EXELIS

Visual Information Solutions

Case Study:
ENVI helps The Green Belt Movement analyse vital Kenyan ecosystem

CUSTOMER CHALLENGE

The Aberdares Forest is the source of drinking water for millions of Kenyans, including the population of Nairobi; however deforestation and destruction of the critical watersheds has negatively impacted these vital water resources. To contribute towards addressing this problem, the Green Belt Movement (GBM) came up with a plan to plant two million indigenous trees on 2,000 hectares of degraded forestland in Aberdares to help restore the water catchments. This initiative required GBM to first analyse the situation on the ground in order to determine the suitable mitigation measures.

SOLUTION ACHIEVED

ENVI image analysis tools were used, in conjunction with ArcGIS® for Desktop, to extract and fuse information from LANDSAT, GeoEye and IKONOS to determine the different land use classifications and habitats. In addition, ENVI's interoperability with ArcGIS® allowed the easy movement of land use and land cover information from geospatial imagery into ArcGIS® for additional analysis.

BACKGROUND

The Green Belt Movement (GBM) was founded in 1977 by Professor Wangari Maathai[1] in response to the needs of rural Kenyan women who reported their streams were drying up, food supplies were less secure, and firewood was becoming scarce. GBM encouraged the women to work together to grow seedlings and plant trees to bind the soil, provide food and firewood and restore critical water catchments.

Despite its critical role in the economy and livelihoods of the communities in Kenya, the Aberdares forest faced enormous deforestation and degradation in around 1990 – 2005 as a result of illegal logging, charcoal burning and cattle grazing and cultivation. The Aberdare Range is located in central Kenya, on the eastern edge of the Rift Valley. The forest belt of the Aberdare Range covers over 250,000 hectares and comprises a number of forest reserves, including Aberdare, Kikuyu Escarpment, Kijabe Hill, Kipipiri and Nyamweru, as well as some forest areas in the Aberdare National Park. The critical watersheds in Aberdares were rapidly losing their capacity to deliver the much-needed ecosystem services by the communities which included providing water. In addition, due to deforestation, there were high incidences of riverbank collapse, flash floods, and topsoil erosion downstreams. This was largely due to unsustainable farming methods, removal of streamside vegetation buffers, illegal logging and poor management of forest plantations. The forest's rich biodiversity and its ability to provide ecosystem services were rapidly diminishing as a result of these unsustainable activities.

The Aberdare Forest is the source of drinking water for millions of Kenyans, including the population of Nairobi, but the change of water volumes was having a direct and adverse effect on the population. In response, GBM initiated The Restoration of Aberdare Ecosystem Project with the goal of planting two million indigenous trees on 2,000 hectares of degraded forestland.

The specific objectives of this project were to[3]:

- Rehabilitate degraded areas to maintain hydrology, the soil, and forest biodiversity
- Support and diversify, in a sustainable manner, sources of income and promote an alternative and profitable use of the forest
- Promote protection initiatives for the forest by civil society
- Create conditions for replication of a pilot project for total rehabilitation of forest basin.

The project also anticipated benefiting 3,000 impoverished households through training, income generating activities and improved availability of water and fodder, with 90 per cent of the project beneficiaries being women[2].

USING ENVI TO SEE THE FOREST AND THE TREES

ENVI image analysis tools, in conjunction with ArcGIS® for Desktop, were used to extract land cover information and quantify change in an efficient and cost-effective way. GBM's staff used ENVI to extract and fuse information from LANDSAT, GeoEye and IKONOS to determine the different land use classifications and habitats. In addition, ENVI's interoperability with ArcGIS® enabled him to easily move land use, land cover and other information from geospatial imagery into ArcGIS® for additional analysis.

"We were able to produce deforestation maps at a much finer spatial scale that provided a reflection of the reality on the ground," said Joseph Munyao, GIS Analyst at GBM. "I am confident that the information gathered in this project, such as the various land cover information and state of the forest, will be extremely important in the implementation of our future community-based watershed restoration programs."

Land cover change maps created in ENVI provided up-to-date, accurate information that helped project implementation managers to determine:

- The potential watershed restoration activities that would support the protection and conservation of vital habitats in the Aberdare ecosystem
- The approximate area that required immediate restoration
- The resources that would be required to effectively restore the ecosystem.

Manually detecting change by visually comparing images, or analysing images pixel by pixel, can be labour intensive and time consuming, as well as leading to mis-identifications and other inadvertent errors. ENVI provides an automated workflow for detecting change that guides you through identifying the type and extent of changes that have taken place.

