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Using Geographic Information Systems to Increment the Knowledge of Cultural Landscapes

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Cultural Landscape

„Geographical area that is uniquely representing the combined work of nature and of man.“

*World Heritage Committee,
UNESCO*

A specific case

Geographical area showing the presence of

- Archaeological sites*
- Historical evidences*
- Other social remains*

A multidisciplinary approach

- *Physics*
- *Chemistry*
- *Geology*
- *Photogrammetry*
- *Remote sensing*
- *Information Technology*
- *(Logistics)*

Remote sensing

- *Aerial surveys*
- *Satellite imagery*
- *Free imagery on the web*
- *Image processing*

Remote sensing techniques

- *Aerial multispectral and hyperspectral imagery*
- *LiDaR - Light Detection and Ranging*
- *SAR – Synthetic Aperture Radar*
- *GPR – Ground Penetrating Laser*
- *Magnetic and electrical tomography*

[Lasaponara - Masini , 2008]

GIS

System (HW / SW) used for

- *Storage / Retrieval*
- *Mapping*
- *Analysis (possibly interactive)*
- *Editing*

of geographic data

Sources for imagery

- *QuickBird (DigitalGlobe)*
- *IKONOS (GeoEye)*
- *SPOT (CNES)*
- *EarthSat (MDA)*

Google Earth

- *Free (basic version)*
- *3D browser*
- *All sources*
- *Resolution: 15m/px → 2.5m/px*
- *Layers*
- *KML (XML)*

Sample applications

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The Philippi site

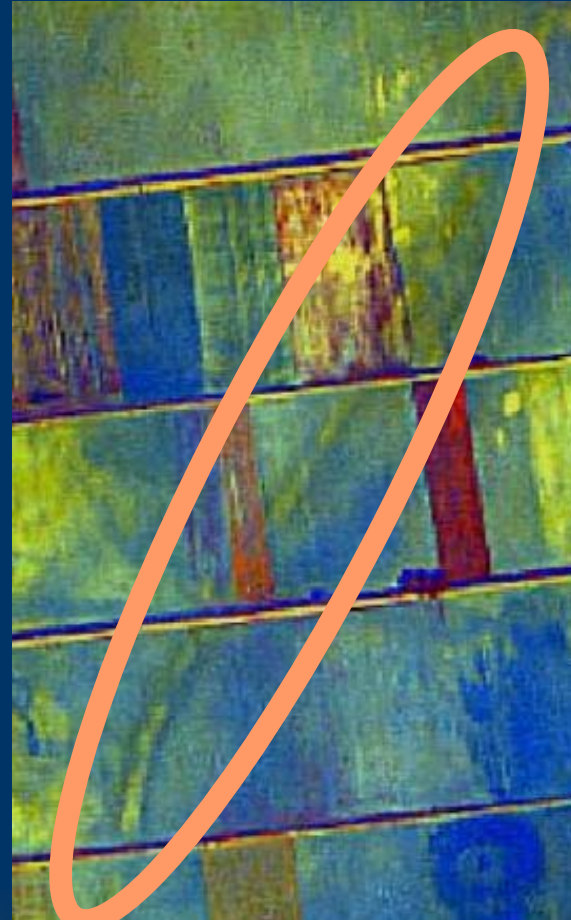
- *Quickbird imagery*
- *Resolution = 0.70m*
- *Panchromatic + multispectral fusion*
- *Buried remains evidences found*

[Georgoula et al. , 2004]

