UTILIZING SATELLITE IMAGERIES TO PROMOTE TOURISM OBJECTS OF NORTH SULAWESI PROVINCE, INDONESIA

EKA WATI S., HASTUTI T.  
National Coordinating Agency for Surveys and Mapping (Bakosurtanal), CIBINONG, BOGOR, INDONESIA

ABSTRACT
Tourism is basically defined as people’s activities to visit a certain interesting place. This activity is commonly conducted in spare time or holiday season. The attractive place gives some advantages to visitors, particularly in relation with relaxation purpose. Besides, tourism activities act as a central and important sector influencing the development of a certain area and total of local income. In this case, tourism activities significantly affect the increasing of supporting facilities, for instance food stall, cottage, transportation line, etc. Based on these reasons, local government tries to promote the existing tourism objects in order to increase both local and national income.

North Sulawesi Province is one of tourism destinations in Indonesia. There are many beautiful places located at nine regencies and four cities under administrative authority of North Sulawesi Province. More than 100 tourism objects exist and offer unforgettable scenery. The objects can be differentiated into natural, cultural, man-made, maritime, shopping, historical and religious objects. In terms of visitors, the number of domestic and foreign tourists in this province is also quite high. From January to December 2009, the number of foreign tourist tends to increase. Therefore, this condition requires the improvement of promotion actions to attract the national and international visitors.

Nowadays, the tourism promotion efforts are commonly represented by creating tourism book, booklet, leaflet, and tourism's website. The contents are description of tourism object, map, and photo. The description consists of some information related to location, history, and supporting facilities. That information can be enhanced by involving Remote Sensing (RS) application. RS itself is utilized to expose view of tourism object from space through satellite imageries. In this paper, RS application is used to process several satellite imageries (Landsat, Quickbird, Ikonos) and Shuttle Radar Topographic Mission (SRTM). Landsat images are processed to obtain four combination bands which are 321, 432, 452, and 542 whereas Quickbird, Ikonos, and SRTM images are presented in natural color. Those images are exploited to visualize the present tourism objects in this province whether in terms of absolute and relative location and distribution as well. All processed information is presented through Tourism Atlas from Space of North Sulawesi Province. The similar method is also applied to develop tourism atlas from space for other provinces in Indonesia in order to support promotion of Indonesian’s tourism.

Keywords: Satellite Imageries, Remote Sensing, Tourism, North Sulawesi Province

INTRODUCTION
Tourism is a human activity in visiting a certain place out of their origin during a period of time (WTO, 1991 in Williams, 1998). Tourism itself is one of important aspects in human life since it is used to release exhaustibility due to daily routine. Beautiful and amazing places attract people to visit and to enjoy their leisure time so that they can forget the pressure of work and study for a while. Tourism not only gives some advantages to the visitors but also to local government where the tourism objects exist. Tourism activity will influence the regional development related to the number of domestic and foreign visitors who go to those interesting places.

Indonesia has many aspects that support tourism’s sector. As an archipelago country located in the equator line, Indonesia has a great opportunity to fascinate a lot of visitors to take pleasure in this country. Tropical climate with natural biodiversity, various ethnics with unique culture and tradition, and hospitality offers unforgettable vacation and holiday in Indonesia. Based on this situation, several kinds of tourism objects which can be chosen are natural object, cultural, maritime, special interest, etc.

One of tourism destinations in Indonesia is North Sulawesi Province. In 2008, the number of international visitors in this area increased 36.34% compared with previous year (Center of Statistical Bureau/BPS, 2010). Generally, the tourism objects in this province are focused on beautiful beach and coastal scenery combined with wonderful coral reef. The most famous tourism object in this area is Bunaken National Park. Nevertheless, there are many objects which can be found around this location, for instance fortress, museum, cave, waterfall, and natural preserve.
The mentioned tourism objects are currently promoted through tourism book and website displaying photo and describing the location of the object and their supporting facilities. Remote Sensing (RS) and Geographic Information System (GIS) are not utilized yet. In fact, this technology is useful to give comprehensive information of tourism object by using satellite imageries and map. Thereby, this paper will explain the use of satellite imageries to assist the tourism promotion action in this province.