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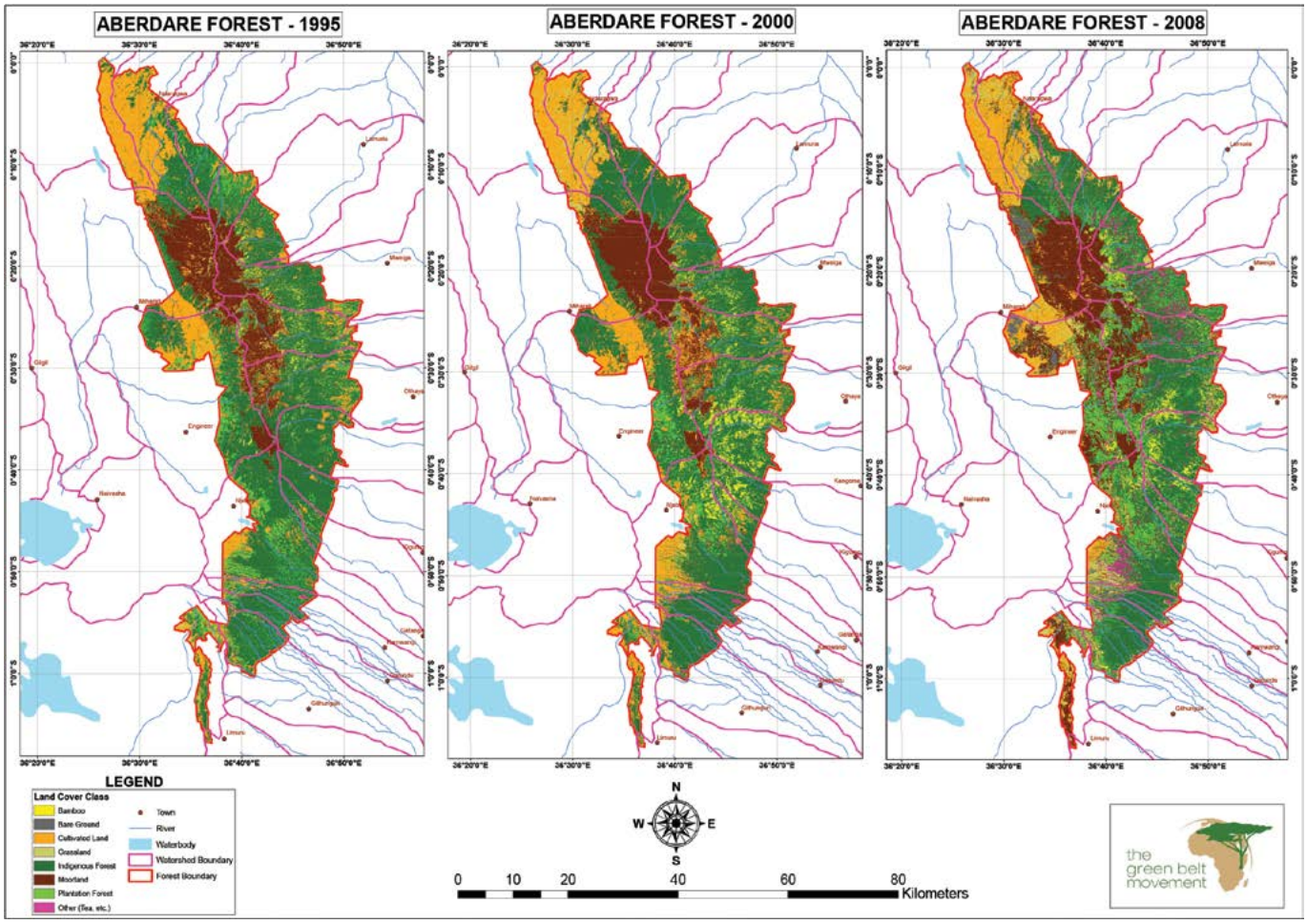

Land cover and change maps were produced quantifying impacted areas and directing reforestation efforts.

ENVI includes intuitive dialog boxes that walk you step-by-step through the workflow and can be used with raw images or images that have been classified by the various types of land cover they contain. The workflow is powerful as well as flexible, giving you the option of using data from different types of sensors taken on different days, or at various times during a single day. Final results are easy to obtain, and can be used to create reports that include output analytics. It allows for image overlay with pertinent results in order to accurately highlight the extent of the change in the area.

Image analysis is just part of the overall geospatial workflow. ENVI image analysis software seamlessly integrates with the existing GIS tools to streamline the overall process. ENVI makes it easy for users to customise features and functionality, update GIS with valuable information from imagery, and collaborate and share results with others. With ENVI fully integrated with ArcGIS®, GBM was able to combine information from imagery with their field data for increased efficiencies and improved decision making.

Results generated in ENVI facilitated the successful implementation of the Restoration of Aberdare Ecosystem project. USAID[2] cites achievements of the Restoration of Aberdare Ecosystem Project as:

- 1,700 hectares of degraded forest areas rehabilitated by planting two million trees along rivers, water-catchment areas, public land and on private farms. The rehabilitated areas show improved conditions: some 60 formerly dried-up streams have begun to flow again
- The project is achieving targets at minimal cost and has integrated agroforestry and food crops, increasing the resiliency of beneficiary households
- The community has earned over US$80,000 in revenue from selling tree seedlings
- Monitoring of trees with GIS technology as well as close surveillance by youth ‘green rangers’ show significant tree growth and improved ground vegetation
- The project has strengthened community forest associations, enabling them to co-manage forest areas with the Kenya Forest Service.

ENVI

To find out more about ENVI visit www.exelisvis.eu

REFERENCES AND NOTES

1 Professor Wangari Maathai (1940-2011) was the founder of the Green Belt Movement and in 2004 became the first African woman to receive the Nobel Peace Prize for "her contribution to sustainable development, democracy and peace"

2 USAID "The Green Belt Movement in Kenya"

3 Agence Française de Développement (AFD)

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