/Recycle Dual	$8,000	• Software link to determine pick up need • No access for rodents or rain • No lid to remove or lift to access waste • Recycle material cannot be taken • Door opening does not allow for large inappropriate waste items	• Removing and lifting bag from liner (suction) • Cost • Large items can get stuck and disable unit • Client complaints about having to pull a handle for access - germs

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu

Website: www.bigbelly.com

Wheeled Containers

Application: Collecting trash/recycle and compost materials

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Toter and Schaefer	32-96 gallon containers	Varies on size of container	• 2 or 4 wheels • Allows for easier transport to dump site • Fit on electric or battery tippers at dump site for automated dumping	• Containers can get heavy when full

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.toter.com/products/category-list.cfm/category/carts

http://www.ssi-schaefer-asia.com/waste-management/products-for-the-collection-of-waste-and-recyclable-materials/2-wheel-containers.html

EXV2 Patriot Refuse Hauler w/Tipper

Application: Automate dumping waste into towable

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
E-Ride Electric Vehicle	EXV2	$30,000	• Small size to navigate tight spaces • Eliminates manual lift into towable • Electric and powerful to climp steep slopes • Hopper can dump into towable or Packer truck	• Charge for 8 hours • Battery loses charge over time • Waste can spill when dumping into towable • Not an off the shelf solution

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.e-ride.com/e-ride-Industries-EXV2-Patriot-inventory.htm?id=315094&used=1&fm=2&vin=

Electric Vehicle with Automatic Dumper for Collecting Trash

Application: Collection of trash material

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Taylor Dunn	#T48AC48 Refuse Truck	$24,000	• Custom side opening lowers access height • Automatically dumps contents into 3 yard bin • 2 speed settings – (Slow and Fast) make it easier to go up hills on campus	• Limited space in cabin – difficult for larger stature staff to drive • Small mirrors increase blind spots • No shield or visor from the sun – added to truck later

For More Information: Randy Sauser, UC Los Angeles
rsauser@ehs.ucla.edu

Website: http://www.taylor-dunn.com/vehicle_search.aspx?mode=custom&base=T-48GT&feature=all

Recyclable Material Dump Truck

Application: Collection of recycle material

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
GMC	Custom design	$126,000	**Pro:** • Compactor inside truck • Runs on natural gas **Con:** • Material gets stuck inside compactor area • Big truck needs experienced driver • Had to custom design and install platform on front of truck to transport cart to pickup trash

For More Information: Cindy Burt, UC Los Angeles
burt@ehs.ucla.edu

Website: www.gmc.com

Mechanized Lifter for Dumping Wheeled Carts

Application: Automate dumping of wheeled carts

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
MarBorg	Custom	$8,000 - $12,000	**Pro:** • Reduces manual material handling • Eliminates lifting above shoulder height **Con:** • Cost

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu

Website: www.marborg.com/greenwastecollection

Large Hauler with Tipper

Application: Automate dumping of wheeled totes and truck bed at final collection site

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Perkins Manufacturing	SAT800	$21,000.00 *(truck not included)*	**Pro:** • Eliminates manual lifting and dumping wheeled toters • Automates dumping of bed **Con:** • Must match with final collection container lip height

contents
- Comes in 3,6 & 8 yard models
- Customizable design options

For More Information: Roger Edberg, Senior Ground Superintendent rjedberg@ucsc.edu
Brian MacDonald, Campus Ergonomist bmacdon1@ucsc.edu

Website: www.perkinsmfg.com

Custom Trailer

Application: Transport of 3 & 5 yard dumpsters

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Ray GaskinService	3- & 5-yd. Bin Dumpster Hauler	$12,000	• Transport dumpster to transfer site	• Hauler is attached to back of truck

For More Information: Yvonne Ybarra, UC Riverside
Yvonne.ybarra@ucr.edu

Website: www.raygaskinservice.com

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Industrial Equipment

Used to reduced manual material handling

Picture	Name of Equipment	Applications	Justification for Use	Contact
	John Deere 3520 Tractor Loader	Manual Materials Handling *Appropriate for heavy lifting*	*Bucket:* *picks up green waste and brush and dumps into large waste container	Julie McAbee *UC Santa Barbara* Julie.mcabee@ehs.ucsb.edu
	John Deere 310G Backhoe with 4 in 1 bucket	Manual Material Handling *Appropriate for heavy lifting*	*4 in 1 bucket:* *picks up green waste, brush and chipped material and loads into dump truck *Backhoe*: *picks up tree trunks and places on transport vehicle *picks up green waste and dumps into 40 yd. waste container	Julie McAbee *UC Santa Barbara* Julie.mcabee@ehs.ucsb.edu
	Bobcat S70 Skid Steer Loader *attachments available*	Manual Materials Handling *Collects green waste; gets in small spaces, breaks up and transports concrete*	Works well in small or enclosed spaces. Replaces backhoe for small jobs.	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu

Picture	Name of Equipment	Applications	Justification for Use	Contact
	Case ih Farmall C Series Tractor with attachments *Fork lift attachment*	Manual Materials Handling *Large grounds work*	*Forklift attachment:* *Assists in moving pallets, loaded with material, directly to site location	Bill Collier *UC Merced* Bcollier2@ucmerced.edu
	Bucket truck	Providing access to high locations for pruning	Bucket allows for safe transport up to high locations that are typically inaccessible	Brian MacDonald *UC Santa Cruz* bmacdon1@ucsc.edu
	Big Tex Trailer	Manual Materials Handling *Reduces lifting small wheeled equipment*	*Efficiently transports small wheeled equipment, tools and heavy materials directly to site location *Attaches directly to transport vehicle *Optional: holders for long handled tools available for purchase to help keep items separate	Bill Collier *UC Merced* Bcollier2@ucmerced.edu
	PJ Trailer *Optional compartments to separate items*	Manual Materials Handling *Easy transport of equipment and debris*	*Easily attaches to existing truck *Lift gate allows wheeled equipment to be easily loaded	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu
	Stake bed trucks with lift gate	Manual Materials Handling	Helps transport wheeled containers throughout locations	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu

Picture	Name of Equipment	Applications	Justification for Use	Contact
	Tommy Lift Gate for Truck Bed	Manual Materials Handling *Allows small wheeled equipment to be easily loaded*	*Reduces manual material handling in/out of truck *Saves time to transport needed materials/equipment to site locations	Bill Collier *UC Merced* Bcollier2@ucmerced.edu
	Ditch witch mini skid steer SK750 with trenching attachment	Trenching	*Digs trenches for sprinkler lines or drainage *Stand on unit is easy to control *Does not dig as deep as dedicated equipment	Brian MacDonald *UC Santa Cruz* bmacdon1@ucsc.edu
	Ditch witch mini skid steer SK750 with auger attachment	Digging holes	*Attachment helps dig holes *Stand on unit is easy to control	Brian MacDonald *UC Santa Cruz* bmacdon1@ucsc.edu
	Ditch witch mini skid steer SK750 with grapple attachment *Branch Manager grapple attachment*	Manual Materials Handling Moving tree trunks and large branches	*Lifts and transports heavy tree trunks *Helps position tree trunks at proper height when using chipper	Brian MacDonald *UC Santa Cruz* bmacdon1@ucsc.edu
	Boxer mini skid steer (stand on) with trenching attachment (532DX)	Trenching	*Compact; good for small spaces *Easier to control with less vibration than walk behind equipment *Does not dig as deep as dedicated equipment	Belinda Manalac *UC Irvine* bmanalac@uci.edu
	John Deere 25 compact tractor with back hoe attachment	Digging	*Backhoe* is for digging holes *Compact; good for both large and small landscape areas	Bill Collier *UC Merced* Bcollier2@ucmerced.edu

Picture	Name of Equipment	Applications	Justification for Use	Contact
			*Ride on is easy to control and has less vibration than walk behind or stand on units *Does not dig as deep as dedicated units	
	Small walk behind trencher Vermeer RT200	Trenching	Preparing trench to install water lines	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu
	Ditch Witch Ride on Trencher with Back hoe (RT45)	Digging and Trenching	Easy to control with less vibration; digs deeper than units with attachments *Backhoe:* *Digging holes *Trencher:* *Digs long and narrow holes for pipe, sprinkler lines and drainage	Belinda Manalac *UC Irvine* bmanalac@uci.edu
	Big ride on trencher (Vermeer V-4150)	Trenching	Easy to control with less vibration; digs deeper than units with attachments *Digs long and narrow holes for pipe, sprinkler lines and drainage	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu
	Bandit Mobile Chipper	Chipping branches and tree trunks	*Attaches on back of transport vehicle *Heavy duty; handles large tree trunks *Optional attachment allows chips to be loaded into dump truck	Brian MacDonald *UC Santa Cruz* bmacdon1@ucsc.edu

Picture	Name of Equipment	Applications	Justification for Use	Contact
	Optional hydraulic winch attachment for the Bandit Mobile Chipper	Handling Tree Trunks *Placing into chipper*	*Integrates with chipper to reduce manual material handling *Attaches to tree trunk and lifts to desired location for placing in chipper	Brian MacDonald *UC Santa Cruz* bmacdon1@ucsc.edu
	Towable chipper *Vermeer 935 Auto feed 2*	Chipping branches and tree trunks	*Chipping material *Attaches on back of transport vehicle *Chipped material shots out onto ground	Greg Ryan *UC Berkeley* gryan@berkeley.edu
	John Deere Gator *Attachments are available*	Manual Materials Handling *Automatic dump bed reduces manually handling loads*	*Electric vehicle *Small size provides easier access through campus service areas *Low bed height provides easier access *Dump bed reduces manual material handling	Julie McAbee *UC Santa Barbara* Julie.mcabee@ehs.ucsb.edu
	Cart with Jacobsen Dump Bed	Manual Materials Handling *Automatic dump bed reduces manually handling loads*	*Diesel vehicle *Small size provides easier access through campus service areas *Low bed height provides easier access *Dump bed reduces manual material handling	Yvonne Ybarra *UC Riverside* Yvonne.ybarra@ucr.edu
	Tennant 810 Outdoor Sweeper	Debris Maintenance *Picks up debris on hardscape*	Works well on small hardscape areas	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu

