REMONTE SENSING FOR ASSIST TO THE ARCHAEOLOGY IN THE PROVINCE OF SANTA CRUZ, ARGENTINA.

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The use of satellite images as a working tool in archaeological investigation has become a promising field of application in regions as Patagonia (Argentina), which hosted diverse groups of hunter-gatherers in a scenery of specific geomorphological and climatic characteristics during the Holocene.

The aim of this presentation is to evaluate how this tool can provide information to the discussion on the process of human settlement in southern Patagonia.

GR PGR00189 Project

“Tecnologie di telerilevamento per la gestione smart dei beni culturali e naturalistici per aree pilota in Italia ed Argentina: dalla conoscenza e valorizzazione al monitoraggio dei rischi e mitigazione”.
RESEARCH AREA

Environments:
- Coast
- Steppe
- Forest
PALEOENVIRONMENTAL FLUCTUATIONS

Paleoenvironments: dynamic frame.

Ice fields advances and setbacks.

Holocene vulcanism.

Changes in main western winds: higher intensity for 6000 years BP and for 1800 years BP (Ariztegui et al. 2009)

Limits from fluctuating vegetation.

Shrub steppe expansion and lake levels decline.

Medieval Climatic Anomaly 900 years BP.
ARCHAEOLOGICAL RECORD

The study region covers:

250km North-South
120km East-West

Total of sites registered:

Low lands: 85
High lands: 177

Sources of data worked on:

* Technology
* Zooarchaeology
* Rock art
* Bioarchaeology
* Stable isotopes
**ARCHAEOLOGICAL RECORD**

**Caves:** earliest occupation and rock art (Cueva de las Manos cave - UNESCO 1999).

**Rock shelters and rock walls:** rock art can be found, including zoomorphic and anthropomorphic designs as well as geometrical drawings.

**Open air sites:**
1) Superficial concentrations of lithic and archaeofaunistical materials.
2) Stone structures: There are different types of structures such as *chenques* and *parapetos* (or hunting blinds).
PRINCIPAL PREY

Guanaco (*Lama guanicoe*)

Ñandú (*Pterocnemia pennata*)
- Mid- Holocene (6000-3000/2500 years BP): low sign in the study region.

- Initial Late Holocene (3000/2500 – 900 years BP): all areas are occupied.

- Final Late Holocene (post 900 years BP): stressed occupation trend
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-Final Late Holocene (post 900 years BP): stressed occupation trend
LOW LANDS

- 100-300 m.a.s.l
- Shrub steppe
- Low amount of snow during winter.
LOW LANDS

- More frequency of grinding artifacts and ceramic in surface archaeological sites.
- Artifactual richness.

- Human burial concentration in Salitroso lake basin: all ages and sexes represented.
- Protein diets of sample of 73 individuals were based on resources from the surrounding steppe.

- More variety of animal species represented in archaeological record. Generalized age range structures
- Intensive butchering patterns.

- Intermediate quantity of motifs mainly paint.

*Residential use
*Semipermanent settlement
HIGH LANDS

- 900-1200 m.a.s.l
- Important amount of snow during winter.
- Basaltic plateaux: herb steppe
HIGH LANDS

- High quantity of hunting blinds
- More frequency of and projectile points.

- No human burials

- Mainly Guanaco, high degree of anatomic incompleteness.
- Presence of offspring in archaeological record
- High quantity of rock art motifs: mainly engraved abstract and figuratives motifs.

*Logistic use:
- Hunting.
- Lithic raw material.
- Information exchange.
MODEL

LATE HOLOCENE

- Regional drought processes
- Human concentration in lake basins
- Use of high lands would have been in a more scheduled and planned way
- Widespread shelter.
- Both spaces would have functioned in a complementary manner: logistic and seasonal use of higher sectors opposed to a residential role and semi permanent use of lower sectors

Binford 1980
HOW REMONTE SENSING CAN BE USEFUL TO THIS ARCHAEOLOGICAL MODEL?

1) LOCATION OF EARLY ARCHAEOLOGICAL SITES: FLOODING

2) RELATIONSHIP BETWEEN VEGETATION AND HUMAN SETTLEMENT

3) LOCATION OF HUNTING BLINDS (ROCK STRUCTURES): HUNTING STRATEGIES

4) ASE MODEL: LOCATION OF NEW ARCHAEOLOGICAL SITES
Flooding Basin
Pueyrredon-Posadas-Salitroso Lake
Modern Level

- 180-200 masl (5000 years BP)
- > 300 masl (7000 years BP)

Horta et al. 2012

Pueyrredón- Posadas – Salitroso Lake
Modern Level

> 300 masl (7000 years BP)

Horta et al. 2012

Pueyrredón- Posadas – Salitroso Lake

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Pueyrredón- Posadas – Salitroso Lake

Horta et al. 2012
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Pueyrredón- Posadas – Salitroso Lake

Horta et al. 2012

Modern Level

180-200 masl (5000 years BP)

> 300 masl (7000 years BP)
Schinus Polygamus (Molle)
Spectral Signature
Slow growing spiny shrub

They can last 500 years

Can became a 1-5 m tall bush

It can cover a surface between 6 and 8 m², whereas two plants together cover almost 20 m².

The berries are dull and greyish-purple to black and have a peppery taste. Different parts of the plant have medicinal uses.
Bushes as shelters

Etnographic information from North America and Africa
Pueyrredón- Posadas – Salitroso Lake
Image: SPOT4 681-446
Merge:
Pancromatic image 2 m x Pixel / Multispectral 10m x Pixel
Sierra Colorada

Spectral signature
Steppe and sand dunes
Molle (*Schinus polygamus*)

Sand dunes are ideal colonizing spaces for the plant as they retain water that the long roots of the molle (up to 3 m long) are able to obtain.
Remote detection
Hunting blinds (Parapetos)
Hunting blinds

Etnographic information from Kalahari (Botswana)
HUNTING TECHNIQUES

- Ethology of guanaco
- Disponibility of water
- Direction of wind
- Topography
Parapetos sector A

15 0
30 m
Parapetos sector B
Parapetos sector C
Geographic Information System
ASE Model Application to settlement Patterns – Section of Poster

Spatial Analysis for the Study of Environmental Settlement Patterns: The Archaeological Sites of the Santa Cruz County

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Thanks very much for your attention