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The Cost of Shooting a Gun in the Rocky Mountain West©2022

By Michael Schaubs

In the year following the Battle of Pierre's Hole Warren Ferris wrote in his journal: "*The trees both within and outside of the pen, were covered with the marks of balls, or of the axes successfully employed by our comrades, to exhume and save them; lead being very valuable in these remote regions, where it is so extremely necessary, both to the purposes of defense and subsistence."*[1]

Clearly lead was an extremely valuable commodity to promote this kind of salvage operation. For the trappers of the northern Rocky Mountain Region, it was not only a costly item, but depending on season and place, it could be difficult to replace once expended.

This study will explore all of the costs involved in shooting a gun or rifle in the Rocky Mountain West and how those costs may have influenced the types of firearms the trappers chose to carry. Excluding the cost of the gun (smoothbore) or rifle, there are three cost components in shooting a firearm:

1) Cost of the projectile, being a lead round ball or shot.
2) Cost of the propellant, being gunpowder.
3) Cost of the ignition source, either a gunflint or percussion cap.

The costs of ignition sources can be estimated with a fair degree of reliability, as can the costs of lead, which would be variable with caliber of the firearm. The most difficult parameter to estimate is gunpowder which would vary both with the caliber of the gun and with usage preferences of the individual shooting that gun. There are three ways in which powder quantities can be estimated: using optimum load data for modern black powder rifles; using load specifications in the 1842 Army Ordnance Manual or other military sources, and using data available from historic sources, including entries in the Fort Hall ledgers which run from August 4, 1834 through December 31, 1835. Retail prices used to estimate shooting costs are based on Fort Hall ledger prices[2]. Rather than attempt to estimate grains of powder required for different bore diameters, a general lead to powder ratio will be estimated that can then be applied to a range of bore diameters.

Fort Hall at that time the ledgers were recorded was owned and operated by Nathaniel Wyeth's Columbia River Fishing and Trading Company. During this period the ledgers list nearly 7,400 line items showing retail prices of goods and often wholesale costs as well. The ledger books provide multiple entries for the retail prices of gunflints, percussion caps, gunpowder, ammunition, lead balls, and lead. The typical retail prices charged employees at Fort Hall for shooting components are listed below on Table 1. These components will be discussed in subsequent sections.

Table 1. Fort Hall Retail Costs of Shooting Components	
Gunflints (dozen)	$1.00
Percussion Caps (each)	$0.01
Lead Balls (pound)	$1.25
Bar or Bulk Lead (pound)	$1.25
Gunpowder (pound)	$2.50
Ammunition (each)	$0.10

Employees were not given any kind of a discount or cost break. The ledgers show that the company employees were charged the same amount for goods and supplies as free trappers and/or men employed by opposition companies that happened to be passing through. The only advantage in being a company employee was that these employees were allowed to run an account, whereas all others had to settle up at the time of the purchase.

One other hunting related item the Fort Hall ledgers reveal are employee purchases of "ammunition." Ammunition as described in the ledgers is clearly a cartridge, consisting of a premeasured charge of powder and one ball.[3] Figure 1 shows the construction of a military musket cartridge.[4] The ammunition or cartridges at Fort Hall were likely manufactured at the fort by company personnel in a manner similar to that shown on Figure 1. There is no information in the Fort Hall Ledgers to indicate what bore diameter the ammunition was sized for or if there was a range in sizes that were made available. The ledgers indicate that most of the ammunition was dispersed to the Indians, and at least these were likely intended for use in smoothbore trade guns, probably of about .62 caliber or 20 balls to the pound. The retail price of ammunition is listed on the ledgers as 10¢ each. During the period represented by the ledgers, 19 fusils or guns and 19 rifles were purchased or lent to employees indicating that there was no special preference for either smoothbore or rifled firearms. The accounts show that Osborne Russell, a company employee, did purchase small quantities of ammunition though he also states in *Journal of a Trapper* that "*I had an elegant one [rifle] but had little experience in using one.*"[5] If Russell was purchasing ammunition for his own use, this suggests that ammunition may have been available in multiple sizes. However, the ledgers show that virtually all of Russell's purchases for powder and lead were by the pound, so Russell may have been purchasing ammunition for use as an inexpensive item to gift or trade to Indians and if so would likely have been for a trade gun of about 62 caliber.

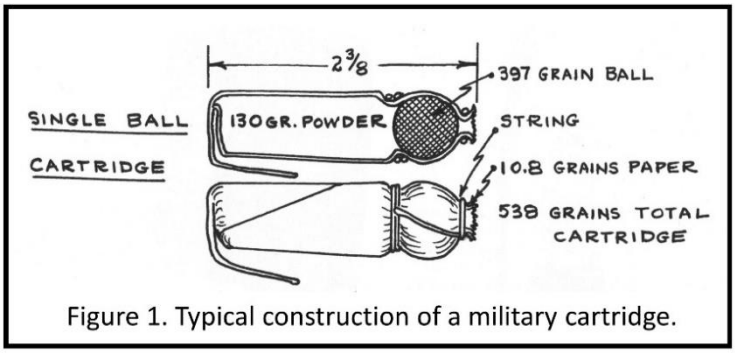


Figure 1. Typical construction of a military cartridge.

