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A Tree Planter's Guide to Reducing Musculoskeletal Injuries

Ernst Stjernberg, FPInnovations -Feric Division

Suzanne Kinney, Human Factor West Ergonomics and Safety Consulting Ltd.

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Reducing Musculoskeletal Injuries (MSIs)

MSIs are one of the most troublesome injuries found in otherwise safe industries with excellent safety programs. MSIs include tendonitis and other repetitive and muscle strain injuries. Some MSIs, such as a back muscle strain, can occur suddenly, while others develop gradually from over-exposure to commonly accepted MSI risk factors such as force, repetition or awkward postures.

Tree planters are predisposed to injuries because their work is hard and repetitive. The ergonomic guidelines in this guide are aimed at helping the planters stay healthy:

- Tree planters should know how to practice safe work procedures and how to select appropriate equipment.
- Planting contractors should have safety guidelines that minimize the MSI risk factors.
- Supervisors may need to adjust expected daily planting rates and hours worked to help rookie crews and individuals to manage soreness and fatigue.

Supervisors should use this guide in the induction process of new tree planter, during individual or group training sessions, and at pre-work and safety meetings. Planters should then use this guide for self-study as needed.

A musculoskeletal injury (MSI), as defined by WorkSafeBC, is an injury or disorder of the muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissue including sprains and inflammations, that may be caused or aggravated by work. It includes overuse injuries such as tendonitis as well as overexertion injuries such as muscle strain.

Ergonomics is the study of human abilities and characteristics that affect the design of equipment, systems and jobs.

Signs and Symptoms of MSIs

Recognize early signs and symptoms of MSIs, seek treatment quickly and take steps to avoid further risks.

Signs that can be observed are:

- Swelling
- Redness
- Difficulty moving a particular body part
- Tenderness along the course of the tendon
- Crepitus (leathery creaking sensation; in a joint it can represent cartilage wear in the joint space)

Symptoms that can be felt but cannot be observed are:

- Numbness
- Tingling
- Pain

If you are experiencing signs and symptoms of MSI:

- STOP - Do not try to "tough it out"!
- Inform your supervisor and follow her/his advice on proper action to take (e.g., modify/change planting technique and pace)
- Report to first aid
- Visit your family doctor, if necessary

What Are MSI Risk Factors?[1]

Musculoskeletal Injury (MSI) risk factors are the aspects of a job or task that impose biomechanical stress on the worker. Exposure to MSI risk factors can cause or contribute to the risk of developing MSIs. The following MSI risk factors are most likely to cause or contribute to MSIs when combined:

1. Force (i.e., forceful exertions including dynamic motions)
2. Repetition
3. Awkward postures
4. Static postures
5. Contact stress
6. Vibration
7. Cold temperatures

1 For more information, go to: **http://tinyurl.com/h50e**

1. Force

The physical effort required to accomplish a task or motion. Tasks or motions requiring application of higher force place higher mechanical loads on muscles, tendons, ligaments and joints. Tasks involving high forces may cause muscles to fatigue more quickly, and may irritate, inflame, strain and tear muscles, tendons and other tissues.

2. Repetition

A task or series of motions over and over again with little variation. When motions are repeated often for extended periods (e.g., every few seconds for several hours), fatigue and strain of muscles and tendons can occur because of inadequate time for recovery. When task cycles are short, the same muscles are in constant use and the muscles get no rest from the force required to perform the task cycle.

3. Awkward postures

Positions of limbs, joints and back that deviate significantly from the neutral position which is the position of a body joint that requires the least amount of muscle activity to maintain. Awkward postures often are significant contributors to MSIs because they increase the required work and muscle force.

4. Static postures

Physical exertion in which the same posture or position is held throughout the exertion (also called "static loading"). These types of exertions put increased load or forces on the muscles and tendons, contributing to fatigue. This occurs because not moving impedes the flow of blood needed to bring nutrients to the muscles and to carry away the waste products of muscle metabolism.

5. Contact stress

Occasional, repeated or continuous contact between a hard or sharp object and sensitive body tissue such as on fingers, palms, forearms, thighs, shins and feet. If this contact creates pressure over a single area of the body (e.g., wrist, forearm), it can inhibit blood flow, tendon and muscle movement and nerve function.

6. Vibration

Oscillatory motion of an object. Localized vibration, such as vibration of the hand and arm, occurs when specific body parts come into contact with vibrating objects such as powered hand tools. Mechanical shock refers to an acceleration that is much greater than the background vibration level, and is caused by a sudden impact between the body (e.g., hand) and a solid object (e.g., tool handle). Mechanical shock results in high forces and contact stresses.

7. Cold temperatures

Cold temperatures can reduce the dexterity and tactile sensitivity of the hand, and can reduce muscle strength and increase fatigue. Cold also reduces blood flow to the hand. Because the fingers have a large surface-area/mass ratio, they are particularly susceptible to cold injury and need proper protection. Cold can be a problem in combination with other risk factors, especially when present with vibration exposure, e.g., when planting in hard, rocky ground. Cold temperature is a risk factor that can be mitigated by having warm, dry clothing available in case of abrupt weather changes, common during the planting season.

How to Use this Guide

The information provided in this guide is divided into 6 topics:

- **MSI Risk Factors:** to remember while working.
- **Planting Guidelines** show the movements involved in each step of the Planting Cycle. These safe work procedures will reduce MSI Risk Factors such as the awkward postures and force. Pictures illustrate "Do's (✔) and Don'ts (✕)".
- **Equipment Guidelines** show how equipment affects posture, and help to choose shovels and bags.
- **Glossary of Ergonomic Terms** including neutral and awkward postures for the different body parts used when planting.
- **Warm-up Exercises** help you get ready for the day's work.
- **Exercises for Injury Prevention** show exercises that can be done during the work day to:
    - Prevent muscle imbalances from developing.
    - Keep joints flexible.
    - Enhance proper body mechanics.

"Caution" statements can be found in these boxes.

Additional information can be found in these boxes.

The Planting Cycle

For the purpose of illustrating the different movements made by the planter, the planting cycle has been divided into seven separate elements:

1. Selecting the spot
2. Screefing (when required)
3. Retrieving the seedling
4. Penetrating the soil
5. Opening hole and inserting the seedling
6. Closing the hole
7. Moving to next spot

Planting Guidelines

Always use fluid motions and avoid extreme postures.