STUDY AREA
North Sulawesi Province is geographically located between 00030’ – 04030’ N and 123000’ – 127000’ E. The area is bordered by Philippines in the north, North Maluku Province in the east, Tomini Bay in the south, and Gorontalo Province in the west. The width area of this province is 15,277.16 Km2 and it is physically dominated by mountain and hills, for example Mount Klabat, Mount Lokon, and Mount Soputan. Besides, there are two famous lakes in this province, i.e. Tondano Lake (4,278 Ha) in Minahasa Regency and Mooat Lake (617 Ha) in Bolaang Mongondow Regency.

In terms of tourism, the number of tourist visiting North Sulawesi Province is quite high. In 2009, there were 29,715 people who went to North Sulawesi through Sam Ratulangi Airport. This number increased compared with the number of visitor in 2008 which was 21,795 people (BPS, 2010). Figure 1 shows that the number of visitors in 2009 is generally higher than in 2008 and 2010 for the same month. Thereby, tourism sector in this province must be improved in order to attract more guests to visit North Sulawesi Province.

![Figure 1. Graph of the Number of Visitors in North Sulawesi Province in 2008, 2009, and 2010 (BPS, 2010)](image)

METHOD
Tourism Atlas from Space of North Sulawesi Province was developed by harnessing several data. Those data were satellite imageries, maps, photos, and description of tourism object. The satellite imageries used were Landsat ETM+ 2000/2002/2003, Ikonos 2004, Quickbird 2003/2004/2005/2006, and SRTM. On the other hand, the map was taken from topographic map scale 1:250,000 produced by National Coordinating Agency for Surveys and Mapping (Bakosurtanal). In addition, photos and description representing the situation of tourism object were collected through field survey.

Field survey is a preliminary activity in this project. The survey was intended to gather accurate and reliable information about tourism object. Prior to field survey, secondary data (booklet, leaflet, and other tourism object information) were collected in a related institution which is cultural and tourism department. Based on the obtained data, field survey was subsequently done to get recent situation in each tourism object.

After field survey, the project was continued with data processing. In this stage, the collected satellite imageries and maps were processed by using Remote Sensing and Geographic Information System. On the other hand, photos and description of tourism objects were managed by graphical design software and Microsoft office software respectively.

The satellite image processing stage was conducted by utilizing Er Mapper and Arcview Image Analyst. The sequence stages done in Er Mapper are:

a. Developed composite images (321, 452, 432, and 542) of Landsat ETM 7+ to display particular features. This process was intended to show up certain tourism objects. As an example, lake is displayed by using...
composite image of 542 or 452 in which lake will be represented by blue color. On the other side, Quickbird and Ikonos image was generated in natural color.

b. Enhanced the composite images to improve the quality of the images. The image enhancement was done by using image enhancement tool.

The next activities were related to simple image analysis carried out by using Arcview Image Analyst as below:

a. Plotted the location of tourism objects on the composite images. In this case, each tourism object was put over the images according to its geographic coordinate.

b. Layout the images to achieve map of satellite images. This map was created for each object.

The following stage was photo enhancement performed to improve the photo quality of tourism objects. Photo enhancement was done by adjusting the brightness, contrast, and adding a certain effect to the photos. Apart from that, the description of each tourism object was also made in order to give brief information about location, route to reach the location, entrance fee, and supporting facilities. The description was created in two languages, i.e. Indonesian and English so the atlas can be used not only by domestic tourist but also international visitor. The last activity was called layout done by employing graphical design software which is Freehand. This session combined all processed data and arranged them attractively.

During the process to produce tourism atlas, quality control was executed as well. This is the important activity since it is used to minimize the mistakes. The quality control was done several times. In this project, quality control was conducted after processing data and layout stage. The processed data must be controlled to make sure that there was no improper result. Apart from that, data which have been arranged into a certain layout should be checked in order to avoid monotonous style.