Ignition Source

Firearms utilizing a gunflint as an ignition source were most common in the Rocky Mountain West through the 1830's and 40's though limited quantities of guns using the percussion ignition source did make their way to the mountains during this period.[6] At Fort Hall five men of the 140 listed on the ledgers made purchases of percussion caps. Although an individual gunflint was considerably more costly than a single percussion cap, gunflints could be utilized multiple times, whereas a percussion cap was functional for only a single use. According to the U.S. Army Ordnance Manual of 1841 a good musket gunflint was to be serviceable for a minimum of 50 firings.[7] Sydney Skertchly, who studied gunflint manufacturing at Brandon, England in 1879, found that a new pistol gunflint was nearly as reliable at the end of a sequence of 100 shots as at the beginning[8]. Modern-day experiments testing the sparking reliabilities of mint condition English and French wedge-shaped and rectangular gunflints recovered from historic sites suggest ignition reliabilities exceeding 85% after 50 or more firings were not unusual.[9] Thus gunflints, although not as reliable as percussion caps, were far more economical as an ignition source. Use of percussion caps represents a fixed cost (one firing=one cap), whereas the cost of using a gunflint is variable to a certain degree, depending on the service life of the individual gunflint.

Gunflints at Fort Hall are described variously as fusil flints, fuzee flints, rifle flints, gun flints, and flints. With the exception of three transactions for which rifle flints sold for 50 cents per dozen, all other retail gunflint transactions took place at a rate of $1.00/dozen or 8.33 cents each. If a gunflint remained serviceable for a minimum of 50 shots, the prorated cost of a gunflint is 0.167 cent per shot. If a gunflint was functional for 100 shots, the cost per shot would fall to less than a tenth of a cent per shot. For this study we will use an estimated service life of 50 shots/gunflint for a cost of 0.167 cent per shot.

Over the 17-month period covered by the Fort Hall Ledgers, there are only five transactions recorded for percussion caps. Retail prices for caps were quite variable, 0.25¢, 0.5¢, 0.6¢ and 1.0¢ per cap. It almost seems that transaction prices for percussion caps at Fort Hall were so infrequent that the trader or clerk recording the trade was uncertain as to the amount to charge. The retail price of 1.0¢ each is used for this study because it represents a wholesale-to-retail markup more typical of overall markups at Fort Hall.[10]

Lead Projectiles

Extant inventories show that lead shot did come to the mountains but in relatively small quantities for hunting small game and fowl. Round ball for hunting big game and defensive purposes was far more common. At Fort Hall, there is listed a single purchase of a shotgun, and another purchase of a shot pouch. However, there is no line item showing that shot was ever sold at this location. It is possible that if shot was sold here it may have been simply listed on the ledgers as lead and sold by the pound. Because there is no information available to even speculate about the amount of shot that was used in hunting small game this type of projectile is not evaluated as a cost component for this study.

For use in a rifle, the diameter of a lead round ball is essentially fixed for that caliber, being a few thousands or a hundredth of an inch smaller than the bore diameter. Smoothbore guns could more easily accept undersized round ball, though for purposes of this analysis will assumed to be a fixed diameter slightly smaller than the diameter of the bore. Thus, lead is generally a fixed cost relative to the bore diameter of the gun or rifle.

The Fort Hall ledgers list balls, musket balls, lead, and bar lead as items that were sold. The ledger descriptions suggest that lead bars were sold in one, two and three pound sizes. Other entries describe 86-pound lead bars, but these apparently were not for retail sale. The ledgers list 127 individual purchases of lead, bar lead, and lead balls. With only a couple of exceptions, all of the lead products, whether bars, or cast balls, were sold at $1.25 per pound.

Gunpowder

The Fort Hall Ledgers list 125 individual purchases of gunpowder, and all of these with the exception of two transactions were at a retail price of $2.50 per pound. However, it is not known with any confidence what the bore diameter of the firearms the company's employees were carrying, nor if they used a heavy or light charge of powder in their guns. The quantity of gunpowder used and therefore the cost of this component per shot is the most difficult parameter to estimate. Powder useage would have depended in part on the bore diameter of the gun, and in part on how much energy the user wanted the projectile to have. Journals of the mountaineers simply do not provide sufficient detail to determine how much powder they used and from reports of exploding powder horns, it is apparent that at least some of the trappers didn't measure powder at all, simply pouring it directly from their powder horn down the barrel.[11] There are however several ways that powder usage can be estimated by determining

approximate lead to powder consumption ratios and then applying these ratios to a range of lead ball diameters.