Picture	Name of Equipment	Applications	Justification for Use	Contact
	Elgin Pelican Street Sweeper	Debris Maintenance *Picks up debris on hardscape*	Works great on large hardscape areas Suction waste into hopper with automatic lift component that dumps straight into 40 yard flat bed	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu
	Little Wonder Leaf and Debris Vacuum	Debris Maintenance	Picks up many things including bottles, caps, pine cones - all of which would have to be picked up by hand; manually dump debris bag when filled	Bill Collier *UC Merced* Bcollier2@ucmerced.edu
	Walker ride on mower with mulching deck	Manual Materials Handling	The automatic dumping device works like a dump truck. This eliminates manually lifting the hopper to empty the contents.	Bill Collier *UC Merced* Bcollier2@ucmerced.edu
	John Deere 7H17 Mower with mulching deck *Walk behind*	Manual Materials Handling	Mulching takes less time than bagging, thus reduces manual materials handling	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu
	Truck with Robo-lift trailer	Manual Materials Handling	Transport yard disposal containers to disposal site	Cindy Burt *UC Los Angeles* burt@ehs.ucla.edu

Hedge Trimming

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Best Practices Bulletin: *Hedge Trimming*

Presented by Office of the President Risk Services- June 2015

Hedge trimming requires manipulating tools to cut the hedge to its desired shape and size. The upper body holds the tool while either stabilizing or moving the lower body for sustained periods of time. Some hedge trimming power tools are manually started with a pull cord, which may contribute to repetitive motion injuries. Grounds crews are often raised above ground level, on lift equipment, to reach taller hedges. Some of the risk factors include:

- Awkward back, shoulder, elbow and wrist postures to reach specific areas of hedges
- Repetitive motions of the upper extremities to cut hedges
- Forceful and sustained muscular exertions of the upper limbs while holding tools
- Vibration from power tools

Best Practices

Selecting the appropriate tools for the type and shape of hedges is critical to reduce musculoskeletal stress to the body. Using proper body mechanics and the best tools reduces the major risk factors. The information below includes best practices that can be implemented to reduce risk and improve efficiency.

Considerations for Choosing Hand or Power Trimming Tools

- Type of plant
  - Branches thicker than a finger may require a gas powered trimmer
- Size and shape of plants
  - Smaller, shorter plants and hedges with less depth may be cut with a hand shear
- Rate of growth
  - Selective hand trimming may reduce the growth rate and reduce the frequency of maintenance
- Aesthetic goals of landscape design
  - Selective hand trimming can increase the density of a hedge compared to powered trimmers

Hedge Trimming Equipment

- Select lightweight, well balanced trimmers that afford the use of safe body mechanics *(refer to Product Recommendation Sheet)*
- Purchase equipment with an efficient vibration-dampening system
- Use anti-vibration gloves that offer good dexterity *(refer to Product Recommendation Sheet)*
- Use battery powered hedge trimmers to reduce weight and repetitive motion (starter cord) *(refer to Product Recommendation Sheet)*
- Do not use hedge trimmers with power cords
- Use gas powered hedge trimmers to cut thicker and woodier branches *(refer to Product Recommendation Sheet)*
- When trimming hedges between knee and chest height and accessible from *both* sides
  - use a 20 inch long blade when hedge is less than 30 inches deep
  - use a 30 inch long blade when hedge is less than 50 inches deep
  - use an extended trimmer when depth is greater than 50 inches
- When trimming hedges between knee and chest height and accessible from *one* side only
  - use a 20 inch long blade when hedge is less than 20 inches deep
  - use a 30 inch long blade when hedge is less than 30 inches deep
  - use an extended trimmer when depth is greater than 30 inches
- Double-sided trimmers should be equipped with an adjustable rear handle for increased

flexibility in hand positioning *(refer to Product Recommendation Sheet)*

- Some employees will benefit from using lighter, one-sided trimmers with longer blades that are good for straight cuts *(refer to Product Recommendation Sheet)*
- Use an extended, articulating trimmer for hedges above shoulder height or below knee level *(refer to Product Recommendation Sheet)*
- Use a harness with padded shoulder strap(s) when manipulating long trimmers to reduce force requirements on the hands and arms *(refer to Product Recommendation Sheet)*
- Use lightweight hand hedge shears with comfortable grips to cut smaller, medium height hedges *(refer to Product Recommendation Sheet)*
- Use a scissor lift or bucket lift for higher hedges that can't be reached with an extended trimmer; do not use ladders for hedge trimming

Temperature

- To reduce heat stress provide the following:
    - Have and maintain one area of shade (use a portable, stand up umbrella or canopy as needed) when the temperature exceeds 80 degrees
    - Provide access to drinking water
- Dress appropriately when working in cold and/or wet environments to improve muscle flexibility, dexterity and grip strength

Equipment Purchasing Process

Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two–week trial period

During the pilot period, consider the following:

- Vibration levels
- Adjustability, size and weight of equipment to accommodate wide range of body types
- Location of controls and ease of operation
- Storage and transporting needs

- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

Training

Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury.

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Specifics for hedge trimming
    - Adjust handles so grounds crew can attain an upright standing position with elbows close to the body
    - Manipulate entire trimmer or rotate handle to maintain straight wrist postures
    - Use only enough grip force to stabilize the trimmer; don't use a death grip
    - Use trimmers for short periods of continuous use before feeling fatigue (20- 30 minutes) and rotate job tasks to break up repetitive stress
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
    - Maintenance:
        - Follow manufacturer's maintenance guidelines
        - Keep the blades sharp to reduce the force requirement of the job
        - Implement a regular maintenance schedule for cleaning, lubricating and part replacement
- Instructions on ergonomic practices focusing on the following:
    - practicing neutral postures
    - safe lifting, carrying, and pushing techniques
    - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

Work and staffing guidelines

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

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Product Recommendation Sheet: *Hedge Trimming*

Grounds Product Recommendations

Task: Cutting hedges

Criteria: Lightweight, low vibration and well-balanced tools

Dual Blade Trimmer (Battery)

Application: To cut hedges *less than 30" deep and medium height* (between knee and chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	HSA 66	$499	• Push button start • Low noise • Low emissions/no fueling • Multi-position handle • 20 inch blade	• Power • Battery run time/life

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.stihlusa.com/products/hedge-trimmers/professional-hedge-trimmers/hsa66/

Dual Blade Trimmer (Battery)

Application: To cut hedges *less than 30" deep and medium height* (between knee and chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Echo	58V Cordless	$450	• Low noise level • Low emissions • 24" blade • Push button start	• Power • Non-adjustable handle • Battery run time/Life

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.echocordless.com/products/hedge-trimmer/

Single Blade Trimmer (Gas)

Application: To cut hedges *less than 30'' deep and medium height* (between knee and chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Echo	HC-235	$470	• Long blade good for straight cuts • Adjustable handle • Power	• Single sided blade promotes movement in one direction • Starter cord • Battery operated not available

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.echo-usa.com/Products/Hedge-Trimmers/HC-235#BVRRContainer

Single Blade Trimmer (Gas)

Application: To cut hedges *less than 30'' deep and medium height* (between knee and chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Red Max	HTZ2460	$450	• Long cutting blade • Good for flat cutting • Power	• Single sided blade promotes movement in one direction • Starter cord • Emissions

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.redmax.com/products/hedge-trimmers/htz2460/

Single Blade Trimmer (Gas)

Application: To cut hedges *less than 30'' deep and medium height* (between knee and chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	HS 86 T	$480	• Long 30'' blade • 40" blade option • Good for straight cuts • Lightweight	• Single sided blade promotes movement in one direction • Emissions • Starter cord

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.stihlusa.com/products/hedge-trimmers/professional-hedge-trimmers/hs86t/

Extended Articulating Hedge Trimmer (Battery)

Application: To cut *low and high hedges* (below knee and above chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	HLA 85	$450	• Variable speed trigger • Telescoping shaft • 115° articulating head	• Long shaft increases load on body • Battery life • Does not have as much power as gas

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.stihlusa.com/products/hedge-trimmers/professional-hedge-trimmers/hla85/

Extended Articulating Hedge Trimmer (Battery)

Application: To cut *low and high hedges* (below knee and above chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	HLA 65	$420	• Various handle options • Long reach • 115° articulating head	• Long shaft increases load on body • Does not have as much power as gas

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.stihlusa.com/products/hedge-trimmers/professional-hedge-

Extended Articulating Hedge Trimmer (Gas)

Application: To cut *low and high hedges* (below knee and above chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	HL 100 K (135º)	$480	• Well balanced • Anti-vibration system • Powerful 135° articulating head	• Long shaft increases load on body • Gas emissions

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.stihlusa.com/products/hedge-trimmers/professional-hedge-trimmers/hl100k135/

Extended Articulating Hedge Trimmer (Gas)

Application: To cut *low and high hedges* (below knee and above chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Echo	HCA-266	$450	• Well balanced • Anti-Vibration handles • 180° articulating head	• Long shaft increases load on body • Gas emissions

For More Information: Greg Ryan, UC Berkeley gryan@berkeley.edu

Website: http://www.echo-usa.com/Products/Hedge-Trimmers/HCA-266

Extended Hedge Trimmer (Gas)

Application: To cut *deep (over 50"), medium height* (between knee and chest level hedges)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Echo	SHC-225S	$450	• Adjustable handle • Longer than standard trimmers • Anti-vibration system • Powerful • Extended shaft	• Long shaft increases load on body • Gas emissions • Heavy than standard length trimmers • Battery operated not available

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.echo-usa.com/Products/Hedge-Trimmers/SHC-225S

Extended Hedge Trimmer (Gas)

Application: To cut *deep (over 50"), medium height* (between knee and chest level hedges)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	HL 90 K (0°)	$420	• Long reach • Anti-vibration system • Powerful	• Long shaft increases load on body • Gas emissions • No adjustable handles

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.stihlusa.com/products/hedge-trimmers/professional-hedge-trimmers/hl90k/

Anti-Vibration Gloves

Application: To protect and reduce vibration to the hand

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Impacto	Blackmax Vibration Reducing Gloves	$18	**Pro:** • Good dexterity • Anti-vibration/ impact • Anti-slip	**Con:** • Reduces range of motion

