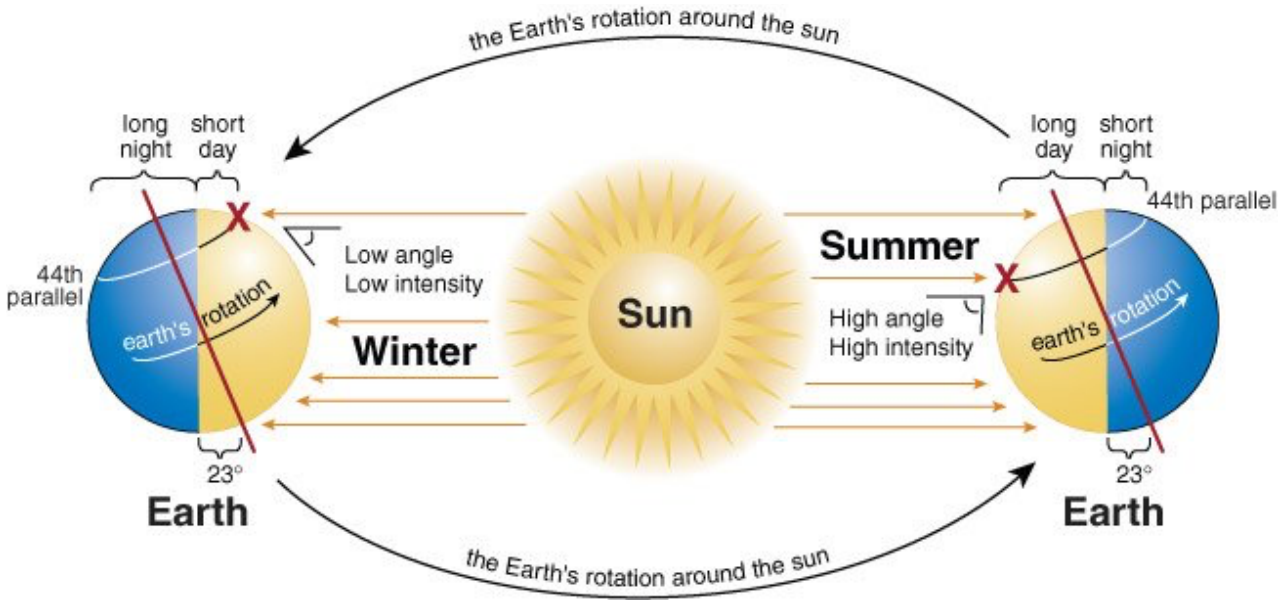
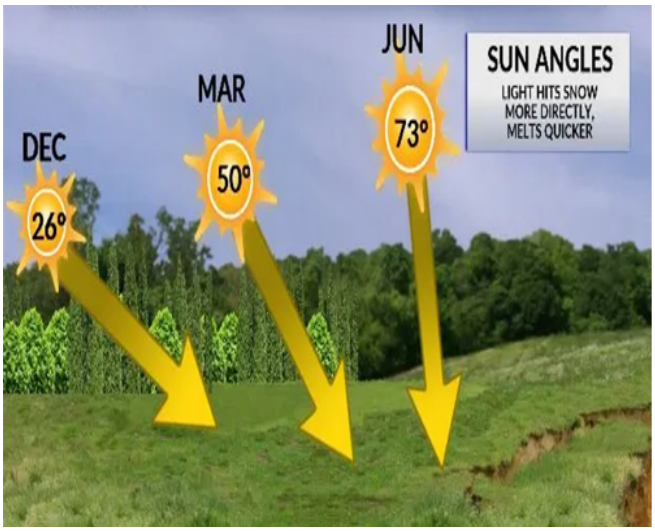
Why Temperature Plays a Major Role in Winter: Paved Surfaces v. Nonpaved

