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LIVING

June brings sun's great glory

Summer solstice is reminder of how much nature relies on heat and light

Although not as glamorous as the recent transit of Venus, a much more significant celestial event is also taking place this month – one to which all of nature responds in a massive pulse of growth and abundance. June 20 marks the summer solstice, the longest day of the year and the first official day of summer.



Drew Monkman

OUR
CHANGING
SEASONS

Understanding the science of the solstice amounts to a lesson in why we have seasons. Let's begin by thinking of a globe. You have no doubt noticed that a globe is tilted, as is the Earth. In other words, the imaginary line between the Earth's north and south poles is not vertical but on a 23.5 degree angle. Because the Earth is also rotating on its own axis, this means that the northern hemisphere ends up being tilted toward the sun for part of the year – our spring and summer – and away from the sun for part of the year – our fall and winter. The main consequence of this tilting is a huge difference in the amount of heating that occurs on the Earth's surface from one season to the next.

FURTHEST POINT NORTH

At the summer solstice, Earth cruises past the point in its orbit that results in the greatest tilt of the northern hemisphere toward the sun. The sun rises and sets at its furthest point north and traces its highest and longest arc through the sky. Sunlight therefore strikes our part of the globe much more perpendicularly than at other times of the year and, in doing so, heats the Earth much more efficiently. The solar radiation also takes a shorter path through the energy-absorbing atmosphere before striking the Earth. In winter, on the other hand, the sun casts a weaker, angled light from its position much lower in the southern sky. The sunlight must also travel through more atmosphere. Therefore, far less heating of the Earth's surface occurs. The difference in heating between the summer and winter can also be illustrated by pointing a flashlight at a tabletop. Summer is akin to shining the beam directly down on the table from straight above so that the light focuses on a small area. The table top will soon feel warm to the touch. For winter conditions, angle the beam to the side so that the light scatters over a larger area. Far less heating occurs.

STANDING STILL

For several days before and after the solstice, the "sol" (Latin for sun) appears to "stace" (Latin for standing still) in the sky – that is, it rises in exactly the same spot on the eastern horizon and sets in the same position on the western horizon. If you were to watch a time-lapse movie of a year's worth of sunrises, you would notice that the sun appears to "walk" back and forth across the western horizon. The winter solstice marks the southern limit of the sun's journey and the summer solstice is the northern boundary. At each end of the walk, the sun pauses for a few days, before heading in the opposite direction.

The significance of the difference in heating and in day length between summer and winter is profound. All life responds, be it the phenomenal plant growth and birdsong of sunlight-rich June or the plant dormancy and avian silence of sun-deprived December. The tilted axis is also the reason why there are more hours of daylight in the summer and fewer hours of daylight in the winter. This, too, makes a huge difference in the lives of plants and



WIKIPEDIA PHOTO

A summer solstice sunrise over Stonehenge in England.



DREW MONKMAN Special to The Examiner

These white ash leaves emerging from a bud are powered by the energy of the June sun, which reaches its peak next week on the summer solstice.

animals. One of the main reasons that birds migrate north in the spring – instead of staying in the tropics, for example – is to take advantage of the longer days of the temperate zone summer. The longer days mean more time for birds to gather food to feed their young, hence greater reproductive success.

RADIATION RESPONSE

The impact of so much solar radiation at this time of year is best appreciated by looking at how plants respond. Sunlight, of course, is basic to a plant's growth, since the plant uses energy from the sun to grow. The longer the day, the more sunlight is available and the more growth can occur. All of the fresh, young leaves we see right now are harnessing the long hours of day-

light to make sugars through the process of photosynthesis. These sugars are converted into plant tissues – leaves, stems, flowers and seeds – or are stored as starch in roots. I like to think of a tree's gift of shade as the unintended result of the race going on above our heads as leaves strive to capture the most light possible. With some species, growth can be explosive. White ash shoots, for example, can grow over two centimetres in a single day.

TREE TRUNK MEASURE

You can see how impressive spring growth is by looking at the rings on a tree trunk or sawn log. The first thing you'll notice is that there are two types of rings: a wide, light-coloured ring and a much narrower, dark-coloured ring. The pale ring

represents the large amount of growth that occurs during the spring and early summer. The wood formed at this time of year grows fast and is lighter in colour because it is made up of large cells. However, in mid- through late summer the growth is slower and more limited. The cells are also smaller and darker. A year's growth for a tree is therefore composed of a wide, pale ring of early wood and a narrow dark ring of late wood. Just count the number of dark rings in order to tell how old a tree was when it was cut down.

ENERGY TRANSFER

June's bounty of solar energy ripples through all of nature as it is transferred from one living organism to another in the form of food. Let's look at one example.

The energy contained in the fast-growing ash leaves is often transferred to tiger moth caterpillars that gorge themselves on the succulent plant tissue. The caterpillars, in turn, are gobbled up by hungry warblers that feed them to their fast-growing young. A warbler, in turn, may fall prey to predators such as sharp-shinned hawks. From sun to leaf to caterpillar to warbler to hawk, energy moves through the food chain.

The cultural and spiritual dimensions of the solstice are fascinating, as well. Also known as Midsummer, Litha, or St. John's Day, the summer solstice used to be celebrated with astonishment, joy and thankfulness by cultures all over the northern latitudes. This is not surprising. Warm temperatures had returned; plants were leafing out and blooming in abundance; food was easier to find; crops had been planted, and life was simply a little easier. This time of plenty was also the traditional period for weddings and remains so today. In some traditions, newly weds drank a daily cup of honeyed wine (mead) during the first month of their married life – hence the term "honeymoon."

STONEHENGE RITUAL

We can only imagine the solstice rituals that took place at prehistoric sites such as the great stone circle at Stonehenge in England. It is well known that if you stand within the circle and face north-east, you can see the sun rise directly above the "heelstone" (which lies just outside the main entrance) on the morning of the solstice. Another stone site that is aligned to the Sun's yearly travels can be found in the Big Horn Mountains of Wyoming. Here, Native Americans constructed a wheel of stones with a clear summer solstice sunrise alignment. The wheel is 25 m in diameter and has 28 spokes made of stones. The spokes emerge from a stone cairn in the middle of the circle. On the outside of the circle there are six more cairns. A line joining one of the outside cairns with the centre cairn points to the exact location on the horizon where the summer solstice sun rises, another line points to where the sun sets, and still other lines point to where various bright stars such as Sirius and Aldebaran rise. Because of the cultural significance of the summer solstice to aboriginal peoples, the Canadian government declared June 21 as National Aboriginal Day in Canada.

GET TO A HILL

By witnessing the summer solstice ourselves, we can at least begin to imagine the spiritual significance that this event held for ancient peoples. The solstice is best observed from a height of land that provides an unobstructed view of the horizon. Armour Hill in Peterborough is a good location. Try to note the exact point on the horizon where the sun rises and, at the end of the day, where it sets. At the beginning of each of the other seasons, repeat these observations, being careful to watch from the same spot each time. You will be astonished at the difference in sunrise and sunset points between June and December. You should also try to make these same observations from your own home, even if your view of the horizon is somewhat obstructed. Knowing where the sun rises and sets at different times of the year is strangely satisfying and helps you to connect more fully with the place you live.

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