The Philippi site



Orthomosaic



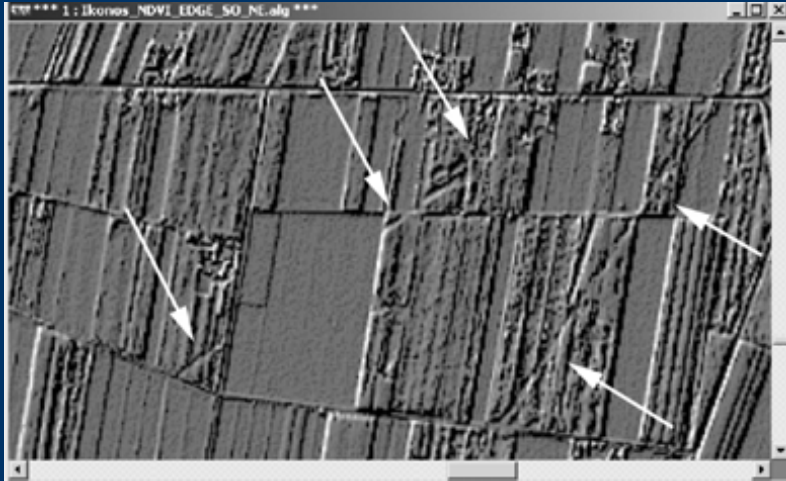
FCC image

Tuscany landscape

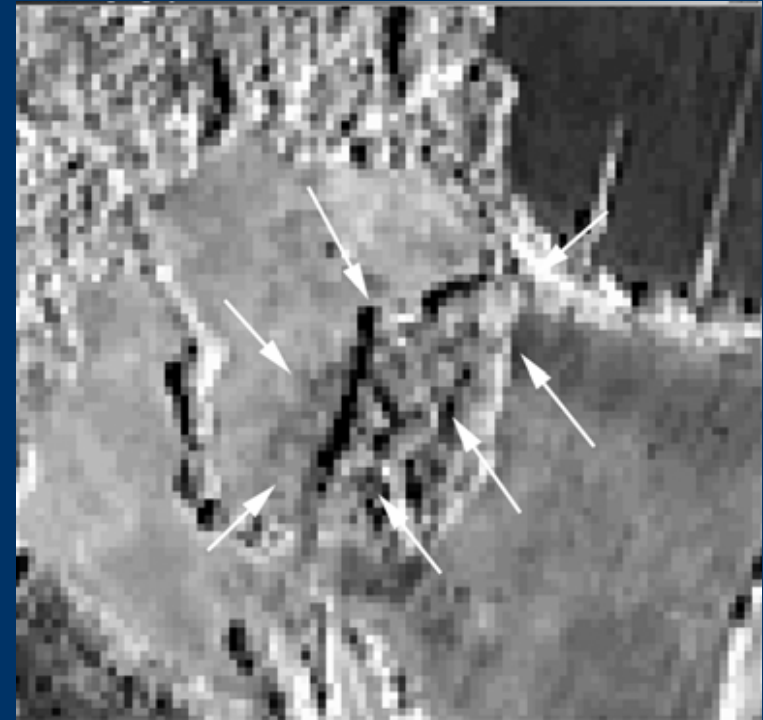
- *Ikonos imagery*
- *Resolution = 4m*
- *R, G, B, nIR*
- *Survey of large areas*

[Campana , 2002]

Tuscany landscape



*NDVI and edge enhancement
of zones showing linear
features*



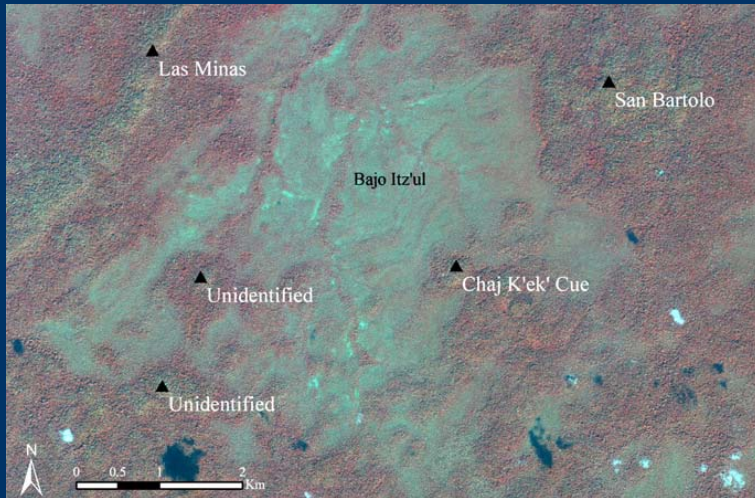
*Early medieval Monastery of
San Pietro ad Asso*

