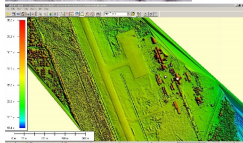
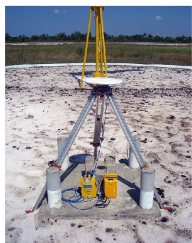


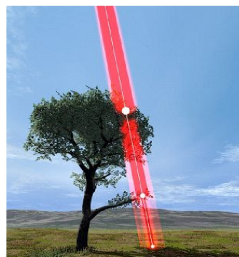
LiDAR Survey of Galangan SSGM in Katingan



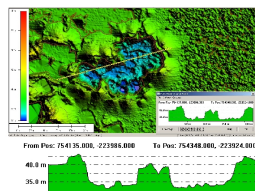
DGPS at Palangka Raya Airport with the 25m reference point



Photo from March 2007 with big holes in the landscape

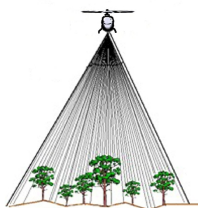


Single Laser beam with first and last echo, emitting of 100000 Laser pulses per second to get a Laser pulse density of 1.4/m²



LiDAR-DTM with big digged holes in the landscape and profile

Airborne Laser Scanner



Survey of Small Scale Gold Mining in Galangan area, district Katingan, Central Kalimantan with LiDAR- and Ortho-Photo Technology on 8. Aug. 2007 using the Digital Terrain Model (DTM, topography) by

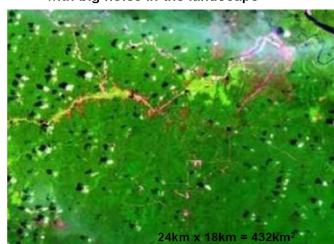
Dr. H.-D.V. Boehm and Juergen Frank
viktorb Boehm@t-online.de www.kalteng.org



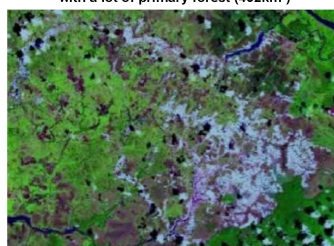
ALS team with LiDAR and Ortho-Photo equipment installed on helicopter



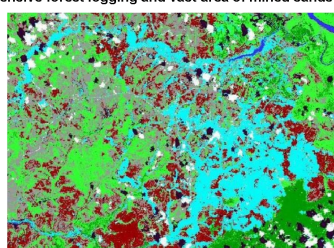
SSGM-Technology using Dulang and Mercury at Galangan taken in June 1998 near Kereng Pangli near to the main road



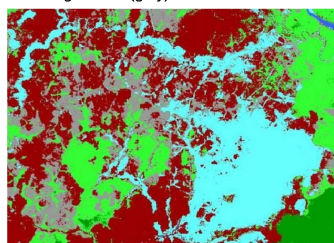
Landsat TM5 from 1989 18km x 24km with a lot of primary forest (432km²)



Landsat image from 1999 with huge changes! Extensive forest logging and vast area of mined sands



Classified Landsat image from 1999 Sand from mining (cyan) 78km² 18% +/- 2% of 432km², exposed soil (brown) 64km² 15% +/- 2%, agriculture (grey) 117km² 27% +/- 2%

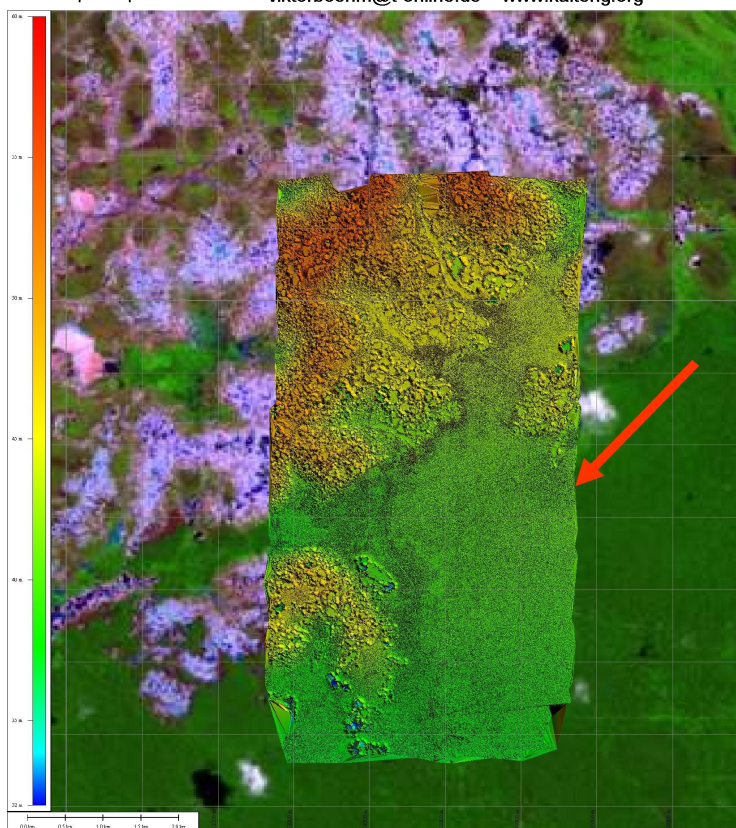


Classified Landsat image from 2002: Sand from mining (cyan) 102km² 24% +/- 2% of 432km² Since 1990 - 2006 16 years

