In Search of the Perfect Pot

By David Wescott, with Steve Watts and Don Kevilus, 2020

Part 4 – Efficiency: A 3-Legged Stool

ED- Please be aware that quotes and sources need to be italicized

(QUOTE)

The Campfire's Uncertain Future…perhaps the real lesson here is that the campfire has had its day. With massive wildfires raging all summer long and exhausting state budgets, and with participation in outdoor recreation booming to record numbers, maybe the negative impacts of the campfire now outweigh tradition and comfort.

Wes Siler, "The Case For Killing Fire" *Outside Online*, October 2016

There are those who would like to see the open fire outlawed for a variety of reasons – few of which are arguable from a scientific point of view. However, there are arguments that are valid and need to be addressed by those of the wilderness persuasion who enjoy the company of the open flame and "*the taste of honest grub cooked over an open fire."*

(QUOTE)

The LNT Myth

An imported 4oz mini non-renewable fuel canister will boil 8 liters of water:

- *12oz of alcohol will do the same thing.*
- *10oz esbit/heximine (1 ½ packages) will do the same thing.*
- *12oz of charcoal will do the same thing.*
- *24oz of twigs will do the same thing.*

Don Kevilus, *"Potology"* Four Dog Stove Company

Use a Pot On a Tin Can Stove – Efficiency

All of the alternative fuels listed above are renewable resources and when used with a secondary burn stove, will burn almost all available gases, leaving no smoke or ash.

(QUOTE)

Efficiency is a 3-legged stool -
Leg #1 – How is energy extracted from the fuel?
Leg #2 – How well is the heat transferred to the pot?
Leg #3 – How well is the heat transferred to the contents of the pot?

Don Kevilus, *"Potology"* Four Dog Stove Company

Efficiency – Leg #1: How is energy extracted from the fuel?
(QUOTE)
Efficiency is the ability to produce a desired result while minimizing the wasting of materials, energy, effort, money, or time .....the ability to successfully do things well, without waste. Wikipedia

Impact is one of the easiest criticisms available when arguing against the use of open fires in the outdoors. Creating fire in the open can create fire scars, impact campsites by fuel gathering, and emit smoke and ash into the environment.

Using a tin can stove that burns renewable biomass defeats the argument on almost all levels. When cooking on an open fire or folding box stove, the efficiency of the fuel burn that is transferred to the pot, is about 15-30%. When cooking on a tin can stove with a secondary burn design, the efficiency goes up to 60-70%. Not only that, but a secondary burn stove creates no ash or smoke, uses fuels that create less impact than modern stove fuels, and makes superior use of relatively low BTU fuels like wood. It also contains the fire, limiting the chance of wildfire and impact to the campsite.

The Tin Can Stove
The oldest information on a tin can stove I can find is the *Kreigie Stove* (*Boy's Life*, Nov. 1949) *Kriegsgefangenen* is a German word that means "*prisoners of war*." It is a 3-can design, and "*although small – it burns only a handful of fuel – it will boil a large can of water in about eight minutes, will not smoke if handled properly, and is exceedingly efficient – you'll have only a few ashes left."* **(QUOTE)**

Photo 1 - Kriegie Stove, 1949

Another stove found in the *Boy's Life* magazine a few years later is called the "Tin-Can Camp Stove." It is haled as *"easy to pack and yet large enough to cook a one-man or two-man dinner. It uses pencil-size twigs for fuel, is practically smokeless in operation, and will boil a small pan of water in about eight minutes. And it costs nothing to make."* **(QUOTE)**

