

Abstract of the Work

The aim of this study is focused on seasonal potential mapping of fish habitat and understanding the lake environment, especially ecology and generating the multi-temporal flood maps by MODIS data. Algorithms for calibrated Surface Water Temperature (SWT) and estimated Water Depth Temperature (WDT) using satellite imagery were developed and validation was carried out with the actual dataset.

Some dataset such as water quality parameters, land use changes, agricultural management surrounding the lake, topography, existing flooded data with NDVI, True color composite of the 16-day composites MODIS imageries, meteorology, social conditions, flood cover and polluted locations were used to extract the physical condition of the lake environment as well as annual flood mapping. By integration of these aspects, the understanding of the lake environment can be defined. Finally, the seasonal fish habitat mappings were generated. The validation with chemical water

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quality parameters and fishing lot data were integrated. Additionally, the sensitivity analyses on the fish habitat area by using water quality parameters have been integrated to reach higher accuracy. In addition, the daily MODIS image with the actual SWT and WDT have been successfully used to generate the algorithms in order to obtain the calibrated SWT and estimated WDT from remotely sensed data.

Finally, the results show that the adopted methodology was efficient in achieving the research objectives. Use of 16-day composite of MODIS images is a good technique for extraction of flood map. Also, it was found that the lake environment is facing with high sedimentation in wet season as well as pollution especially, reduction amount of Dissolve Oxygen (DO) in dry season. The degradation of natural vegetation covers and poor management leads to decreasing of aquatic production in the lake. In additions, the study reveals that the use of multi-criteria analysis along with GIS and remote sensing yields, mapping of potential fish habitats which will be very useful in future planning of fishery. Successful algorithms generated for calibrated SWT through remote sensing imagery show that, the calibrated SWT can be apparently used as WDT.

9. Keywords (minimum 5; maximum 10)

GIS, RS, Flood Maps, Satellite images, Limnology, Ecology, Fishery, Habitat Area Assessment and Validation, Temperatures Algorithm Generation and Development.

10. Bibliographic data

Ahmad M., Hap, N., Vuthy, L., and Tiongco M. 1998. Socio-economics Assessment of Freshwater Capture Fisheries of Cambodia

Calson, R.E. and J. Simpson, 1996. A coordinator's guide to volunteer lake monitoring methods. north American Lake management Society, 96-105 pp.

Carbonel, J.P., In W. J. Rainboth, 1996.

Ciesin, 2005. The Use of Satellite Remote Sensing To Study The Human Dimensions of Global Environmental Change. URL: <http://ciesin.columbia.edu/TG/RS/RS-home.html> [12-March-05]

Department of Geography and Environment, 2005. ENVIRONMENTAL GIS: GRG 360G, Lab 8: Field Based Floodplain Mapping and GPS Error Assessment. Texas University, USA. URL: http://www.utexas.edu/depts/grg/hudson/grg360g/EGIS/labs_04/Lab8/Lab8_fall_2005.htm
Department of Primary Industries and Fisheries, 2005. Fish Habitat Areas. Queensland Government.

URL: <http://www.dpi.qld.gov.au/fishweb/13401.html> [11-Jan-05]

DoF (Department of Fishery), Statistical information of fishing yield from 2000 to 2005 and fishing lots spatial data. Ministry of Agriculture, Forest and Fishery, Royal Government of Cambodia.

DoRWM (Department of River Work Management), Water level and water quality data. Ministry of water resources managements, Royal Government of Cambodia.

Eileen, L. Penaflo, 2003. Environmental Investigation at Tonle Sap Lake Using MODIS and Ground Truth Data. Printed in AIT, Thailand.

Environment Waikato (EW), 2005. Water Quality Glossary.

URL:<http://www.ew.govt.nz/enviroinfo/water/healthyivers/glossaryhr.htm#heading4> [15-Jan 2005]

Guenther, B., X, Xiong, V.V. Salomonson, W.I. Barnes, J. Young, 2002. On-orbit performance of the Earth Observing system Moderate Resolution Imaging Spectroradiometer; first year of data. Remote Sensing Environment.

Jensen, J. R., 1996. Introductory Digital image Processing, A remote sensing perspective. Second edition, printed in USA.

JICA, 2003. The administrative maps in spatial data format. Ministry of Public Work and Transportation, Cambodia.

John LOW, Soo Chin LIEW, Leong Keong KWOH (CRISP), 2003. Automated Near-Real time Flood Detection and Mapping Using Terra MODIS.

Khiruddin Abdullah, 1998, Dual Channel Algorithm for Retrieval of Sea Surface Temperatures from Satellite Thermal Images.

Kit, G., 2000. Developing A Hydrological Model for the Mekong Basin: Impact of Basin Development in Fisheries Productivity. International Water Management Institute, Colombo, Sri Lanka, 141-152 pp.

Krousar Thmey. Le Tonle Sap: Source of Lives. UNSCO/Krousar Thmey Switzerland.

URL: <http://www.myfriend.org/krousar-thmey/tonlesape>

Lamberts, D., 2001. Tonle Sap Fisheries: A case study on Floodplain Gillnet Fisheries. RAP Publication 2001/11. Asia-Pacific Fishery Commission, Food and Agriculture Organization of the United Nations, Regional Office for Asia and the Pacific, Bangkok, Thailand.

Lancaster, Jill 2005. Freshwater Ecosystems Ecology.

