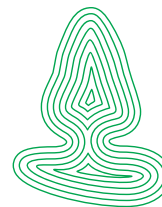


Oppdragsrapport  
fra Skog og landskap

15/2010



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## SUDAN FORESTRY SECTOR PROGRAM 2009 GIS UNIT

Establishing the Land Resource Survey and  
Information Centre

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Hanne Gro Wallin, Tom Joar Kristiansen

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landskap

NORSK INSTITUTT FOR  
SKOG OG LANDSKAP

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Cover Photo:

The paper maps are now history. All the maps are digitized and georeferenced so it is available in a GIS tool. Photo: Ole Martin Garseg, Skog og landskap.

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[Norsk institutt for skog og landskap, Pb 115, NO-1431 Ås](#)

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## SUMMARY

The primary mission of the project is to create a Land Resource Survey and Information Centre in Juba with the necessary knowledge, computer equipment, GIS-software and the satellite images to map and monitor land resources. The office and its employees will be the independent land cover mapping authority in Southern Sudan. The Norwegian role is to support capacity building in the institution. The actual survey, mapping and monitoring activities should be carried out by the institution itself.

The project was a continuation of work started in 2008. In 2009, more advanced training in GPS, digital mapping, remote sensing and production was carried out and a forest inventory was started.

The office was upgraded with an installation of a battery backup system which provide power enough to run the office for 3-5 hours in case of no electricity. A network of contacts with other relevant activities in South-Sudan was also established.

The first land cover map produced by the office, covering the area between Yei and Juba, was produced based on interpretation in satellite images and verification in the field. The map "Forest reserves in Southern Sudan" was upgraded to show the known forest reserves included as polygons with their actual shape and size.

**Nøkkelord:** Opprette GIS-enhet/-kontor i Juba. Undervisning i Microsoft-programvare, GIS-programvare, bildetolking, bruk av GPS-mottaker, kartprojeksjon og datum. Digitalisering. Dataorganisering. Nettverksbygging.

**Key word:** Establish a GIS-unit/-office in Juba. Training in Microsoft-software, GIS-software, image interpretation, using GPS-receiver, projection and datum. Digitization. Data organisation. Building network.

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## 1. Report from Year 2 – 2009

In 2009 more advanced training in GPS, digital mapping, remote sensing and map production was carried out. The forest inventories started and travel to Juba had to be coordinated with NORSKOG to make for efficient visits. It proved important to have overlapping periods to coordinate the tasks.

The GIS team will produce data (background information) in advance of the field inventory work. The results from the inventory will then be presented as statistics (attribute tables) and thematic maps.



The most significant technical improvement in 2009 was the installation of a battery backup system.

A combination of UPS (Uninterruptible Power Supply) and Inverter (a device to convert direct current into alternating current), provides enough power to run the office for 3 - 5 hours on the batteries alone.

This is a huge advantage in Juba where the power supply in general is quite unreliable.

Most of the initial problems experienced are history, and most of the daily technical challenges are now manageable.

A good Internet connection is still lacking being both slow and unstable.