Estimating Lead:Powder Ratios

The Fort Hall ledgers probably provide the most meaningful way to determine the ratio at which lead and gunpowder were being consumed, at least for that time and place. The ledgers list purchase records of individual employees of the Columbia River Fishing and Trading Company at Fort Hall showing both quantities and retail prices for lead and powder as well as gunflints and percussion caps. In reviewing these ledgers, there are 27 employees that made a total of 50 paired transactions of lead and powder, that is purchased both items in a single transaction or on a single day. Lead includes any or all combinations of lead, bar lead and lead balls. Table 2 shows lead:powder purchase ratios for all paired transactions at Fort Hall listed on these ledgers.

Table 2. Lead:Powder Ratios in Paired Transactions

Number of Paired Transactions	Unique Purchasers	Lead:Powder Ratios and Number of Transactions.						Ratio of Median & Mode	Weighted Average Ratio
		1:1	1.66:1	1.88:1	2:1	2.4:1	3:1	2:1	1.9365:1
50	27	3	1	2	41	1	2		

The median and mode of the ratios shown on Table 2 are both 2:1 and weighted average of all paired transactions is 1.936:1. That this ratio is representative can be verified by tabulating the total quantities of lead and powder sold to individuals at Fort Hall from August 1834 through December 1835, regardless of whether these are paired transactions or not. Over this time period there were 127 purchases of bulk lead and/or cast lead balls with a cumulative weight of 231.7 pounds and 125 purchases of gunpowder with a cumulative weight of 118 pounds. The ratio of cumulative lead:powder is 1.963:1, nearly identical to the ratio of 1.936:1 determined for paired purchases. Thus, the Fort Hall ledger ratio of 1.936:1 seems to be a valid consumption ratio at Fort Hall. However, the use of four significant figures in the ratio implies a degree of confidence and precision which cannot be justified, especially because most of the purchases were in even pound lots. A lead:powder ratio of 2:1 will be used as the Fort Hall consumption ratio.

Not all of the powder purchased would have gone down the barrel as propellant: for flintlocks, some powder would be used to prime the lock. The U.S. Army 1841 Ordnance Manual specifies that 6 to 12 grains of powder from a charge were to be used for priming purposes. And whether a flint or percussion weapon, there were also likely one-time losses in transferring purchased gunpowder to a powder horn or flask, as well as losses in transferring powder from the powder horn or flask down the muzzle. However, these additional uses and associated losses would still be part of the cost of shooting.

For a .54 caliber rifle, with a ball weight of 230 grains, lead:powder consumption at a ratio of 2:1 would suggest a powder charge of 115 grains of powder, a feasible, though demanding load. However, using this ratio indicates that a .62 caliber trade gun with a lead ball weight of 359 grains should take 180 grains of powder, which would have been a brutal load. In 1845 Edward Tryon, a British firearms manufacturer, proofed trade gun barrels with "*200 grains Troy wt. of best rifle powder, one ball and two wads.*" Henry Lehman received contracts in 1841 and 1842 to provide North West guns that were "*double proved*." [12] If 200 grains of powder is equivalent to double proved, this suggests that approximately 100 grains of powder for a North West trade gun was an normal charge of powder for this type of firearm. A load of 100 grains is therefore used in the cost analysis for a 62 caliber gun,

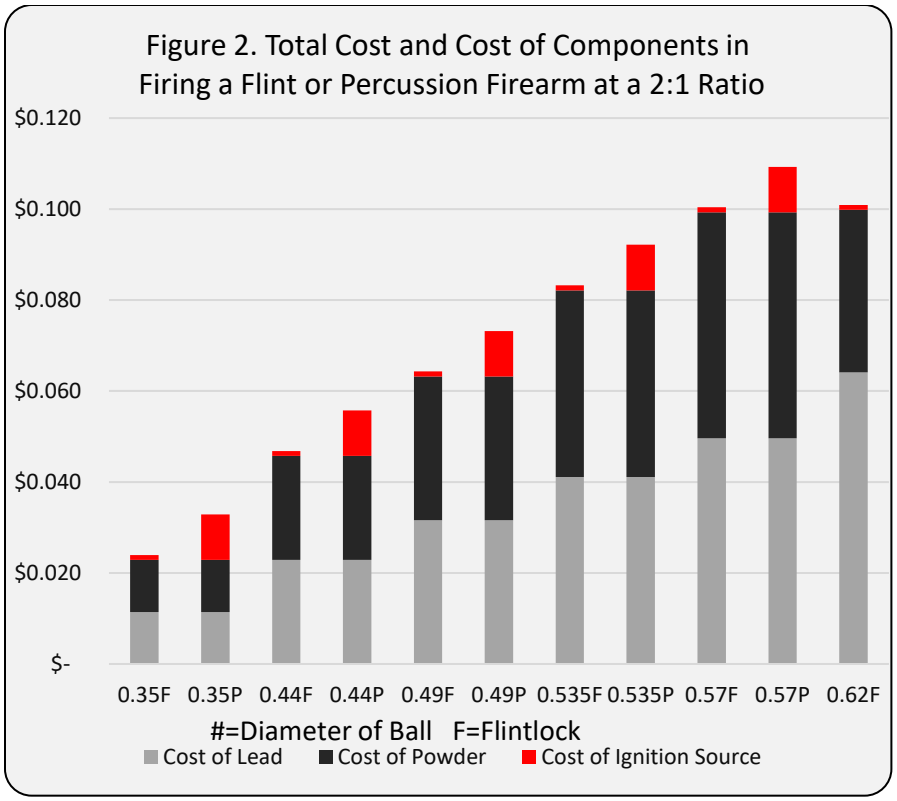
yielding a cost of just over 10 cents per shot. This cost corresponds nicely with the cost of "ammunition" at 10 cents each, which we speculated previously to have been for 62 caliber trade guns. Table 3 below shows estimated powder charge, shooting component costs and total costs for different calibers of firearms, both flintlock and percussion, utilizing a lead:powder ratio of 2:1 except for the 62 caliber trade gun. Although this table shows a large range in firearms size, in the Rocky Mountain West most trappers probably used firearms ranging between .45 to .62 caliber.