The atlas was developed by involving some people from several related institutions. Those are National Institute of Aeronautics and Space (LAPAN), Geography Department of University of Indonesia, Ministry of Cultural and Tourism of the Republic of Indonesia, and Daily Newspaper of Republika. Their ideas, experiences, and skills are needed as one of significant inputs to produce a good product.

The content of atlas is arranged by accommodating several aspects, as follow:

a. The brief explanation in relation with remote sensing technology and interpretation key of Landsat image is included since the information in this atlas is dominated by the utilization of satellite images, especially Landsat.

b. The tourism object in each regency/city is arranged regarding to alphabetical order so that the reader can be easier to find a certain object in the atlas. In this case, the order was regarding to Indonesian language. Besides, the profile of each regency/city is also added to give short information related to capital, width area, geographical position, and administrative boundaries.

c. The map in this atlas used various symbols representing some features, for instance the classification of administrative boundaries, road class, elevation class, tourism object symbol, etc. Therefore, a special page explaining the symbols was provided.

RESULT

North Sulawesi Province has many tourism objects. There are 524 tourism objects located at nine regencies and four cities in this province (Transportation, Communication, and Informatics Department of North Sulawesi Province, 2010). Those objects can be classified into natural, cultural, historical, and special interest object. Natural objects consist of beach, agro tourism, waterfall, hot spring water, natural preserve, cave, mount, plantation, and national park. Cultural objects are commonly related to traditional ceremony whereas historical objects comprise old building, grave, museum, monument, and statue. Special interest objects in this area are golf yard, recreational park, and zoo.

Not all of tourism objects are published in Tourism Atlas from Space of North Sulawesi Province. It is related to data availability obtained during field survey in 2006. There are 91 prominent tourism objects which are included in the atlas. Then, there is no tourism object in North Bolaang Mongondow Regency showed in this book since field survey and secondary data did not find any location where had been developed as recreational spot. The list of those tourism objects can be seen in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Regency/City</th>
<th>Tourism Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bolaang Mongondow</td>
<td>Mooat Lake, Lolan Beach, Molosing Beach, White Sand Beach of Tiga Island, National Park of Bogani Nani Wartabone</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>Attractions</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>Sangihe Islands</td>
<td>Kadadima Waterfall, Nguralawo Waterfall, Under Sea Volcano of Mahangetang, Coral Beach of Sarenggih Lebbo, Kalasuge Beach, Leppe Beach, Maselihe Beach, Pananualeng Beach, Ria Kolongan Beha Beach, The Peak of Lenganeng Village, Dutch Omission House, Recreational Park of Manente</td>
</tr>
<tr>
<td>3</td>
<td>Sitaro Islands</td>
<td>Bulangan Hot Spring Water and Beach, The Old Church and Missionary Grave of Paul Keling, Karangetang Volcano, Kisihang Beach, Lanage Beach, Hot Bathing Place of Lehi Beach, Bathing Place of Akasio, Nutmeg Plantation of Siau Island, Tagulandang Zallaca Plantation</td>
</tr>
<tr>
<td>4</td>
<td>Talaud Islands</td>
<td>Orchid of Mount Piapi, Arangkaa Cave, Totombatu Cave, Wetta Cave, Widduanne Cave, The Grave of King Passae Tingginehe, Melonguane Beach, White Sand Beach of Bitunuris, White Sand Beach of Sara Island, Tambioe Beach, Teluk Beo Beach, Moronge Ancient Statue, Rangka Batu Ular, Mane’e: The Tourism Object of Catching Fish</td>
</tr>
<tr>
<td>5</td>
<td>Minahasa</td>
<td>Kali Waterfall, Kasih Kanonang Hill, Watu Pinawetengan Natural Preserve, Linau Lake, Tondano Lake, Japan Cave, The Grave of Kiai Mojo, Tasik Ria Beach, Korengreng Statue, Hot Bathing Place of Ranpaso, Puri Harsatara, The Grave of Imam Bonjol</td>
</tr>
<tr>
<td>6</td>
<td>South Minahasa</td>
<td>Modoinding Agro Tourism, Batu Dinding, Doa Pinaling Hill, Alar Beach, Blangko Beach, Moinit Beach</td>
</tr>
<tr>
<td>7</td>
<td>South East Minahasa</td>
<td>Bentenan Beach</td>
</tr>
<tr>
<td>8</td>
<td>North Minahasa</td>
<td>Kima Bajo Resort, Batu Nona Beach, Buha Beach, Gangga Beach, Likupang Beach, Kema Beach, Pulisan Beach, Hot Bathing Place of Tumetenden, Archaeological Park of Waruga Sawangan</td>
</tr>
<tr>
<td>9</td>
<td>Bitung City</td>
<td>Kumersot Waterfall, Mount Batu Angus, Mount Dua Saudara, The Natural Forest of Danowudu, Nae Mundung Zoo, Sen Bo Kiong Temple, Japanese Monument, Batu Puthi Beach, Kungkungan Beach, Tangkoko National Park</td>
</tr>
<tr>
<td>10</td>
<td>Kotamubago City</td>
<td>Natural Preserve of Mount Ambang</td>
</tr>
<tr>
<td>11</td>
<td>Manado City</td>
<td>Batu Meja, Blue Banter Marina, Mount Tumpa, Ban Hin Kiong Temple, State Museum of North Sulawesi Province, Masyarakat Beach, Bunaken National Park, The Shrine of Tiong Tan Lie Goan Swee, Wenang Golf</td>
</tr>
<tr>
<td>12</td>
<td>Tomohon City</td>
<td>Rurukan Agro Tourism, Tumimperas Waterfall, Mount Lokon, Mount Mahawu, Industry of Woloan Traditional House (Podium House)</td>
</tr>
</tbody>
</table>