Maya lowlands - Guatemala

- *Ikonos imagery*
- *Resolution = 1m*
- *R, G, B, nIR*
- *Pansharpening, PCT, FCC*

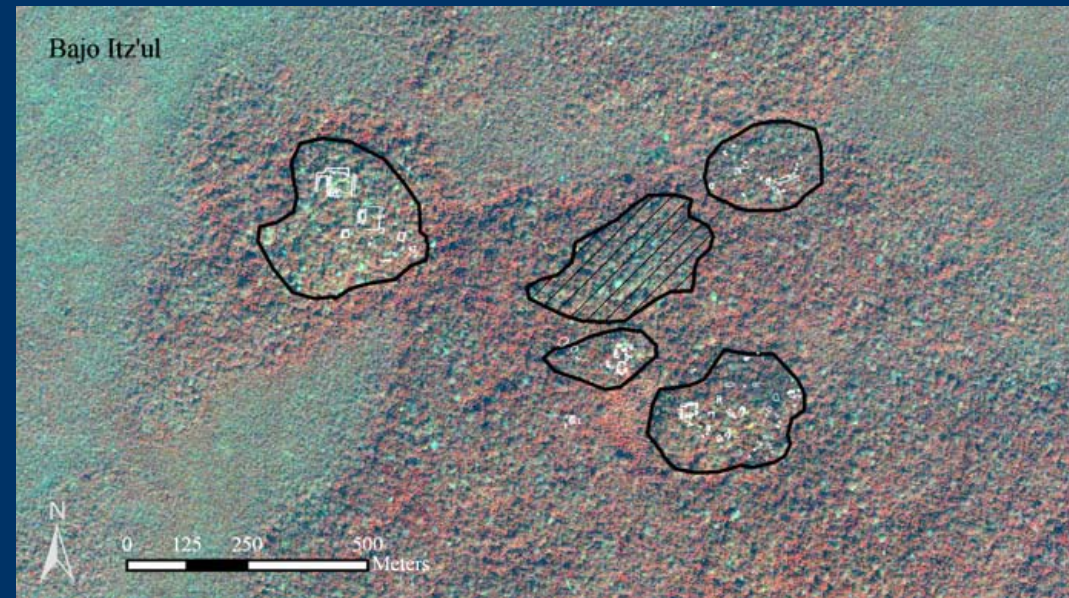
[Garrison et al., 2008]

