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Layering is comprised of insulating garments to create an effective and efficient cold and/or wet weather system. The purpose of layering is to keep the activist warm and dry in cool or cold weather. Why is dry important? Because when the body is wet it is cooled, and in cold weather a quickly cooling body equals hypothermia, frostbite, or death. Layering is important because it allows the regulation of body heat retained. This is achieved by adding or taking away layers from the system. Simply stated, an effective and efficient system allows the user to take pieces off when temperatures rise and put layers on when temperatures drop. This sounds easy and common sense, but there are many different types of layering pieces and sometimes their usefulness in some situations is not always clear. In order to maximize effectiveness of this system a better understanding of the 3 components is necessary:

- 1, Base Layer - Next to skin, this is thermal underwear.
2. Mid Layer- Different layers of insulation(shirts, sweaters, jackets, pants)
3. Outer Layer- This is the shell layer. The piece that covers and protects the first two layers.

1. The Base Layer - This layer is often known as the, wicking layer. Wicking is the garments ability to pull moisture away from the body to the outside of the garment. It is important to know that even a light sweat induced by moderate activity can produce enough moisture to cause hypothermia. With an effective wicker moisture is pulled away from the body to the outside of the garment where it evaporates quickly. This leaves the user warm and dry. In cold weather, it is extremely important, that moisture is pulled from the body even when you feel HOT! Once you stop exerting energy, any moisture remaining on the surface of the skin causes the body to cool extremely fast, and causes the person to chill, maybe even becoming hypothermic.

There are many different types of base layers: Capilene(a Patagonia synthetic), Polypropylene (Helly-Hansen, among others), Thermax(DuPont), Thinsulate, and Silk. All of these wick moisture, but some come in varying weights providing more warmth or thermal prosperities as they are wicking. Silk is relatively the lightest layer while Capilene, Polypropylene, and the other wickers all have a range of weights. All of these are excellent wickers and provide some insulation even when wet. The question may arise as to which of the weights to choose from? For example, if you were cycling in warm to cool weather, a silk or lightweight synthetic (polypropylene or Capilene) would be appropriate. On the other hand, if you were backpacking in the Rockies during the winter, a heavyweight polypropylene or capilene garment would be appropriate as a best layer.

Cotton (the waffle-style print sold in stores as long-johns and any cotton T-shirt) should never be used a layering piece. Cotton will never wick and possesses no thermal value when wet. It increases the risk of hypothermia by allowing heat to continually escape from the body!! Cotton absorbs moisture and does not have any wicking capabilities. Once cotton becomes saturated it stays wet for long periods and the wearer expends precious body heat trying to warm this cold, clammy layer covering the skin. Essentially, wet cotton robs body heat in situations where the main objective is to retain body heat.

NEVER USE ANY FORM OF COTTON AS A BASE LAYER, even in hiking boots.

2. The Mid Layer- This layer is often known as the insulation layer. There are many types of insulating fabrics; wool, fleece, pile, down and acrylic. All of these materials are excellent insulators, because they retain body warmth efficiently. Fleece and pile have recently become very popular because they are lighter and dry 3 to 4 times faster than wool.

A mid layer can be made of three to four different pieces of clothing. These extra pieces should have the ability of being added to or taken away from the system, easily. They should be used at the user's comfort and discretion.

Synthetic fleece or Polar fleece (commonly referred to as fleece) can come in many styles and weights. The weights coincide with their intended uses. Micro-denier fleece is a great mid layer on those cool spring and autumn hikes or bike rides. Usually the manufacturers will list their fleece at a weight of 100, 200, and 300. This used to be the standard, but as competition increases, different companies want to specialize their products and offer 250s, 375s, and 400s. But an easy way of looking at it is that 100 is extremely light, 200 is a mid, and 300 is a very warm piece of fleece.

There is also a new fleece on the market. PCR (post-consumer recycled) fleece is made from recycled plastic bottles. This stemmed from the fact that many outdoor manufacturers are looking for ways to reduce waste. As a result they started using recycled bottles as a way to reduce their dependency on new material. Synthetic material used in plastic bottles is similar to that used in polar fleece, so recycled plastic bottle is an excellent material for the outdoor industry. The result is an effective, comfortable fabric that is made of recycled material. So keep recycling!!!

