Modern-day coral reefs have well defined environmental envelopes for light, sea surface temperature (SST) and aragonite saturation state ($\Omega_{\text{arag}}$). We examine the changes in global coral reef habitat on multi-millennial timescales with regard to SST and $\Omega_{\text{arag}}$ using a three-dimensional climate model including a fully coupled carbon cycle and a parameterization for continental weathering (the UVic ESCM). The model is forced with several emission scenarios releasing between 1000 GtC and 5000 GtC after year 2000. We find that the long-term climate change response is independent of the rate at which CO$_2$ is emitted over the next few centuries. For the high emission simulations, only one fifth of the emitted carbon remains in the atmosphere after 10,000 years when including weathering compared to over half for the control simulations. Surface air temperature anomalies recover by 50% when weathering is taken into account compared to almost no change for the control simulations. While the environmental conditions for SST and $\Omega_{\text{arag}}$ stay globally hostile for coral reefs in our control simulations, introducing the weathering feedback results in the first areas of potential habitat recovery for $\Omega_{\text{arag}}$ to emerge by the year 6300 AD. The faster decrease in atmospheric CO$_2$ due to weathering allows $\Omega_{\text{arag}}$ to recover to near modern-day conditions in large parts of the modern-day coral reef habitat within 10,000 years. Although SSTs stay significantly higher (~3-4°C), about 17% of the coral reef habitat has recovered to fall within acceptable SST and $\Omega_{\text{arag}}$ environmental envelopes by 10,000 AD.