Maya lowlands - Guatemala



*San Bartolo region
(RGB/4, 3, 1)*

*Chaj K'ek' Cue settlements
(same FCC)*



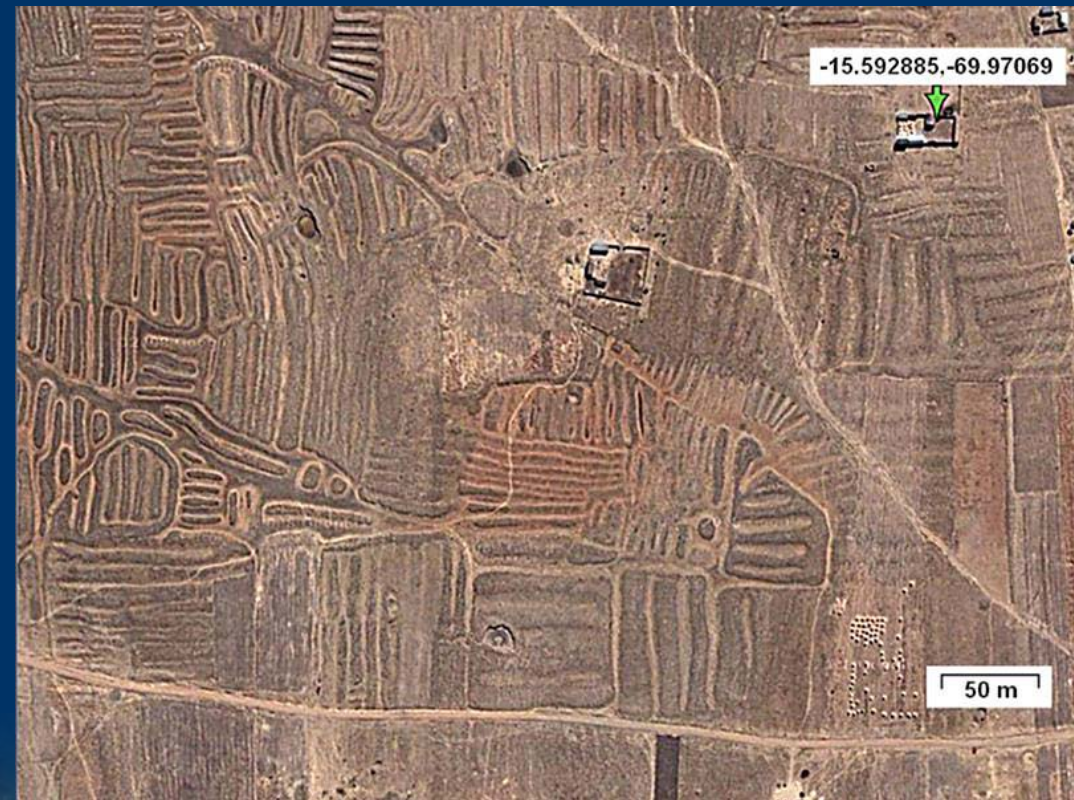
Titicaca geoglyphs

- *Google imagery*
- *Visible range*
- *Custom wavelet filter*

[Sparavigna, 2010]

Titicaca geoglyphs (Peru)

Raised fields earthworks



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„Desert Kytes“ and stone circles

– Syrian Desert

- Google imagery*
- Visible range*
- Custom wavelet filter*

[Sparavigna, 2011]

„Desert Kytes“ and stone circles – Syrian Desert



„Desert Kyte“

Stone circles

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Final notes

- *Cheap tools*
- *Good accuracy*
- *Wide dissemination*
- *Possible threat (looting, pothunters)*
- *Highlighting and documenting looting*

[Conroy et al., 2008]

[Contreras and Brodie, 2010]

Images adapted from

[Campana, 2002] Campana S., *Ikonos-2 multispectral satellite imagery to the study of archaeological landscapes: an integrated multi-sensor approach in combination with “traditional” methods*, in *The Digital Heritage of Archaeology, CAA 2002, Computer Applications and Quantitative Methods in Archaeology, Proceedings of the XXXth Conference, Heraklion, Crete, 2002, 219-225.*

[Garrison et al., 2008] Garrison T.G., Houston S.D., Golden C., Inomata T., Nelson Z., Munson J., *Evaluating the use of IKONOS satellite imagery in lowland Maya settlement archaeology*, *Journal of Archaeological Science*, 35, 2008, 2770–2777.

[Georgoula et al., 2004] Georgoula O., Kaimaris D., Tsakiri M., Patias P., *From the aerial photo to high-resolution satellite image: tools for the archaeological research*, *Proceedings of the XXth ISPRS Congress, Istanbul, Turkey, 2004.*

[Lasaponara and Masini, 2008] Lasaponara R., Masini N., *Advances on remote sensing for archaeology and cultural heritage management*, in Lasaponara R. and Masini N. (eds) *Proceedings of the 1st International EARSeL Workshop CNR, Rome. 2008.*

[Sparavigna, 2010] Sparavigna A.C., *The geoglyphs of Titicaca*, *Archaeogate*, October 13, 2010, <http://www.archaeogate.org/classica/article/1305/1/>

[Sparavigna, 2011] Sparavigna A.C., *Stone structures in the Syrian Desert*, *Archaeogate*, July 14, 2011, http://www.archaeogate.org/vicino_oriente/article/1445/1/

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