URL: <http://www.lenntech.com/water-ecology-FAQ.htm> [15-Jan-05]

Lenntech, 2005. Water Treatment and Air Purification.

URL: <http://www.lenntech.com/water-ecology-FAQ.htm> [15-Jan-05]

Lillsand, Thomas, M., and Ralph W. Kiefer, 2000. Remote Sensing and Image Interpretation. Fourth Edition.

Lilly, J. Paul, 1993. Soil Facts on Wetland Issues.

URL:<http://www.soil.ncsu.edu/publications/Soilfacts/AG-439-26/> [10-Jan-06]

Lyon, G. John and Kirt, F. adkins, 1995. Uses of a GIS for identify the wetland, the St. Clair Flats, Michigan. Wetland and Environmental application of GIS. 49-52 pp

Mark B. Bain and Nathalie J. Stevenson, 1999, Aquatic Habitat Assessment.

MoE (Ministry of Environment), G. British Columbia. Wetland Definition.

URL:<http://wlapwww.gov.bc.ca/wld/wetland.htm> [03-Jan-05]

MoLWA (Ministry of land, water and air protection), 2005. Fish & Habitat. Government of British Columbia.

URL: <http://wlapwww.gov.bc.ca/wld/fishhabitats/> [4-Jan-05]

MRC, 2000. Flooding Spatial Data. Cambodian National Center for Flood Focusing and Mitigation.

MRC, 2000. Tonle Sap Biosphere Reserve

URL:[http://www.mekonginfo.org/mrc_en/Contact.nsf/0/4F339FEA20A5F7C0872569210017C0BD/\\$FILE/leaflet.html](http://www.mekonginfo.org/mrc_en/Contact.nsf/0/4F339FEA20A5F7C0872569210017C0BD/$FILE/leaflet.html) [May, 05]

NASA, 1999, Land Surface Temperature Algorithm

NASA, 2000. MODIS level 1B Product User's Guide. For Level 1B Version 2.3x. Release2. MCST Document #MCM-PUG-01-U-DNCN. NAS / Goddard Space Flight Center, 58- 89 pp.

URL: www.mcst.ssai.biz/mcstweb/LIB/docs/L1B_PUG_V2.3x_r2.doc [12-Jan 05]

NASA, Landsat 7 Science Data User Handbook.

URL: http://ltpwww.gsfc.nasa.gov/IAS/handbook/handbook_toc.html [14-Jan-05]

NASA_1a, Sea Surface Temperature calculations.

URL:http://daac.gsfc.nasa.gov/MODIS/FAQ/A_L1B_SST.shtml [3-Jan-2006]

National Institute of Statistic, 2003. Statistical Year Book. Ministry of Planning, Royal Government of Cambodia edition in 2003.

Odum, Eugene P., 1971: Fundamental of Ecology. Third Edition. W.B. Saunders Company. Printed in USA.

Onefish, Tonle Sap Environmental Management (Cambodia).

URL:<http://www.onefish.org/servlet/CDSServlet?status=ND04MDMxMS5wcmo4MjMzMiY2PWVuJmZPXByb2plY3RzJmM3PWluZm8~> [16-Aug-06]

Otis, B. Brown and Peter J. Minnett, 1999. MODIS Infrared Sea Surface Temperature Algorithm, Algorithm Theoretical Basis Document Version 2.0, 20-70 pp.

PFMC (Pacific Fishery Management Council), 2005. Information Sheet: Essential Fish Habitat.

URL: <http://www.pcouncil.org/facts/habitat.pdf> [17-March-05]

Raosoftware, 2004. Sample Size Calculators.

URL: <http://www.raosoftware.com/samplesize.html> [25-March-05]

Rath, R.K., 2000. Fresh water Aquaculture. Scientific Publishers (INDIA), JODHPUR

Stickney, R. Robert, 1994, Principle of Aquaculture. 44- 65 pp.

STOAS, 1993. Fish Farming in Ponds in the Tropics. Foundation for the Development of Agricultural education and Trainings Wageningen, The Netherlands, 100- 106 pp.

Susaki Junichi, 2005. Land Surface Temperature. Remote Sensing for Land Surface Monitoring lecture notes.

Taylor, W. William and Ferreri, C. Paola, 1999. Great Lakes Fisheries Policy and Management. 209-215 pp.

U.S Environmental Agency, 2005. Water Quality Criteria.

URL:<http://www.epa.gov/waterscience/criteria/wqcriteria.html#M2> [4-Feb-05]

USGS, 2003. Water Quality.

URL: <http://ga.water.usgs.gov/edu/waterquality.html> [12-Jan-05]

Van Zalinge, N., L.Deap, P. Ngor, J. Sarkkula and J. Koponen, 2003. Mekong Flood Level and Tonle Sap Fish Catches. The Second International Symposium on Management of Large Rivers for Fishery. 14-20 pp,

WWF, Thai, Youth Power on Wetland Conservation.

URL: http://www.wwfthai.org/eng/news/articles/wetland_conservation.asp [18-May-06]

X. Zhan, R.A. Sohlberg, J.R.G. Townshend, C. DiMiceli, M.L. Carroll, J.C. Eastman, M.C. Hansen, R.S. DeFries, 2002. Detection of land cover changes using MODIS 250 m data.

URL: www.lars2.org [01-Jan-05]