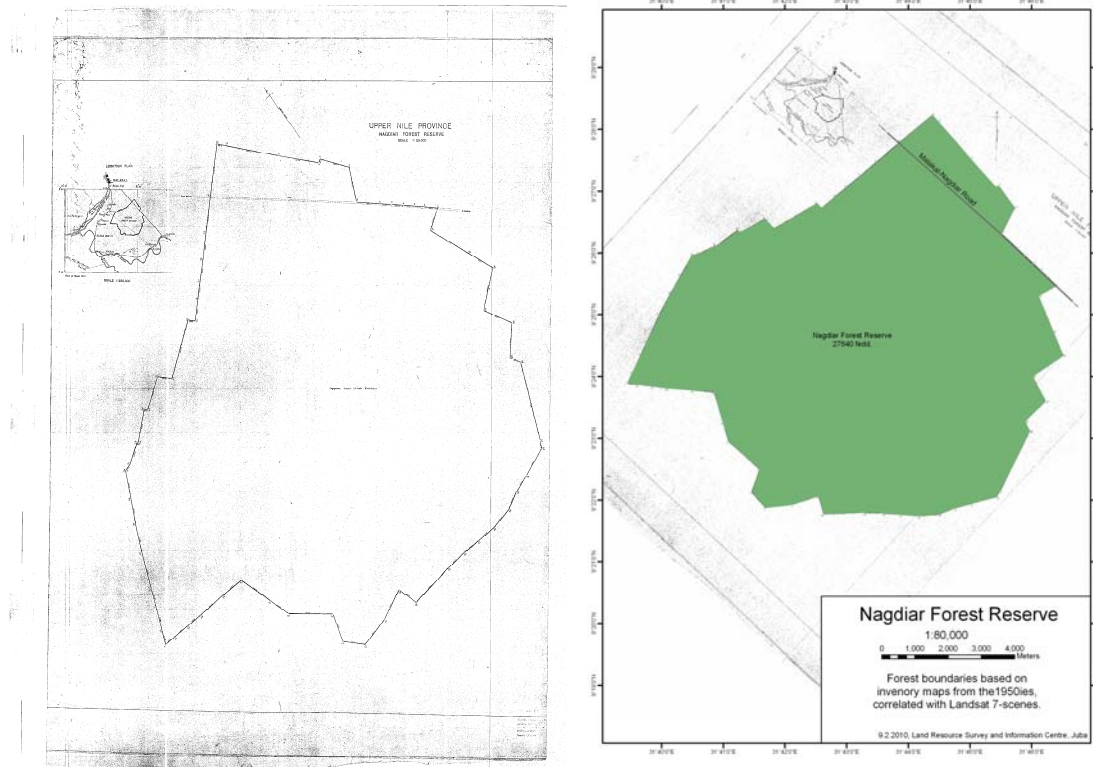
*This arrangement provides enough power for 3 to 5 hours depending on the number of computers in use.*

Some of the old forest reserve maps stored in Khartoum were retrieved.

The maps had been scanned, so the staff was trained in how to digitise and geo-reference the maps. Some of the maps did not have any coordinates and the sites were therefore very difficult or even impossible to locate. Local knowledge and Google Earth were used to find the location and coordinates.

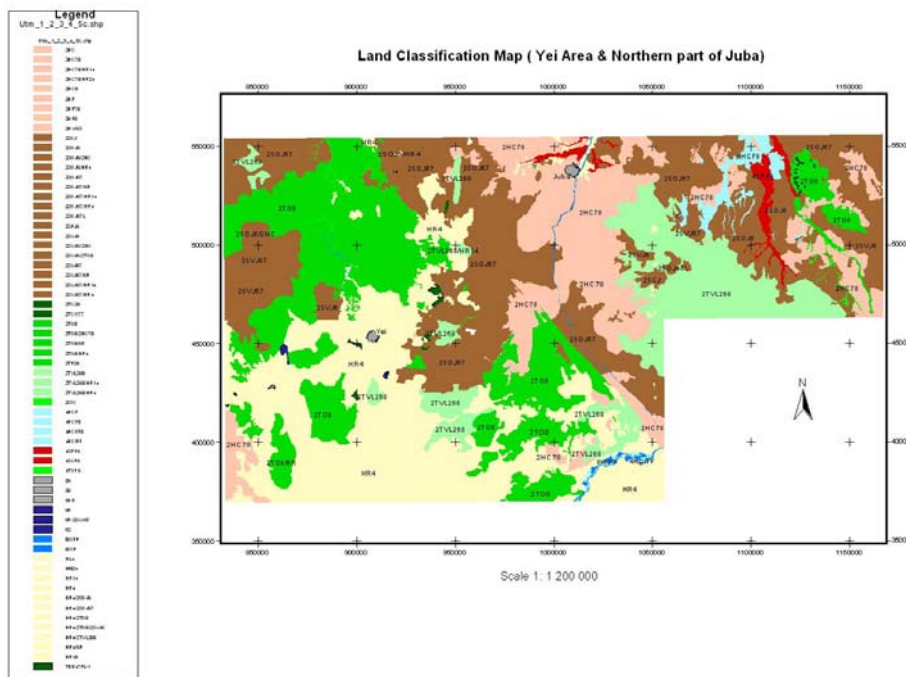
While working in Sudan, NFG have sought out other organisations or institutes/office that have relevant activities and where collaboration and sharing of information could have a synergy effect.

