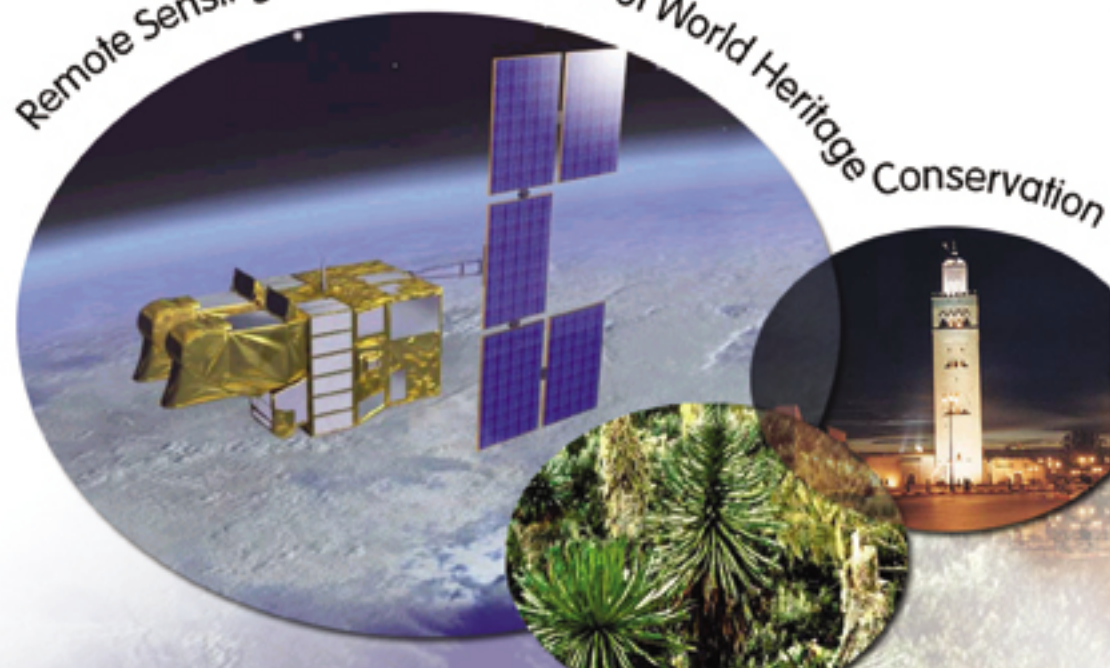


# Remote Sensing and GIS in support of World Heritage Conservation



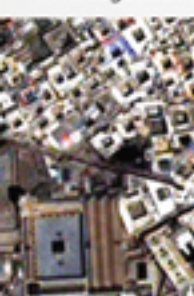
# Introduction



To address the increasing number of threats numerous natural and cultural sites of exceptional value for humanity are facing, UNESCO in 1972 adopted the *Convention Concerning the Protection of the World Heritage*. The same year, the launch of the very first civilian remote sensing satellite marked the beginning of a technological quest towards an ever better understanding and more painstakingly monitoring of the evolution of our planet. This project aims to demonstrate the usability of remote sensing for cartography, land cover change studies and support to World Heritage site management and conservation, using the example of 5 particular World Heritage sites. The selected sites represent a wide variety of natural or cultural/historical characteristics: tropical forest, savanna and coastal area for the natural sites, a European historic center and an Islamic city for the cultural sites.

## Medina of Marrakesh (Morocco)

Marrakesh, the major city of central Morocco, is a fascinating and very lively city just on the border of the desert. The Medina contains an impressive number of remarkable examples of Islamic architecture: the walls built in 1126-1127, the Kutubiya Mosque with its unsurpassed minaret, the Ben Youssef madrasa, Saadian tombs, palaces and characteristic old houses. The Medina was designated as World Heritage site in 1985. Satellite imagery is useful to assess changes in the urban fabric as well as the growth of the city. The comparison of a Corona reconnaissance photograph acquired in 1965 and a very high resolution QuickBird image acquired in 2002 highlights these changes and assesses the threats they represent.



## Cultural World Heritage sites



## Virunga National Park (Democratic Republic of the Congo)

The Virunga National Park is the oldest and most famous park in the Democratic Republic of the Congo. It offers an incomparable diversity of habitats and hosts one of the remaining populations of mountain gorillas. The park was inscribed on the World Heritage List in 1979. Satellite images illustrate clearly the abrupt change from dense to sparse vegetation. Hence, they allow detecting and mapping the boundary of the park.

Satellite data are also useful to monitor volcanic eruptions or to assess deforestation. The war and the subsequent massive influx of refugees from Rwanda led to massive deforestation and poaching at the site and threatens the habitats for endangered species. For these reasons the park was added to the list of World Heritage in Danger.



## Natural World Heritage Sites



## Historic Centre of Warsaw (Poland)

Warsaw is the capital and largest city of Poland. Its 18th-century historic centre was destroyed for over 85 percent during the second World War. After the war, a five-year reconstruction campaign resulted in today's meticulous reproduction of the Royal Castle, churches, palaces and the market place, the symbols of Polish culture. This exceptional example of a total reconstruction of a span of history from the 13th to the 20th century was inscribed as a World Heritage site in 1980. Through comparison of aerial photographs taken in 1935, 1947 and 1990, we can assess this reconstruction process. Very high resolution satellite imagery can now be used to survey the evolution (urbanization, tourism infrastructure development) and the preservation of this part of the city.



## Niokolo-Koba National Park (Senegal)

Niokolo-Koba National Park, situated in southeastern Senegal, was inscribed in 1981 as a World Heritage Site. The park is also part of a UNESCO Man and Biosphere Reserve. The park holds a typical savanna ecosystem with gallery forests along the Gambia river, hosting a remarkable diversity of mammals. Satellite images, combined with field observations allow monitoring the status and dynamics of different vegetation types and animal populations as well as assessing the impact of human activities such as tourism on the park environment. Bush fires, occurring frequently in savanna areas, can be detected easily on the images, which are also useful to assess the impact of the burning on the fauna and flora, and to monitor the vegetation recovery.

# Contact

Project financed by the Belgian federal science policy <http://www.belspo.be/>

In the light of the 30th anniversary of the UNESCO World Heritage Convention (<http://whc.unesco.org/>) and of civilian remote sensing satellites and in the framework of the conference Space Application for Heritage Conservation co-sponsored by UNESCO and ESA (November 2002)

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## Ha Long Bay (Vietnam)

Ha Long Bay, located in the North of Vietnam forms a spectacular seascape of hundreds of islands and of limestone pillars. The exceptional aesthetic values of this site are complimented by its great biological interest. It was inscribed as a World Heritage Site in 1994 and 2000. Many human activities threaten this site: rapidly increasing built-up areas in the buffer zone of the protected area, tourism expansion with construction of dykes to link some islands, and coal industry as large quantities of coal are piled up on the shore. Satellite imagery is used to monitor changes, to follow the evolution of the threats and to shape sustainable management options.