Table 3. Shooting Components and Costs at 2:1 Ratio

Ball Diameter*	Grains of Lead	Grains of Powder	Cost of Lead	Cost of Powder	Cost of Ignition Source	Total Cost to Shoot
0.35F	64	32.0	$ 0.011	$ 0.011	$ 0.0011	$ 0.024
0.35P	64	32.0	$ 0.011	$ 0.011	$ 0.0100	$ 0.033
0.44F	128	64.0	$ 0.023	$ 0.023	$ 0.0011	$ 0.047
0.44P	128	64.0	$ 0.023	$ 0.023	$ 0.0100	$ 0.056
0.49F	177	88.5	$ 0.032	$ 0.032	$ 0.0011	$ 0.064
0.49P	177	88.5	$ 0.032	$ 0.032	$ 0.0100	$ 0.073
0.535F	230	115.0	$ 0.041	$ 0.041	$ 0.0011	$ 0.083
0.535P	230	115.0	$ 0.041	$ 0.041	$ 0.0100	$ 0.092
0.57F	278	139.0	$ 0.050	$ 0.050	$ 0.0011	$ 0.100
0.57P	278	139.0	$ 0.050	$ 0.050	$ 0.0100	$ 0.109
0.62F	359	100.0	$ 0.064	$ 0.036	$ 0.0011	$ 0.101

*P=Percussion Lock, F=Flintlock

Figure 2 is a graphic depicting the cost of components and total cost to shoot different firearms sizes.



For small bore firearms, the cost of a percussion cap, at one cent each, can add as much as 30% to the cost of shooting the gun, while for large bore firearms, it can add 9% to the cost. Assuming a service life of 50 shots, the cost for the use of a gunflint is relatively insignificant for all bore diameters.

The U.S. Army Ordnance Manual (1841) specifies actual powder charges to be used with different types and calibers of military weapons in use by the Army at that time.[13] These specifications are shown on Table 4 below.

Table 4. U.S. Army Ordnance Manual (1841) Specifications for Powder Charges

Type of Firearm	Ball Diameter (in)	Ball Weight (grains)	Powder Charge (grains)	Ratio Ball Weight/Powder Charge	Cost to Shoot Using Fort Hall Retail Prices
Musket	0.64	389	130	3.0	$ 0.116
Musketoon	0.64	389	85	4.6	$ 0.100
Hall's Carbine, musket calibre	0.64	389	75	5.2	$ 0.096
Hall's Carbine, rifle calibre	0.525	219	75	2.9	$ 0.066
Hall's Rifle	0.525	219	100	2.2	$ 0.075
Common Rifle	0.525	219	100	2.2	$ 0.075
Pistol	0.525	219	50	4.4	$ 0.057

These powder charges include priming, about 6 to 12 grains, for all the arms exept the carbine which has a percussion lock.

From Table 4 we see that the powder charge varied both with the ball diameter and with the type of weapon. The lead:powder ratio for the musket-type weapons is quite variable but overall is a relatively light powder charge. For rifles the consumption ratio varies between 2.2:1 to 2.9:1. These are, of course, military standards and requirements for manufacturing paper cartridges. Even if the Rocky Mountain trappers were aware of such standards, there is little certainty they would have been inclined to follow them.