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.impacto.ca/catalog.php?item=1339

Anti-Vibration Gloves

Application: To protect and reduce vibration to the hand

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Valeo	V435/GAFS	$22	**Pro:** • Good dexterity • Wrist support	**Con:** • Can get hot

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.valeowork.com/?id=10&prodId=217&CatId=37&Parent=32

Shoulder Harness for Long Trimmers

Application: To reduce the force requirements of the hands and arms

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Stihl	Deluxe Single Harness	$20	**Pro:** • Increases range of motion for arms • Easy to put on • Padded	**Con:** • Single Strap

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.stihlusa.com/products/trimmers-and-brushcutters/accessories/straps-and-harnesses/dlxsngharness/

Shoulder Harness for Long Trimmers

Application: To reduce the force requirements of the hands and arms

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	Double Standard Harness	$ 45	• Increases range of motion for arms • Plate clip reduces contact stress at hip • Distributes weight of trimmer more evenly • Padded	• No hip belt • Takes time to adjust

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.stihlusa.com/products/trimmers-and-brushcutters/accessories/straps-and-harnesses/dlxsngharness/

Shoulder Harness for Long Trimmers

Application: To reduce the force requirements of the hands and arms

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	Universal Double Shoulder Harness	$60	• Increases range of motion for arms • Padded dual straps • Symmetric weight distribution • Hip belt • Plate clip reduces	• Decreases mobility • Added weight • Takes time to adjust

contact
stress at hip

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.stihlusa.com/products/trimmers-and-brushcutters/accessories/straps-and-harnesses/uniharness/

Detachable Sternum Straps for Backpacks

Application: Offers better weight distribution on backpack blowers

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Timbuk2	Sternum Strap for Backpacks	$5.00	• Easy to attach • Easy to adjust	• None reported

For More Information: Melanie Alexandre, Lawrence Berkeley National Lab
mmalexandre@lbl.gov

Website: http://www.timbuk2.com/sternum-strap-for-backpacks/9525.html

Hand Shear

Application: To manually cut hedges *less than 50" deep and medium height* (between knee and chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Corona	Extendable Handle Hedge Shear	$40	• Soft handles • Anti-impact bumper • Long reach • Adjustable length handles	• Manual • Repetitive motions

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.coronatools.com/item/hs-3930?referer=hedge-shears

Hand Shear

Application: To manually cut hedges *less than 30" deep and medium height* (between knee and chest level)

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Fiskars	Power Gear	$45	• Easy/precise cuts • Long blade to reduce repetition • Shock absorption bumpers	• Manual • Repetitive motions

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www2.fiskars.com/Gardening-and-Yard-Care/Products/Hedge-and-Grass-Shears/PowerGear-Hedge-Shears-23#.VTdHFiFVjCB

Tree Trimming

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Best Practices Bulletin: *Tree Trimming*

Presented by Office of the President Risk Services- June 2015

Tree trimming involves pruning, repairing, maintaining and removing trees. These activities may involve the transport and use of heavy mechanized equipment, climbing equipment and hand held power tools, as well as manually operated hand held cutters and loppers. Some of the risk factors for these jobs include:

- Low back and wrist strain when handling heavy tree limbs and trunks
- Shoulder, elbow, wrist and hand strain while manually ascending and descending trees
- Repetitive motions and awkward postures when operating hand held powered and non-powered cutting tools

Best Practices

Best practices include outsourcing tree trimming, chipping, large de-stumping and log removal operations as much as possible

It is recognized, however, that this can be cost prohibitive at campuses that exist in terrain that require a high volume of tree work. The information below includes best practices for the conduct of tree trimming work to achieve the goal of optimal risk reduction.

UC tree crew field supervisors and contractors should be certified by the International Society of Arboriculture (ISA) or Tree Care Industry Association (TCIA) and uphold tree care industry safety standards including ANSI Z133-2012, Cal/OSHA GISO Article 12 and OSHA 1910.269 and 266.

Ascending into Trees

- When using rope climbing techniques, utilize the single rope or "foot locking" technique to reduce efforts needed to ascend into the trees via the rope and harness system. This requires less effort than the double rope techniques.
- When purchasing a bucket truck, consider the design of the bucket controls. These controls should allow for comfort, straight hand/wrist postures and easy movement. Newer trucks may offer an improved design. If needed, contact the campus ergonomist or Environment, Health and Safety specialist to review the design of bucket controls.

Bringing Tools into the Trees From the Ground

- Do not hand carry tools into the trees; clip light weight hand tools with scabbards to belt *(refer to Product Recommendation Sheet)*
- Pull up other items separately via rope, or have partner on the ground deliver heavier tools via a pulley system

Trimming Branches above Shoulder Height*

**On the ground or up in the trees*

- Use extendable pruners and loppers to reach areas above shoulder height while keeping arms in the safe work zone *(refer to Product Recommendation Sheet and "Safe Work Zone" in Appendices)*
- Use light weight pole chainsaws when cutting branches to reduce effort *(refer to Product Recommendation Sheet)*
- Brace the pole of chainsaw against the shoulder and operate with the arms to increase stability and reduce cutting efforts
- Adjust tool handles to provide comfortable grip while cutting

Trimming Branches lower than Shoulder Height*

**On the ground or up in the trees*

- Use the lightest weight chainsaw for the job *(refer to Product Recommendation Sheet)*
- Ensure proper techniques are used while operating chainsaw (right hand activating throttle trigger and left hand on forward handle)
- Brace the back of the heavier chainsaws against the forward, dominant leg and close to the body to increases control and reduce fatigue

- Adjust tool handles to use safe body mechanics
- Use light weight safety helmets with mesh visors to reduce neck/upper body muscle tension and improve visibility while working *(refer to Product Recommendation Sheet)*
- Use anti-vibration gloves to reduce vibration exposure to the hands when using gas powered saws *(refer to Product Recommendation Sheet)*

Handling Large Tree Trunks and Cutting Trunks into Smaller Pieces

- Use motorized winches and grapples to automate dragging, lifting and carrying tree debris to feed into chippers *(refer to Industrial Equipment Matrix)*
- When manually handling large tree trunks and limbs, cut into smaller sections with a light weight heavy duty chainsaw *(refer to Product Recommendation Sheet)*
- Chipping may produce a high amount of fine airborne particulate matter; use a PAPR respirator for further protection *(refer to Product Recommendation Sheet)*
- Refer to the Manual Material Handling Section

Temperature

- To reduce heat stress provide the following:
    - Have and maintain one area of shade (use a portable, stand up umbrella or canopy as needed) when the temperature exceeds 80 degrees
    - Provide access to drinking water
- Dress appropriately when working in cold and/or wet environments to improve muscle flexibility, dexterity and grip strength

Equipment

Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two–week trial period

During the pilot period, consider the following:

- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

Training

Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury.

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Specifics for tree trimming
    - Adjust handles so grounds crew can attain an upright standing position with elbows close to the body
    - Manipulate tool handle to maintain straight wrist postures
    - Use only enough grip force to stabilize the tool; don't use a death grip
    - Use tools for short periods of continuous use before feeling fatigue (20- 30 minutes) and rotate job tasks to break up repetitive stress
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
    - practicing neutral postures
    - safe lifting, carrying, and pushing techniques
    - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

Body Mechanics

Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
    - Appropriate equipment is not available ***and***
        - The load is too heavy for one person, ***or***
        - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
    - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
    - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
    - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.

Work and Staffing Guidelines

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

References

UC Davis, Tree Safety Training Materials 2015; EORM, Ergonomic Evaluation for Public Works – Contra Costa County, California 2012; ISA Tree Worker Safety Course 2015; ANSI Z133-2012; OSHA 1910.269 and 266; Cal/OSHA GISO Article 12; https://www.dir.ca.gov/dosh/dosh_publications/Erg_Landscaping.pdf; http://www.lni.wa.gov/safety/SprainsStrains/demofnl/landscaping-fnl.pdf; http://safety.ucanr.edu/Programs/Heat_Illness_Prevention/

Product Recommendation Sheet: *Tree Trimming*

Grounds Product Recommendations

Task: Trimming/cutting trees

Criteria: Lightweight, low vibration, well balanced, efficient and durable equipment

Hand Pruner with Scabbard

Application: To manually cut small branches within easy reach

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Felco	F611	$60.00	• Stays sharp • Blade cover (scabbard) included • Good for small branches	• Cost

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.felcostore.com/item/f611?referer=saws

Extended Reach Pruner

Application: To cut small branches above shoulder height

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	PP100	$200.00	• Light weight • Durable • Easy to use • Different lengths available • Very maneuverable	• None

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/pole-pruners/accessories/pole-pruner-accessories/prunlop/

Pole Pruner Lopper Attachment

Application: To cut small branches

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Stihl	None	$75.00	**Pro:** • Light weight • Rope pulls easily • Maneuverable • Attaches to pole **Con:** • None

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/pole-pruners/accessories/pole-pruner-accessories/prunlop/

Pole Chainsaw (Pruner)

Application: To cut large, dense branches above shoulder height

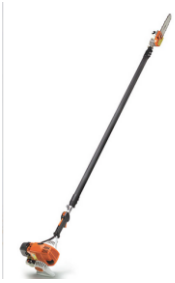
Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Echo	PPT-265	$650.00	**Pro:** • Cuts well • Comfortable handle controls **Con:** • Cost • Gas powered

For More Information: Julie McAbee, UC Santa Barbara
Julie.Mcabee@ehs.ucsb.edu

Website: http://www.echo-usa.com/Products/Power-Pruners/PPT-280

Pole Chainsaw (Pruner)

Application: To cut large, dense branches above shoulder height



Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Stihl	HT 131	$500.00	**Pro:** • Cuts extremely well • Anti-vibration system • Comfortable handle controls • Telescoping pole • Easy to start **Con:** • Heavier than other models • Cost • Gas powered

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/pole-pruners/professionalpole-pruners/ht131/

Pole Chainsaw (Pruner – Electric/Battery)

Application: To cut large, dense branches above shoulder height

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Stihl	HTA-85	$600.00	**Pro:** • Holds charge for long time • Good power compared to gas models • Telescoping **Con:** • Heavy with battery • Cost

