

The Inner West Hunters Club Inc.

How Bullets Kill

A rifle bullet kills an animal by destroying tissue, disrupting the function of vital organs or the central nervous system, causing blood loss, and perhaps by shock to the animal's system. The latter can be almost instantly fatal, or almost completely lacking, depending on circumstances beyond the hunter's control.

Shock seems most likely to occur when light framed animals are hit by high velocity bullets. The classic case would be when a small (50 kg), relaxed, deer or kangaroo is hit by a 130 grain .270 bullet at short to medium range. Sometimes the animal goes down so fast that it seems as if the earth was jerked from under its feet. This is the "four feet in the air" effect. But if the same animal were frightened or excited before he was hit, he might run a considerable distance before expiring. As I said, shock can be deadly, but it is unpredictable.

Energy and Killing Power

Kinetic energy, the ability to do work (or in this case damage), is the most common measure of killing power for rifle bullets. And it is, in fact, a reasonable indicator. But it is by no means the only factor, or even the most important factor. Energy gives us an idea of how much power there is to initiate things like bullet expansion and penetration, but does not guarantee that they will occur.

It is generally recommended that a bullet suitable for medium size big game deliver about 1220 Newton/metres of energy when it hits. Energy is greatest at the muzzle, and diminishes as the bullet loses velocity. When the velocity reaches zero, so does the energy. But long before that the bullet has fallen below the recommended level of energy for humanely killing deer size animals. So the practical hunting range of any cartridge is ultimately limited by how much energy remains. (It is also limited by other factors, for example trajectory, but that is another subject.)

As an example, let's take a .30-30 rifle firing a Federal factory load with a 150 grain bullet at a muzzle velocity of 728 metres/second. At the muzzle that bullet carries 2576 Newton/metres of energy. At 100 metres the energy has fallen to 1837 Newton metres. At 200 metres the energy is down to 1281 Newton metres. At 300 metres the energy has fallen to only 881 Newton/metres which is below our 1220 Newton/metres minimum. The velocity, by the way, is down to 577 Newton/metres at 300 metres. One could conclude that the .30-30 is about a 200 metre deer cartridge, based on its energy, and one would be right.

Sectional Density

Sectional density (along with bullet construction and impact velocity) is among the key factors in determining penetration. Penetration is important because the bullet must get well inside the animal to disrupt the functioning of its vital organs. A bullet that fails to penetrate the fur, skin, muscle, and bone necessary to reach the vital organs is very unlikely to bring an animal down.

Sectional density is a bullet's weight (in kg) divided by its diameter (in cm) squared. Basically, a long thin bullet of a given weight penetrates better than a short, fat one. Which makes sense when you think about it. For example, if other factors (like impact velocity and bullet construction) are equal, a 150 grain .270 bullet will penetrate better than a 150 grain .35 caliber bullet.

Here are some typical hunting bullets and their sectional densities which are recognized as effective for medium game animals: 100 grain .24 (6mm), SD=.242; 100 grain .25, SD=.216; 120 grain .26 (6.5mm), SD=.247; 130 grain .27, SD=.242; 140 grain .28 (7mm), SD=.248; 150 grain .30, SD=.226; 170 grain .32 (8mm), SD=.236; 200 grain .33, SD=.250; 200 grain .35, SD=.223. As you can see, all of these have a sectional density over .215. That is the kind of SD you should look for in a bullet for medium game.

For large game, bullets with higher sectional density should be chosen. Good examples of such bullets would be the 140 grain .26 (6.5mm), SD=.287; 150 grain .27, SD=.279; 160 grain .28 (7mm), SD=.283; 180 grain .30, SD=.271; 225 grain .33, SD=.281; 250 grain .35, SD=.279; 400 grain .45, SD=.272. All of these have a sectional density over .270. The average SD of these bullets is about .279. Bullets of this sectional density, if well constructed, have proven able to penetrate deep into big game animals.

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Bullet Weight and Diameter

The bigger the bullet diameter, the larger the hole it tends to make in an animal. 6mm/.24 caliber is the minimum bullet diameter recommended for use on big game animals.