1. Selecting the Spot

- Use travel time to relax your grip on the shovel.
- Avoid directing the shovel before you have determined the spot as it tenses the muscles unnecessarily.

- Position your body for the spot.
- Do not overextend to reach the planting spot.

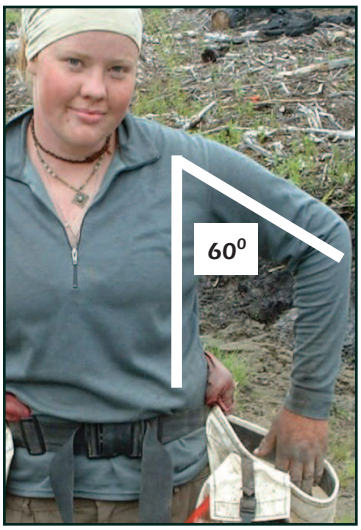
- Learn to recognize good spots based on vegetation and ground contours.
- To avoid hitting rocks and roots causing impact shocks probe lightly, until a suitable spot is found.
- Be aware of the ground conditions, e.g., rocks, stumps, compact soils.

2. Screefing

- Use visual cues to identify suitable spots. Microsites closer to large objects (e.g., stumps, logs) are often easier to screef than areas out in the open.
- Try to avoid boot-screefing the planting spot.
- Screefing the planting spot with the shovel, and alternating the screefing side, is less stressful than boot-screefing.
  Screef only if necessary.

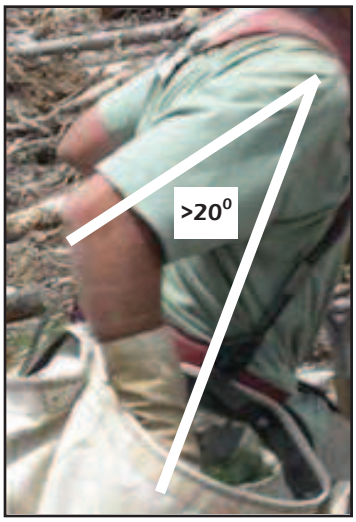
Caution: Boot-screefing creates impact forces around the knee. Caulked footwear is prone to catching on solid or enmeshed objects in the ground, adding to the force.

3. Retrieving the Seedling



- Keep elbow within 60˚ from the side of the body comparable to putting your hands on your hips.
- Adjust the bag setup so elbow does not have to be raised.

- Keep arm within 20° behind the body.
- Position seedlings in the bag so that the tops are pointing slightly backwards to facilitate retrieval of the seedling at the root collar level.



- Keep the wrist as straight as possible.

- When planting one species only, avoid looking at the seedling.
- Avoid, as much as possible, rotating the forearm.

- Grip the seedling loosely by the root mass.
- Do not over grip with the thumb and little finger.

4. Penetrating the Soil

- Keep the elbow within 60° from the side of the body.

- Keep the shovel hand below head height.

- When possible, such as in softer ground, use elbow motion instead of shoulder motion when penetrating the soil.

- Aim the shovel to the front and center of the body.

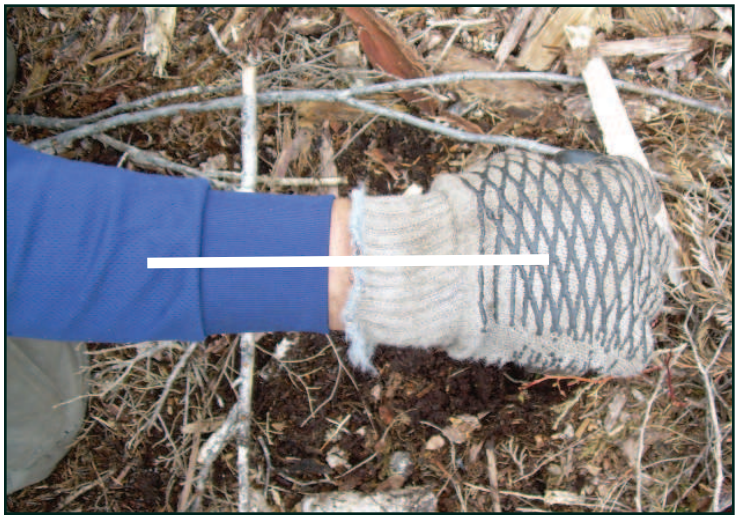
A well placed hole reduces twisting of the body when inserting the seedling.

Land the shovel with the elbow bent at approximately 120° and with the wrist straight.

Elbow and wrist postures are neutral.

Elbow posture is good but wrist posture is awkward.

Elbow and wrist postures are awkward.



Keep wrist straight, i.e., in a neutral position.

Use a "let-go" technique to reduce shock impact in the hand and arm.

Loosening the grip of the handle as the shovel hits the soil will reduce the shock and vibrations transmitted through the hand and arm. In hard ground, use the foot kicker on the blade to push the shovel into the ground. Although these are good techniques to use to reduce the severity and number of impacts that your arm receives in the planting day, you should keep your wrist posture neutral (see illustration in glossary) and minimize repeated force to the foot and leg.

Penetrate soil with the body as upright as possible:

Plant uphill.

Plant high spots if that is allowed.

In hard and rocky ground use the kicker on the shovel instead of hand force:

5. Opening the Hole and Inserting the Seedling

- Make a hole big enough for the seedling and seedling hand but not so big that extra work is needed to close it with the shovel or fingers; this is especially important in compact soils.
- Do not push seedling into a hole too small for your hand.

Do not flex seedling wrist when inserting the seedling

- Keep shovel wrist neutral when opening the hole.
- Bend knees to reduce strain on the lower back when bending forward.

Keep the body close to the hole to minimize forward reaching:

- Reaching forward while bending is more stressful to the lower back than keeping the trunk close to the hole.

Approach the hole symmetrically to avoid twisting or over-using one side of the body:

- Minimize twisting when pulling the shovel out of the hole; more of a problem for planters with D-handled shovels.

The spine is weaker and less able to resist stress in a rotated (twisted) posture. Thus workers are more susceptible to back injury when the back is twisted.

- To reduce twisting, hold the shaft of the shovel if bringing the shovel straight up out of the ground, or bring the shovel backwards instead of up.

6. Closing the Hole

- In soft soils, use light force if you close hole with seedling hand, or use your fist.

Beware of creating air pockets when using hand closure.

- In harder ground, use back blade with the shovel or press lightly with boot to close the hole.
- Alternate with using hand closure.