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: http://www.stihlusa.com/products/pole-pruners/professional-pole-pruners/hta85/

Lightweight Chainsaw

Application: To cut tree branches and smaller tree trunks

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	MS 192 T C-E	$400.00	• Lightweight – 7 lbs • Top handle has easy grip • Easy to start • Low vibration • Different lengths available • More powerful than the MS 150	• None

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/chain-saws/in-tree-saws/ms192tce/

Lightweight Chainsaw

Application: To cut tree branches and smaller tree trunks

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	MS 150 T C-E	$350.00	• Lightweight- 5.7 lbs • Top handle design offers secure grip • Easy to start • Low vibration • 12 inch bar only	• None

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/chain-saws/in-tree-saws/ms150tce/

Heavy Duty Chainsaw

Application: To cut large, dense branches and trunks

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	MS 441 CM-Q Magnum	$800.00	• Lightweight, yet good power • Auto chain break • Anti-vibration system • Easy to start	• None

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/chain-saws/professional-saws/ms441cq/

Anti-Vibration Gloves

Application: To protect and reduce vibration to the hand

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	Anti-Vibration	$30.00	• Stays cool • Allows secure grip on tools/saws	• Reduces sensitivity at finger tips

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/protective-and-work-wear/gloves/antivibration/

Heavy Industry PAPR Kit

Application: Respiratory protection when wood chipping

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
3M	TR-300	$1500.00	• Lightweight • Integrated helmet • Integrates with hearing protection, face	• None

shield and wireless comm. system

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.pksafety.com/3m-versaflo-hi-papr-kit-tr-300-hik.html?gclid=CPnu2ZLjlMUCFRNafgodh4MAVg

Forestry Helmet System

Application: For use with all chain saws

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	Pro-Mark	$100.00	• Lightweight • Helps user remain cool on hot days • Integrated with hearing protection	• Earmuffs may be uncomfortable

For More Information: Brian MacDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.stihlusa.com/products/protective-and-work-wear/head-and-face-protection/pmfh/

Debris Maintenance for Landscape and Hardscape

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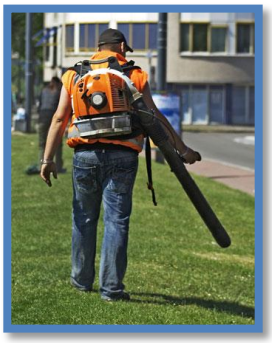
Best Practices Bulletin: *Debris Maintenance on Landscapes and Hardscapes*

Presented by Office of the President Risk Services- June 2015

Light weight debris, such as leaves, pods, sticks, paper and grass clippings, is consolidated throughout campuses. This material is managed by blowing, raking, sweeping, vacuuming and using large equipment on both landscape and hardscape areas. Some of the risk factors for these job tasks include:

- Awkward neck, shoulder and lower back postures
- Repetitive bending while picking up light weight material from ground

Best Practices

Best practices include the use of automated machinery, equipment and power tools. This is not always feasible due to the equipment costs and varying terrain, such as slopes and hills. The information below presents additional best practices to achieve the same goals of optimal risk reduction and operational efficiency.

Landscape Debris Maintenance and Hardscape Debris Collection

- Utilize automated equipment, such as an outdoor vacuum or sweeper, etc. to collect debris *(refer to Product Recommendation Sheet and Industrial Equipment Matrix)*
- When consolidating debris, use light weight, low vibration, handheld backpack blowers *(refer to Product Recommendation Sheet)*
- Attach an external sternum strap to the backpack blower straps to improve the weight distribution of the equipment *(refer to Product Recommendation Sheet)*

- Use push or self-propelled blowers to clear leaves off of large fields *(refer to Product Recommendation Sheet)*
- Utilize rakes made of light weight and durable material (*refer to Product Recommendation Sheet)*

Collecting Debris

- Use light weight hand tools, debris bags with handles, a wheeled container placed on its side or other equipment to help with manual debris collection *(refer to Product Recommendation Sheet)*
- Utilize a steam extractor for removal of gum and grit on sidewalks *(refer to Product Recommendation Sheet)*
- Use litter grabber/sticks to assist with collecting light weight trash *(refer to Product Recommendation Sheet)*

Transporting, Loading and Unloading Debris

See Safe Manual Material Handling information in appendix

Temperature

- To reduce heat stress provide the following:
    - Have and maintain one area of shade (use a portable, stand up umbrella or canopy as needed) when the temperature exceeds 80 degrees
    - Provide access to drinking water
- Dress appropriately when working in cold and/or wet environments to improve muscle flexibility, dexterity and grip strength

Equipment

Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations

- Pilot the preferred equipment for a minimum two–week trial period

During the pilot period, consider the following:

- Vibration levels
- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

Training

Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury.

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
    - practicing neutral postures
    - safe lifting, carrying, and pushing techniques
    - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

Body mechanics

Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
    - Appropriate equipment is not available ***and***
        - The load is too heavy for one person, ***or***
        - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
    - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
    - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
    - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.

Work and staffing guidelines

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

References

http://www.lni.wa.gov/safety/SprainsStrains/demofnl/landscaping-fnl.pdf
http://safety.ucanr.edu/Programs/Heat_Illness_Prevention/

Product Recommendation Sheet: *Debris Maintenance on Landscapes and Hardscapes*

Grounds Product Recommendations

Task: Consolidating debris, picking up light weight debris and removing gum from concrete surfaces

Criteria: Using lightweight tools and larger equipment to reduce manual material handling

Turf Vacuum/Rake

Application: Picking up debris on the lawn

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Harper	TV30	$27,000	• Eliminates picking up most debris after mowing • Collected material can be dumped automatically • Saves time and increases productivity	• Cost • Requires a lot of storage room • Noisy • Uses diesel

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu

Website: www.harperturfequipment.com

Turf Vacuum/Rake

Application: Consolidate debris on landscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Smith Co	Sweep Star V72	$25,000	• Collects leaves and debris on sports fields • Vacuum and sweep at the same time • Automatically dumps debris	• Tractor driven • Requires lots of storage space • Loud Generates dust

For More Information: Yvonne Ybarra, UC Riverside
yvonne.ybarra@ucr.edu

Website: http://www.smithco.com/golf-course-maintenance/sweepers/sweep-star-v72-big-vac/

Hardscape Sweeper

Application: Consolidate debris on hardscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Tennant	414-424 Green Air Sweeper	$32,000	• Self-propelled • Walk behind or ride on • Good around students: quiet and good dust control	• Slow: (backpacks are faster) • Cost • Have to dump collection container

For More Information: Greg Ryan, UC Berkeley
gryan@berkeley.edu

Website: www.tennantco.com

Self Propelled Outdoor Vacuum

Application: Picking up leaves and lawn litter on landscape

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Billy Goat	TKD	$2,000	• Self propelled • Easy to maneuver	• Loud • Generates dust • Manually empty debris bag

For More Information: Yvonne Ybarra, UC Riverside
yvonne.ybarra@ucr.edu

Website: www.billygoat.com

Back Pack Blower

Application: Consolidate debris on landscape and hardscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
STHL®	BR600	$600-800	• Lightweight • Quiet • Blows leaves well, even at low setting	• Cannot use in left hand

For More Information: Bill Collier, UC Merced, bcollier2@ucmerced.edu; Melanie Alexandre, LBNL mmalexandre@lbl.gov

Website: http://www.stihlusa.com/products/blowers-and-shredder-vacs/professional-blowers/br600/

Back Pack Blower

Application: Consolidate debris on landscape and hardscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Echo	PB 770H	$500	• Lightweight • Quiet • Blows leaves very well even at low setting • Left hand throttle available	• None reported

For More Information: Bill Collier, UC Merced bcollier2@ucmerced.edu

Website: http://www.echo-usa.com/Products/Blowers/PB-770H

Handheld Blower

Application: Consolidate debris on landscape and hardscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
EGO Power Plus	LB4801	$200	**Pro:** • Lightweight • Quiet • Low decibels rating • Low emissions **Con:** • Low battery life • Spare battery costs $130.00-200.00 depending on amps

For More Information: Randy Sauser, UCLA
rsauser@ehs.ucla.edu
Website: http://egopowerplus.com/products/blower

Handheld Blower and Vacuum

Application: Consolidate debris on hardscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Echo	ES250	$250	**Pro:** • Works well in small areas • Quicker/easier than sweeping • Weighs 10-12 lbs. **Con:** • Does not work well vacuuming up twigs • Loud • Can get heavy when bag is full

For More Information: Yvonne Ybarra, UC Riverside
yvonne.ybarra@ucr.edu
Website: http://echo-usa.com

Detachable Sternum Straps for Backpacks

Application: Offers better weight distribution on backpack blowers

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Timbuk2	Sternum Strap for Backpacks	$5.00	**Pro:** • Easy to attach • Easy to adjust **Con:** • None reported

For More Information: Melanie Alexandre, Lawrence Berkeley National Lab
mmalexandre@lbl.gov

Website: http://www.timbuk2.com/sternum-strap-for-backpacks/9525.html

Walk Behind Blower

Application: Clear leaves from large field

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Billy Goat	F9	Varies	• More powerful than a backpack blower • Clears a large field in 30 minutes • Self propel option reduces fatigue • Angled and padded handle	• Generates a lot of dust

For More Information: Randy Sauser, UCLA
rsauser@ehs.ucla.edu

Website: www.billygoat.com

Lightweight Rakes

Application: Consolidate debris on landscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Flex Rake	2A	$19.00	• Lightweight • Sturdy • Long handle provides good reach • Handle is comfortable in all types of climates	• None reported

For More Information: Randy Sauser, UCLA
rsauser@ehs.ucla.edu

Website: http://flexrake.com

Lightweight Container

Application: Pick up leaves and flowers on landscape and hardscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Unger	Nifty Nabber Bagger 40 gal	$29.00	• Light weight • Handles for easier transport • Drainage holes for easy cleaning • Collapses for easy storage • Best for leaves and flowers • Rugged plastic bottom	• Punctures easily – not good for twigs