A network of contacts in Juba has been built up, e.g. UNJLC - United Nations Joint Logistics Centre; UNOCHA - United Nations Office for the Coordination of Humanitarian Affairs; UNMAO - United Nations Mine Action Office; BSF - Basic Service Fund secretariat; CDE - Centre for Development and Environment, Berne, Switzerland; Barbi Nilsen and Karsten Dax have attended and arranged two GIS-workshops in Juba together with CDE. In August 2009, Tom Joar Kristiansen attended the African GIS 2009 conference in Monyonyo, Uganda. One result was an increase in information exchange and a good contact with the University in Kampala and other institutes performing courses and training in Africa.



On the left: A scanned paper map from Khartoum. On the right: The digitised and geo-referenced map shown in ArcView 3.3.

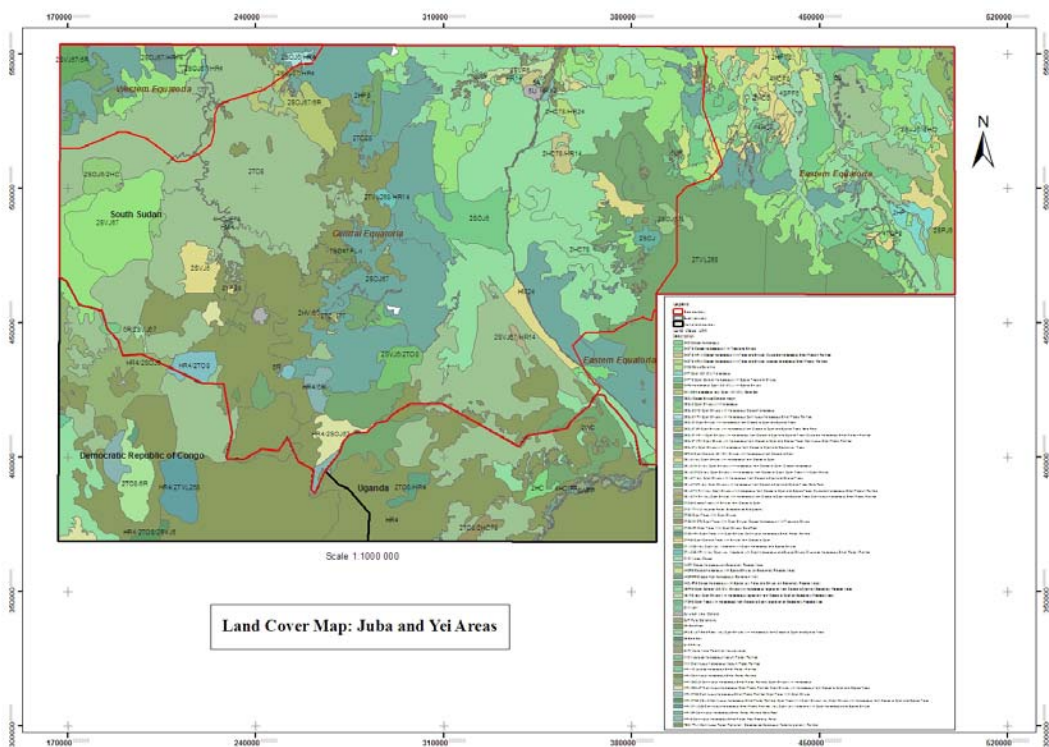
The National Forestry Authority (NFA) in Uganda carried out remote sensing training in Sudan in collaboration with NFG. The training included image interpretation in the office, ground truthing in the field and development of a land cover classification system. The initial classification system is the LCCS system from Africover (FAO).



Advanced software such as Erdas Imagine and GeoVis are now being used for the remote sensing activities. The consultant engaged from NFA is John Diisi, who carries out courses between June and August when few Norwegians are present in Sudan.

The first Land Cover Map prepared by LRSIC, covering the area between Yei and Juba, is shown below. The map has been verified in field in the forest plantation areas. Some control points were made in other areas as well, but it has been difficult to get people to understand the importance of documenting the quality of other land use types. Routines for ground truthing need to be implemented for both documentation and in the form of Guidelines for new staff members. The layout of the land cover map below was done by LRSIC. To ensure ownership and commitment to the task, development of a draft map by staff members alone followed by advice from consultants on means for improvement of the product.

The same map is provided below based on the results of the interpretation from satellite images and a proper field control. The next step will be to provide more training in cartography with the aim of improving the layout.



In April 2009, NORSKOG initiated forest inventory activities in South Sudan. In collaboration with the foresters, the office has mapped two Forest Reserves and made a presentation of the inventory for these two plantations.