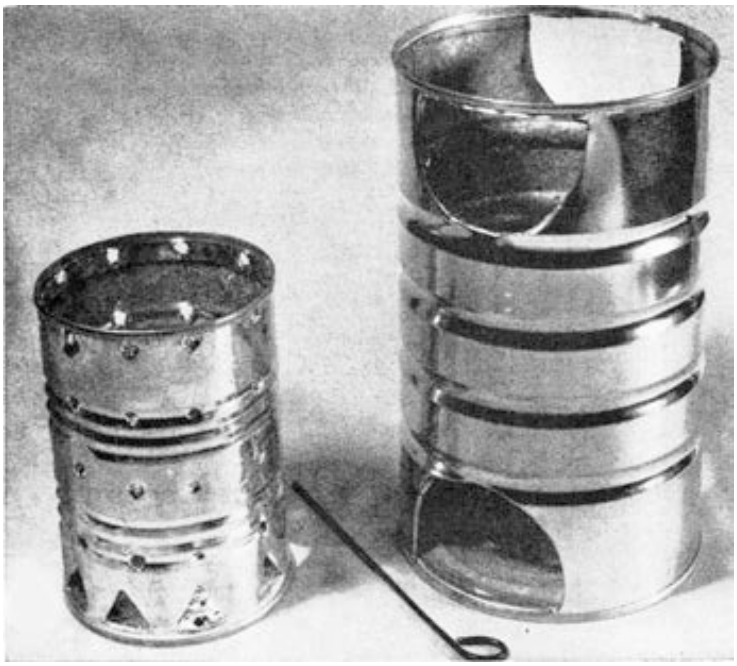

Photo 2 - The Tin-Can Camp Stove

Photo 3- Replicated stoves – The Tin Can Camp Stove (left) and the Kriegie Stove (right). Both are simply perforated fire pots suspended inside of a larger can – the start of understanding fuel efficiency.

Photo 4 – Interior views of the perforated fire pots suspended inside the outer can.

The Tin Can Bushcooker Stoves

Don Kevilius of Four Dog Stove Company designed a #10 Bushcooker stove that places the cook pot below the stove rim, thus increasing heat contact time as well as providing a partial windscreen/heat exchanger. He has also came up with an ingenious alternative for a secondary burn stove design made from a 1-pint and 1-quart paint can and calls it the *Tin Can Bushcooker*. His 5-part video series is a step-by-step tutorial on how to make one. This is 21st century knowledge applied to 20th century technology. What an improvement when combining the two.

Photo 5- The #10 Can Bushcooker and the secondary burn Tin Can Bushcooker made from 1 quart and 1 pint paint cans.

Photo 6 - The fan, made from the can lid, actually creates turbulence that mixes the heat and air as well as the volatile gases for a cleaner burn at the point of secondary combustion. The #10 can does not have this capability, but uses heat exchanger technology to improve efficiency.

https://www.youtube.com/user/fourdogstoveco

Efficiency – Leg #2: How well is the heat transferred to the pot?

Although the size, shape and materials of the pot affect this leg of the efficiency stool, the windscreen-heat exchanger design of the stove significantly improves the efficiency of the fuel use as well as the transfer of heat to the pot.

The Windscreen-Heat Exchanger for Stove Use

All pots improve efficiency with the addition of a windscreen or heat exchanger. A windscreen improves how heat is transferred to the contents of the pot. The optimum set-up for a windscreen-heat exchanger system covers where the flame and the pot meet.

The #10 Can Bushcooker is a simple stove to make, but employs windscreen/heat exchanger technology to improve fuel efficiency rather than the secondary burn design. The fan at the bottom of the pot is new technology, but the idea of placing the cooking pot closer to the fuel source, thus increasing the time the heat is in contact with the pot as well as reducing the loss of heat through convection, is nothing new. We were doing this at BOSS back in the 90s with our simple bottom-load mountain stoves.

Photo 7

Photos 8 and 9 - Simple bottom-load mountain stoves. The wire mesh provides a spark arrestor as well as a pot rest that allows the stove to act as a heat exchanger/windscreen to improve efficiency.


Jennifer Mancke Photo (credit)
Photos 10 & 11 - Steve Watts demonstrating a top-load / bottom feed tin can stove.

Stove Opening to Pot-Size Ratio

When using a pot on a biomass-burning stove, the pot should be about twice the diameter of the stove top - more contact time with flame to heat the bottom of the pot and wrap up the side. If the pot is too wide it chokes out the stove; too much of a damper effect creates a bad draw. For optimal speed and efficiency, use a secondary burn stove, and properly match the pot size to the size of the stove burner/fire pot and add a windscreen/heat exchanger. For optimal performance a windscreen will protect the flame source and increase contact time with the bottom of the pot.

Photo 12 – Stove to Pot Ratios

Efficiency – Leg #3: How well is the heat transferred to the contents of the pot?

Photo 13 - Clay Pots

When cooking in a clay pot, the cook is concerned more with technique than material. A clay pot has a round or conical base so it is hard to balance. This is overcome by placing 3 stones in the fire, using them as a tripod to balance and raise the pot slightly out of the flame. This method could be classified as an early stove, being used more in the world today than any other method. Used with skill it is almost as efficient as a modern stove

Along with the shape, surface treatments may create additional area for flames to engage the pot – heating it faster. The pot is tipped on its side so the contents may be observed and stirred when needed. A stick may be placed on the rim of an upright pot to break the surface tension of a possible boil-over.

