Monitoring the Deserts from Space

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Although deserts occupy approximately 20% of the landmasses of the Earth, they remain one of the least understood of all its features. Among the reasons for this is the fact that deserts cover immense areas where harsh conditions prevail. Their remoteness and inaccessibility preclude their study by conventional means. However, remote sensing from space provides a unique opportunity to study monitor the desert environment. This is particularly true because deserts must be studied on a regional basis and because climatic conditions are nearly always favorable to monitoring from space.

Available data from manned space missions and Landsat satellites show that the reflectance properties of desert surfaces are indicative of the composition of the exposed rock rubble. Examples are given of distinct color zones in desert photographs that correlate with the amount of sand, desert-varnished pebbeles, and clay minerals in the exposed soil.

Similarly, it has been shown that desert sands become redder as their distance from the source increases. This is due to the fact that individual sand grains become coated with an increased amount of iron oxides with the passage of time. This property is clearly demonstrated in the Sturt and Simpson deserts of south central Australia, the Namib Desert of southwest Africa, and the Emptly Quarter of Saudi Arabia. Color zones in space photographs of these areas can be used to delineate relative age zones within the sand fields.

Space photographs also provide an efficient way to monitor the extent of vegetation in arid regions. Photographs taken of the same area west of the Nile Delta by Gemini (1965) and Apollo-Soyuz (1975) astronauts clearly delineate the success of one desert reclamtion project and the lack of progress in another. Landsat images of an area in southeastern Libya, which were taken at various times, show the stages of progress of a reclamation project based on the utilization of underground water.

These and other examples confirm the utility of space photographs and Landsat images in the investigation of desert landforms and of reclamation projects. However, the need exists for a complete survey of all parameters of the arid environments that can be successfully monitored from space; for example, the parameters that can be indicative of desertification, particularly in large regions such as the African Sahel. Similarly, the need exists to categorize the photocharacteristics of areas that exhibit good soil and hence can be reclaimed from the desert.

Today, the lack of meteorological data prohibits a full understanding of the desert environment. Space age technilogy can remedy the situation. Meteorological stations can be placed in remote areas to collect data and beam them to orbiting communications satellites. The latter can transmit the data to ground stations for analysis and synthesi. Monitoring the deserts from space in this way will help us utilize more of the land area of the Earth for the benefit of mankind.