Regarding to the consideration discussed in the previous chapter, cover and some pages describing brief explanation of remote sensing, interpretation key, the sequence of tourism object based on alphabetic, regency/city profile, and map legend can be seen in Figure 2 – 7 respectively.
Sekilas Penginderaan Jauh
Remote Sensing Overview

Remote sensing can be defined as "observation of objects from a distance" and can be applied to any situation in which information, concerning some aspect of objects, areas, or phenomena through sensing data that is acquired in remote distance from the objects, area, or phenomena.

The main source of energy electromagnetic in nature is the Sun. Energy electromagnetic interacts with objects in the earth surface and reflects energy to sensor. In active remote sensing, such as in radar systems, artificial energy is emitted to the objects in the earth surface and energy reflected from the objects is received by the sensor.

Sensor in remote sensing could be a camera, spectrometric scanner, or radar. Space sensor is carried out by satellite and aerial sensor is carried out by plane or balloon. Picture generated from these sensors is called an image or remotely sensed imagery.

Atlas of North Sulawesi from Space is not different from previous atlas series of Atlas from Space. It presents some pictures of tourism objects in North Sulawesi Province through the images of Quickbird, Ikonos, and Landsat ETM+. Besides that, there are also used SRTM (Shuttle Radar Topography Mission) and aerial photos to enrich atlas appearance. The images of Quickbird, Ikonos SRTM, and aerial photos are presented according to the original color while image of Landsat 7 ETM+ is presented in a few band combinations.
Figure 4. Interpretation Key

Figure 5. Contents
In terms of the appearance of tourism objects, every object in this atlas is equipped by map of satellite image, map, photos, and bilingual description. SRTM is attached at some objects as well. For example, as
seen in the Figure 8, Maselihe Beach is presented through photo from the upper location, SRTM, and map of Quickbird image. The description explains the scenery of the beach and how to reach this location.

