Third United Nations International UN-SPIDER Bonn Workshop: "Disaster Management and Space Technology- From Concepts to Application"

21-23 October 2009, Bonn, Germany

Use of space-based technologies and national SLM-IS for forecasting and reduce of disaster risks in Fergana Valley, Uzbekistan
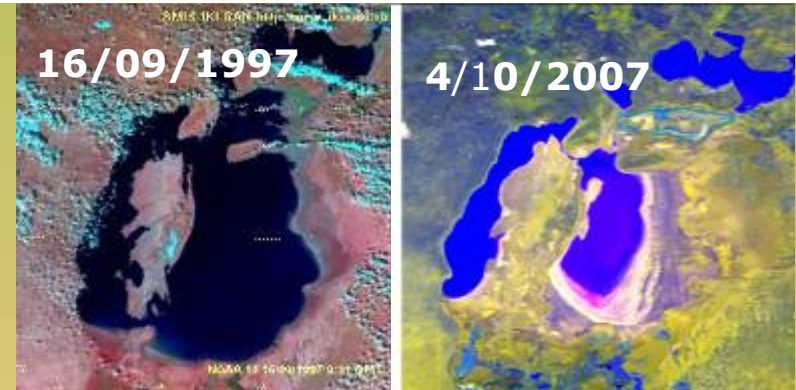
Gulchekhra Khasankhanova, UZGIP,MAWR, Uzbekistan

The Central Asian Countries Initiative for Land Management (CACILM)

Use of space-based technologies and national SLM-IS for forecasting and reduce of disaster risks in Fergana Valley, Uzbekistan

Growing Concerns:

q   Land degradation&desertification and water shortage and water resource contamination in time and in space is major environmental challenges, threatening the country's natural resources and social and economic development;

q   Stable warming tendency is observed today in Uzbekistan and other Central Asian countries. Average rates of warming since 1950 along the territory of the Republic have been 0.29°C per decade, which is more than twice the world average.

q   Worsening of water and energy infrastructure and rapid growth costs for its maintenance represent serious threat for food and environmental security in the region.

Drought

Drought is very negative event which is cause substantial losses in agricultural production and difficulties in the fresh water supply for population.