The bullet weight required increases as bullet diameter increases. A good deer bullet for .24-.25 caliber cartridges weighs about 90-100 grains. For .26 caliber cartridges, a 120-125 grain bullet is about right. For the .27-.28 caliber cartridges, a 130-140 grain bullet is excellent. For .30-.32 caliber cartridges a 150-170 grain bullet works well. It is interesting to note that while a 100 grain bullet is a big game bullet in the 6mm Remington cartridge, a 100 grain bullet is a varmint bullet in the .270 Winchester, and absolutely not for use on big game.

Expansion and Penetration

More important than initial bullet diameter is expanded bullet diameter. A bullet that does not expand generally imparts little shock to an animal's system, and disrupts little tissue. Bullet construction is very important to killing power, both for rapid expansion and for the penetration required to reach the vitals of large animals.

Bullet makers use various strategies to attain the terminal performance desired. Usually a combination of expansion and penetration is sought. The front part of the bullet should expand rapidly to approximately twice the bullet's original diameter, in order to cause as much tissue damage as possible as the bullet plows through the target. The rear portion of the bullet should remain intact, to retain as much weight as possible to aid penetration. If the design works perfectly, the bullet tears through the target's vitals fully mushroomed.

Velocity has a great impact on expansion. Generally, the higher the velocity, the more violent the expansion. Bullets must be designed for a particular range of impact velocities. Bullets of conventional soft point, hollow point, and plastic tip design generally perform best in conventional calibers. Using the popular .30 caliber cartridges as an example, these would range from the .30-30 Winchester to the .30-06 Springfield. Big case magnum cartridges, from the .300 WSM on up, require tougher bullets to control expansion and prevent premature bullet break-up at impact velocities over 914 metres/second. This is particularly true for the lighter bullets in any caliber.

A good bullet for medium size game should expand quickly and create a wide wound channel that destroys the maximum amount of tissue on its way through the animal's lungs. Ideally, a bullet should retain some of its core to aid penetration. However, a bullet that penetrates to the vitals and then fragments and scatters bits of lead and jacket material all through the animal's heart/lung area will kill quicker than one which creates a long, narrow wound channel through the lungs and exits the far side. For light framed animals less than 130 kg, a quick expanding bullet that dumps the maximum amount of energy into the heart/lung area gives the quickest kills.

Bullets for Medium Game

The Barnes Original, Federal Hi-Shock, Hornady Interlock, Nosler Ballistic Tip, Remington Bronze Point and Core-Lokt, Sierra Pro-Hunter and Game King, Speer Hot-Core, Swift Scirocco, and Winchester Power Point and Silvertip bullets all deliver the rapid expansion necessary for quick kills on medium size animals. These are also usually very accurate bullets.

At the high impact velocities that occur at close range with standard high intensity calibers and medium-close range with magnums, the core of conventional bullets will often separate from the jacket, which quickly brings penetration to an end. The remains of such bullets, perhaps amounting to 40% of their original weight, are often found just under the skin on the far side of an animal's chest, indicating that they dumped all of their energy inside of the animal. At lower impact velocity bullets of this type may retain their core and produce mushrooms like those seen in the magazine advertisements.

These bullets of relatively straightforward design are probably the best choice when hunting medium game with standard rifles, and even with magnum rifles when the heavier bullet weights are chosen. They will also do a good job on large game with broadside rib shots, even at high impact velocity. But conventional bullets may

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lack the penetration necessary to reach the heart/lung area on shots delivered from other angles, or if the bullet must penetrate large bones on its way to the vitals, especially at high impact velocity.

General Purpose Bullets

The Remington Core-Lokt and Core-Lokt Ultra bullet features a jacket with an inner belt to limit expansion. They are designed to retain a significant portion of their core to sustain penetration. This design provides good initial expansion with superior retained weight for deeper penetration than conventional bullets. They are good general-purpose bullets, more reliable on large game than the conventional bullets. The premium Core-Lokt Ultra is a tougher bullet than the regular Core-Lokt, intended primarily for high velocity rifles.