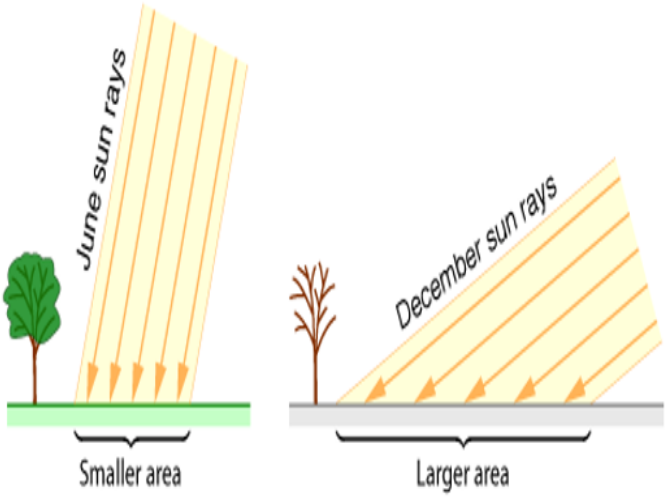
Envision yourself on a snowy day as you look outside your window. It's snowing and you just are in pure bliss by the sight of it. However, you immediately see that makes you question why is there a discrepancy in the total accumulation of snowfall on the grass versus the concrete or paved asphalt? The scientific question to your answer must solely do with temperature!

As we approach the heart of winter, the sun's angle and its intensity are changing quite drastically as that is how we get our seasons. It's due to the Earth's tilted axis and rotation around the sun. A visualization of this process is shown below to help explain this natural occurrence. During the winter season in the Northern Hemisphere, the sun angle relative to an observer for example on Earth, is lower in the sky and the suns' rays travel at longer lengths making them much less intense.



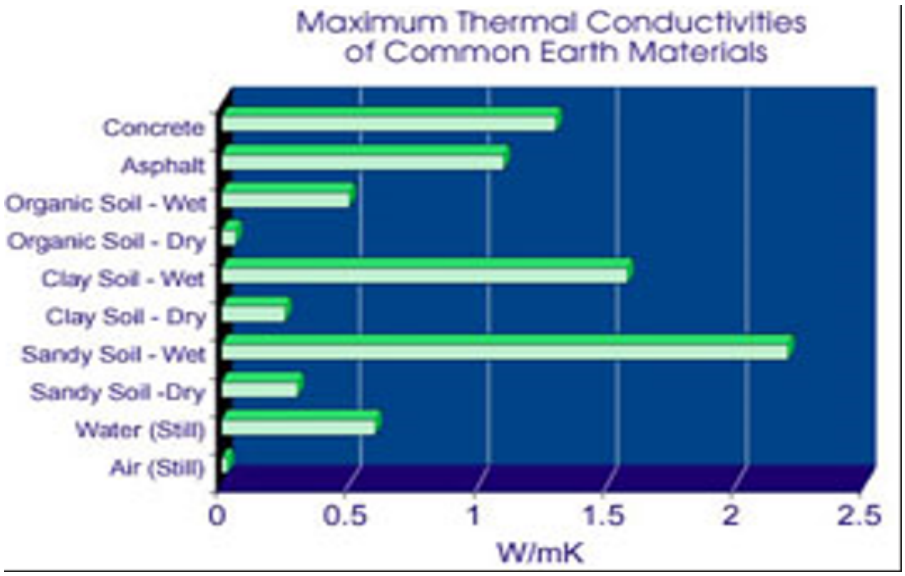
Now, in the heart of the winter since the sun is low on the horizon, this means the energy is coming in at a low angle. A higher sun angle like in the Spring, makes it more difficult for snow to accumulate on paved surfaces especially, since the sun's intensity increases as the Spring equinox approaches. The daytime hours are also very short, so there isn't much time to provide a lot of energy during the Winter. All of this has to do with temperature. The sun's rays have direct implications on both the air temperature and the temperature of a material exposed. Now in months like December or January, technically if it's snowing at a good clip, there won't really be an issue with snow sticking to all surfaces. However, **below we'll imagine we're in either late fall or late winter to early Spring.**



