Energy and Radiation, the Basics

A knowledge of energy transfer is necessary to understand all environmental processes. Most of this energy is electromagnetic energy. This travels at the "speed of light" and is broken down into bands based on wavelength. Terms like X-rays, light, heat, micro waves and radio waves are just different parts of the spectrum and differ only in wavelength.

Any object with a temperature above absolute zero will radiate or emit e-m energy. The hotter the object, the more energy it emits. Also the hotter the object, the shorter the wave length it emits. Finally the shorter the wavelength, the more energy the wave carries. Light wavelengths are shorter than heat wavelengths and thus carry more energy.

Both the sun and the earth are above absolute zero so both emit energy. The sun is hotter so it emits more energy at shorter wavelengths, most of which is white light or visible light. The earth absorbs a small part of the energy the sun produces, but this still drives all the physical and life processes on the planet. The earth is cooler than the sun, so it emits less energy and at longer wavelengths. Most of these are in the thermal infrared band and are called heat.

Another principle is that good absorbers of energy are good emitters of energy. The earth is a pretty good absorber. It absorbs about 2/3 of the sun's energy that hits it. So it reflects only about 1/3 of the sun's energy away. The 2/3 that is absorbed goes through a variety of conversions and processes but ultimately is emitted (radiated) back to space. Thus the earth has an equilibrium temperature at which the amount of energy going out to space is just equal to the amount absorbed from the sun. The equilibrium temperature is higher in summer than in winter. It is higher on a sunny day than a cloudy day.

Most remote sensing technology is concerned with measuring some band of emitted or reflected energy and using that data to gather information about earth or atmospheric processes.