

BASIC LAYERING

Outward Bound Wilderness First Aid concept:

- Gain more heat than you lose; define as HEAT CHALLENGE
- Lose more heat than you gain; define as COLD CHALLENGE

Heat Loss

1. Conductive heat loss
 - Body contact with cooler surface
2. Convection heat loss
 - Body heat warms the air adjacent to the body; air then rises and moves away from the body and fresh cooler air replaces it. (e.g. windchill)
3. Radiant heat loss
 - Escape of infrared radiation from the body, which can be minimised by wearing insulated fabrics or with reflective fabric that reflects heat back.
4. Evaporative heat loss
 - perspiration on skin evaporates, drawing heat from the body
 - minimise sweating; extra energy will be used to cool or warm the body

Trapping your body heat

- Best insulation:
 - Layer of static; unmoving air close to the body, “dead air”
 - Air is warmed by heat given off by own body
 - maintains ‘microclimate’ around body
- For Singapore:
 - worn primarily to provide shade
 - minimise overheating rather than to insulate

Layer Principle

- Maintain comfortable body temperature without excessive sweating
- ‘Layer up’ and ‘Layer down’ concept; temperature condition and activity level
- Different layering combination
- Not too tight, compresses dead air space, therefore increased insulation value.

Four Factors:

1. Activity Level
 - Increased or decreased heat that your body would generate
2. Clothing Layers
 - Number and types of layers would allow sufficient dead air space
3. Staying Dry
 - Retain heat is to minimise wetness
 - Lose heat 25 times faster in wet clothing than dry
 - Internally and externally
4. Ventilation
 - Opening or closing the layers
 - ‘Bellow action’ occurs as we move; pumps accumulated warm air out and sucks/pulls cool air in. Thus, helps to reduce body’s insulation by 50%
 - Effective sealing and opening
 - Also prevents moisture buildup from perspiration
 - Clothing for easy ventilation (e.g. full-zip outer shell, armpit zipper, front zipper turtle neck...)

Clothing layers

- a. Inner layers
 - Hydrophobic (water-hating); best to wear
 - Hydrophilic (water-hating); best to avoid
 - transport moisture when hot; insulates when cold
- (i) Polypropylene and polyester
 - Synthetic fiber; do not absorb water
 - Extremely effective, worn directly against the skin
 - hydrophobic inner layer; hydrophilic outer layer

Pro: Minimise moisture next to the skin when high conductive heat loss can occur
Con: Not wind-proof, best used as inner layer
- (ii) Vapour barrier (Second-level inner layer)
 - Water-proof; barrier to the transportation of the water vapour
 - Keep water vapour near to the skin
 - Once humidity level rises to the point when the body detects it, our body will automatically shut off perspiration
 - Best not to use directly against the skin, because any evaporation of the moisture will directly leads to greater heat loss through the skin
 - Best to have polypropylene or hydrophobic layer between the skin and the vapour barrier; that will allow moisture to be transported away from the skin.
 - effective for some people in some condition

- Determine activity level 'Moisture comfort'

(iii) Middle layer

- provides some insulations and protections from the element
- Mid and heavyweight; not polypropylene or lightweight pile or wool tops/bottoms; work well for this layer

Fleece

- Synthetic fabric (polyester, polyolefin, polypropylene)
- Remains warm when wet; does not absorb moisture; dry quickly
- Similar to wool

Pro: provide equivalent warmth of the wool at half of the weight

Con: Poor wind resistance; requires an additional wind-resistant layer

Wool

- Elastic, 3-D wavy crimp in fibre that traps the air
- 80% wool cloth can be air
- Remain warmth when moist
- High absorbent rate; heavy when wet

Pro: Cheap, quite wind-resistant (if it is tightly woven)

Con: Long time to dry, Itchy and can be sensitive to skin

(iii) Outer Layer

- Provide insulation
- Often worn at the beginning and end of the day in camp, or when there is a decreased in the activity level

Shell Layer

- Protects from the wind, rain, snow, and sun
- Windproof and waterproof

(a) Breathable shell

- Nylon or nylon blend
- Lightweight and tightly woven

Pro: Windproof, allows body moisture to escape

Con: Not waterproof

(b) Waterproof shell

- Coated nylon

Pro: very waterproof and windproof

Con: Significant body moisture buildup

(c) Waterproof / Breathable shell

- Gortex (micro-porous membrane)
- Ultrex (micro-porous coating)
- Principle: Water droplets from the rain are 20,000 times larger than vapour passes through from the inside

Pro: Degree of waterproofness; Degree of breathability; Windproof

Con: Degree of waterproofness; Degree of breathability; some body moisture will buildup; expensive

Head Layers

- Sun, rain, heat loss protection
- Heat conservation when cold
- 70% of body heat loss through the head
- Preferably wool or synthetic
- Once warm, allows body to send more blood to cold peripheral areas (extremities)

Hand Layers

- Gloves, mittens should fit snugly; not tightly
- Gloves: Greater flexibility, colder than mittens
- Mittens: Greater surface areas at fingers: radiates heat
- Polypropylene glove liners and wool mittens are the best combination for cold weather
- Mittens shells, Wind and waterproof, would help to increase heat

Feet Layers

- Insulation / cushioning feet from getting blisters
- Lightweight, synthetic liner socks will help to pass moisture away from the foot
- On top of that would be the medium to heavy weight wool, wool-nylon blend and synthetic hiking socks
- Friction from boots is taken up between sock layers rather than against the skin
- Smoother sock of all wrinkles to prevent blisters
- Minimum three sets, one to wear, one to dry, one always dry (back up)

Clothing Techniques

- (1) Morning: Activity low; temperature low
: All layers on until breakfast is over and things become more active
- (2) - Once active, shed some layers
- Good rule of thumb: layer down till feeling cool; not chilled
- Too many layers will lead to overheating and sweating
- Opening and closing of the zippers, rolling sleeves, hat off / hat on
- (3) - Rest stop (not more than five minutes)
- Add layer from getting chilled
- Keep extra layers at hand
- (4) - Wet clothing; CHANGE!!
- Otherwise, body would not be able to warm up
- (5) End of the day: Activity and temperature is low
Add layers before cool down, takes a lot to heat up the body
Good to put on more than you think you need, it will only get colder
Too warm, regulate by ventilation

Ref: Backpackers manual for the Great outdoor (Rick Curtis)

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