Shooting Uphill and Downhill

By

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Of all the ways a precision rifleman must compensate when firing – such as for distance, for wind and for target movement – the most confounding and confusing is compensating for shooting uphill or downhill. That's because it's logical -- even instinctive -- to lead a moving target, to aim into a crosswind and to hold high when shooting beyond your zero distance. But shooting up or down? Many shooters find the whole concept contradictory – the opposite of what they'd visualize in their mind's eye.

Let's start with an explanation of what's happening.

Say you're tossing a softball underhand at a milk carton 15 yards away. You naturally understand that you must toss it a bit high so the resulting arc allows it to descend and hit the milk carton. That's pretty understandable. However, what if the carton is still 15 yards away by ground distance, but now it's two stories up, on a cliff? The same arc above your line-of-sight that allowed your softball to hit the carton at ground level will now cause it to pass over the milk carton – the ground distance is still 15 yards, but if you use the same arc vis-a-vis the carton, you'll miss it – *get it*? It's simply that zeroing your rifle over flat ground creates one arc, while shooting up or down requires a slightly different arc. The arc of a projectile crossing flat ground to a target will not put that projectile exactly on target when you're aiming significantly uphill or downhill at that same distance. The effect of this error increases with distance and steepness of angle to a maximum of 60 degrees.

Counter-intuitively, this error applies to shooting both uphill and downhill. Whether shooting an up *or* down slant, you must ***hold low*** to hit the target.

The Basic Rules

This can seem pretty confusing but there's the good news: You don't have to understand the theory or my explanation – just faithfully apply the proper compensation and you'll be fine. Here are the basics for up/down compensation:

1. At close range (100 yards or less) so little compensation is required that it's fine to just aim dead-on, no matter the steepness of angle.
2. Up and down shooting both require compensation, with the same amount needed for 45 degrees *up* as 45 degrees *down*, 30 degrees *up* as 30 degrees *down*, etc.
3. You always compensate by aiming LOW. Keep this in mind by visualizing a limbo dancer – YOU MUST AIM LOW -- *Low*, *Low*, *Low*.
4. It's easy to over-estimate the sharpness of angle – be as exact as possible.
5. Your zero distance is not an issue – the amount of up or down compensation is determined solely by the up/down angle and distance to your target.
6. The amount of required compensation increases significantly with distance and steepness of angle to a maximum of 60 degrees up or down.

Now, let's look at some ways to calculate the required compensation.

The Precision Solution

First, we're going to look at the most precise way to calculate the required up/down compensation, and later, a simpler way. Our starting point is to find "Bullet Drop" for the cartridge you're firing. This is the ballistic measurement of how many inches a bullet falls when the rifle is fired with its barrel perfectly parallel with the earth.

Many riflemen do not have access to this data, although cartridge manufacturers have it, and it can be found on-line, as well as in any quality Exterior Ballistics program, such as Sierra's Infinity Program. Let's assume that you have Bullet Drop data – here's what to do with it.

To find up/down compensation, take the Bullet Drop data (which is stated in hundreds of yards) and multiple it by the factors in the accompanying chart, based upon the steepness of angle to your target. For example, your target is 400 yards away, uphill 45 degrees, and you're firing a .223 Remington, 69-gr. Match round. You already have the data that your Bullet Drop is 36.3 inches at 400 yards. Therefore, you multiply the 36.3 Bullet Drop inches by .293 and find you must hold low 10.63 inches for a perfect hit.

UP / DOWN COMPENSATION FACTORS
5 Degrees: Drop Inches x .004
10 Degrees: Drop Inches x .015
15 Degrees: Drop Inches x .034
20 Degrees: Drop Inches x .060
25 Degrees: Drop Inches x .094
30 Degrees: Drop Inches x .134
35 Degrees: Drop Inches x .181
40 Degrees: Drop Inches x .235
45 Degrees: Drop Inches x .293
50 Degrees: Drop Inches x .357
55 Degrees: Drop Inches x .426
60 Degrees: Drop Inches x .500

It would be a tedious, slow process to calculate this before each shot in a field setting, so a smart rifleman calculates all the up/down compensation for his cartridge at 100-yard increments, for 30 degrees, 45 degrees and 60 degrees, puts it on a card and carries it with him. Over time, he may even memorize it.

A less precise – but very fast – alternative is to use a system I

developed, which I've dubbed, "Quick-Fix."

"Quick-Fix" Compensation for Up/Down Shooting

I cannot take credit for inventing this brilliant means of up/down compensation since I picked it up from the FBI. However, their formula needed some tweaking so it cannot be called the FBI Technique, either. I've named it the Quick-Fix because you can calculate it all in your head and adjust your scope, or know how much to hold low, about as quickly as you read this sentence. It's a compromise on precision, but I think it more than makes up for it in speed and simplicity.

Here's how it works: You see a target at 500 yards that's 30 degrees up or down. Shoot it the same as if the target is on flat ground, at 90 percent of that distance. This means, treat it as a target at 450 yards – whether you adjust an elevation knob or Bullet Drop Compensator for 450 yards, or just use the proper holdover for 450 yards, you'll hit very close to true. The first Quick-Fix is: **Engage any 30 degree target as if it were 90 percent of its actual distance.** That's easy enough to remember and calculate in your head.

When employed with .308 Cal. 168 gr. Match ammo, this 30 degree Quick Fix has a maximum error of 4 inches at 600 yards, with an average error of less than 2 inches at ranges less than 600 yards. That's a great tradeoff of speed for precision.

But earlier, didn't I emphasize that Up / Down compensation requires holding low? Absolutely. With Quick-Fix you'll still be shooting low because you'll be pretending the target is closer than its actual distance, and thus compensating by aiming low.

The other Quick-Fix is for engaging targets that are 45 degrees up or down. In this case, you shoot as if the target is on flat ground, *at 70 percent of that distance*. This means treat

that 500-yard target as if it were on flat ground and fire as if were 450 yards away. Thus the second Quick-Fix is: **Engage any 45 degree target as if it were 70 percent of its actual distance**.

Out to 600 yards, firing .308 Winchester 168 gr. Match ammo, using 70 percent of the distance, the maximum error is 4 inches, with an average error of less than 3 inches. Not a bad tradeoff of precision for how quickly this can be done.

Well, then, what about shooting at 60 degrees, where the uphill/downhill effect is greatest and requires the most compensation? Bullet drop variances are too great at 60 degree angles for a simple "Quick-Fix" rule-of-thumb – but I'm not all that concerned.

Ask yourself, where would you fire at an angle *steeper* than 45 degrees? Carefully look halfway from the ground to vertical – straight up – and consider how truly steep is 45 degrees. When have you ever needed to take a shot at a target more than 45 degrees up or down? Most likely that would have been a critter in a tree – but that treed animal would be less than 100 yards anyhow, and not even require compensation.

Still, if it concerns you, you can take the extra step of finding your cartridge's Bullet Drop and use the "Up / Down Compensation Factors" listed above, and then actually calculate the 60 degree compensation.

Happy shooting.

The End