Figure 8. Maselihe Beach
For several objects where are close one to another, the objects are shown in the one map. The position of Maselihe Beach in the map is gathered by the other objects (Kalasuge Beach, Ria Kolongan Beha Beach, Leppe Beach, and Pananualeng Beach) as illustrated in Figure 9.
Figure 9. Map Depicting Location of Maselihe Beach

The other example is portrayed in Figure 10 and 11. Tondano Lake, one of the tourism objects in Minahasa Regency is described by using photo, map, map of Landsat image with 542-band composite, and SRTM. This object is also showed by using Ikonos image covering part of Tondano Lake.
National Park of Bunaken, the most famous tourism object in this province gets the special part in this atlas. If another tourism object is generally presented on one up to three pages, this object portrayed on four pages. Several photos and Ikonos image representing the whole Bunaken Island (see Figure 12-13).
CONCLUSION

Taman Nasional Bunaken adalah salah satu keunikan alam di Indonesia yang sangat menarik untuk dikunjungi. Kebudayaan dan keanekaragaman hayati di sini membuatnya menjadi tujuan wisata yang luar biasa. Namun, penting untuk diingat bahwa pertahanan dan pengyamlakan keanekaragaman hayati adalah tanggung jawab bersama seluruh masyarakat.

Kota Manado

**Figure 12. Bunaken National Park**

**Figure 13. Map of Ikonos Image of Bunaken Island**

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Bunaken National Park is established as an National Park by the government and approved by the President of the Republic of Indonesia on 24 December 1991. This national park is a conservation area which is divided into two separated parts, i.e. (a) the north part consists of five islands: Bunaken, Manado Tua, Manado Bua, and Manado, and the south area consists of the islands of Kabui, Menjangan, and Tomia. The national park is a conservation area which has high variety of vegetation and marine life. There are three kinds of vegetation types: tropical forests, savannah, and mangrove forest. These are not only tropical forests in Manado Tua Island but also in other places in the area.

**If you decide to go to Manado, don’t forget to visit the National Park of Bunaken. The existence of Manado City cannot be separated from this park.**

Manado is the capital city of North Sulawesi Province, Indonesia. It is a popular tourist destination due to its beautiful beaches, crystal-clear waters, and rich marine life. The city is also known for its vibrant culture and traditional arts and crafts.

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**Figure 13. Map of Ikonos Image of Bunaken Island**

Many visitors usually visit Bunaken National Park to see coral reefs. The type of coral reef present in Bunaken National Park is generally fringing reef. Part of the coral reef at Manado Tua Island is barrier reef type. There are four of patch reefs at Bunaken-Wuruksempu area.

So, prepare yourself to make unforgettable memory of Bunaken National Park. We can reach the location easily by motorboat from Manado Harbor. You need about 30 minutes to reach Pulau Bunaken, 30 minutes to Pulau Manado, and around 20 minutes to Pulau Nain.

There are some facilities at that place, such as lodging and the places for having pleasant and satisfying meals. You can also buy some gifts like t-shirts, traditional food, and handicrafts.
Tourism atlas from space is a unique version of tourism book. This atlas not only employs photos, maps, and description of tourism objects but satellite imageries as well. This book can be functioned as tourism promotion tool and knowledge-information sharing. Community is introduced by a new approach to show up the beautiful scenery in their location by means of remote sensing technology.

Tourism Atlas from Space of North Sulawesi Province is one of the ways to promote tourism sector in North Sulawesi Province. This product is developed to support the local government policy to increase local income and to enhance regional development in the tourism objects and surroundings. Interest information and picture displayed in this atlas hopefully can attract domestic and foreign people to come and to enjoy the natural beauty of North Sulawesi Province. Besides, local community has a chance to build some supporting facilities as one of the efforts to increase their income, such as food stall, rest area, cottage, restaurant, travel agent, etc.

FUTURE PLAN
Tourism atlas from space is developed to provide tourism information in Indonesia. It means that the atlas will cover the whole province in Indonesia. Previous tourism atlases from space that have been produced are 1st Volume of Bali from Space (2004), Nusa Tenggara Barat (NTB) from Space (2005), Banten from Space (2006). The North Sulawesi from Space itself was created in 2007 followed by Sumatera Selatan from Space (2008) and 2nd Volume of Bali from Space (2009). In the next years, the development of tourism atlas from space hopefully can be continued in the other provinces.

REFERENCES