Another military source for information from which lead:powder ratios can be inferred are the Journals of Lewis and Clark. Before departing on their transcontinental expedition, Meriwether Lewis had lead canisters manufactured for protecting some of the expedition's gunpowder supplies during storage and transportation. As a further refinement, Lewis designed the canisters to provide the proper weight of lead for casting bullets to be fired by the contained gunpowder, *"…I had fallen on securing the powder by means of the lead having the latter formed into canisters which were filled with the necessary proportion of powder to discharge the lead when used*."[14] According to their journals, the canisters each weighed about 8 pounds and contained 4 pounds of gunpowder, a lead:powder ratio of 2:1.[15] A number of authors have asserted that the men of the expedition were equipped in whole or in part with the Model 1803 Harper's Ferry Rifle, a .54 caliber muzzle-loading flintlock.[16] However, it is more likely that the expedition was equipped with a motley assortment of military issue Model 1795 muskets, fusils, Model 1792 contract rifles and personal rifled long-arms.[17]

An indication of lead:powder ratios may also be obtained from historic inventories of supplies and goods taken to the mountains or supplied to trappers and/or Indians. The Fontenelle, Drips & UMO inventory of goods taken to the 1834 Rendezvous lists 1,070 pounds of lead balls and 535 pounds of DuPont's powder for a lead:powder ratio of exactly 2:1.[18] The December 2nd 1837 Fort Jackson inventory of goods taken on a trading expedition to the Cheyenne Indians lists 100 pounds of trade balls, 20 pounds of lead and 50 pounds of powder for a lead:powder ratio of 2.4:1.[19] The ratios for both these inventories are only indicative of what the company or trader anticipated would be sold, not what was actually purchased and consumed.

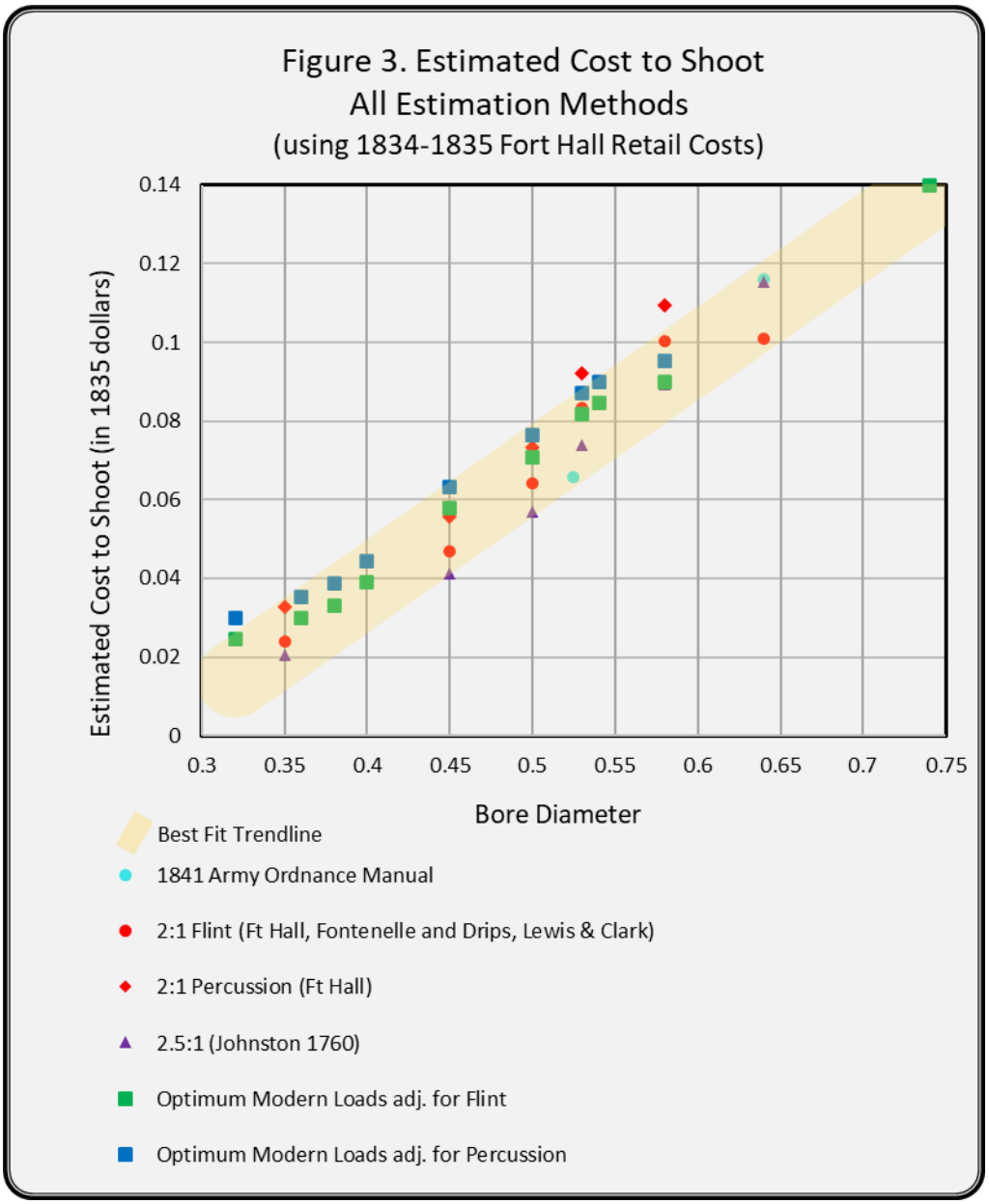
In 1760 Sir William Johnston, the British Indian agent in North America at that time, in a report stated that native hunters were consuming lead and gunpowder at a ratio of 2.5:1.[20] With the exception of the 1841 loading specifications for military muskets, this is amongst the highest apparent historic overall ratio of lead:gunpowder consumption. An unlikely explanation for this is that the British were providing a superior formulation of gunpowder to the Indians, resulting in a requirement for a lighter charge of powder. A more likely explanation can be found in the geographic location for which Johnston was administering at that time. His Indian consumers were primarily Eastern Woodland Indians and their animal food sources would have consisted of a mix of animals that were generally much smaller than those hunted in the west, and effective shooting distances would have been relatively shorter while hunting in a wooded environment. Thus, these Indians wouldn't have required the stopping power or range of firearms used in the west.