For More Information: Mallory Lynch, UC Berkeley
mlynch@berkeley.edu

Website: https://www.ungercleaning.com/p-1411-niftynabber-bagger.aspx

Lightweight Container

Application: Pick up leaves and flowers on landscape and hardscape surfaces

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
AM Leonard	Debris Bag- 2 cu. ft	$14.99	• Light weight • Folds up for easy storage and transport • Best for leaves and flowers • Does not rot or mildew • Woven poly material	• Punctures easily – not good for twigs • Does not holds its shape when empty

For More Information: Mallory Lynch, UC Berkeley
mlynch@berkeley.edu

Website: www.amleo.com/debris-bag

Steam Extractor

Application: Removal of gum and grit from sidewalk

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Dupray	Carmen Super Inox Steam Extractor	$4,000	**Pro:** • Effective at removing gum • On board wet/dry vacuum for waste water and gum • Transports easily by tipping unit • 34 accessory tools **Con:** • Uses water • 110V is not as powerful as 220V option • Not as powerful when vacuum and steamer are both on • Corded

For More Information: Randy Sauser, UCLA
rsauser@ehs.ucla.edu

Website: http://dupray.com/steam-cleaners/steam-cleaning/gum-removal-machines/

Litter/Grabber Stick

Application: Pick up light weight trash

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
EZ-Reacher	Pro Pickup 32P and 40P	$18-27	**Pro:** • Weighs 2 lbs. • Locking feature reduces sustained gripping • Helps pick up items without bending over as far • Rust proof **Con:** • Repetitive gripping

For More Information: Julie Mcabee, UC Santa Barbara
Julie.Mcabee@ehs.ucsb.edu

Website: Many online vendors

Digging, Shoveling, Trenching and Irrigation

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Best Practices Bulletin: *Digging, Shoveling and Trenching and Maintaining/Repairing Irrigation Equipment*

Presented by Office of the President Risk Services- June 2015

Digging, shoveling and trenching tasks are performed by grounds crews and irrigation specialists. These tasks are physically demanding when done by hand and when using walk behind trenchers. In addition, shoveling in tight spaces and/or in poor weather conditions increases the risk of injury. Some of the risk factors include:

- Repetitive bending and twisting while digging and shoveling
- Repetitive and forceful gripping when using tools and equipment
- Knee compression when working on the ground
- Overexertion when digging by hand for extended periods of time

Best Practices

Use power equipment whenever possible to reduce the risk of injury. When this is not feasible, the best practices below offer ways to select hand tools and use them safely to also reduce the risk of injury.

Automated Digging, Trenching and Excavating

Use industrial equipment with appropriate digging attachments or dedicated equipment specific to the job *(refer to Industrial Equipment Matrix)*

Factors to consider when choosing digging, trenching and excavating equipment:

1. Dimensions of hole or trench

   An *auger* cuts a deep, round hole, a *trencher* cuts a narrow, shallow and longer ditch or trench and an *excavator* digs deep and wide. The depth of the openings will depend on the blades selected.

2. Dedicated or attached
   - *Dedicated equipment* is compact, good in small areas, efficient, digs deeper but costs more and is not as versatile
   - *Attachments* offer versatility. Auger attachments can usually dig deeper than dedicated, hand-held powered augers, but trenching attachments do not dig as deep as dedicated equipment.
3. Ease of control and vibration levels:
   - *Walk behind equipment* is the least expensive and self-propelled, but hard to control, requires strong physical force to steer and has higher vibration levels
   - *Stand on equipment* is more expensive than walk behind but easier to control, requires less force to steer and offers less vibration
   - *Ride on equipment* is the most expensive, but easier to control, uses less force to operate, offers lower vibration levels and digs deeper than either walk behind or stand on equipment
4. Space and condition of environment
5. Access to work area
6. Consult with your supervisor for special considerations, such as locating utilities, depth and width of concrete, condition of soil, need for extra help and renting specialized equipment *(see references below)*

Digging and Shoveling by Hand

- Select the best shovel for the job with consideration for handle length, blade type and weight:
  - Select a round-bladed shovel for sand and dry earth
  - Use a square-bladed shovel for coarse-grained materials, such as gravel or rocky soil, from piles
  - Select a shovel with a rolled step for digging in hard earth so the pressure applied to the bottom of the foot is spread over a wider area

  - Use smaller shovel heads to reduce the weight of material lifted; material can be wet and heavy when trenching

- Practice safe shoveling techniques (refer to Training section below)
- When working on the ground, change positions every 10-15 minutes and use knee protection to reduce compression *(refer to Product Recommendation Sheet)*
- Utilize fitted boots to make it easier to work in muddy/wet environments *(refer to Product Recommendation Sheet)*
- Use a portable pump to remove water prior to digging and select a shovel with a steel blade and holes when soil is muddy *(refer to Product Recommendation Sheet)*

Specialized Tools For Digging

- Use specialized tools (i.e. Hori Hori knife, Sawzall, Pulaski, auger etc.) designed to cut roots and other plant matter when digging *(refer to Product Recommendation Sheet)*

Maintaining and Repairing Irrigation Systems

- Use a pipe cutting tool to reduce cutting forces *(refer to Product Recommendation Sheet)*

Temperature

- To reduce heat stress provide the following:
  - Have and maintain one area of shade (use a portable, stand up umbrella or canopy as needed) when the temperature exceeds 80 degrees
  - Provide access to drinking water
- Dress appropriately when working in cold and/or wet environments to improve muscle flexibility, dexterity and grip strength

Equipment

Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- If a longer trial is needed, rent the equipment before purchasing
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations. Pilot the preferred equipment for a

minimum two–week trial period

During the pilot period, consider the following:

- Vibration levels
- Adjustability, size and weight of equipment to accommodate wide range of body types
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

Training

Training should include: Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury.

Training should include:

- Hands-on performance of job tasks and related activities, such as safe shoveling techniques
    - Start with lighter loads on your shovel and a slower pace; gradually increase the load and your pace
    - Keep your legs apart for stability
    - Turn your body as a unit; don't twist
    - Push, rather than lift, the shoveled load
    - Reduce the throwing distance by placing wheelbarrows close to the digging area. The optimal throw distance is approximately 3 feet and should not exceed 4 feet.
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
    - practicing neutral postures
    - safe lifting, carrying, and pushing techniques
    - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace

- Sufficient opportunity for questions

Body mechanics

Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
    - Appropriate equipment is not available ***and***
        - The load is too heavy for one person, ***or***
        - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
    - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
    - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
    - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.

Work and staffing guidelines

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

References

http://www.ccohs.ca/oshanswers/phys_agents/vibration/vibration_measure.html
http://www.worksafebc.com/publications/health_and_safety/bulletins/msi/assets/pdf/msi6_tree_planting.pdf
https://www.osha.gov/SLTC/etools/electricalcontractors/installation/digging.html
https://www.osha.gov/SLTC/heatillness/heat_index/using_heat_protect_workers.html
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http://www.dir.ca.gov/dosh/dosh_publications/Erg_Laborer.pdf
https://www.osha.gov/Publications/osha2226.pdf
http://www.lni.wa.gov/safety/SprainsStrains/demofnl/landscaping-fnl.pdf

Product Recommendation Sheet: *Digging, Shoveling, Trenching and Maintaining/Repairing Irrigation Equipment*

Grounds Product Recommendations

Task: Digging, shoveling, trenching and maintaining/repairing irrigation equipment

Criteria: Hand tools and accessories for digging, shoveling, trenching and maintaining/repairing irrigation equipment

Kneeling Mat

Application: Reducing knee compression when working on the ground

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
ErgoKneel Working Concepts	Kneeling Mats (different sizes)	$15-30.00	**Pro:** • Portable • Easier to use than knee pads • Provides good cushioning	**Con:** • Breaks down when used frequently in wet conditions

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu

Website: http://www.pksafety.com/all-products/ergonomics-1/mats.html

Knee Pads

Application: Reducing knee compression when working on the ground

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Impacto	Gel Comfort 865-00	$41.00	**Pro:** • Gel provides less knee compression	**Con:** • Extra time to put on/off • Tends to slip down leg when going up & down frequently

For More Information: Yvonne Ybarra, UC Riverside
yvonne.ybarra@ucr.edu

Website: http://www.impacto.ca/catalog.php?page=1&category=26

Knee Pads

Application: Reducing knee compression when working on the ground

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Lift Apex	Gel Knee Guard/Pad	$40.00	**Pro:** • Very comfortable • Gel provides less knee compression	**Con:** • None mentioned

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu

Website: http://www.globalindustrial.com/p/safety/support/knee-pad-supports/apex-gel-knee-guard

Knee Pads

Application: Reducing knee compression when working on the ground

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Troxell Super-soft	No. 17-209 soft	$40.00	**Pro:** • Holds up well	**Con:** • None mentioned

For More Information: Julie McAbee, UC Santa Barbara
julie.mcabee@ehs.ucsb.edu

Website: http://www.troxellusa.com/Product/EN-US/Category.aspx?cid=33&cn=Knee+Pads&d=s

Boots

Application: Working in muddy and wet areas

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Bogs	Classic High	$100.00	**Pro:** • Boot does not get sucked into mud; foot stays in boot • Sized to fit • Comfortable foot support • Insulated **Con:** • Expensive (available through Grainger as of 4/2015) • Foot may get too hot on hot days

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu
Website: http://www.bogsfootwear.com/shop/style/60142-001.html

Boots

Application: Working in muddy and wet areas

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
XTRATUF	Standard	$115-130.00	**Pro:** • Provides good foot support; comfortable • Sized to fit • Boot does not get sucked into mud • Long-lasting • Feet stay cooler on hot days (no insulation) **Con:** • Feet may get cold in colder weather • Expensive

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu
Website: http://www.xtratufboots.com/

12VDC Self Priming Transfer Pump

Application: Removing standing water prior to irrigation or digging tasks

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Little Giant	Grainger: 5UXN4 Model 360	$128.00	**Pro:** • Non-submersible water pump • Hooks to truck battery **Con:** • Cord length • Intermittent duty: 15 minutes on/ 45 minutes off

For More Information: Mallory Lynch, UC Berkeley
mlynch@berkeley.edu
Website: www.grainger.com