*Left: Tormod Dale with participants on the field trip to Kadule Forest Reserve, Tereka.  
Right: Christopher B. Lemi filling out the registration form.*

In the process of acquiring a plot for establishing a new LRSIC office, several areas were measured and mapped in Juba. This involved using GPS-receivers for collecting points and lines, transferring of data to the computers and creating a map from the gathered data and other items in the GIS software (ArcView 3.3).

Training this year again revealed that some of the staff members do not put the expected effort into their work and this makes teaching a challenge, despite presenting the subjects with both theoretical and practical exercises.

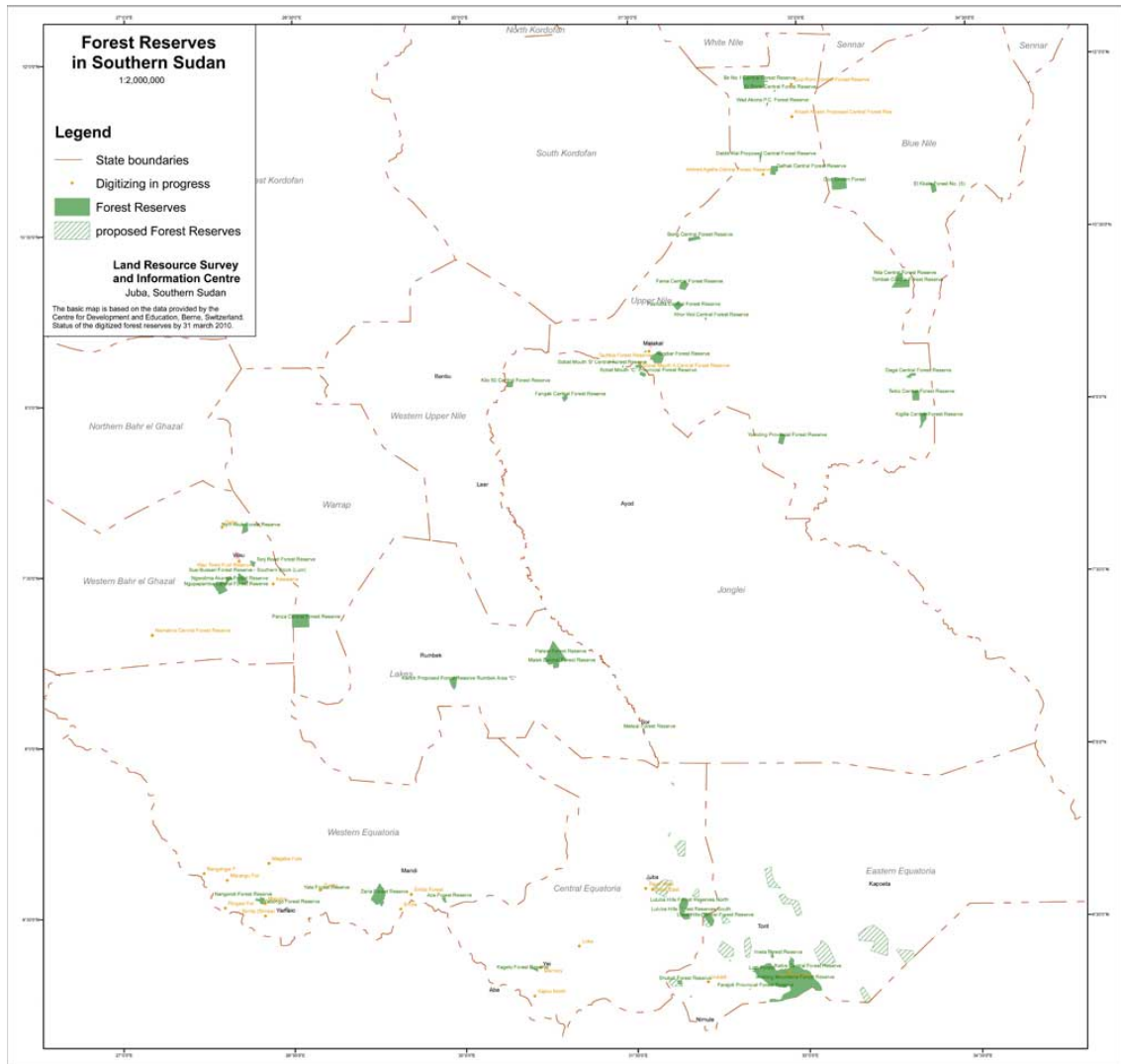
The progress in digitising of maps and progress in training is lagging behind due to the low level of interest from the participants. The Steering Committee is informed about this concern and it is hoped that new Trainees with a higher level of motivation can be engaged in the Programme. It should, however, also be pointed out that some members of the staff are highly motivated and one was sent to ITC in Holland for a 3 month course in GIS and remote sensing.

