



An Engineering Evaluation of Camping Stove Technology By A Lightweight Backpacker

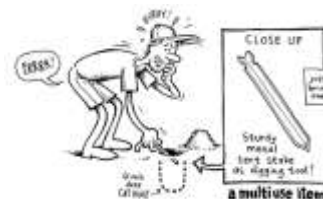
(with BSA and CCP Policy Update)

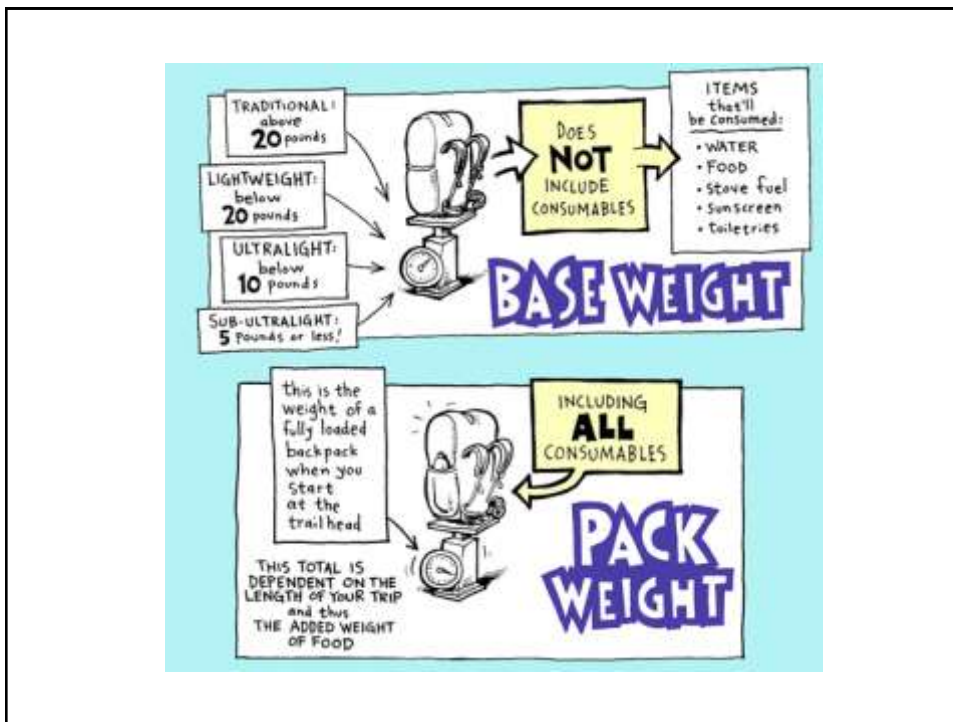
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Principles of Lightweight Backpacking

1. Take enough gear to be safe, comfortable and confident.
2. Know the actual weight of each item.
3. Whenever possible, use multipurpose items.
4. Look at the heaviest items first.
5. When selecting items, use the smallest items that will suit your needs.
6. Choose lightweight gear that is useful, sturdy and dependable.





Packing Categories

| No. | Description | Notes |
|-----|--------------------------|--|
| 1 | Risk Management | Know before you go: weather forecast , terrain, route and water sources. |
| 2 | Pack Weight | My objective is 10-12 lbs |
| 3 | Footwear | Trail shoes or low cut hiking boots |
| 4 | Backpacks | Gossamer Gear Mariposa |
| 5 | Navigation | Map, compass, GPS |
| 7 | Clothing System | Weather protection, thermoregulation and layers |
| 8 | Sleep System | Sleeping bag or quilt, pad, sleep wear |
| 9 | Shelter | Tarp tent |
| 10 | Hydration | Platypus , purification tablets |
| 11 | Food & Cooking Equipment | Plan for about 2 lbs of food per day, stove, fuel, pot/bowl/cup, spoon |
| 12 | Hygiene | Toothbrush, toothpaste (mini size) |
| 13 | First Aid | Advil, bandaids, moleskin, tweezer |

Trail Food and Cooking On The Trail

- Your meal plans, choice of stove, fuel requirements, cooking and eating equipment are all interrelated issues. That's why I don't think of individual gear - only the overall solution to the Food and Nutrition **Category**.
- Simple meals = Simple and light equipment, simple meal preparation, little or no cleanup, more enjoyment
- Do I need hot water for cooking? How much?
- Do I need to boil water for water treatment?

