Infrared Photography

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THE SPECTRUM OF electromagnetic radiation includes visible or white light which can be readily recorded on film. The length of the light wave determines its visibility and its ability to be recorded on film. The visible light spectrum includes a band of color ranging from violet through blue, green, yellow, orange, red and deep red. The visible wavelength range is about 400 nm (nanometers — one millionth of a millimeter) at the violet end to about 700 nm at the extreme red end. At each end of the visible spectrum there is invisible radiation.

Extending beyond the violet end of the spectrum is ultraviolet radiation that has shorter wavelengths. On the other end of the spectrum beyond the red is infrared, which has longer wavelengths. Extending beyond infrared, the radiation merges into heat waves. The spectral range of infrared photography is between 700 nm and 900 nm.

In doing infrared photography, Kodak Ektachrome Infrared 35 mm film can be used in a regular 35 mm camera with a lens filter. A Kodak Wratten filter No. 12 should be used over the lens; however, a No. 8, 15, or 21 can also be used. If color balance is desired, a No. 12 is preferred. Other infrared films and filters may be used; some of them are especially designed for aerial photography.

The camera's ASA setting can vary depending upon the amount of light falling on the image and its reflection. An ASA setting of 100 is a good starting point. Because most cameras and light meters are designed to measure visible light, determining the appropriate shutter speed and lens opening may be difficult. Read the instructions in the film box and talk to the professional at your local camera shop for some useful ideas.

When photographing an image, it is best to keep in mind that the film is

Natural photo (left) and infrared photo (right) of No. 18 green taken the same day at ground level during the Walker Cup Match in August, 1977. Notice that in infrared photography, healthy green plant tissue is recorded as red, whereas tissue under stress photographs in other hues. Note wilting areas on front left portion of this green.

recording reflected light. Infrared radiation and visible radiation often are reflected and transmitted quite differently by natural and man-made objects. For example, chlorophyll in live green foliage and grass absorbs a large percentage of the visible radiation which falls on it, but it transmits most of the infrared. We do not fully understand what mechanisms are involved within the living plant tissue which cause healthy tissue to reflect the infrared spectrum. Qualitatively though, healthy plant tissue has a greater capacity to reflect infrared radiation than does unhealthy plant tissue. This phenomenon therefore can be recorded on Ektachrome Infrared film.

BY USING INFRARED film to photograph the golf course, one can detect various pathological and physiological occurrences not only to plant life, but to the entire recreational facility as well. The method used to photograph the golf course was to fly over the golf course in a single-engine plane at approximately 1,000 feet while photographing through a side window of the plane.

The transparent slides have to be interpreted after the photograph has been completed. Color infrared photos have been effective in locating drain tile lines. This is possible due to the fact that Ektachrome Infrared film has a high degree of sensitivity and the turf growing over the tile line has less stress on it, especially if the moisture in the soil is at or exceeds field capacity.

Fertilizer distribution patterns are easily evaluated and irrigation distribution patterns are observed easily. Both the lack of adequate water and the overapplication of irrigation water is quite apparent. Weed infestations, the quality of herbicide applications and effectiveness of the herbicides are recordable on film. Disease and insect infestations are sometimes apparent, and the total area affected is more easily seen with infrared photography than by the naked eye. The amount of silt which has become mixed with the sand in the bunkers is seen easily and provides a clue to the playing condition of the sand bunkers. Golf cart traffic patterns can be observed before either redirecting them or placing cart paths. The health of deciduous and evergreen trees can be studied for small or large areas. Problems can be dealt with before they become disasters.

By using infrared photography as a tool of management, one can gain knowledge about the challenges and problems at hand. For those interested in pursuing the opportunities afforded by infrared photography, the following publications are recommended. Both are available at your local camera shop.

1. Applied Infrared Photography. Kodak Publication M-28.

2. Photography from Light Planes and Helicopters. Kodak Publication M-5.