- Rate of mining - 8km² / y
- Gold recoveries 11.9 t
- Value of Gold 210 Mio Dollars; today 26.6.2010 527 Mio\$ with 1254\$/ounce, price varies over time 13 Mio \$ per year
- 35 Mio \$ per year for Galangan area including dredges
- Directly supports about 40,000 people - 875 \$ per year
- Any alternative must be as big



Google Earth landsat image from 2003, bigger area



LIDAR-DTM-Mosaik 4km x 8km and Landsat image (11.04.2003) as background of Galangan Small Scale Gold Mining (SSGM) area near Kasonagan in Katingan with a 1km x 1km grid and an elevation range between 32m (blue) and 60m (red). There are huge digging activity along old river arms. In LS means red logged trees and white SSGM activities. Clouds are black and white

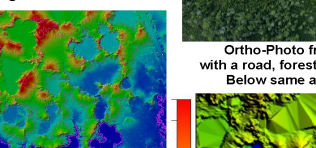
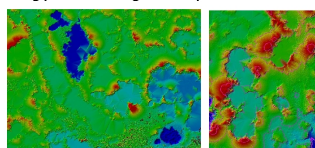
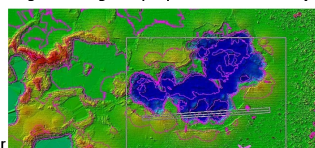
Background Info and Findings

On 8th August 2007 Kalteng Consultants flew with a Bell helicopter equipped with the ALS-sensor and a 22MB-Hasselblad camera over the Galangan area with artisanal and Small Scale Gold Mining (SSGM) area and over the villages Kasonagan and Kereng Pangli in Kecamatan Katingan, Central Kalimantan.

We gathered several single flight-tracks and 12 overlapping flight-tracks, which we processed to an ALS 4km x 8km grid as DSM- and DTM. Each tile has a size of 1km x 1km and is geo-referenced. They can be stored directly into a GIS. Additional we gathered approx. 210 RGB/Ortho-Photos (4080 x 5440 pixels) and many Aerial-Photos.

So we are able to estimate the sand-volumes and number of holes, which were digged by the gold miners to collect alluvial gold with the toxic mercury (amalgam) technique. We have shown flood simulation of the big holes.

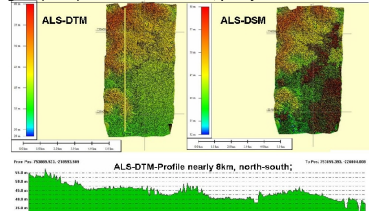
The bio-mass of the remaining forest has been determined with the DSM + DTM. With this Hg-technique many locals are exposed to mercury vapours and global contamination of food e.g. fishes, which causes neurological damages to people and animals. Many mining pits and amalgamation ponds are remaining. Processed on 29.6.2010



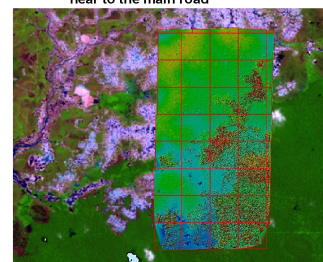
3 LiDAR-DTM images from Galangan SSGM. Red shows higher (sand) and blue lower area, partly lakes or sand holes.



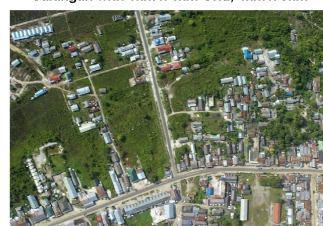
LiDAR-DTM image and Ortho-Photo from same SSGM area with different information



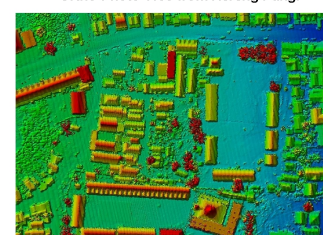
LiDAR-DTM + DSM with cross-section over the 8km SSGM area showing different information



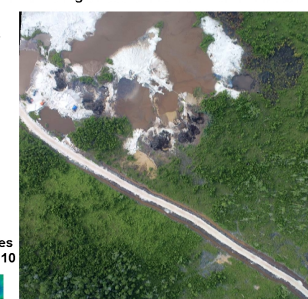
LIDAR-DSM and Landsat image (4-2003) from Galangan with 1km x 1km Grid, 4km x 8km



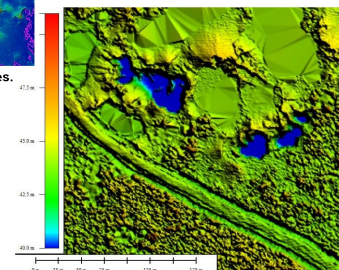
Ortho-Photo 1133 from Kereng Pangli



LIDAR-DSM from Kereng Pangli Red are high trees or roofs and blue low area



Ortho-Photo from Galangan area with a road, forest, lakes and sand hills. Below same area as LiDAR-DTM



LiDAR-DTM from Galangan area. Yellow shows higher sand hills, green partly lakes and blue sand holes; topography, no trees