Gas Water Pump

Application: Removing standing water prior to digging or irrigation tasks

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Honda	WX15	$500.00	**Pro:** • Easily removes standing water • Does not rely on electric source **Con:** • Uses gas • Weighs 20 lbs. without gas

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu
Website: http://powerequipment.honda.com/pumps/models/wx15

Hori Hori Knife

Application: Digging in small areas, trenches, confined spaces and through roots & hard soils

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*
Hori Hori Knife	Item # 21773	$26.50	**Pro:** • Dual use tool for digging and cutting through smaller roots in soil • Very sharp and effective **Con:** • Limited use for thicker roots

For More Information: Mallory Lynch, UC Berkeley
mlynch@berkeley.edu
Website: http://www.gemplers.com/search/hori+hori+knife

Compact Reciprocating Cordless Saw

Application: Digging in small areas, trenches, confined spaces and through roots & hard soils

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Milwaukee Sawzall	Item # 6FKP4	$140.00 + accessories	• Eliminates manually cutting roots in soil	• Some vibration • Battery will need to be charged

For More Information: Ginnie Thomas UC Santa Barbara
gthomas@housing.ucsb.edu

Website: http://www.grainger.com/product/MILWAUKEE-Cordless-Reciprocating-Saw-6FKP4#reviews

Hand Held Powered Earth Auger

Application: Digging multiple holes for planting

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
			Pro:	**Con:**
Stihl	BT 121	$900-1000	• Reduces and eliminates manual digging • Easy to maintain and durable • Has safety shut off • Vibration dampening system	• Gas • Heavy for one person over time (21 lbs without gas) • Must maintain squatting position as unit digs deeper • Some jerkiness when it shuts off

For More Information: Ginnie Thomas, UC Santa Barbara
gthomas@housing.ucsb.edu

Website: http://www.stihlusa.com/products/augers-and-drills/earth-auger/bt121/

Pulaski

Application: Digging in small areas, trenches, confined spaces and through roots & hard soils

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Pulaski Axe	Wood or Fiberglass	$65-75	**Pro:** • Dual use • Saves time to keep from switching tools	**Con:** • Requires physical effort

For More Information: Ginnie Thomas UC Santa Barbara
gthomas@housing.ucsb.edu

Website: http://www.grainger.com/product/FLAMEFIGHTER-Pulaski-Axe-6ATM6

Drain Spade

Application: Digging in small areas, trenches, confined spaces and through roots & hard soils

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Jackson Drain Spade	Long handled (48") Drain Spade (SFGDS16L)	35.00	**Pro:** • Cuts well in different types of soil • Minimizes force & bending with long handle • Cushioned at end of handle for comfortable gripping	**Con:** • None mentioned

For More Information: Brian McDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.jacksonprofessional.com

Ratcheting pipe cutters

Application: Cutting pipes for irrigation

Make	Model	Cost *(approximate)*	Comments *(Pros and Cons)*	
Wiss	WRPCLG #	$30.00	**Pro:** • Comfortable grip • Durable design • Circumference control	**Con:** • Not automated

For More Information: Brian McDonald, UC Santa Cruz
bmacdon1@ucsc.edu

Website: http://www.all-spec.com/products/WRPCLG.html?gclid=CIeP6r2P4MMCFRRgfgodc0YAoQ

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Environment, Health, and Safety
The Office of the President
1111 Franklin Street, 10th floor
Oakland, California 94607-5200

Ergonomics Study of Grounds 2014/2015

Questionnaire: Identify Top At-Risk Tasks

Instructions: Please reach out to the grounds department (management and employees) at your location and work with them to complete the questionnaire by providing answers to the following questions.

Your completed questionnaire can be returned to kristie.elton@ucop.edu by **September 19, 2014**. *Your input will be included in the final project report.*

With respect to ergonomics, what are the top 5 at-risk tasks for your location's grounds department employees (1 being the most at-risk, 5 being the least)? Please be specific and provide details. *Note that this includes all job duties related to grounds: machine operation, equipment maintenance, mowing, trash, irrigation maintenance, recycle and trash, etc.*

	Task
example	Emptying outdoor trash receptacles on campus
1	
2	
3	
4	
5	

UNIVERSITY OF CALIFORNIA

October 30, 2014

Dear UC Ergonomists-

The following is a questionnaire created by the Grounds Study Project Team designed to collect information from all UC locations that will assist us with the Grounds project. We are asking that each of you complete the attached questionnaire with information specific to your location. It is our team's goal to use this information to create the following documents: *ergonomic guidelines for landscape and facility design, best practice bulletins, and recommended product lists*.

The questionnaire contains five sets of questions that address each of the top 5 at-risk tasks. These include:

1. Manual Material Handling
2. Hedge Trimming
3. Tree Trimming
4. Debris Maintenance
5. Digging,Shoveling,Trenching and Irrigation

As you complete this questionnaire, please consider the following:

1. The information is best communicated when you schedule an in-person meeting with the staff to discuss the responses. We recommend that you meet with supervisors and/or managers to review SOP's and any design issues. We also recommend that you spend time with front-line employees to gain their perspective on the task issues.
2. While meeting with the staff, please ask to see the equipment and tasks so that you can best understand how you want to record their feedback. Pictures are encouraged.
3. We are asking that you take the time to compile the answers in the attached questionnaire (electronic format).
4. Please provide your answers in a ***concise, bulleted*** format. The fields expand to fit content.

We envision that this may take a substantial amount of your time and appreciate your contribution to this project. The ease with which we can complete this project and the quality of the product is dependent on the information that we collect from this questionnaire. ***Completed questionnaires are due to Kristie Elton on or before November 28, 2014.***

Thank you for your assistance with this project,

The Grounds Project Team

Ergonomist's Name: _____

Location: _____

Manual Material Handling

This task is separated into 3 sections:

1. Green waste, brush, tree limbs and trunks
2. Equipment and Materials
3. Trash and Recycle

Green waste, brush, tree limbs and trunks

Describe (show me) the steps for the following tasks:

Collecting cut material using burlap sacks, a sweeper, dragging etc. *(list specifics for each type of material)*

Brush *(cuttings and clippings)*	
Branches and tree limbs	
Tree trunks	

Placing above materials into transport vehicles

Removing above materials into transport vehicles

Placing material into a wood chipper, cutting and moving large limbs or trunks into smaller pieces or using a log mover

Distributing chipped material back onto campus grounds or into possibly a towable container

Removing green waste from living roof or inaccessible planting areas where standard equipment cannot be utilized

Regarding each of the 6 tasks above:

What seems to work well about the process?

Which part(s) of the process are difficult and why?

What, if anything, has been done to improve the process?

What job techniques have you learned to reduce **manual** material handling?

Is there any equipment that you are using to make this task easier? (Make and model)

What on-the-job techniques have you learned to reduce awkward postures? *(such as extended reaching or bending at the waist)*

If you could re-design the work flow to make any of the tasks easier, what changes would you make?

What design changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Have you implemented any changes that were unsuccessful? If so, why do you believe they were not effective?

Are there any other ideas that you have that you believe would make any of the tasks easier?

Materials, tools and equipment

Describe (show me) the steps for the following tasks:

Lifting or moving:

Heavy awkward materials, such as bags of seed and flats or pots of plants	
Large heavy equipment, such as mowers, power washers and rototillers	
Other heavy items, such as planter boxes, gates, tables and large non-powered tools	

Transporting materials, tools and equipment between storage location and vehicle (i.e. manually pushing or pulling, carrying, getting assistance or using mechanical aid etc.)

Lifting and/or moving materials, tools and equipment into and out of the vehicle (i.e. lift gates on vehicle, portable ramps, straight lifting and getting assistance with heavy lifts etc.)

Transporting materials, tools and equipment between vehicle and worksite (i.e. manually pushing or pulling, carrying, getting assistance or using mechanical aid etc.)*

**Note to ergonomists: this may pose additional challenges due to terrain and lack of mechanical aid*

Regarding each of the 4 tasks above:

What seems to work well about the process?

Which part(s) of the process are difficult and why?

What, if anything, has been done to improve the process?

What job techniques have you learned to reduce **manual** material handling?

Is there any equipment that you are using to make this task easier? (Make and model)

What on-the-job techniques have you learned to reduce awkward postures? *(such as extended reaching or bending at the waist)*

If you could re-design the work flow to make any of the tasks easier, what changes would you make?

What design changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Have you implemented any changes that were unsuccessful? If so, why do you believe they were not effective?

Are there any other ideas that you have that you believe would make any of the tasks easier?

Trash and Recycle

Describe (show me) the steps for the following tasks:

Lifting or moving containers filled with trash

Emptying trash containers into larger containers

Emptying trash containers into transport vehicle

Transporting wheeled trash containers to pick-up area

Transporting trash to collection site

Dumping trash

Lifting or moving containers filled with recycle material

Emptying recycle containers into larger containers

Emptying recycle containers into transport vehicle

Transporting wheeled containers to pick-up area

Transporting recycle trash to collection site

Dumping recycle

Regarding each of the tasks above:

What seems to work well about the process?

Which part(s) of the process are difficult and why?

What, if anything, has been done to improve the process?

What job techniques have you learned to reduce **manual** material handling?

Is there any equipment that you are using to make this task easier? (Make and model)

What on-the-job techniques have you learned to reduce awkward postures? *(such as extended reaching or bending at the waist)*

If you could re-design the work flow to make any of the tasks easier, what changes would you make?

What design changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Have you implemented any changes that were unsuccessful? If so, why do you believe they were not effective?

Are there any other ideas that you have that you believe would make any of the tasks easier?

Hedge Trimming

Terminology:

- **Hedge:** a fence or boundary formed by closely growing bushes or shrubs
- **Low/medium hedge**: A hedge at or below waist level
- **Tall hedge**: A hedge above waist level

Trimming Low or Medium Hedges

Describe (show me) the steps and equipment used for trimming low to medium hedges

What seems to work well about the process?

Which part(s) of the process are difficult and why?

What, if anything, has been done to improve the process?

Do you have any suggestions to improve the process?

Is there any equipment that you are using to make this task easier? (Make and model)

Are there any other pieces of equipment being used for this task (harnesses etc.)

