

PROGRESS ON APPLICATION OF AIRBORNE RADAR AND GIS TO SAN CLEMENTE ISLAND ARCHAEOLOGY

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We report on progress in application remote sensing data, principally AirSAR airborne radar, and GIS to cultural resource management. The DoD and DoE are legally required to locate and care for cultural resources on lands they control. Much is unsurveyed and current methods are slow and expensive. Presently over 19 million acres of DoD land alone are unsurveyed. In the western US surveys cost \$30-\$35 per acre, far more in the heavily vegetated eastern US. Evaluation and mitigation are required before site disturbance. Delays and significant schedule impact can occur should archaeological sites inadvertently be discovered. We seek to evaluate JPL AIRSAR multiparameter radar imagery and TOPSAR high resolution digital elevation data (<http://airsar.jpl.nasa.gov/>) as a tool to help locate environments likely to contain sites, or even directly detect some classes of sites. The radar imagery is collected at three wavelengths (~68cm or "P-Band", ~24cm or "L-Band", and ~5.6cm or "C-Band") and full polarization diversity (HH, HV, VV, VH, where H=horizontal, V=vertical polarization, first letter is transmit polarization, second letter is receive polarization). Resolution is up to 1m per pixel (picture element). TOPSAR topographic data is achieved in an interferometric mode. Phase variations in radar echoes simultaneously received at two antennas are used to calculate topography. TOPSAR digital elevation models (DEMs) have vertical resolutions as high as 1.5 m. These attributes are unique to AIRSAR. These data allow characterization the landscape in terms of its potential use by native peoples. San Clemente Island, offshore southern California is used as an initial study site and has many positive features. The northern part is well surveyed archaeologically, and data for the island is available in GIS format. The southern part is less well characterized, providing a well controlled "unknown" study site. Because the island has been controlled by the Navy for many years, modern cultural effects are reduced. Meanwhile, the cultures are identical to those well studied onshore. AIRSAR and TOPSAR data of San Clemente Island have been collected and processed, analysis is underway. The high resolution TOPSAR DEM has been extremely useful. The meter scale accuracy has allowed construction of a hydrologic network which provides insight into locations of water resources. In addition, the accurate DEM permits precise orthorectification of older data sets. Airphotos from the early 1950s have now been digitized and orthorectified to a common datum. Many archaeological sites now obscured by vegetation were exposed in earlier years when the island was overrun with goats. Work to date on the radar imagery has shown that many archaeology sites are bright in the various radar images. The radar images thus act as target finders in identifying

locations for field investigation. The radar scattering mechanisms involved relate to the native Americans collecting the rocks surrounding their habitation sites and using them for shelter foundations and windbreaks. In addition, these former habitation sites become preferential habitats for various types of vegetation. Present work includes trying to discriminate and identify the vegetation types based on the radar signatures. We are also incorporating other remote sensing data into the analysis including hyperspectral (AVIRIS and Hyperion), ASTER, and ALI. In summary, the remote sensing data shows promise of being a significant aid in the evaluation of cultural resources when incorporated into a GIS.