



CALIFORNIA STATE SCIENCE FAIR 2008 PROJECT SUMMARY

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Project Title Transforming Terrain: An Analysis of Man's Effect on the Absorption of Solar Radiation by the Earth's Surface	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project was to determine the percent increase of solar radiation absorbed by the earth's surface when man alters: A coniferous forest into a grassland. (Process #1) A grassland into urban asphalt. (Process #2) A coniferous forest into urban asphalt. (Process #3)</p> <p>Methods/Materials The software program SBDART was used to produce the raw data for this experiment. SBDART stands for Santa Barbara Discreet Atmospheric Radiative Transfer. It is a FORTRAN (FORMula TRANslation) computer code designed by established atmospheric scientists to analyze a wide variety of radiative transfer problems encountered in satellite remote sensing and atmospheric energy budget studies.</p> <ol style="list-style-type: none">1. Using SBDART, radiative flux in the longwave radiation spectral range was graphed, for the bottom of the atmosphere downward, with wavelength (in microns) versus Watts per square meter, for the three surface albedo models: "Conifers", "Grass", and "Asphalt".2. The critical region (the integral) of each graph was calculated using a method of my own derivation.3. The difference between each of the three critical regions was calculated.4. Each numerical difference was divided by its respective original value (the area of the larger critical region) to obtain the expected percent increase in the absorption of solar energy by the earth's surface. <p>Results According to the data, the absorption of solar radiation at the earth's surface increases by... 3.32% when man deforests a coniferous forest into grassland. (Process #1) 5.24% when man urbanizes grassland into asphalt. (Process #2) 8.58% when man urbanizes a coniferous forest into asphalt. (Process #3)</p> <p>Conclusions/Discussion The percent increase of radiation absorption when humans deforest or urbanize a region may be slight, but when millions of acres of land are altered, the effect can be globally significant. Clearly, the practices of deforestation and urbanization are counterproductive if humankind aims to offset global climate change. Society can implement new, efficient technologies and fresh, innovative alternative energy sources to lower global greenhouse gas emissions. But if humans continue a trend of landscape development, an increase in radiation absorption could potentially negate any decrease in greenhouse gas emissions.</p>	
Summary Statement This project concerns the absorption of solar radiation at the earth's surface, and how humans can affect this phenomenon.	
Help Received I studied under Dr. Catherine Gautier at the University of California, Santa Barbara last summer. Dr. Gautier, one of the three designers of SBDART, introduced me to the software program. My ability to use SBDART allowed me to independently pursue answering the question posed in this experiment.	