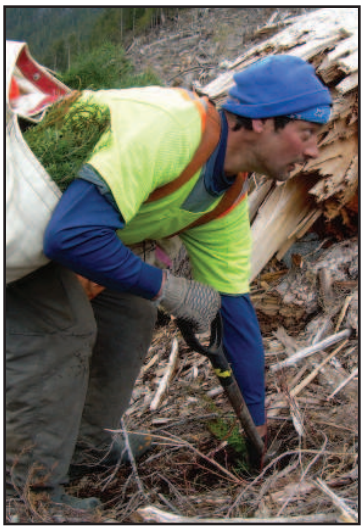
Beware of scarring the bark of the seedling.

- Keep elbow close to body and wrist straight when leaning on shovel to close the hole.

- Limit the rotation of the shovel forearm when using the shovel to close the hole in order to avoid moving into an awkward posture.

7. Moving to next spot

- Look up before standing up to assist the spine into neutral posture.
- Relax grip on handle while moving between spots.



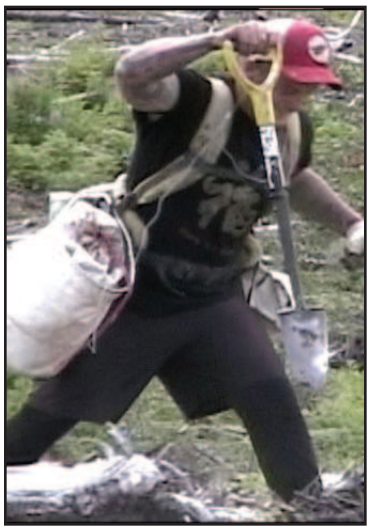
- Don't stay crouched when moving from planting spot to planting spot.

Equipment Guidelines

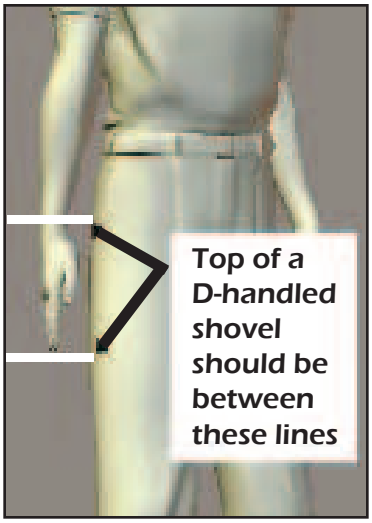
Shovels

Length

- When standing upright, with your arm straight down by your side, the top of your D-handle shovel should be between your fingertips and wrist.
- Staff handle lengths should be no higher than shoulder height when the planter is standing upright.



Shovels that are too long make shoulder posture worse, especially when planting on sites above foot level on steeper ground.



This is the appropriate shovel length for most planters and conditions, and reduces risk of MSI.

Shovels that are too short make back posture worse, especially on flat ground.

Consider keeping shovels of varying lengths and types for different conditions (e.g., steep / flat ground). Some shovels have exchangeable parts — handle, shaft, and blade which allows you to adjust the shovel to the conditions at hand.

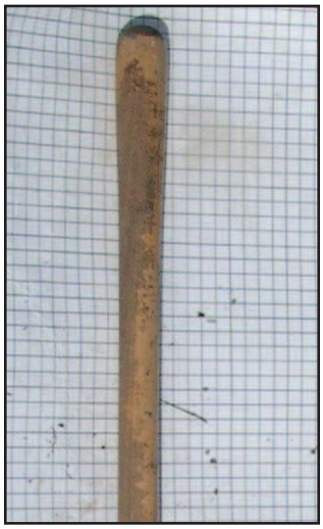
Weight

Lighter weight shovels are easier to lift many times day after day:

- Hollow shovel shafts, such as those made of fiberglass, are lighter than solid wood shafts.
- Blades also add to the weight and new blades can be cut to the approximate size of the planter's hand.
- Shovels should weigh less than 1.5 kg.

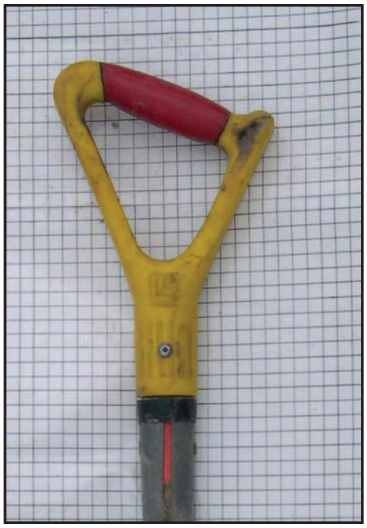
Keep at least one kicker on blade as needed, e.g., on hard ground.

Handles



Staff

Standard D



Ergo D

Oval D

Using D-handles may result in better shoulder and wrist postures than when using staff handles but staff handles reduce shock in the hand and arm. Since the goal is to minimize force and awkward postures, D-handles are good to use when repeated force and shock impact are not concerns, such as when planting in softer ground.

D-handles

- When using this type of handle (Standard D, Ergo D, or Oval D), keep the shoulder and wrist postures neutral.
- Try to keep your elbow within 60° of the side of the body when penetrating the soil.
- Make sure the wrist is neutral when gripping the shovel handle, e.g., when penetrating the soil, opening the hole and closing the hole.

Neutral shoulder and wrist postures

Inside Handle Width

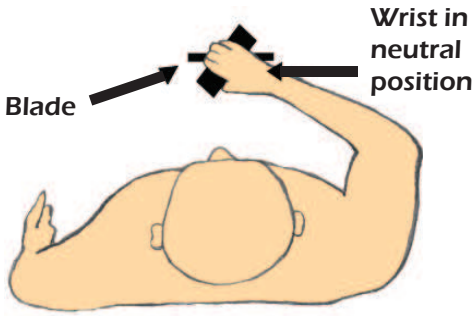
Ensure enough clearance to fit hand and glove (if worn) inside the handle.

- Inside clearance to be slightly larger than hand width.

- Ergo-D handles that are too wide may cause you to grip with extra force to prevent the hand from slipping and sliding.

