A Sense of the Past

Studies in current archaeological applications of remote sensing and non-invasive prospection methods

Edited by

Hans Kamermans
Martin Gojda
Axel G. Posluschny

BAR International Series 2588
2014
A Sense of the Past: Studies in current archaeological applications of remote sensing and non-invasive prospection methods

© Archaeopress and the individual authors 2014

ISBN 978 1 4073 1216 3

Front cover illustration: DTM of a set of artillery forts (a later addition to the great fortified town of Terezín (north-west Bohemia, Czech Republic) which was constructed across the Labe river in the mid 19th century), a result of ALS (March 2011). The current state of the monument which has been partly levelled (forts 1 and 4) is well illustrated by this way. Also, a dense network of former trackways and linear earthworks of which some may have been connected with the fort system is apparent.

Back cover illustration: Vladař (western Bohemia, Czech Republic) DTM of extensively fortified Iron Age hillfort produced from airborne laser scanned data acquired in March 2010. The image displays perfectly the current state of the site and its individual components, such as the so-called acropolis situated in the highest part of the hillfort (coloured blue) and the fortification system of ramparts and ditches in the western and northern parts of the flat table hill.

The project ArchaeoLandscapes Europe has been funded with support from the European Commission (Culture Programme 2007–2013–CU7–MULT7 Agreement Number 2010-1486 / 001-001). This publication reflects the views of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Printed in England by 4edge, Hockley

All BAR titles are available from:

Hadrian Books Ltd
122 Banbury Road
Oxford
OX2 7BP
England
www.hadrianbooks.co.uk

The current BAR catalogue with details of all titles in print, prices and means of payment is available free from Hadrian Books or may be downloaded from www.archaeopress.com
STUDYING PREHISTORIC DRYLAND AGRICULTURAL SYSTEMS IN CENTRAL ARIZONA THROUGH AERIAL LiDAR, PEDOLOGY, HYDROLOGY, AND PALEOBOTANY

Robert M. Wegener, Richard Ciolek-Torello, Jeffrey A. Homburg and Michelle Wienhold

Abstract: Statistical Research Inc. (SRI) conducted phased data recovery at two large dryland agricultural fields and associated Hohokam habitation sites along U.S. Highway 60 in central Arizona. The agricultural fields consisted of cross channel and contour rock alignments and rock piles covering many acres within and outside of a newly proposed highway right-of-way along Queen Creek. Nearby were small, seasonal habitation sites occupied between AD 400 and 1350. Aerial 3-Dimensional Laser Range Finding (LiDAR) was used to map the fields, construct 10 cm digital elevation models, and examine field slope, aspect, and drainage patterns. Drainage patterns before and after field construction were then modeled to compare natural versus human-modified field topography and hydrology, and to infer the aboriginal aims of field construction. Field function was further examined with soil moisture and chemistry studies to characterize anthropogenic soil signatures, and pollen and flotation analysis to identify cultivars and cultigens. Contrary to expectations, this detailed functional study found little evidence for agave cultivation, which has been the primary cultivar found in other dryland fields of central Arizona. The Queen Creek fields were built prior to the large-scale production of agave in central Arizona. Although agave occurs naturally nearby, these fields were used for a mix of crops, including maize, native cacti, and possibly even cotton and helped sustain a series of intermittently occupied farmsteads and hamlets.

Keywords: American Southwest – Hohokam – dryland agriculture – LiDAR – soil chemistry – agave cultivation

Introduction

Water management and harvesting is an essential element of successful agriculture, especially in arid to semi-arid environments. Often this involves the complicated manipulation and modification of the existing environment. The construction of canals to channel water onto desert lands is perhaps the best known method and the Hohokam of the American Southwest are perhaps best known for the development of the largest and most technologically sophisticated irrigation systems of North America (Doolittle 1990, 79-80). Developed as early as between 130 BC and AD 275 in the Salt and Gila River Valleys of central Arizona (Henderson 1989, 194-196), these systems in their final form were a complex web of canals, several over 16 km in length that could have watered over 24,000 acres (Howard - Huckleberry 1991) and even as much as 9,000 ha (Schroeder 1943, 380-381) (Fig. 1). It has been a long-held view that these canal systems were constructed gradually through a process of accretionary growth that sustained the in situ development of a complex network of large villages and the elaborate irrigation-based Hohokam cultural pattern (Woodbury 1960; Haury 1976; Wilcox - Shenk 1977; Upham - Rice 1980; Neitzel 1987). Recent research, however, reveals that individual canal alignments exhibit a high degree of instability with numerous instances of abandonment. Canals had a short use-life and were constantly rebuilt, often in response to catastrophic flooding (Greenwald - Ciolek-Torrello 1988; Ackerly - Henderson 1989; Howard 1993). Henderson (1989, 198-199) estimates that the average use-life of canals in one system was roughly 35 years. According to Doolittle (2002, 408): “...the entire Salt River Valley for the period extending from AD 0 to 1450 was a dynamic landscape of canals of various sizes and locations undergoing constant renovation and relocation... the valley can be best characterized in terms of the irrigated landscape as a constantly changing mosaic.”

Ciolek-Torrello (1998; 2012) argues that the instability of Hohokam canal systems, especially prior to the Classic period, resulted in the expansion of Hohokam agricultural technology and settlements into the smaller river valleys surrounding the Phoenix Basin between the late Pioneer and early Colonial periods (AD 600-900). Small farming settlements were established in the tributaries of the Salt and Gila Rivers, such as the Agua Fria, New River, Cave Creek, and Lower Verde Rivers along the northern edge of the Phoenix Basin and the Queen Creek and Buttes Dam area along its southeastern edge. These areas lacked the large expanses of arable alluvium present along the Salt and Gila Rivers at the center of the Phoenix Basin, but the lower flows of the smaller drainages in these peripheral valleys may have been more easily managed. Furthermore, these valleys were located in more upland areas that provided a great variety of important wild plants that could be exploited and encouraged. Game was also abundant, and these valleys may have been important sources of protein for the large settlements along the Salt and Gila Rivers (Abbott 2000). In