Precipitation, January - March

Runoff hydrograph

Норма — 2000

Temperature, January - March
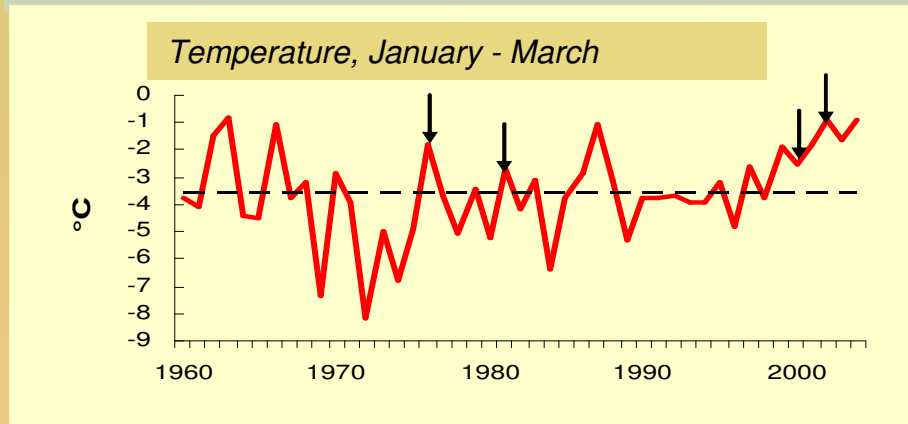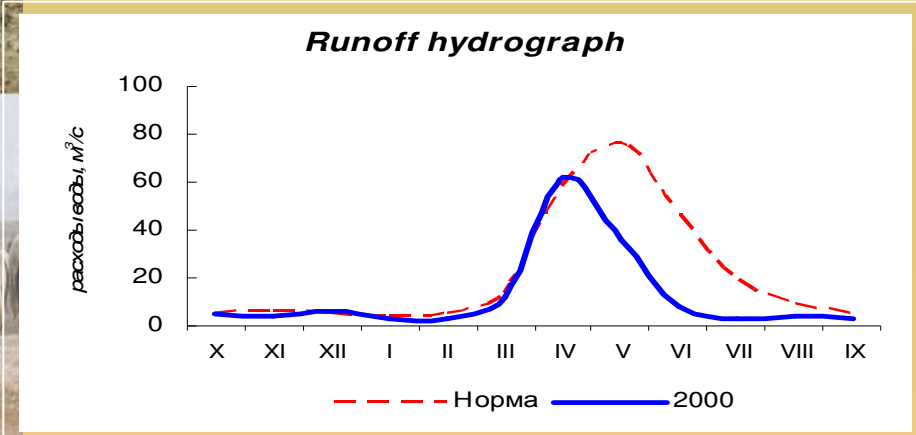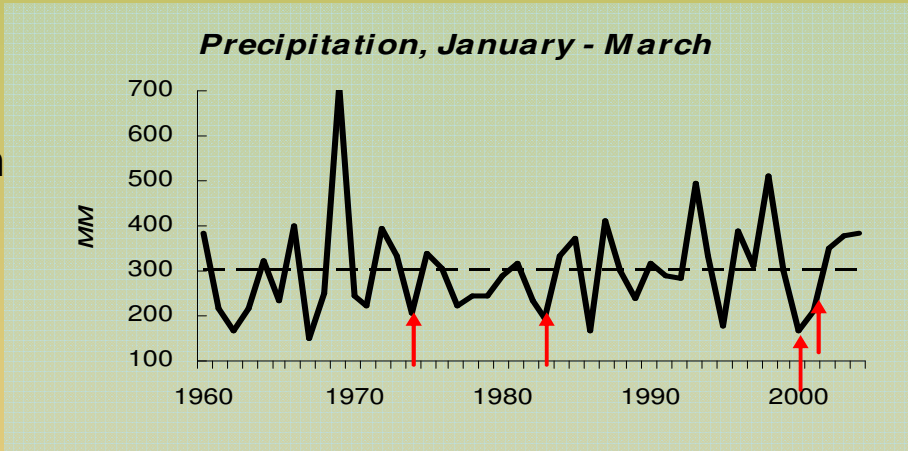
q   The assessment of the extreme climate change scenarios 2050 shows that vegetation flow in Amudarya and Syrdarya river basins could be reduced by 25-40%.

q   Expected losses of crop yields to 2050 because of deficiency of water will make on the average 35-50 %.

Hazardous Phenomena

Mudflows and avalanches

Mudflow number per century and mud/low risk areas in the Eastern Uzbekistan

- 12% of Uzbekistan territory (foothill and mountain areas) are mudflow and avalanche prone;
- 468 water courses in Uzbekistan are mudflow prone;
- the intensive rain is the reason of 80% cases of the mudflows and avalanches.
- territory of Republic is threatened with 271 lakes of various origins, and their majority is located outside Republic.

Expected change of rain-related mudflows for the Climate Change scenarios (A2, B2) is follows:

- *up to 2030-2050 the increase of the mudflows frequency to 17-19% and mudflow risk periods are expected;*

- *probability of avalanching is expected to decrease about 1,2-1,3 times up to 2030 and 2050.*

The Central Asian Countries Initiative for Land Management (CACILM)

CACILM - a multi-country and multi-donor partnership program aimed at restoring, maintaining and enhancing productive functions of land in Central Asia countries leading to improved economic and social well-being, while preserving the ecological functions of these lands in the spirit of the UNCCD.

The oversight of CACILM program is performed by the Steering Committee, that includes representatives of the participating Central Asian countries and partner organizations (ADB, GTZ, CIDA, FAO, GM, IFAD, SDC, UNDP, UNCCD Secretariat and other).

CACILM National Programming Frameworks on SLM forms its strategic basis under GEF-3 OP-15 focal area programmatic goal.

CACILM Multicountry Partnership Framework Support Project (CMPF), sponsored by GEF, supports the adaptation an integrated approach to land use planning and management, taking into consideration current international efforts towards a harmonization of land data and information management.

CACILM Sustainable Land Management Information System - SLM-IS

Objective and Methods

CACILM
The Location Map of the NPF Projects in Uzbekistan

Project objective is to enhance the countries' institutional capacity to assess and monitor land degradation and to adopt integrated land use planning and management in support of SLM.

Specific objective is an application of FAO LADA approach and methodology for design and development of SLM-Information system in assessment and mitigation of land degradation and climate change impact.