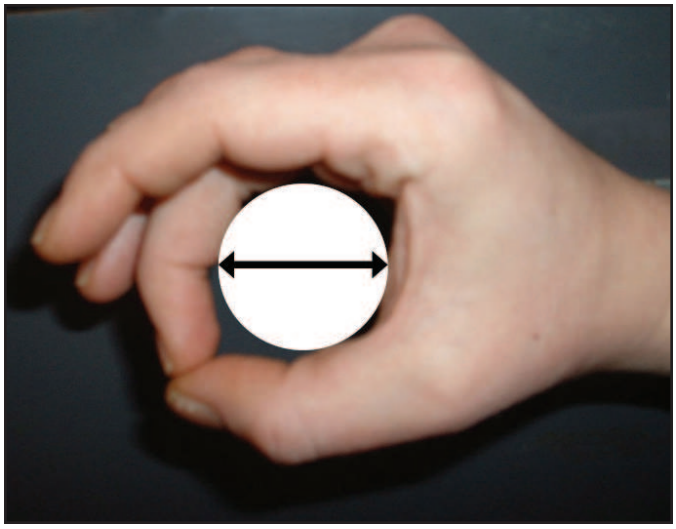
Handle Offset

- If you want to insert the shovel blade parallel to your body, offset the handle from the blade to keep the wrist in neutral position when centering a hole in front of you.
- If you don't offset the handle, dig the hole at an angle to your body so that the wrist on the shovel hand is maintained in a neutral position.



Rotate the handle so that your wrist is in a neutral position when the blade is parallel to you and the shovel is centered in front of you

Handle or Staff Diameter



- The handle should be loose in your grip when you hold the tip of your thumb and middle finger together.
- Make handles 1 cm smaller than your hand's grip diameter.
- Most people have a grip diameter of 4–5 cm. Handle diameters are approximately 3.5 cm, and thus are appropriate for the average hand size. If you have a large or small hand, the handle may not fit properly in your hand and you will increase your grip force.

- If the handle or staff diameter is too small in your hand, build up the diameter by wrapping the handle with material e.g. neoprene or bicycle handle wrap.
- If the handle is too big, rebuild it by peeling the existing handle off and covering the core to appropriate thickness.

Staff Handles

The grip on this type of handle reduces shock impact to the hand and arm.
Use a staff handle when you:

- Plant in hard or rocky ground
- Experience symptoms of tendonitis in your shovel arm

Caution: When using the staff handle, avoid bending the thumb-side of the wrist toward the forearm — an awkward wrist posture called radial deviation. This may occur when aiming a shorter shovel too far forward to penetrate the soil.

This can be avoided by using a staff handle of appropriate length and penetrating the soil closer to the body.

Avoid twisting the blade using your wrist. This awkward wrist posture may occur when opening or closing the hole. Keep wrist neutral and move elbow towards your body instead.

- Avoid raising the hand above head height when penetrating the soil.

Staff handle lengths should be no longer than shoulder height of the planter.

Shovel Blades - Length and Width

Key: have a blade large enough to make a hole of adequate size.

- Avoid inserting the seedling with any force using the seedling hand. To avoid excessive force, make sure the hole is deep enough for the seedling plug to fit properly and wide enough to fit your hand.
- Blades should be as long as the longest plug to be planted, or at least 15 cm, so that the hole is deep enough to allow the seedling plug to be fully inserted. If the blade is shorter than the plug, you can't push the shovel into the ground with your foot and still dig an adequate hole.
- Blades with a slightly pointed and tapered shape not only make it easier to penetrate the ground, but also form a definitive bottom in the hole into which the plug should fit.
- A kicker allows the blade to be pushed in by the foot in harder ground; for right-handed planters, it should be located on the right side facing the concave side of the shovel.
- Blades should be as wide as your hand at the knuckles. If you wear a glove on the seedling hand, consider the extra clearance needed to fit your hand and glove into the hole.
- Note that blades wear down several centimeters per season.

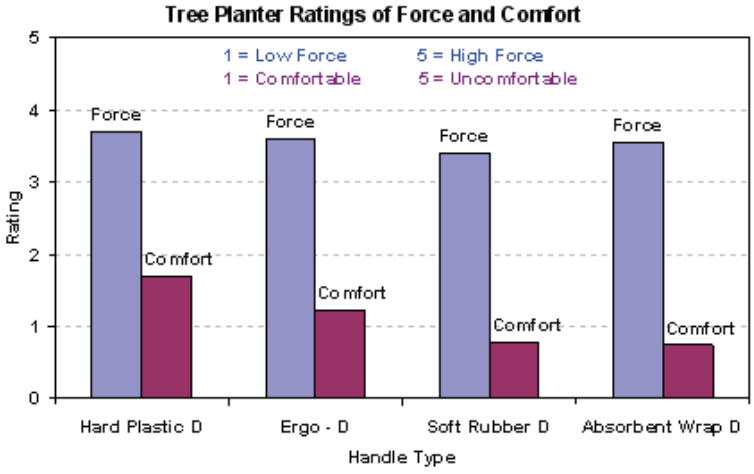
Shock and Vibration

In tree planting, repeated shocks to the hand and arm are a major concern for chronic injury.

- *Unexpectedly high forces can be generated at the hand when the planting tool strikes hidden roots or rocks.*
- *If the handle is made from a hard material (left), use a layer of softer vibration absorbent material between the handle and hand to cushion impacts (right).*

Vibration absorbent material, available as handle wraps or in gloves, can reduce risk of injury and improve performance by:

- *Reducing contact stress by deforming to the shape of the hand, spreading the load and lowering tissue stress for the same force.*
- *Absorbing higher frequencies of vibration that accompany impacts.*
- *Reducing lateral and fore-aft vibrations transmitted to the hand.*
- *Providing greater comfort.*



Impact & vibration absorbing materials are sold under trade names such as: Viscolas, Visco Elastic Polymer, Sorbothane.

Handle wrap & glove suppliers:
National Ergonomic Supply Inc. (B.C.), Ergotech Protective Devices Inc. (Ont.), or your tree planting equipment supplier.

Vibration-absorbent wraps and gloves

- A material with good deformation properties feels more comfortable, i.e., no concentrated areas of high tissue pressure.
- When built into a glove, vibration-absorbent material also protects hands from cold, improving blood flow, tactile sensitivity and dexterity.
- If the glove is too bulky, it will reduce dexterity and tactile sensitivity. Therefore, optimum glove thickness is important and depends on the task complexity.