Lead:powder ratios can be also be determined from load data for modern muzzle-loading black-powder guns. The expanded edition of Gun Digest: Black Powder Loading Manual gives optimum and big-game load recommendations for a wide range of bore diameters for modern muzzle-loading guns produced by numerous manufacturers.[21] In determining load values the authors of the Black Powder Loading Manual used only modern formulations of black powders. Pyrodex and other synthetic powders were excluded from testing. Although the Black Powder Loading Manual evaluated powder loads for in-line and other unusual configurations of black powder firearms, for this investigation only traditional styles of muzzle-loading firearms were tabulated. The difficulty in using modern black powder firearms and powder is that modern barrel metallurgy and manufacturing methods as well as black powder formulations may not be typical of those of the 1830s, and likewise the resulting lead:powder ratios may not be representative. Table 5 below summarizes load values and ratios for different modern black-powder bore diameters. The lead:powder ratios vary considerably between the different bore diameters, however produces an average for all bore diameters (excluding 74 caliber) of 1.91:1.

Table 5. Powder loads for Modern Muzzle-Loading Firearms.										
	.32-cal	.36-cal	.38-cal	.40-cal	.45-cal	.50-cal	.53 cal	.54-cal	.58-cal	.74-cal
# of guns tabulated in caliber size	8	6	1	2	13	32	1	11	10	1
Range of Powder Loads (Grains)	25-40	30-50	40	50	70-110	70-120	110	90-130	60-150	80
Average Powder Load (Grains)	32.5	38.3	40	50	85	97.3	110	109.1	99	80
Ball Diameter (inches)	0.31	0.35	0.375	0.395	0.445	0.49	0.52	0.535	0.57	0.735
Ball Weight (Grains)	47	65	80	93	128	177	212	230	280	598
Average Lead/Powder Ratio	1.45:1	1.7:1	2:01	1.86:1	1.51:1	1.82:1	1.92:1	2.1:1	2.82:1	7.48:1
Cost to Shoot*	$ 0.020	$ 0.025	$ 0.029	$ 0.034	$ 0.053	$ 0.066	$ 0.077	$ 0.080	$ 0.085	$ 0.135
Cost Adjusted for Flintlock	$ 0.025	$ 0.030	$ 0.033	$ 0.039	$ 0.058	$ 0.071	$ 0.082	$ 0.085	$ 0.090	$ 0.140
Cost Adjusted for Percussion Lock	$ 0.030	$ 0.035	$ 0.039	$ 0.044	$ 0.063	$ 0.076	$ 0.087	$ 0.090	$ 0.095	$ 0.145
*Using Fort Hall 1835 Retail Prices										

And from Table 5 we see that for those calibers likely to have been in widespread use in the Rocky Mountain West (45 caliber to 58 caliber) that the average ratio of lead to powder is 2.03. This ratio does not consider additional powder that might be used to prime flintlocks or pro-rated costs of ignition source. Costs are estimated based on Fort Hall retail ledger prices, and then adjusted for flintlock ignition (eight grains of additional powder for priming and flint costs prorated for 50 shots) and for percussion ignition.

Costs to shoot a firearm as determined from all methods of estimating lead:powder ratios are shown below on Figure 3 for a wide range of lead ball diameters. In spite of disparate ratios determined by the various estimation methods, the cost values as a whole lie on a 2:1 trend line and within a range of +/- one cent.