The global datasets (GLC-2000, AgroMaps, SRTM data) and guidelines has been supported by FAO LADA.

MODIS Vegetation Indices Dataset (MOD13Q1, 250m) of 2007-2008 and LANDSAT TM has been the primary data source.

The Central Asian Countries Initiative for Land Management (CACILM)

Targeted tasks and achievements

- Assessment of baseline land degradation and rural livelihoods, and hotspot and bright sports analysis based on FAO LADA approach;

- Establish baseline information to assess and monitor of climate-related risks for decision making in land/water management with using landuse, landcover, socio-economic data, and recent spaced-based techniques data and indicators;

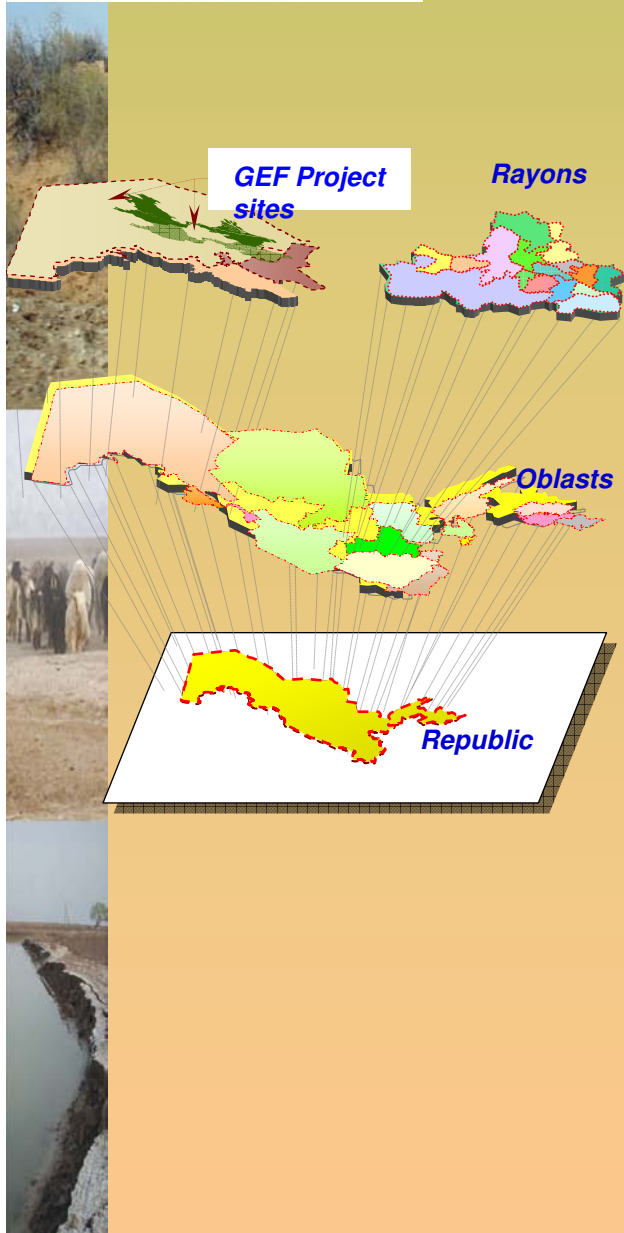- Integration into global FAO Land Use System (FAO LADA LUS)

SLM-IS Components and Data Flows

Primary Data:

(organised by sources of information: i.e. owners of data):

- Statistics Agencies
- Soils Institutes / GozNPCZem
- HYDROMET orgs.
- Hydro-Geological Meliorative Expedn.
- Rangeland / Arid Zone Research
- Topographical Mapping
- Google Earth (internet & JPEGs)
- individual's data (e.g. farmers)
- data of other projects
- original project data
- (annotated bibliography)
- (establishment of METADATABASE)

Remarks:
1. includes all data as received in original format by the project;
2. much of this data is in paper format;
3. some anomalies & mistakes are seen;
4. thorough checking necessary;
5. much excellent baseline data.

Processed Data, Digital Format

- Stats Agencies
- Soils Institutes / GozNPCZem
- HYDROMET org.
- Hydro-Geological Meliorative Expdn.
- Rangeland / Arid Zone Research
- Topographical Mapping
- Google Earth (internet & JPEGs)
- individual's data (e.g. farmers)
- data of other projects
- original project data
- (annotated bibliography)
- (establishment of METADATABASE)

Remarks: main formats of data:
- xls / dbf database format;
- shp (ArcGIS shape files: vector format);
- JPEG raster images.