Use a glove designed for the job

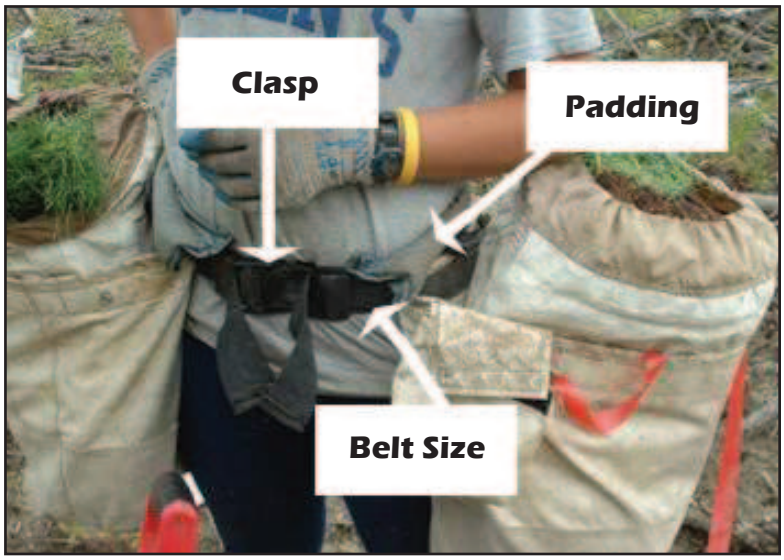
- Vibration absorbent material should cover the palm and the first joints of the fingers.
- Half-finger gloves allow greater finger sensitivity and dexterity.
- In hot weather, use a handle-wrap with a thin glove.
- In cold weather, a vibration absorbent glove will also provide thermal protection.

Planting Bags

Padding Material, Width and Thickness

Things to look for when purchasing a set of bags:

- **Padding** – Obtain replaceable padding, since padding that wears thin puts more stress on the body.
- **Clasps** – Keep spare clasps since they tend to break.
- **Sizing** – If using the harness, make sure the belts adjust enough to fit your waist and shoulders.



Experienced planters replace the original padded waistbelt with a replacement backpack waistband sold by larger outdoor stores. They also replace the waistbelt clasp with an unbreakable seat belt buckle.

Considering the amount of time a planter has to wear the bags, the weight of the bags and the work/terrain conditions, it makes good ergonomic and economic sense to make carrying them as comfortable as possible.

Bag Loading

The muscles surrounding the spine work less when the spine is evenly loaded.

- Keep seedling weight balanced on both sides of your body.
- Shift seedlings as planting progresses to avoid uneven loading.

Bag Weight

Recommended maximum sustained back pack weight is 15% of your body weight.

Therefore, if you weigh 77 kg (170 lbs), you should not carry more than 12 kg (26 lbs) on your back on a continuous basis. If some of the load is carried on the hips and planting steadily decreases this load, the maximum bag weight should be no more than 18 kg (40 lbs) or 23% of body weight.

- **Caution**: Bag weights that greatly exceed the guideline will accelerate spinal fatigue and increase risk of back pain.
- Use secondary caches on long runs and bag up more often to reduce bag weights.

Support Location

- Fasten the waist belt above your hips to support most of the weight on the hips when standing upright.
- If used, shoulder straps help to balance and stabilize the load, and to take some of the load off the hips, e.g., 20% on the shoulders and 80% on the hips.
- If too much of the load is carried by the shoulder straps, they may impede upper-body freedom of movement and put extra weight on the spine. Adjust them accordingly.

Additional Information

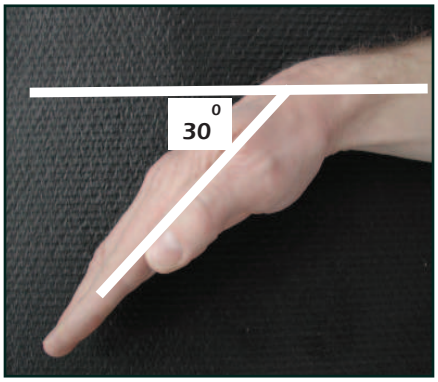
It is impossible to plant trees without using some awkward postures, as defined in the Glossary, so the aim of this *ergonomics* guide is to show how to minimize the awkward postures and perform stretches that reduce the effects of those postures. Together with advice on choosing the right equipment, warm-up exercises and injury prevention exercises, this guide will help reduce the risk of musculoskeletal injuries.

Tree planters should also be aware of other important issues that will affect their health at work. Dr. Delia Roberts studied the benefits of pre-season training and the results are presented in a 'Fit to Plant Video' and a 'Training Log' available for download at http://selkirk.ca/treeplanting/ . Here you can also download dietary advice in the form of a 'Power Eating for Power Planting Manual' and 'Top Ten Tips' on what and when to eat for maximum energy and recovery.

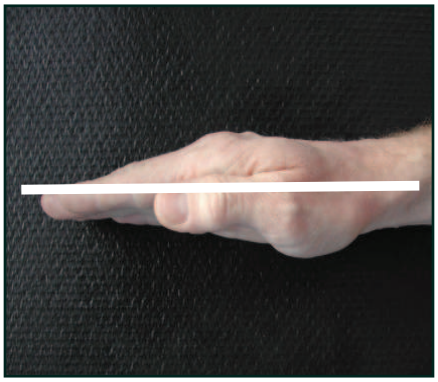
For more information on MSI, go to: http://tinyurl.com/yvzy5r

Glossary of Ergonomic Terms

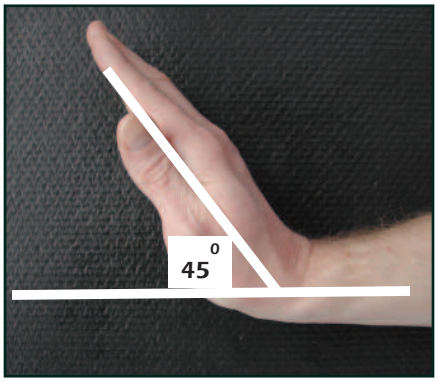
Wrist postures of interest



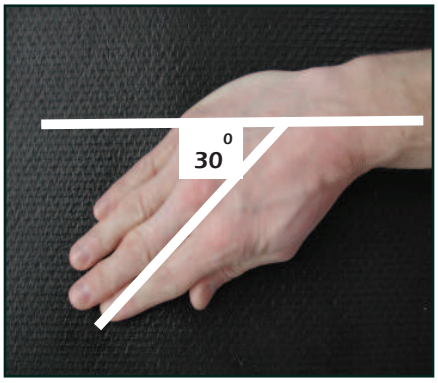
Flexed wrist posture
(palm bent down):
awkward posture is >30^0