Fuel Options

| Type | Examples | Pros and Cons |
|-----------|---|---|
| Solid | Esbit or Trioxane fuel tablets | Very small stoves. Each tablet can burn for about 15 minutes and boil up to 2-3 cups of water. Only have to bring what you need. |
| Liquid #1 | Denatured Alcohol | Only bring the fuel you need. Can boil 1-2 cups of water at a time. Not ideal for windy conditions, very cold temperatures or high altitude (> 15,000 ft). Can spill or leak. |
| Liquid #2 | White Gas (aka Coleman Fuel) | Only bring the fuel you need. Good at all temperatures. Priming and pumping requires some skill. Require maintenance. Can spill or leak. |
| Canister | Isobutane Mix | Easiest to use. No maintenance. High heat output. Operating problems at very cold temperatures. How to manage used canisters? |
| Biofuel | Small branches, twigs, leaves, pine needles | Fuel is free and everywhere. Beware that stove and pot get covered with soot. |

What Size Pot Do I Really Need?

- 1 cup=8oz=235ml, 2 cups=16oz=470ml
- Cups/Mugs
 - \$13 for GSI 530ml Glacier Stainless Mug (4.4 oz)
 - \$36 for SnowPeak 450ml Titanium Mug (1.9 oz)
- Kettles (with lids)
 - \$40 for SnowPeak Trek 700ml Ti Mug (4.8 oz)
 - \$55 for Vargo 700ml Ti-Lite Mug (4.9 oz)
 - \$60 for MSR 830ml Titan Tea Kettle (4 oz)
- Pot
 - \$16 for Open Country 2 Qt Aluminum Pot (5 oz)
 - \$55 for Evernew 1.3L Titanium Pot (4.6oz)
- Sets
 - GSI Outdoors Soloist or Dualist Sets (\$45-\$65)
 - SnowPeak Mini Solo Set (\$65)



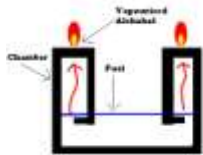
Esbit Fuel Tablets

- Fuel Availability: Most sporting goods stores
- Fuel Cost: \$7 for 12 0.5-oz tablets
- Most efficient for boiling 1-2 cups of water, 5-6 minutes
- One 14g tablet will burn for about 12 minutes
- Fuel required to boil 2 cups: < 1 tablet
- Can use unburned leftover tablet or cut to size
- Stove Cost
 - \$12 for Esbit Pocket Stove (includes 6 tablets)
 - \$15 for Esbit Titanium "Wing" Stove
 - \$30 for Esbit 535ml Cookset (Wt=7 oz)
- Cook With Cup or Mug or Small Kettle








Alcohol




- Fuel Availability: Denatured alcohol (ethanol) can be found in hardware and paint stores. Yellow HEET (methanol) can be purchased at auto supply stores. Do not use isopropyl alcohol or Iso-HEET!
- Fuel Cost: \$8 for 1 qt (32oz)
- Time to boil 1-2 cups: 5-6 minutes
- Fuel required to boil 2 cups: 1.5 oz
- Most efficient method for boiling 1-2 cups or 3-4 cups of water at time depending on size of stove and pot. Beware of fuel spillage or container leaks.
- Stove Cost
 - \$15 for Gran Weenie PRO Stove (Capacity=1 oz)
 - \$23 for White Box Solo II Stove (Capacity=1.5 oz)
 - \$23 for Original White Box Stove (Capacity=3 oz)
 - \$20 for Trangia or Esbit Alcohol Stove (Capacity=3 oz)







White Gas aka Coleman Fuel




- Fuel Availability: All sporting goods stores
- Fuel Cost: \$13 for 1 qt (32oz), 110 mins/20oz
- Time to boil 2 cups: 4-5 minutes
- Fuel required to boil 2 cups: 0.5 oz
- Requires some skill to efficiently pump, prime and light. Universal models can burn various liquid fuels as well as canisters. Requires maintenance. Beware of spills & leaks.
- Stove Cost
 - \$80 for MSR Whisperlite Shaker Jet
 - \$139 for MSR Dragonfly
 - \$140 for MSR Whisperlite Universal
 - \$154 for Primus Omnifuel (Universal)





Isobutane Canisters



- Fuel Availability: All sporting goods stores
- Fuel Cost:
 - \$6 for 100/110g “mini” canister (26 min, Wt=6.6 oz)
 - \$10 for 230g “regular” canister (55 min, Wt=
- Fuel required to boil 2 cups: 5g
- Fast lighting and quick boil (3min). Canister top mount or tripod styles. Optional built-in piezo lighter.
- How to manage partially used canisters?
- Stove Cost (\$30-\$150)
 - \$40 for MSR PocketRocket
 - \$50 for SnowPeak Gigapower w/Piezo Lighter
 - \$100 for Jetboil Flash, \$150 for Solo Ti, \$130 for Sumo
 - \$140 for MSR Whisperlite Universal