Thus it seems safe to use a lead:powder consumption ratio of 2:1 for estimating shooting costs for trappers in the Rocky Mountain West. Although shooting costs probably varied considerably between individual hunter/trappers, overall the costs to trapper/hunters in 1834-35 of shooting a gun or rifle probably falls within the range of values determined by this investigation.

Fur company personnel in the bush, especially considering the dangers and risks they were taking as part of their profession, were generally not highly compensated individuals. Of the 140 men recorded on the Fort Hall ledgers, annual wages are either given or can be calculated for 43 of these men. Wages range from a low of $120/year (about 33 cents/day) for the Kanakas (Hawaiians) and the "negro" (unnamed), to a high of $600/year to Davis Crow, the company hunter.[22] As company hunter, Crow must have been provided by the company with shooting supplies because he is not listed on the ledgers as ever having purchased powder, lead, gunflints or percussion caps at any time during the time period covered by the ledgers. Interestingly, the two men that were successively in charge of operations at the fort, Robert Evans and Able Baker Jr. were only compensated at a rate of $300/year, although they did

receive their purchases of goods at cost plus 50% and cost plus 75% respectively, a considerable discount from what the other employees were receiving.[23] We can speculate that perhaps they were promised a share of the profits and were thus willing to accept a lower salary. The average compensation of the men based on wages which are listed in the ledgers comes to $213.37/year, or 58 cents/day. Thus, the cost of powder, lead, percussion cap or pro-rated gunflint of a single gun-shot (ranging in total cost from approximately 6¢ to 11¢ for those calibers mostly likely in use in the Rocky Mountain West) represents a substantial portion of a man's daily income. For larger calibers the total costs of lead, powder and ignition could approach 20 percent of an average day's wages. The cost of lead alone, from a single shot, depending on bore diameter, could run from 5% to over 10% of a man's daily wages. Thus, the lead balls lodged in trees and branches after the battle of Pierre's Hole were certainly worth the effort to recover. Further, although there is no documentation supporting this, we can venture that Rocky Mountain trappers and hunters made similar efforts to recover spent lead projectiles from the bodies of large game animals that they had shot.

The component breakdown of per shot costs may also in part explain the preference of the Rocky Mountain trappers for flintlock firearms over those utilizing percussion locks. The use of percussion caps, at a penny each adds 19 percent to the total cost of shooting a percussion .45 caliber firearm over a comparable flintlock, and adds 9 percent to the total cost of shooting a percussion .58 caliber firearm over a comparable flintlock. Although the Rocky Mountain trappers probably never analyzed costs in this manner, the cost differential would have been readily apparent and may have been an important factor in their preference for firearms utilizing the flintlock ignition system.

There are numerous statements in original source materials that made it seem that the trappers would discharge their firearms with reckless abandon, often on the approach of friends, or to signal friendly intent. Warren Ferris writes, "*When they* [*Flatheads, Nezperces, and Pend'orielles] had approached within fifty paces, they discharged their guns in the air, reloaded, and fired them off again in like manner. The salute of course, was returned by our party.[24]"* Joe Meek states that the trappers and Nez Perce Indians welcomed the pack train hauling goods, and including the missionaries Marcus Whitman and Henry Spalding and their wives to the 1836 Rendezvous by a "*demoniac hub-bub*" including the discharge of firearms[25]. These were of course, special occasions. It would seem that under most ordinary circumstances, due to costs, that a man would take some thought before pulling the trigger.

Osborne Russell, while an employee working out of Fort Hall, is listed on the ledgers with an annual wage of $166.67/year, or 46 cents/day.[26] While a greenhorn, Russell describes his first hunt for buffalo as follows; "*I now prepared myself for the first time in my life to kill meat for my supper with a Rifle. I had an elegant one but had little experience in using it, I however approached the band of Buffaloe* [sic] *crawling on my hands and knees within about 80 yards of them then raised my body erect took aim and shot at a Bull: at the crack of the gun the Buffaloe* [sic] *all ran off excepting the Bull which I had wounded, I then reloaded and shot as fast as I could untill* [sic] *I had driven 25 bullets at, in and about him which was all that I had in my bullet pouch whilst the Bull still stood apparently riveted to the spot I watched him anxiously for half an hour in hopes of seeing him fall, but to no purpose, I was obliged to give it up as a bad job and retreat to our encampment without meat.*"[27] If Russell's cost per shot was 8¢, a value consistent with a .54 caliber rifle, he then expended powder and ball valued at nearly four and one-half days wages with nothing to show for it but the experience. Though Russell fails to mention it in his journal, without a doubt, the old hands back at camp found Russell's hunting expedition enormously amusing.