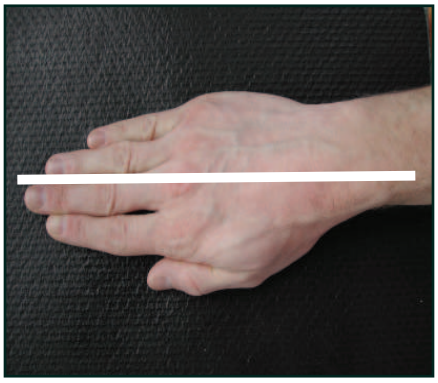
Neutral wrist posture:
wrist is straight in line with forearm



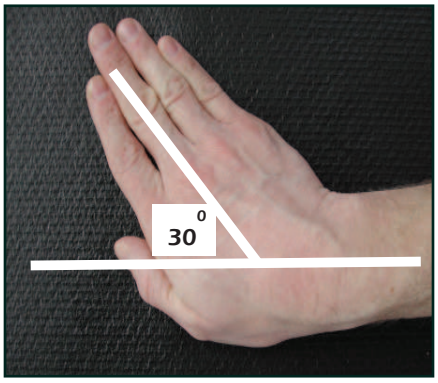
Extended wrist posture
(palm bent up):
awkward posture is >45^0



Right wrist radial deviation posture
(palm bent towards thumb):
awkward posture is >30^0



Right wrist posture:
neutral position



Right wrist ulnar deviation posture
(palm bent towards pinkie):
awkward posture is >30^0

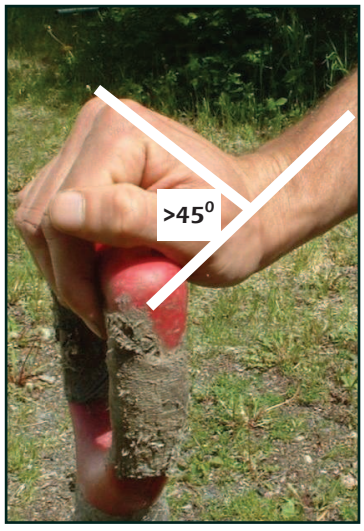
Seedling Wrist

Neutral wrist posture

Awkward wrist posture: flexion

Shovel Wrist

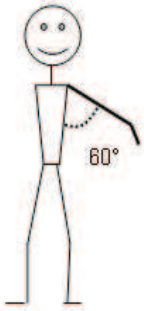
Neutral wrist posture



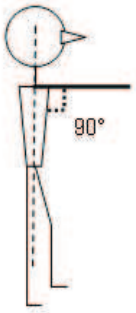
Awkward wrist posture: extension

Awkward wrist posture: radial deviation

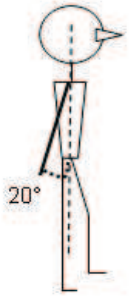
Shoulder postures of interest



Shoulder Abduction
(elbow out to the side of the body):
awkward posture is > 60^0



Shoulder Flexion
(arm is in the front of the body):
awkward posture is > 90^0



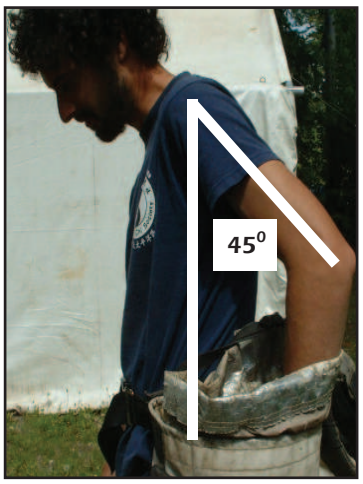
Shoulder Extension
(arm is behind the body):
awkward posture is >20^0

Seedling Arm, when retrieving seedling

Arm behind the body

Neutral posture
(hand on hip)

Elbow out to the side of the body



Mild to moderate
awkward posture

Shovel Arm, with elbow out to the side of the body

Neutral posture

Mild to moderate awkward posture

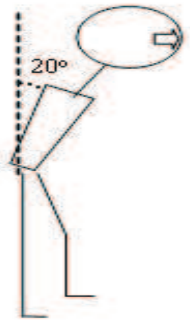
Moderate to really awkward posture

Shovel Arm, with arm in front of the body

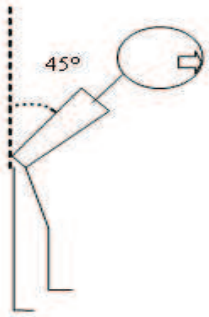
Neutral posture

Awkward posture: hand above head

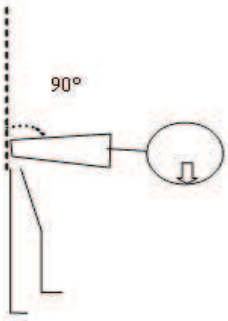
Trunk postures of interest



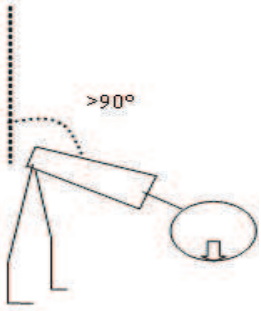
Neutral



Mildly awkward



Moderately awkward



Really awkward

Trunk postures when planting

Neutral

Mildly awkward

Moderately awkward

Really awkward

No twist: neutral trunk posture

Twisting results in an awkward trunk posture.

Warm-Up Exercises

Avoid exercising immediately upon rising from bed without first warming up the entire body. For example, spend 5-10 minutes getting ready for the workday. This decreases spine stiffness and prepares the body for specific stretching exercises, such as those described on the following pages.

Do not over-stretch. The purpose of these exercises is to move through a normal range of motions, lubricate the joints, and encourage muscle balance. It is not the right time to try and gain flexibility by doing a deep stretch.

Perform the movements slowly and purposely. Focus on keeping the body aligned. Never bounce.

Never push yourself through an exercise if it feels uncomfortable. The warm-up exercises presented here should not be difficult to perform. However, everybody is different. Modify the exercise to suit your fitness and health level. Back off the stretch and correct your body alignment if you feel pain or discomfort.

Warm-up Exercises

Perform these exercises prior to physical activity, especially first thing in a work-shift and after a break when the body has cooled down.

1. The Bicycle - for lower body

A.

- Lift right leg out in front of body.
- Lead with the knee.

B.

- Straighten Right leg out.
- You should feel a muscle stretch down the back of the thigh (hamstrings).