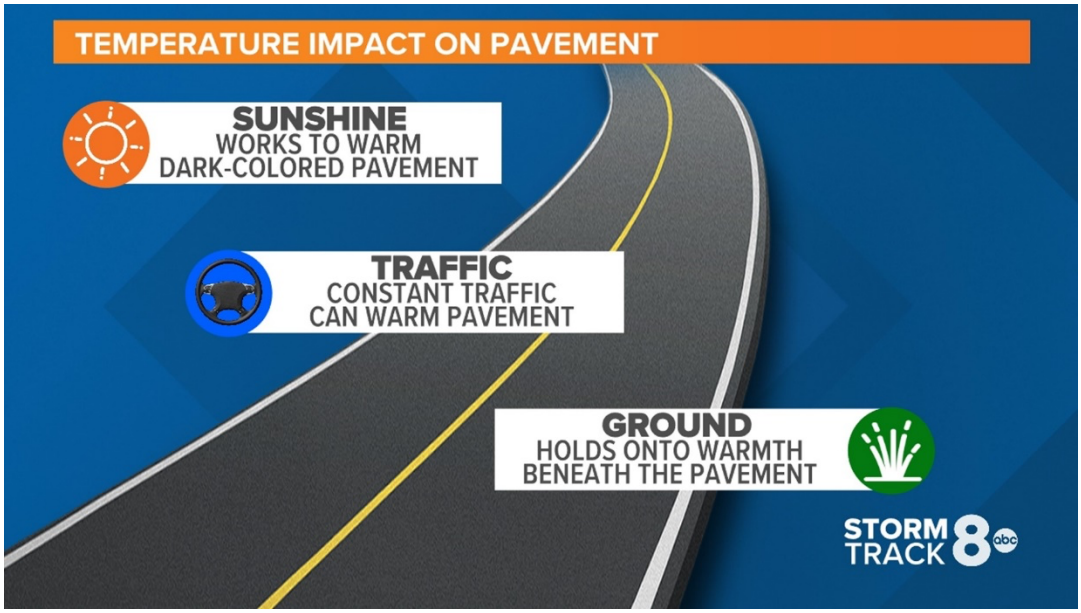


You've likely come across the terms of thermal heat capacity and albedo. Different materials and substances respond to heat in different ways. Thermal heat capacity is essentially how much heat it takes to increase the temperature of an object by 1 degree Celsius. Albedo explains the amount of reflected energy that occurs from a surface. Darker colors (like pavements in this case) have an albedo closer to the value of zero meaning the amount of reflected light is basically trivial. Compare that to snow or ice (lighter colors), which contains a value close to one, this means it reflects a very high amount of radiation back to the atmosphere and doesn't absorb nearly as much of heat.

Taking this information now and applying it to our original question, why are the paved surfaces not seeing snow accumulate faster than on the soil or grass? It's because concrete or asphalt absorbs that energy from the sun (**time of year matters significantly**), which are good conductors of heat since it can absorb radiation faster than grass. Since it's able to absorb heat quicker than soil or grass, this means the heat now is directly transferred to the snow falling into it and therefore melting it. Below a graphic reveals the differences in the thermal heat conductivities of the varying substances, and we see how significantly more in terms of thermal conductivity that concrete and asphalt have relative to organic soils. Blades of grass contain very little specific heat and are poor conductors, so snow is much easier to stick and accumulate.



A graphic that also sums up well the impacts of temperature on paved vs. nonpaved surfaces from WQAD.com reveals other factors as well primarily on the roads. Again, sunshine plays the major role in terms of melting that can occur, but also in fact due to traffic. Heat is transferred from the tires of cars to the surfaces of the roads, thereby increasing temperatures. Along with that, since we now know darker surfaces reflect little sunlight and hold onto the heat instead, this also bolsters the melting potential.



Once again, the time of year significantly does matter! A sun angle in January has about the same magnitude relative to November. The further away from the Winter solstice, the more intense the sun's intensity becomes. It also matters the type of winter event. A light snowfall during the heart of winter as well can be a bit ineffective at producing snow accumulation on those pavements versus a situation with heavy snow falling. So time of year and intensity of the snow event play major roles when it comes to snow sticking!