Sun Will End Earthly Life in 2.8 Billion Years

The **final** days of life on Earth will come some 2.8 billion years from now, suggests a new study. **Currently** at a comfortable temperature for life on Earth, our **aging** sun will slowly warm over its lifetime. Within about five billion years, the sun will **exhaust** its nuclear **fuel** and expand into a "red giant" star that may even engulf our planet. It will become very hot for existing life-forms long before that red giant **stage** is **reached**. The question examined by a team led by astrobiologist Jack O'Malley-James, University of St. Andrews in Scotland, is: When will things get too hot for life to continue? Using **measures** such as temperature and the **abundance** of water and food to **examine** the future health of Earth's biosphere, the scientists have mapped out how all life may begin to die off. They also analyzed what Earth's "biosignature" might look like to a **distant** alien civilization searching for life. The study was published in the International Journal of Astrobiology and **released** on the physics archive **maintained** by the Cornell University Library.

Plants Go First

The team's **long-range** weather forecast for the far future shows that as temperatures on Earth begin to slowly rise, more water vapor will **form**, resulting in the **steady removal** of carbon dioxide from the atmosphere. Plants rely on carbon dioxide to **generate** energy through photosynthesis, so the **complete** removal of CO2 would be bad news for foliage. The first hints of the death of life on Earth will come in 500 million years, when less-hardy species of plants begin to die off as global carbon dioxide **levels** drop. As more plant species **go extinct**, so will the animals that rely on them as a **source** of food and oxygen. "When plant numbers **decline**, these two commodities become increasingly **scarce**, **resulting in** the **simultaneous** end of animals over the next billion years alongside the end of plants," the study says.

Only Microbes Left

By about 2.8 billion years from now, only hardy communities of microbes will be left behind to inherit the Earth. But as the Earth continues to relentlessly warm, oceans will **evaporate**, causing a greenhouse effect, which will lead to **rapid** further heating of the planet and a very scarce supply of liquid water. "Only the hardiest microbes will be able to **cope with** this, until even they can no longer survive when temperatures cross the threshold at which DNA **breaks down**—around 140°C [284°F]," added O'Malley-James.

Signs of Life

The team hopes that these **findings** may help our own search for life beyond Earth, by **expanding** the number of potential signatures of life to look for when we learn to analyze planetary atmospheres in more detail. "A planet in a later stage of its habitable development may appear uninhabited if we only look for the signs of life as we know it on Earth today," said O'Malley-James. "Knowing what other potential signatures life could have could help us make a positive detection of life on a planet that may previously have been **ignored**."

Always Look on the Bright Side

While this model points to a gloomy future for our planet, O'Malley-James and colleagues think that their timeline for future life is probably a conservative one. There are still a lot of unknowns when it comes to **predicting** what life will do under duress, said O'Malley-James. "It is difficult, if not impossible, to predict what **evolutionary** tricks life may have up its sleeve to cope with these future extreme **environmental** changes," he said. But the study no doubt shows that life on Earth is naturally quite resilient to change. If the past is any indication, we can take heart: Despite **major** environmental upheavals and mass extinctions, life has never been **entirely** extinguished since it **emerged**. "While it is depressing to know that life will end one day, there is still plenty of comfort in the fact that it won't happen for an unimaginably long period of time," O'Malley-James said.

Adapted from National Geographic