Biofuel



- Fuel Availability: On the ground
- Fuel Cost: \$0
- Boil 2 cups of water in 10-12 minutes
- Utilizes efficient dual chamber stove design for most efficient fuel burn and heat generation. Pot and stove will get dirty. Some models like Sierra Stove have battery-operated fan while Biolite is self-generating.
- Stove Cost
 - \$70 for ZZ Sierra Stove with fan
 - \$90 for Solo Stove
 - \$120 for Bushbuddy Standard or Ultra
 - \$129 for Biolite CampStove (33 oz)



Gear Geek Extra Biolite CampStove



- Price: \$129.00
- Wow! Burns twigs and generates electricity! That's cool!
- Weight (without pot) = 33 oz. Not lightweight.
- Generates own electricity for internal fan. Good!
- Fire Power Output: 3.4kW (LO), 5.5 kW (HI)
- USB (5V) Power Output: Max continuous=2W, Peak=4W
- 2 hrs of HI continuous burn will only charge a typical smartphone 50%. Not so great! Why bring a phone anyway?
- Scalable for 3rd World Home Use: Biolite HomeStove



Introducing The BioLite HomeStove™

50% Less Wood Consumed

Time and Cash Savings

95% Smoke Reduction

Improved Health

Nearly Eliminates Black Carbon

Protects Climate

Generates Electricity

Charges Phones & LED Lights



Comparisons for 2 Hot Meals

| Type | Equipment & Fuel | Total Weight | Total Cost |
|-------------|--|----------------------------------|------------|
| Esbit | Esbit folding stove GSI Glacier Mug 4x Esbit tablets (0.5 oz each) | 9 oz | \$26 |
| | | (6oz with SnowPeak 450ml Mug) | (\$44) |
| Alcohol | GramWeenie PRO or WhiteBox Solo GSI Glacier Mug 3oz Denatured Alcohol & Bottle Wind Screen | 8 oz | \$32 |
| White Gas | MSR Whisperlite Shaker Jet MSR 11oz fuel container 1 oz White Gas fuel (bring 2 oz) MSR Titanium Kettle | 20 oz | \$155 |
| Canister #1 | MSR Pocket Rocket 100g Isobutane canister MSR Titanium Kettle | 14 oz | \$181 |
| Canister #2 | JetBoil Solo Ti 100g Isobutane canister | 18 oz | \$155 |
| Biofuel | Bushbuddy Ultra MSR Titanium Kettle | 10 oz | \$180 |

Comparisons for 10 Hot Meals

| Type | Equipment & Fuel | Total Weight | Total Cost |
|-------------|--|-----------------------------------|------------|
| Esbit | Esbit folding stove GSI Glacier Mug 10x Esbit tablets | 15 oz | \$30 |
| | | (9 oz with SnowPeak 450ml Mug) | (\$46) |
| Alcohol | White Box Solo II Windscreen SnowPeak 450ml mug 15 oz Denatured Alcohol 16.9 oz Empty Water Bottle | 19 oz | \$65 |
| White Gas | MSR Whisperlite Shaker Jet MSR 20oz fuel container 5 oz White Gas fuel (bring 6 oz) MSR Titanium Kettle | 24 oz | \$165 |
| Canister #1 | MSR Pocket Rocket 100g Isobutane canister MSR Titanium Kettle | 14 oz | \$181 |
| Canister #2 | JetBoil Solo Ti 100g Isobutane canister | 18 oz | \$155 |
| Biofuel | Bushbuddy Ultra Vargo 900ml Ti-Lite Mug | 10 oz (285 g) | \$180 |

Stove and Trail Meal Wrap-Up



1. For a 1-3 nites out, cooking with Esbit tablets or alcohol offer smallest, lightest & least expensive cooking option.
2. For 3-10 nites out, canister, white gas and biofuel stoves are the most efficient options.
3. We have assumed simple solo backpacking meals requiring 2 cups of boiled water.
4. Soup as a first course is a convenient way to rehydrate once in camp as well as restore salt levels.
5. Do-It-Yourself Freezer Bag meals can offer tastier and less expensive alternative to commercial BP meals.
6. Always hang your food at least 100 feet from where you sleep and cook. These 3 areas should form a triangle.

Lightweight Backpacking Recap

1. Go lighter...Enjoy more
2. Lightweight backpacking is not just about the equipment. It's also about having the skills (wilderness first aid too!) and confidence to deal with uncertainty.
3. Don't be reckless in being light. Managing risk is about acting responsibly. Don't push 911 on your the Spot Personal Messenger unless the situation is truly life threatening.
4. Weight your back before and after a trip. What did I forget to bring that I wish I had? What did I bring that I will never use? Too much food? Too much fuel?



LWBP Resources