GIS (ArcView 9.3) (based at MSEC, Bishkek): copies at NSIUs, CAC-5

Data:
- xls / dbf database format;
- shp (ESRI shape files: vector format);
- ESRI Grid files
- JPEG raster images.

GIS Tools:
- raster to vector and vector to raster conversions;
- geo-referencing of scanned maps and satellite images;
- generating points, lines and polygons from GPS coordinates;
- overlay operations of different map layers; clip operations;
- selecting points within polygons; - buffering points, lines and polygons;
- generating contours from point data values;

Cartographic Tools;
- generation of map coverages
- polygon shading
- graduated point symbols
- histograms
- pie-charts centred on points

External Tools: (mainly interactive Excel spreadsheets:

FAO CROPWAT	Evapotranspiration (ETo) & crop water requirement calculation (available through FAO website)
Climate / Rainfall reformatting	Automatic reformatting of daily rainfall & 10-day climate data
Daily Soil Water Balance Model (Rainfall-Runoff Modelling)	Calculation of daily runoff, soil moisture status within 3-layers in profile, soil / crop moisture deficits in terms of mm water and ETa / ETc ratios
Infiltration calculation	Amount of simulated rainwater (mm) infiltrated within 1-hour and 2-hour rain-storms
Irrigation Water Quality	Assesses quality of irrigation water (anions, cations, AdjSAR) according to FAO criteria
Land Evaluation	Assesses Land Quality according to methodology of FAO Framework for Land Evaluation (S1, S2, S3, N2 ratings for different Land Utilization Types)
1-Ha Crop Model Economics	Comparative economics of land use / land management & investment opportunities: calculates net profitability (before and after labour), return per labour-day, and Internal Rate of Return (IRR) for any given interest rate
Rangeland Feed Optimisation	Calculates optimum feed mix from different feed sources with respective costs, including rangeland, crop residues, and concentrates.

Report Formats & On-Screen Outputs (for internal MSEC, NSECs & NSIUs technical users)

Database tables accessible through map coverages (by clicking on points/ lines/ polygons)

Charts: (stand-alone)

Charts-in-maps

Maps (map formats covering standard SKO, Rayon and SO extents)

Tables

Standard-report text formats

Map overlays on GoogleEarth imagery base

Website: (for external users)

- Access by public to all information at general level (scales 1:500.000 - 1:5.000.000) & including CAC-5 & national mapping & data

- General data on environmental problems and current state of environment in CAC-5

- Specific information on indicators of Land and Water Degradation, and tabular / chart data on current status

- Specific information on rangeland, irrigation, and rainfed land use

- Registered access for all Government Depts & Agencies to full GIS & external tools and data

- Guidelines on "Best Practices' in land use and environmental management written for both general public and for specialist users

- Advertisement on services to be provided to private land owners: e.g. Environmental Audits; information on land and water suitability; crop prices and existing and predicted yield levels etc.

Overall SLM-IS: National Level

GEF Project sites

Rayons

Oblasts

Republic

FAO-LADA-LUS
National cut-outs from Global (1:5m) LUS layers & replacement with higher-resolution (1:1m) national layers): Soils; Land Use / Land Cover, etc.

National Coverages:
1: 500.000 - 1:1.500 000 (national)
1: 200.000 - 1:300 000 (oblast)
1: 50.000 - 1:100 000 (rayon)
1: 10.000 - 1:20 000 (municipality; irrigation schemes)
Point data: location of municipality and former kolkhoz / sovkhoz centres (old & new names), etc...

ECONET
(updating of Econet layers, particularly on protected areas, and correcting any errors….)

ICARDA
- agro-climatic layers, etc…
  (any updating, as necessary)

REMOTE SENSING IMAGES
- MODIS, LANDSAT ETM (particularly of higher-resolution coverages)
- *Google Earth* imagery updates, moderate resolution (1: 50.000 – 1:100 000) and high resolution (1:5.000 – 1:10.000) coverages, etc

SLMIS NSIU

National Statistics Agency Rayon and Municipalities Data
- Land Use, Crop Areas,
- Crop Yields, Crop Production
- Population, employment, income, poverty
Baseline Years: 1990, 2000, 2006; also other years over period 1987 – present.