What type of maintenance is required for this equipment?

What is the process for broken or damaged equipment?

Have you used any products to reduce the amount of vibration from the hedge trimmers?

What on the job techniques have you learned to reduce awkward arm and shoulder postures?

What safety precautions do you take when completing this task?

If you could re-design the work flow to make any of the tasks easier, what changes would you make?

What design changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Have you implemented any changes that were unsuccessful? If so, why do you believe they were not effective?

Are there any other ideas that you have that you believe would make this task easier?

Trimming High Hedges

Describe (show me) the steps and equipment used for trimming high hedges

What seems to work well about the process?

Which part(s) of the process are difficult and why?

What, if anything, has been done to improve the process?

Do you have any suggestions to improve the process?

Is there any equipment that you are using to make this task easier? (Make and model)

Are there any other pieces of equipment being used for this task? (i.e. harnesses etc.)

What type of maintenance is required for this equipment?

What is the process for broken or damaged equipment?

Have you used any products to reduce the amount of vibration from the hedge trimmers?

What on the job techniques have you learned to reduce awkward arm and shoulder postures?

What safety precautions do you take when completing this task?

If you could re-design the work flow to make any of the tasks easier, what changes would you make?

What design changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Have you implemented any changes that were unsuccessful? If so, why do you believe they were not effective?

Do you have any other ideas that would make this task easier?

Tree Trimming

Describe (show me) the steps for the following tasks:

Gaining access to trimming the trees using a:

Ladder	
Rope and harness system	
Climbing spikes	
Bucket truck	
Other	

Bringing tools (chainsaws, pruners, loppers and other cutting tools) into the trees from the ground

Using tools to trim branches above shoulder height (while standing on the ground or up inside the trees)

Using tools to trim branches lower than shoulder height (while standing on the ground or up inside the trees)

Regarding each the 4 tasks above:

What seems to work well about the process?

Which part(s) of the process are difficult and why?

What, if anything, has been done to improve the process?

Have you discovered any techniques to reduce the amount of climbing and cutting?

Is there any equipment that you are using to make any of the tasks easier? (Make and model)

Are there job techniques you are using to reduce awkward back, neck, arm and shoulder postures?

What criteria do you use when selecting the cutting/trimming tools you use?

How are power tools maintained?

How are hand tools maintained and sharpened?

If you could re-design the work flow to make any of the above tasks easier, what changes would you make?

Are there tools or personal protective equipment (PPE) design changes you have made that have improved work flow, efficiency or reduced injury risk?

Have you implemented any changes that were unsuccessful along the way? If so, what were they and why do you believe they were not effective?

Are there any other ideas or information that you have that you believe would make any of the tasks easier?

Debris Maintenance of Landscape and Hardscape

Terminology:

- **Debris** – leaves, pods, sticks, paper, grass clippings from edging, pine cones, small tree branches, etc.
- **Hardscape** – any area that is cement, pavers, blacktop, outside hallways, etc.
- **Landscape** – any area that contains vegetation matter – plants, trees, grass, wood chips, etc.

Debris Maintenance of Landscape

Please answer the following questions by describing (showing me) how the tasks are performed:

How is debris consolidated? *(blowing, raking, sweeping, etc.)* – List specifics for each type of debris.

Leaves	
Pods	
Sticks	
Paper	
Grass clippings	
Other	

How is debris picked up once it has been consolidated? *(by hand, with a shovel, rake, etc.)*

What type of container is debris put into for transport? *(gator, bucket, trash can, wheeled container, etc.)*

How is debris removed from transport container? *(dumped by hand, power dumped, etc.)*

Debris Maintenance of Hardscape

Please answer the following questions by describing (showing me) how the tasks are performed:

How is debris consolidated? *(blowing, raking, sweeping, etc.)* – List specifics for each type of debris.

Leaves	

Pods	
Sticks	
Paper	
Grass clippings	
Other	

How is debris picked up once it has been consolidated? *(by hand, with a shovel, rake, etc.)*

What type of container is debris put into for transport? *(gator, bucket, trash can, wheeled container, etc.)*

How is debris removed from transport container? *(dumped by hand, power dumped, etc.)*

Regarding the above tasks for landscape and hardscape:

What seems to work well about the processes?

Which part(s) of the process are difficult and why?

What, if anything, has been done to improve the process?

Is there any equipment that you are using to make these tasks easier? (*Make and model)*

How do you maintain the equipment and tools used for the tasks?

What on the job techniques have you learned to reduce awkward postures, such as bending over at the waist or extended reaching?

What changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Are there any other ideas that you have that you believe would make any of the tasks easier?

Digging, Shoveling, Trenching and Irrigation

Preparing for the job site

Describe (show me) how to prepare for the job site

What is the process for staff to get ready for going to a job site that requires digging, shoveling and/or trenching?

What process improvements, if any, have you implemented?

What are the different tools & equipment used for digging, shoveling & trenching? *(Shovels-different kinds; picks; posthole diggers; DitchWitch; trenchers, etc.)*

How are digging tools maintained & who is responsible for that?

Attaching and unloading automated digging/trenching equipment to/from the trailer

Describe (show me) how the equipment is attached to the trailer and then unloaded from the trailer

What, if anything, has been done to improve this process?

Is there any equipment that you are using to make these tasks easier? (*Make and model)*

What on the job techniques have you learned to reduce awkward postures, such as bending over at the waist or extended reaching?

What changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Are there any other ideas that you have that you believe would make any of the tasks easier?

Manual digging, shoveling and trenching

Describe (show me) the steps involved in manual digging, shoveling and trenching

What, if anything, has been done to improve the process?

Is there any equipment that you are using to make these tasks easier? (*Make and model)*

What on the job techniques have you learned to reduce awkward postures, such as bending over at the waist or extended reaching?

What changes have you implemented that have improved work flow, efficiency or reduced injury risk?

Are there any other ideas that you have that you believe would make any of the tasks easier?

Irrigation work

In addition to the shoveling, digging & trenching issues discussed, what are the other challenges of performing irrigation work?

What, if anything, has been done to address these challenges?

Is there any equipment that you are using to make these tasks easier? (*Make and model)*

What design changes have you made (or wish to make) to improve work flow, efficiency or reduce injury risk?

Are there any other ideas that you have that you believe would make any of the tasks easier?

If you could re-design any of your work structures, loading/unloading areas, irrigation/water meter areas, etc. to make any of the above tasks easier what changes would you make?

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Safe Manual Material Handling

Many jobs require frequent lifting, carrying, pushing, pulling, lowering and raising materials by hand. These job tasks are often referred to as manual materials handling. Staff who lift or perform other materials handling tasks may be at risk for back or other injuries. These injuries may be prevented by redesigning jobs, using mechanical aids, practicing safe body mechanics and safe lifting techniques.

Layout of Equipment and Materials Storage Area

- The layout of storage areas can be arranged to prevent awkward postures such as bending, twisting and over-reaching
- Where possible, store tools between knee and shoulder height
- Frequently used and heavy items should be stored between knee and waist height
- Large, heavy equipment that is used frequently should be accessible for use without moving other items
- Use mechanical aids when placing or moving heavy items that must be stored on the ground
- Ladders or step stools should be provided to reach items stored above chest level

S.M.A.R.T. lifting technique

Size up the load, tool or equipment

- Assess the size, weight and shape. Remove obstacles from the load.
- Assess whether the load actually needs to be moved
- Where is the load going to be placed? Remove obstacles from your path.
- Determine whether mechanical or other assistance is required

Move the load, tool or equipment as close to your body as possible

- The whole hand should be used to ensure a firm grip
- Position yourself as close as possible

Always bend your knees

- Maintain balance
- Keep your feet apart and in a comfortable position

- Minimize bending at the waist
- Bend your knees to a semi squat

***R**aise the load, tool or equipment with your legs*

- Lift smoothly, without jerking
- Maintain the normal curve of your spine throughout the lift

***T**urn your feet in the direction that you want to move the load, tool or equipment*

- Avoid unnecessary bending, twisting and reaching
- Change direction by turning your feet and not your back
- To set down a load, squat down and keep your head up. Let your legs do the work.

The Power Zone

The power zone for lifting is close to the body, between mid-thigh and mid-chest height. Comparable to the strike zone in baseball, this zone is where the arms and back can lift safely with the least amount of effort. *(See picture)*

Use of Mechanical Aids

- Use mechanical aids whenever possible to decrease manual material handling

Team Lifting

- Team lifts are appropriate if:
    - The load, tool or equipment is too heavy for one person
    - The load, tool or equipment is large, bulky or oddly-shaped
    - If you feel uncomfortable lifting the load by yourself

  - Appropriate material handling equipment is not available
- Whenever possible, team members should be of or around the same height and build. If this is not possible, taller members should be at the back.
- Designate a lift leader, who:
  - Plans and coordinates the lift
  - Provides simple and clear instructions
  - Ensures that you lift and lower the load together
- Assess the weight of the load, tool or equipment
- Follow the S.M.A.R.T. lifting technique *(above)*
- The lift leader should ensure that all team members are comfortable once the load, tool or equipment has been lifted. If not, the load should be carefully and immediately lowered.

Overhead loads

- Always use a ladder to lift loads or tools above chest level
- Test the weight of the load or tool before removing it from the storage area
- If possible, slide the object toward you prior to lifting
- Hold the load or tool close to your body as you lower it
- Whenever possible, hand down the load or tool to a co-worker before descending a stool or ladder

Awkward loads

Sometimes different lifting techniques need to be adopted to move awkward loads, tools or equipment.

Over-sized or Odd-shaped

- In many cases, oversized loads may be light enough to carry, but block vision or may be difficult to hold. In such cases, use mechanical assistance or seek help from a co-worker.