Finding more people with a keen interest for GIS and resource mapping is needed to ensure a sustainable GIS environment in the LRSIC office in Juba.

## 2. Examples of Maps Produced in 2009

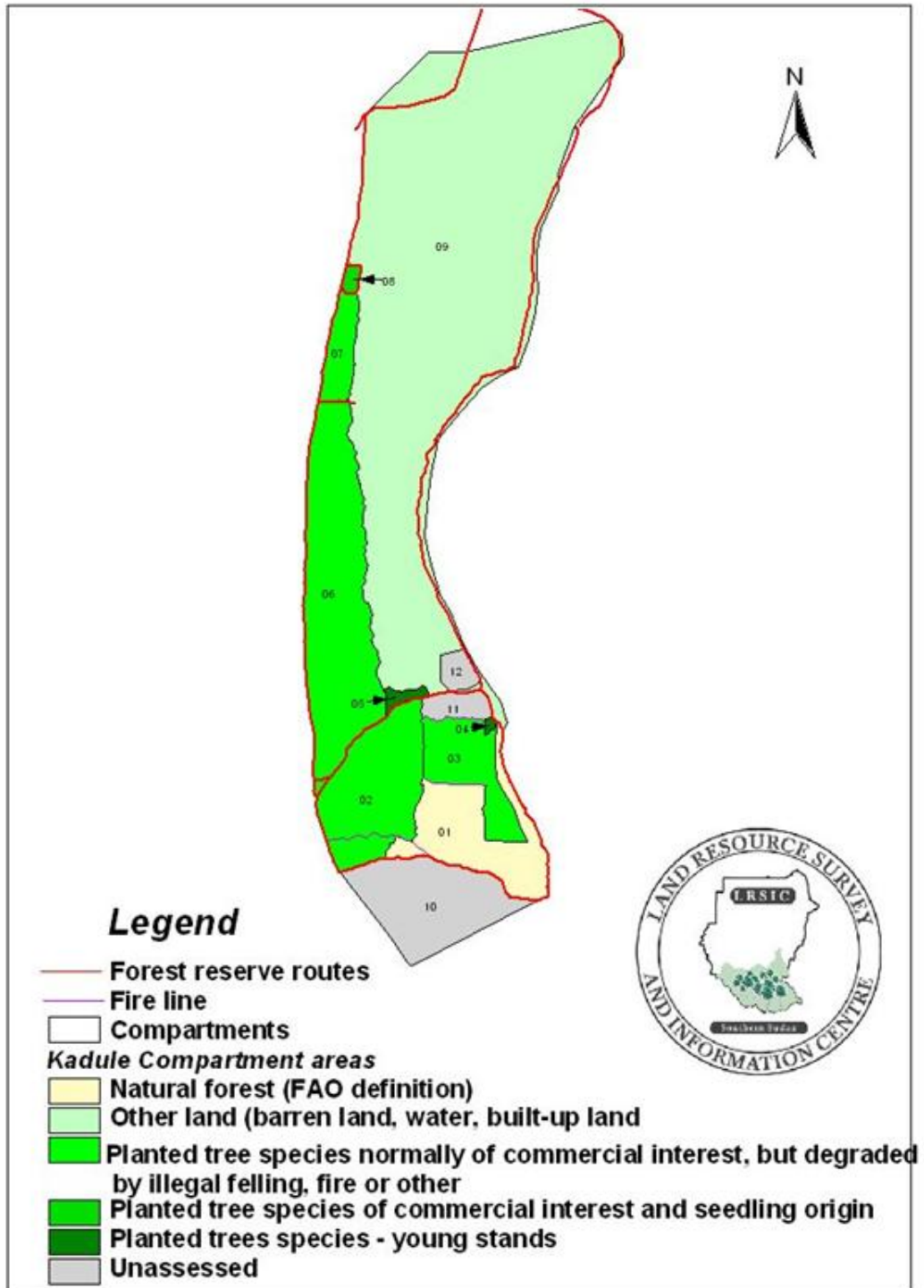
The first map of the "Forest Reserves in Southern Sudan" (2008 version) only showed the location of the reserves as points. In 2009, all of the known forest reserves have been digitised. The new map shows each reserve as a polygon, with their actual shape and size. Some reserves are not yet digitised, but the initial reserves have proven to be a good starting point in making a presentation of the Forest Reserves of Southern Sudan. The map is to be produced in A0-format and presented to the Steering Committee, Ministry of Agriculture and Forestry and other interested institutions.