The premium Nosler Partition bullet is expensive but worth the price. It has a partitioned core that allows the front part of the bullet to expand rapidly, while positively preventing expansion below the partition. It typically retains about 65% of its weight when recovered. The Nosler Partition bullet has earned an enviable reputation on all sorts of game worldwide, including dangerous game. The Partition is an excellent general-purpose bullet, suitable for both medium size and large game over a wide range of velocities. The Swift A-Frame bullet is a similar design, and also qualifies as a general purpose bullet.

The premium, solid copper, hollow point Barnes X-Bullet has also developed something of a reputation as a general-purpose bullet. It is suitable for medium size game and outstanding for very large and dangerous game. It will give good expansion at impact velocities as low as 548 metres/second, and even at high impact velocity it retains 70-100% of its weight for outstanding penetration.

Bullets for Heavy Game

Other controlled expansion bullets are primarily intended for high velocity and/or large animals like buffalo, and similar sized game worldwide. Extra toughness is required to get the bullet past heavy fur, thick skin, and a substantial bone structure before it can enter the animal's vitals. Premium controlled expansion bullets with dual cores, partitioned cores, or bonded cores like the A-Square Dead Tough, Speer Grand Slam, Winchester Fail Safe, and Woodleigh Weldcore are of this type.

These bullets are designed to retain a significant portion (75% or more) of their core to sustain penetration. They are a particularly good choice for use in high velocity and big bore cartridges. When used in standard cartridges, they will kill medium size game like deer, but not as quickly as less heavily constructed bullets.

Such bullets are more complicated and expensive to manufacture than more conventional bullets. Like the Barnes X-Bullet, Nosler Partition and Swift A-Frame (which are also suitable for large game at magnum velocities), they sell for a premium price.

Bullet Placement

Bullet placement is the most important component of killing power. Drive any reasonably adequate bullet into a vital area and a kill will result. If a bullet destroys the function of the animal's lungs or heart it is not long for this world. That is why most experts recommend aiming for the heart/lung area. Such a shot brings a quick and humane death without wasting any of the meat normally eaten. And it is the largest, easiest vital area of the animal to hit.

Whatever the angle at which a game animal is standing, try to drive your bullet into the heart/lung area. If a deer is standing broadside put your bullet just behind the foreleg, and midway between the top of the back and the bottom of the chest. If he is quartering away, a bullet driven through the animal's body toward the off shoulder will usually find the heart/lung area. Whatever direction the animal is facing, try to visualize where his heart/lung area must be and attempt to drive your bullet into that area. If you cannot, pass on the shot and wait for a better opportunity.

A calm rifleman with a lot of experience shooting at moving targets may be able to place a bullet in the heart/lung area of a running animal. But the average hunter simply cannot do so reliably. It is better to wait for a shot at an undisturbed animal.

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A fine shot with an accurate rifle and a good working knowledge of the quarry's anatomy, shooting from a steady position at a reasonable range, may be able to reliably break an animal's neck. This is a lethal shot if properly executed. But the average hunter, shooting from a standing position, cannot reliably hit the neck vertebrae, and a shot anywhere else in the neck is unlikely to kill quickly. Brain shots are even more difficult, and a head shot that misses the brain almost never anchors the animal. Neck and head shots that miss the central nervous system usually result in a wounded animal that escapes, usually to die long after the hunter has given up the chase.

Do not, under any circumstances, risk shooting a game animal in the guts or the rear end. A wounded animal that escapes to die a miserable death later on is the almost inevitable result of a poorly placed shot. Be reasonable, and remember that most expanding bullets will only penetrate about 38-86 cm into the animal. The average big game rifle will not shoot lengthwise through a deer sized animal.

Conclusion

To maximize killing power, pick a bullet design and style suitable for the game to be hunted and the velocity range of the rifle to be used. Select a bullet with an appropriate sectional density. A medium sized animal (like a 50 kg deer) and a large animal (like a 272 kg Buffalo) require different bullets for optimum terminal performance. For a mixed bag hunt, choose one of the general-purpose bullet designs in a compromise weight. Remember that bullet placement is the single most important factor in killing power. Get a reasonably adequate bullet into a vital area, and a clean kill will be the result.