Long, light objects

- Support the load on your shoulder
- Keep the front end higher than the rear

Pushing and Pulling

- Keep your back straight, avoiding excessive bending or twisting
- Use your legs to push or pull
- Keep the load, tool or equipment as close to your body as possible

- When using mechanical equipment to push and pull, the handles should be positioned at a height between the shoulder and waist
- When pushing on a slope or ramp, ask for assistance whenever necessary. Keep in mind that the incline can significantly increase the forces.
- Unevenly distributed loads also require increased push and pull forces

References

Occupational Safety & Health Organization (OSHA). *Ergonomics eTool: Solutions for Electrical Contractors.* http://www.osha.gov. Web. 12 January 2012

Centers For Disease Control and Prevention (CDC). Ergonomic Guidelines for Manual Material Handling. http://www.cdc.gov. Web. 12 January 2012.

Health and Safety Executive. *Getting to Grips with Manual Handling*. http:// www.hse.gov.uk INDG143 (rev2) September 2011. Web. 12 January 2012.

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Safe Manual Material Handling

For management and supervisors

Identifying hazards

Not all manual handling tasks are hazardous. A manual task becomes hazardous when it involves one or more of the following:

- Repetitive or sustained application of force (hedge trimming)
- Repetitive or sustained awkward posture (irrigation tasks)
- Repetitive movement (hand pruning; digging and shoveling)
- Prolonged positions (cutting tree branches for long periods of time)
- Application of high force (lifting tools and equipment out of and into transport vehicle bed)
- Tasks involving handling of unstable or unbalanced loads (tree limbs and tree trunks)

The following information is designed to help you minimize the hazards of manual material handling within your grounds departments.

Layout of equipment and materials storage area

- The layout of storage areas can be arranged to prevent awkward postures such as bending, twisting and over-reaching
- Where possible, store tools between knee and shoulder height
- Frequently used and heavy items should be stored between knee and waist height
- Large, heavy equipment that is used frequently should be accessible for use without moving other items
- Use mechanical aids when placing or moving pallets or heavy bags that must be stored on the ground
- Ladders or step stools should be provided to reach light weight items stored above chest level

Guidelines for safe manual material handling

- Plan the workflow to eliminate unnecessary lifting and minimize distances traveled

- Organize the work so as to gradually increase physical demands and work pace
- Use transport vehicles or carts with lift gates to transport materials, tools and equipment over hilly terrain
- Slide, push or pull instead of carrying, whenever possible
- Reduce the distances that loads, tools and equipment are carried by providing better transport vehicle access to the jobsite
- Keep arms bent and close to the body when holding and using hand/power tools and equipment controls
- Minimize the vertical distances loads, tools and equipment are lifted and lowered; use trailers with ramps to reduce lifting into transport vehicles
- Avoid manually lifting or lowering loads, tools and equipment from/to the floor
    - Store products and materials off of the floor, whenever possible
    - If needed, arrange for materials to be delivered on pallets and keep the materials on pallets during storage
    - Use mechanical assistance to lift or lower an entire pallet, rather than lifting and lowering the material individually
    - Arrange to have material off-loaded from vendor directly into the storage area or a nearby staging area to reduce the manual handling required by staff
    - Use mechanical assistance whenever possible
- For loads, tools and equipment that are unstable and/or heavy
    - Tag the load to alert workers
    - Test the load for stability and weight before carrying or moving the load
    - Use mechanical devices to lift
    - Reduce the weight of the load by:
        - Putting fewer items in the container
        - Using a smaller container
    - If necessary, repack containers so that contents will not shift and the weight is balanced
    - Use team lifting only as temporary measures in lieu of measures identified above
- Reduce the frequency of lifting and the amount of time employees perform lifting tasks by
    - Rotating workers in lifting tasks with other workers in non-lifting tasks
    - Having workers alternate lifting tasks with non-lifting tasks
- Clear spaces to improve access to materials or products being handled. Easy access allows workers to get closer and reduces reaching, bending and twisting.

Guidelines for tool and equipment use

Equipment

- Be sure you buy and use tools and equipment of appropriate capacity for your specific work loads
- Choose tools and equipment appropriate for the materials being handled, the layout of your work environment and the tasks being performed
- Consider using vehicle transport and powered equipment for heavy loads or long distances
- Choose wheeled equipment which minimizes start forces and reduces rolling resistance
- Ensure that equipment alarms and warning devices are audible and working properly
- Inspect and maintain tools and equipment according to manufacturers' recommendations
- Follow all manufacturers' recommendations for proper tool and equipment use

Work practices

- Train employees on proper use of material handling equipment and appropriate work practices and ensure that employees are up to date on OSHA refresher trainings
- Lift, carry, push and pull equipment using proper body mechanics
- Inspect loads, tools and equipment before loading or moving them

References

Centers For Disease Control and Prevention (CDC). Ergonomic Guidelines for Manual Material Handling. http://www.cdc.gov. Web. 12 January 2012.

T.R. Waters, "Manual Material Handling", in: Physical and Biological Hazards of the Workplace (Second Edition). Edited by P. Wald and G. Stave. New York: John Wiley and Sons, 2002.

Ergonomics checklist- *For Manual Material Handling Tasks*

This checklist can be used as a tool to quickly identify potential risks with manual material handling tasks. "Yes" responses are indicative of conditions that present a risk of injury (especially to the lower back). The greater number of "yes" responses that are noted, the greater the potential risk. Once you have indentified risks you can prioritize the risks and establish ways to reduce them.

General

Risk Factor	Yes	No
Does the load, tool or equipment exceed 35 pounds?		
Is the load, tool or equipment difficult to bring close to the body because of its size, bulk or shape?		
Is the load, tool or equipment difficult to handle?		
Is the footing unsafe? (e.g. slippery environment, incline or uneven surfaces)		
Does the task require fast movement such as throwing, swinging or rapid walking?		
Does the task require stressful body postures (e.g. stooping to the ground, twisting, reaching overhead, excessive side bending)?		
Does the task require working in extreme temperatures, with noise and vibration?		
Does the task require working in a confined area?		

Specific

Does the lifting frequency exceed 5 lifts per minute?		
Does the vertical lift distance exceed 3 feet?		
Do carries last longer than 1 minute?		
Do tasks require large sustained pushing or pulling forces that exceed 30 seconds in duration?		
Do tasks require extended reaching that exceeds 1 minute in duration?		

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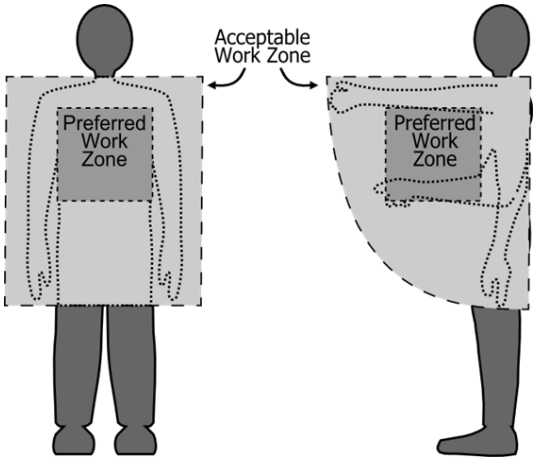
Safe Work Zones

Many grounds tasks require frequent use of hand/power tools and equipment to complete the job. The way staff use their bodies, hold and use tools and equipment can have an impact on their risk of musculoskeletal injuries. The best work zone is between waist and chest height with the body in an upright position.

Safely Using Tools and Equipment

- Hold tools and equipment controls close to your body (see diagrams below)
- Work with your body upright or minimal forward bending
- Stand and face in the direction you are using the tool; do not twist the back
- Use both hands or alternate between left and right



Hedge trimming task

References

Occupational Safety & Health Organization (OSHA). *Ergonomics eTool: Solutions for Electrical Contractors.* http://www.osha.gov. 1/12/2012
http://www.agri-ergonomics.eu/good_practices/good_practices/pruning_files/Pruning_ENG.pdf
http://www.spineuniverse.com/wellness/ergonomics/ergonomics-preferred-work-zone
http://www.ccohs.ca/oshanswers/safety_haz/power_tools/ergo.html

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Environment, Health, and Safety
Office of the President
1111 Franklin Street. 10th Floor
Oakland, California 94607-5200

Ergonomic Pilot Project Application
Grounds

UCOP Risk Services would like your help in reducing the ergonomic risk factors and risk of injury associated with:

Manual Material Handling

Hedge Trimming

Tree Trimming

Debris Maintenance

Digging, shoveling, trenching and irrigation

As an ergonomist, you can help reduce injury risk by working directly with your grounds staff to apply for a $5,000 grant from UCOP. The grant is intended to fund a pilot project at your location that will reduce ergonomic risks associated with the tasks listed above.

Instructions

1. Complete the application below with detailed information regarding the proposed project
2. Email the completed application to Kristie Elton at kristie.elton@ucop.edu
3. Once your project is approved, establish a trial period for your pilot
4. At the conclusion of this trial period, ensure that grounds employees complete the pilot project survey (provided) to share the outcomes of the proposed initiative; completed surveys will provide valuable, front-line information for animal care staff at other University of California locations

APPLICANT INFORMATION	
Date	
UC Location	
Ergonomist's Name	
E-mail Address	
Phone Number	
Grounds Department Contact	

PILOT PROJECT	
Identify the at-risk task(s) you wish to address *(see list above)*	
Name of the department piloting this project	
Provide a brief explanation of the proposed project. Include specific product information or anticipated design changes	
Total cost of project	

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Office of the President
1111 Franklin Street. 10th Floor
Oakland, California 94607-5200

Ergonomic Pilot Project Survey

Grounds

Your feedback is important to us. Please take a few moments to complete this form and return it to your campus ergonomist.

Date:	
UC Location:	

Type of Project:	Equipment _____	Best Practice_____	Design Change_____	Other_____
Description of the pilot project:				
Equipment make and model *(if applicable):*				

Using the scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent

1. How would you rate your overall satisfaction with the pilot project?	**1 2 3 4 5**
2. To what extent will these changes make it easier to do your job?	**1 2 3 4 5**
3. How often will these changes impact your job?	**Daily Weekly Seldom**
If the pilot project involved new equipment:	
4. Did you receive training on the proper use of the equipment?	**Yes No**
5. If so, how well did the training prepare you?	**1 2 3 4 5**

6. Please list the specific work activities where you used this equipment:

7. Please indicate the aspects of the changes that you find most helpful:

8. Please indicate the aspects of the changes that you feel need improvement:

Additional comments