C.

- Swing right leg back until the toes of the right foot reach the heel of the left foot.
- You should feel a muscle stretch in the front of the hips (hip flexors).
- Transfer weight to right leg.
- Repeat cycle with left leg.
- Repeat 15 times

Do not step too far back.

Caution: Watch out behind you as you will travel backwards with each cycle for each leg.

2. Inner/Outer Thigh Stretch - for inner / outer leg muscles

Inner Thigh

- Stand with legs wider than shoulder width apart.
- Lean to one side then the other.
- You should feel a stretch on the inner thigh - repeat 10 times.
- Hold for a count of 3 each side.

Do not let knee go past the foot

Outer Thigh

- Cross right leg in front of left and push hip right.
- You should feel a stretch on the outer right thigh.
- Repeat with other leg.
- Hold for a count of 5 each side.

3. Calf Stretch - for the lower leg muscles and tendons

- Stand facing a tree or another object to lean against.
- Place one foot behind the other - keep both feet facing forward.
- Lean forward towards the wall with the body in a straight line. Bend forward knee slightly while keeping the rear leg straight.
- Press the heels to the floor.
- You should feel a stretch in the calf and ankle of the back foot.
- Do not bounce - hold for a count of 5 each side.

Do not turn the back foot out

4. Hamstring Stretch - for the back of the thighs

Keep lower back flat, not rounded

- Place the left heel out in front of the body.
- Use a sturdy object 30 - 45cm high if available.
- Support some weight onto the right leg if you want to.
- Slowly bring the hands down and away from the body.
- You should feel a stretch down the back of the thigh.
- Hold for a count of 5 each side.

5. Quad Stretch - for the front of the thighs and hips

- Hold onto a wall or other sturdy surface.
- Grab the bottom of your right pant leg.
- Grab your ankle if you are more flexible.
- Push the hips forward.
- You should feel a stretch along the front of hips and thigh.
- Hold for a count of 5 each side.

Do not arch the lower back

6. Arm Swings - to warm up the upper body



- Stand with your feet shoulder width apart.
- Swing arms vigorously backward and forward.
- Accelerate the arms on the backwards swing.
- Keep the shoulders relaxed. Let the shoulders raise and lower as the arms swing; repeat 40 - 50 times.

Do not twist

7. Shoulder Rolls - to warm up the shoulders


- Shrug shoulders then roll shoulders backwards.
- Repeat 5 times.

8. Arm Circles - to warm up the body and arms

A.

B.

C.

D.

- Circle both arms slowly in front of the body in the sequence shown.
- Keep arms as close to the body as possible.
- Think of stretching through the arms to the fingertips as you make the circle.
- You should feel a stretch through the shoulders and arms.
- Move slowly.
- Circle arms slowly 5 times and repeat 5 times in the opposite direction.

Do not let shoulder tense

9. Mid-back Stretch - for mid-back and shoulder blades

- Place one arm across the front of your chest.
- Use the other hand to hold the arm, pressing just above the elbow.
- You should feel a stretch in the back of the shoulder and mid-back area.
- Hold for a count of 5.
- Repeat with other arm.

Keep the shoulder down and relaxed

10. Finger Stretch - to warm up hands

- Open and close hands.
- When opening your hands spread fingers to stretch.
- You should feel a stretch through your hands and fingers.
- Repeat 10 times.

Warm-Up Exercise Reminders

The Bicycle:
Repeat with both legs, 15 times

Arm Swings:
Repeat 40-50 times.

Inner Thigh:
Count of 3; repeat 10 times.
Outer Thigh:
Count of 5 each side.

Shoulder Rolls:
Repeat 5 times.

Calf Stretch:
Count of 5 and switch legs.

Slow Arm Circles:
Repeat 5 times in each direction.

Hamstring Stretch:
Count of 5 and switch legs.

Midack Stretch:
Count of 5; repeat with other arm.

Quad Stretch:
Count of 5 and switch legs.

Finger Stretch:
Repeat 10 times.

Exercises for Injury Prevention

Introduction

The repetitive motions of planting trees use some muscles more than others, and can lead to a muscle imbalance with injuries. Some muscles become long and weak while others become overly strong. When this happens, micro-injuries of the soft tissues occur, and if left untreated, accumulate and develop into an injury. Performing exercises to strengthen commonly weak muscles and stretch commonly tight muscles are crucial for injury prevention. This section demonstrates recommended exercises that can prevent muscle imbalances and the resulting pain and injury.

How repetitive strain injuries develop

Repeated movements and sustained postures during tree planting may lead to changes in muscle length, strength, and patterns of muscle recruitment and use. They can also create stiffness. When this occurs, minor alterations in the precision of movement in the shoulder, back and wrist joints arise. These impairments in movements injure the soft tissues. If allowed to continue, macro-trauma such as repetitive strain injury and pain may result.

Exercises for injury prevention

The main purpose of the following exercises is to prevent muscle imbalances from developing, keep joints flexible and enhance proper body mechanics.

Exercises are divided into sections labeled **Wrists, Shoulders and Lower Back**. Five of the exercises are aimed at stretching. Without stretching, over-used muscles may gradually lose their flexibility and muscle imbalances may develop. One exercise is aimed at conditioning muscles that may become long and weak and correcting common postural faults that may develop.

In addition to injury prevention, these exercises reduce muscle tension and relax the body, enhance body awareness, promote circulation and assist with co-ordination by allowing free and easy movement.

Instruction on worksite exercises

These exercises are intended to be performed often during the planting day, throughout the planting season. They can be performed at the campsite prior to beginning work as part of a warm-up, throughout the work-shift or at the end of the work-shift. If performing these exercises during the work-shift, aim to do them two to three times over the course of the planting day, such as at every second bag-up.

Perform these exercises only with warmed-up muscles, i.e., after a warm-up, or after one bag-up.

Wrists

Continuous gripping of the shovel and seedlings can cause a shortening and over-development of the muscle that curls the thumb under the palm. This can contribute to claw hand and carpal tunnel syndrome symptoms. Frequently stretching the wrists help to prevent these.

Wrist Stretch-to stretch the wrists and forearms

1.

2.

3.

Instructions:

- Press palms on flat surface, hands shoulder width apart (#1).
- Spread fingers and thumb apart. Lean forward over hands (#2).
- Try reversing arm position for a deeper stretch. Hold for a count of 15; repeat 3 times (#3).

