Section IV: Summary and Future Directions

The remote sensing of coral reef ecosystems has advanced in a number of areas, the most prominent of which are the increased spatial and spectral resolution of sensors and the development of algorithms and products that utilize these data. Researchers are constantly developing and utilizing these data to better understand and manage coral reef ecosystems. There is still much work that needs to be done, however.

Much of the information remote sensing scientists seek to derive is rooted in firm biological knowledge of use to coral reef ecosystem biologists and managers. Questions surrounding the contributions and role of individual coral reef stressors along with mitigation techniques involved in enhancing the resilience of coral reefs are still unresolved, debated, or in some cases unknown. Therefore, much work still needs to be done in the biological sciences in order for remote sensing to play a useful role in the monitoring of threats to coral reefs.

From a technical perspective, developments are needed in multiple areas; one of the most prominent is the development of coral reef specific remote sensing platforms capable of providing both high spatial and spectral resolution data. Higher spatial and spectral resolution products with the capability of detecting changes in parameters such as coral cover, coral type, and coral bleaching extent are foremost in the minds of coral reef researchers and managers. While small, site specific, research efforts have achieved some of these goals with varying degrees of success, the broad scale application of, and access to, this information for researchers and managers is still largely unmet. Another area for growth is in the development of algorithms that are capable of deriving water quality parameters of interest to researchers and managers using ocean color remote sensing. A unifying effort that would facilitate developments in a number of remote sensing areas is the acquisition of *in situ* data for use in remote sensing parameterization, calibration, and validation efforts in addition to amalgamated products that use spatially explicit models in conjunction with remote sensing data. Examples of these include light and water quality parameters, such as diffuse attenuation coefficients (Kd PAR/490) for light and turbidity estimates in addition to chlorophyll *a* concentrations.

While much work is to be done, fascinating achievements are becoming visible on the horizon. Remarkable efforts are being undertaken to incorporate progressive computational techniques into research efforts, such as machine learning and large, integrated data sharing storehouses. As the presentations attest, managers utilize remote sensing for more than merely documenting events. Products such as Coral Reef Watch's Bleaching Alert help managers gain credence with area stakeholders by legitimating their management decisions. With outreach and education workshops such as this, attendees in the coral reef and remote sensing communities have the ability to collaboratively discuss pertinent issues and identify legitimate areas of research and management needs to conserve these resplendent natural resources.