Pile is a heavy weight fleece used in weather systems for very frigid conditions.

Down is wonderful, lightweight, compressible, efficient and effective insulator. Its life span is unknown. Unfortunately, down will lose most of its thermal value when it is saturated. Therefore, a down jacket may prove ineffective without a waterproof shell over it. This brings us to the Outer layer (shells) section because, with the right outer system, down can be used safely.

3. Outer Layer- This is another important layer because it provides protection from the elements. The layer needs to be both windproof and waterproof. The mid layer without the outer layer will not be as effective because it is exposed to both wind and moisture. If the piece is windproof, heat will better stay trapped under this layer.

This layer should be worn loosely, in order to accommodate the changing mid layers. This piece should have the ability to be worn in all seasons. That is why it is important for it to have plenty of room. In the winter it can house many mid layers and in the summer time it fits loosely and will have a greater amount of breathability. Ventilation is important during high intensity exercise in order to release excess heat, water, vapor, and sweat.

This is the reason why there are so many waterproof/breathable jackets and pants on the market today. The base and mid layers may wick wonderfully, but if the jacket is not breathable all of this moisture gets trapped under the outer layer. Breathability allows for a greater degree of comfort because it aids in releasing excess water vapor making the

jacket feel less stuffy. Heat is lost around 32 times faster on a wet body than on a dry one, so it is especially important to remain dry under the outer layer.

This might be an important place to look at the different types of outer layers available(also referred to as raingear or shells).

People often hear the words waterproof and water-resistant, but can not truly distinguish between the two terms. It is important to understand this distinction, because your life may depend on it. Waterproof means that no water can penetrate the jacket or pants, even through the seams. Water-resistance, however, only means that it can repel water for a limited amount of time and will eventually wet out (get saturated). This is misleading because many companies use waterproof materials in their garments, but if the seams are not taped or sealed these garments can only be listed as water-resistant. Some manufacturers do not always make this clear, and some salespeople do not either, so be sure to check a catalog or call their customer service numbers and ask. Understandably, water resistant shells are less expensive and perfectly appropriate in certain conditions; for example, on an hour or two dayhike or bike ride where, if you were to get saturated, you would be close to home or your car. A water resistant shell would be totally inappropriate on a weekend backpacking trip where you are days from an adequate shelter should you get saturated. In cool to cold weather, you are at a greater risk of becoming hypothermic, which can endanger your life.

Shells and/or rainwear can be made several different ways. Nylon is the most often used material. However, without treatment nylon is not waterproof. There are four basic ways to treat nylon: Polyurethane coating, Vinyl coating, microporous coating, and lamination, to waterproof/breathables. Vinyl and polyurethane coated jackets and pants good for the budget-conscious user. Both provide a waterproof garment, as long as the seams are sealed. However, both of the garments have no breathability. Therefore making both vinyl and polyurethane coatings feel muggy and sticky to the skin, especially in warmer-humid regions. For those that do not like muggy and sticky, when out on the path, there is the world of waterproof-breathables. Both microporous coated nylons and laminated fabrics are waterproof/breathables, varying in price and durability. Microporous coatings have pores small enough to allow water vapor to escape, but water molecules can not.

A laminated waterproof/breathable is a fabric that has a weave small enough to allow water vapor to pass, while keeping water molecules from passing through. Laminated fabrics have been proven to last longer than coatings but again there is around a \$150-\$200 difference in price. Laminates creates the most comfortable shell to date. The nice part about waterproof/breathables is the fact that when using them in conjunction with the base and mid layers all the moisture is released and the user comes out warm and dry, as they should.

Fit instructions - the outer layer should fit loosely to accommodate different layers at different times of the year. A hood is an important part of the jacket. Make sure it covers the head completely and cinches tightly around the face for extreme conditions. Be sure to take some time to fool around with all the gadgets on the garment. There should be double flaps over the zippers to keep wind and rain from penetrating this vulnerable area, These flaps should be sealed with snaps and/or velcro. Velcro and/or snaps should also be used as closures for neck and wrists. Some jackets will offer a drawcord at the waist, bottom, and hood to ensure a conforming fit. This also aids in the jackets ability to keep wind, rain, and snow from getting in, up, and down the jacket.