[1] Warren Angus Ferris, *Life in the Rocky Mountains: A Diary of Wanderings on the Sources of the Rivers Missouri, Columbia, and Colorado, 1830-1835*, (Denver, The Old West Publishing Company, 1983 edition) edited by Leroy R Hafen, 270-271.
[2] *Ordnance Manual For The Use Of The Officers Of The United States Army*, (Washington, J. and G.S. Gideon Printers, 1841), 177, and Author's research based on Columbia River Fishing & Trading Company Records, microfilmed from the collections of the Oregon Historical Society, MSS 938-1 B.
[3] Russell, 247
[4] Butler, David F., *United States Firearms: The First Century, 1776-1875*, (New York, Winchester Press, 1971), 45.
[5]Osborne Russell, *Journal of a Trapper,* (Lincoln, University of Nebraska Press, 1965) edited by Aubrey L. Haines, 5.
[6] Carl P. Russell, Guns on the Early Frontiers: A History of Firearms from Colonial Times through the Years of the Western Fur Trade, (Berkley and Los Angeles, University of California Press, 1957) 219, 242-43.
[7] *Ordnance Manual For The Use Of The Officers Of The United States Army,* 177.
[8] Sydney B.J. Skertchly, *On the Manufacture of Gun-Flints, The Methods of Excavating for Flint, The Age of Paleolithic Man, and The Connexion* [sic] *Between Neolithic Art and the Gun-Flint Trade*, Memoirs of the Geological Survey, England and Wales, (London, 1879),4. Overall, for the 100 shot sequence Skertchly found that the gun fired or flashed 66% and missed 33%.
[9] T. M. Hamilton and K. O. Emery, *Eighteenth-Century Gunflints from Fort Michilimackinac and other Colonial Sites*, Archaeological Completion Report Series, no. 13 (Mackinac Island State Park Commission, Mackinack Island, Michigan, 1988), 147-151, 247.
[10] Author's research based on Columbia River Fishing & Trading Company Records, microfilmed from the collections of the Oregon Historical Society, MSS 938-1 B.
[11] If a hot ember remained in the barrel from a previous shot, powder poured directly down the barrel would flash up to the horn and cause an explosion. John Kirk Townsend, *Across the Rockies to the Columbia*, (Lincoln and London, University of Nebraska Press, reprinted 1978), 113 and Warren Angus Ferris, *Life in the Rocky Mountains: A diary of Wanderings on the Sources of the Rivers Missouri, Columbia, and Colorado 1830-1835*, (Denver, The Old West Publishing Company, 1983) edited by Leroy R. Hafen, 98.
[12] James A. Hanson with Dick Harmon, *Firearms of the Fur Trade: Encyclopedia of Trade Goods Volume 1* (Chadron, Nebraska, Museum of the Fur Trade, 2011), 395, 403.
[13] *Ordnance Manual for the Use of the Officers of the United States Army*, 177
[14] Russell, 226.
[15] Stuart Kirkland Wier, Meriwether Lewis' Lead Powder Canisters, in *Journal of the Early Americas* 2, no. 4, (August-September 2012),34-38.
[16] Dayton Duncan and Ken Burns, Lewis & Clark: The Journey of the Corps of Discovery, (New York, Alfred A. Knoph, 1997), 11, and Russell, 177, 180, and Butler, 74-76.
[17] Robert J. Moore, Jr., and Michael Haynes, Lewis and Clark, Tailor Made, Trail Worn: Army Life, Clothing & Weapons of the Corps of Discovery, (Helena Montana, Farcountry Press, 2003), 250, 255-259.
[18] Fontenelle, Drips and UMO a/c Expedition 1833, June 1, 1833 to June 25, 1834, Missouri Historical Society, St. Louis, Chouteau-Maffit Collection Fur Trade Ledgers, Volume V American Fur Company West, St. Louis, Pierre Chouteau, Jr. agent, Post Accounts Current, Ledger D 1831-36 (pages 139-146; 161-162).
[19] Guy L. Peterson, *Four Forts of the South Platte* (n.p., Council on America's Military Past, 1982), 55.
[20] Walter S. Dunn, Jr., *The New Imperial Economy: The British Army and the American Frontier, 1764-1768*. (Westport, Connecticut, Praeger Publishers, 2001), 97.
[21] Sam Fadala, *The Gun Digest: Black Powder Loading Manual, Expanded 4th Edition* (Iola, Wisconsin, Krause Publications, 2004), 159-230.
[22] Crow must have been supplied with hunting supplies by the company as the only charge for shooting components is on September 26,1835 is for 10 loads of ammunition, which an accompanying note indicates was paid to Chief Pooewut along with other goods for returning a lost horse.
[23] Able Baker Jr. was given a raise starting January 10th, 1835 to $500/year.
[24] Ferris, 161.
[25] Francis Fuller Victor, River of the West: Life and Adventure in the Rocky Mountains and Oregon, (Newark, New Jersey, R.W. Bliss and Co., 1870), 206.
[26] Author's unpublished research based on Columbia River Fishing & Trading Company Records, microfilmed from the collections of the Oregon Historical Society, MSS 938-1 B.

[27] Russell, 5-6.