When switching to a metal pot, a good cook is concerned with the same ideals – technique over material; where to place the pot in relation to the flame (all pots heat best when suspended above the flame); how much moisture to add so food doesn't scorch, supplying the best fuel source for the most efficient burn….all of these are things a good cook considers. Yes, materials do create another factor, but any good cook can make a pot do his/her bidding. Some points to consider:

Aluminum – Heats quickly and unevenly. When hard anodized, it's as strong as stainless for the same thickness.

Stainless Steel – It's heavier, not as good at transferring heat, but it's tough as nails.

Titanium – Food doesn't cook very well in it; good for boiling water, but it costs a lot.

Tin Can Billy – It's free; you make it yourself; you can cook anything in it that you can in any of the other materials listed above; when it turns black it heats faster; and when you're done with it you can smash it without feeling bad, and make another one - a better one - because you learned a lot from the first one.

Heat Exchange Over the Open Fire – Suspension Systems

The stove-top offers a very controlled way of creating efficient heat exchange from the fuel source to the pot. The open fire, however, adds a number of challenges to the equation. One of the primary problems is in heat transfer – an open fire only transfers about 20% of it's heat to the pot if used improperly.

(QUOTE)

Although Aussies have been brewing tea in a similar way for generations, we recently stole this idea from the Americans and then called it something cooler – just like the canteen cup itself. This is the method for making what the Americans call "Cowboy Coffee". It allows us to brew a great cuppa out bush using real coffee and without any form of filter. What you need is a billy and an enamel mug – quart pot and pannikin works, as does a canteen cup - and you'll also needed boiling water and some coffee grounds. Craig Brown, *Australian Bushcraft Magazine,* 2014

The Aussies have a tradition of simply pushing their one-quart pot into the fire. The broad side of the pot collects more heat and boils quickly. The army GI canteen cup, from whom the Aussies borrowed their idea, works in much the same way.

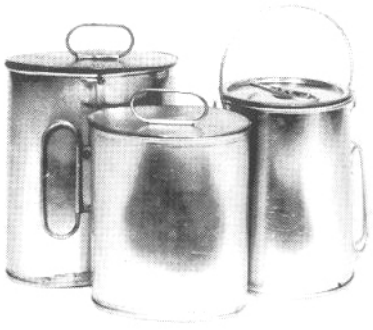

Photo 14 - Stainless steel oval and round pot pannikins.

Hanging pots from some form of suspension system allows the cook to move the pot closer to or away from the heat, adjust the placement of the pot in relation to the fire, as well as work with a variety of shapes and sizes of pot all at the same time.

Systems might include:

Tripod-Quadpod
Tripods with Waugan Stick or Lug Pole
Forked Stick Lug Pole Crane
Tea Sticks - Burtsonsville Rig

(Ed – look at Billy photos for this section)

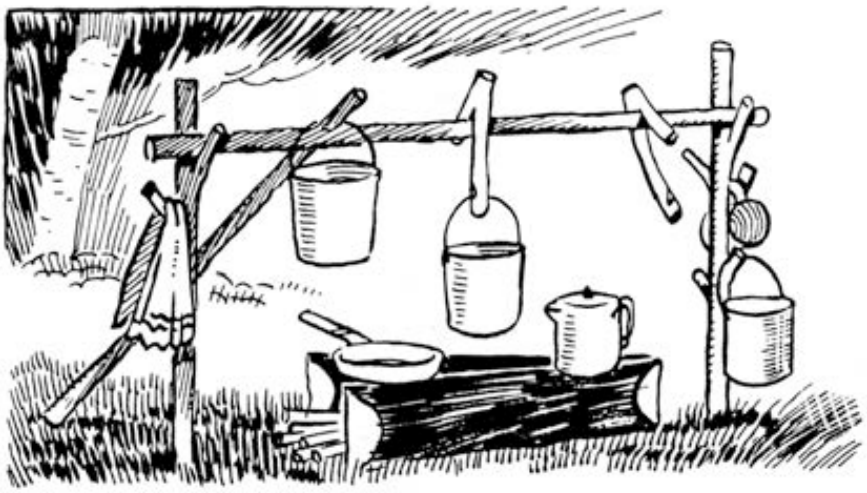

Photo 25 - The Lug Pole or Waugan Stick Crane. Bernard Mason, 1939

Photo 26 - The lazy-man's tea stick. Bernard Mason, 1939

Photo 26 - Cookin' for the masses. **(source unknown but I have the original photo)**

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