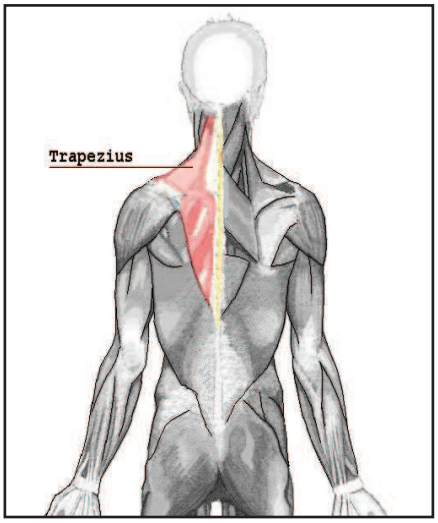
Caution: Stop if you get tingling or numbness in your hand. Do not lock or hyperextend your elbows when you perform the stretch.

Shoulders

When standing upright with proper shoulder posture, the palms of your hands should face your legs, not face backwards which is a common postural fault. Proper alignment is necessary for optimal shoulder health. A muscle imbalance may occur when repetitively using those muscles that turn the palm down and elbow out. This palm-down and elbow out position occurs when you hold a D-handled shovel or reach into a bag to grasp a seedling. If you do not have proper shoulder posture and you repetitively use the arm to plant trees, you may develop an upper body repetitive strain injury.

Some muscles that need strengthening are lengthened when putting a shovel into the ground or reaching into a bag to grasp a seedling. These are the middle back muscles and some of the rotator cuff muscles. For example, the lower trapezius muscle fibers keep the shoulder blades pinched down and in. This muscle may get long and weak, resulting in a lack of precise movement in the shoulder joint. This may lead to problems in the shoulder and arm including tendonitis. The rotator cuff muscles that turn the arm out, such as the infraspinatus and teres minor, are often under-used because of a common postural fault. They can become long and weak from turning the palm down and elbow out when tree planting.

Effect of lower fibers of trapezius muscle on shoulder blade



Trapezius muscle

Shoulder Blade Squeeze

Start position:
Pinch shoulder blades

End Position:
Keep forearms against the flat surface

Don't over-arch the back

Purpose: To strengthen the muscles that turn the palms up and elbows down (infraspinatus and teres minor) and pinch the shoulder blades down and together (lower trapezius). This helps prevent repetitive strain injury from frequent arm motions.

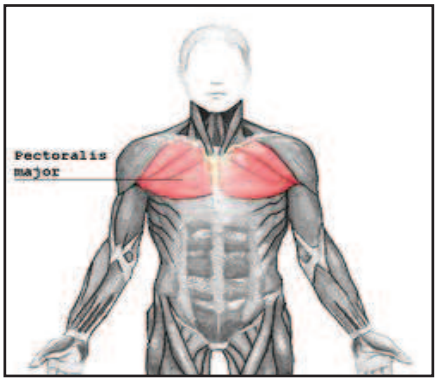
Instructions:

- Lean against a flat surface (or a tree or side of a pick-up seedling carrier) with slightly bent knees; place feet 8" from the surface and keep back as flat as possible; place forearms against the surface, pinching bottom of shoulder blades together; wrists are shoulder height.
- Slide arms up, keeping forearms against surface; hold for a count of 5; repeat three times.

Caution: If you feel numbness in your hands do not bring your arms back as far. Stop if you have pain in the shoulders or neck. Do not arch back.

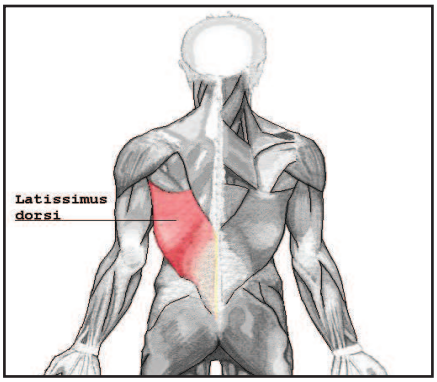
Shoulders - continued

The pectoralis major and latissimus dorsi muscles can become overly strong and tight. These muscles provide the power to insert the shovel into the ground. Even if you have great posture alignment, it is a good idea to stretch these muscles before planting and frequently throughout the day so that shoulder motions are done properly.



(Left) Pectoralis major

(Right) Latissimus dorsi



Shoulder/Pec Stretch

Purpose: To stretch the chest muscle (pectoralis major). Helps to balance repetitive arm motion used in planting trees.

Instructions

- Stand with feet shoulder width apart; place hand behind a sturdy surface so arm is just below shoulder height.
- Gently step forward, feeling a stretch in the front of the shoulder and chest muscles; keep your shoulder back; do not twist; hold for a count of 15 each side; repeat three times.

Caution: Stop if you get pins or needles in your hand. Do not perform this stretch if your shoulder easily dislocates.

Lat Stretch

Start position

End position

Purpose: To stretch major muscles that act on the shoulder.

Instructions

- Grasp tree at about eye height.
- Squat down; you should feel the stretch in your side; hold for 15 seconds; repeat for each side; no cautions.

Lower Back

In the lower body, repetitive lower back bending and occasional twisting can allow a muscle imbalance to develop that may lead to chronic lower back pain. When bending, it is important to have sufficient hamstring flexibility so that bending takes place mainly through the hips and not the spine. To reverse the effects of all the forward bending done when planting trees, stand up and extend yourself backwards to help keep the disc nucleus from straining the posterior ligaments.

Reverse Back Stretch

Purpose: To prevent back stiffness and back ligament strain.

Instructions

- Stand with feet shoulder width apart.
- Look straight ahead.
- Clasp hands behind back, keeping shoulders back.
- Do not let shoulders roll forward.
- Lean backwards without moving hips.
- Work towards being able to gently pull hands away from body while keeping shoulders back.
- Hold for a count of 15; repeat three times.

Caution: If it hurts your shoulder when you bring your arms behind your back, put hands on hips instead.

Hamstring stretch

Start position

Purpose: To stretch the muscle in the back of your thigh. Helps you to bend forward through the hips instead of at the waist, which in turn helps to prevent lower back pain.

End position

Instructions

- Place heel up on a sturdy surface; keep hips in line and knee facing straight up.
- Bend forward from the hips, sliding hand down thigh towards knee; hold for a count of 15; repeat three times each leg.

Caution: Stop if it causes back pain, tingling or numbness in the buttocks or leg(s).

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