The first Forest Reserve map including field information.

# Kadule Forest Reserve



### 3. Task List with Results

Establish a reliable power supply for the office computers;	<i>OK - February 2009</i>
Establish an effective Administration;	<i>Still several challenges;</i>
Carry out introductory training in a variety of topics;	<i>Training completed for GPS, GIS, coordinate systems, image interpretation, organisation of field data, field registration in plantation forestry, processing of field data, data layout and training for Windows software;</i>
IT-training in MS Word, Excel and PowerPoint;	<i>Initial training has been carried out, but more is required; digitising and geo-referencing of Khartoum maps is a priority; More advanced training planned for 2010;</i>
IT-training in Access;	<i>GIS/IT consultant has been trained;</i>
IT-training GIS-software;	<i>Training in both ArcView 3.3 and ArcGIS 9.3</i>
Train staff for data collection in the field;	<i>Training on both agricultural and forest land cover;</i>
Procure new software;	<i>Free software, e.g. gvSIG, is introduced and licenses for ArcGIS 9.3 are purchased;</i>
Train in the use of Erdas Imagine;	<i>Introduction has been provided by John Diisi, NFA Uganda;</i>
Conduct courses in introduction to field inventories - collaboration between NFA/NFG;	<i>6 weeks with John Diisi, NFA Uganda</i>
Establish a Local Area Network (LAN);	<i>OK - September 2009</i>
Standardise data management routines - collaboration between NFA/NFG	<i>More assessment of raw data is necessary before setting a Standard for Southern Sudan</i>
Establish a reliable internet connection for the office;	<i>Postponed until 2010</i>
Establish a map and satellite image archive;	<i>OK - November 2009</i>
Develop a 3-year Work Plan for approval;	<i>OK - December 2009</i>

### 4. Finances

The contract between NFG and NFLI had a value of NOK 2,643,280. The total income to NFLI was NOK 1,891,276 based on consultant fees (NOK 1,405,000) and travel expenses/per diem (NOK 486,276), as shown in the detailed account below.

In addition, expenses for air travel were paid directly by NFG (11 visits costing approximately NOK 110,000). Due to unrest in Southern Sudan in February and March, the number of missions to Sudan was reduced.

<b>Navn og periode</b>	<b>Sum driftsutgifter</b>
T.J.Kristiansen 1.2-18.2.	38 189
Barbi Nilsen 14.4.-24.4.	24 864
Ole M. Garseg 14.4.-24.4.	25 106
T.J.Kristiansen 17.4-7.05	48 540
T.J.Kristiansen 31.5-13.06	36 829
Jan Reyer Elders	1 380
Arb. Giveravg.	1 522
T.J. Kristiansen 18.8.-31.8.	37 447
K. Dax 22.8.28.9	61 001
T.J. Kristiansen 6.10-3.11	59 221
K. Dax 25.10-30.11	55 664
Barbi Nilsen 16.11-27.11	28 031
T.J. Kristiansen 27.11-16.12	53 982
Barbi Nilsen	1 157
Arb.avg.	4 121
Bøker	286
Refusjon utl.	8 936
<b>Totale driftsutgifter 1.1.-31.12.09</b>	<b>486 276</b>

<b>Timer i perioden 1.1.-31.12.09</b>	<b>Antall timer</b>	<b>Kostnader</b>
Hanne Gro Wallin	48.00	38 400
Ole Martin Garseg	79.50	63 600
Tom Joar Kristiansen	844.75	675 800
Barbi Nilsen	260.00	208 000
Geir Harald Strand	1.00	800
Karsten Dax	509.00	407 200
Odd Eilertsen	2.00	1 600
Jan Reyer Elders	12.00	9 600
<b>Totale timekostnader 1.1.-31.12.09</b>	<b>1 756.25</b>	<b>1 405 000</b>

525 for lite utbetalt TJK i mai -juni - utbetalt i 2010 - ikke fakturert i 2009