GEF Project Area Coverages (NSIUs)
- 1:200.000 (Rayon + Oblast)
- 1:50.000
- 1:20.000, 1:10.000 (Municipalities)
  (updates & corrections…)

CACILM / MSEC / ADB Coverages (CAC-5)
- Major River Basin Boundaries
- Dams & Water Diversion Structures
- Hotspot / brightspot areas
- Met. & Hydromet Stations
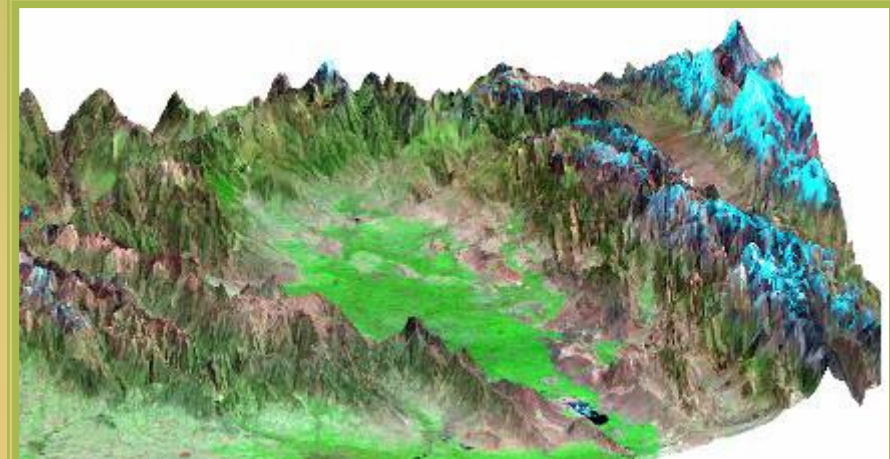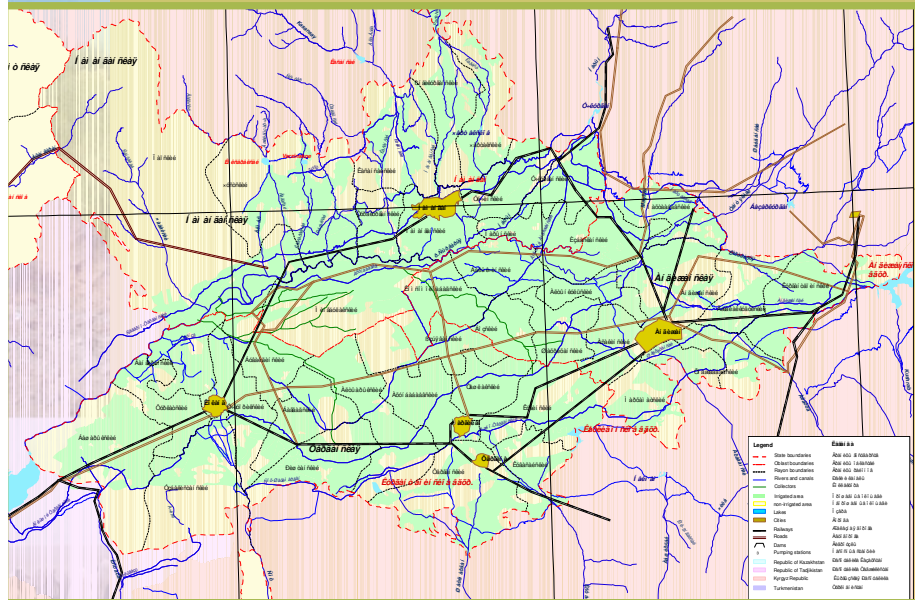- ADB, WB, EU, GTZ project locations

SLM-IS hotspot: Fergana Valley

Case Study Area

Fergana Valley - the most populous and vulnerable region of Uzbekistan (7.5 million people):

(i) Density of population in the Andijan (575 теn/км2) is ten times higher than the its average level by the republic.

(ii) The area of irrigated land per one rural inhabitant is 0.19 ha, as compared with 0.27 ha by the rest of Uzbekistan.

SLM-IS hotspot: Fergana Valley

Walnut Forests   Bare Rock   Mosaic Vegetation   Rainfed   Mosaic Forest   Snow/Glacier   Irrigated Land
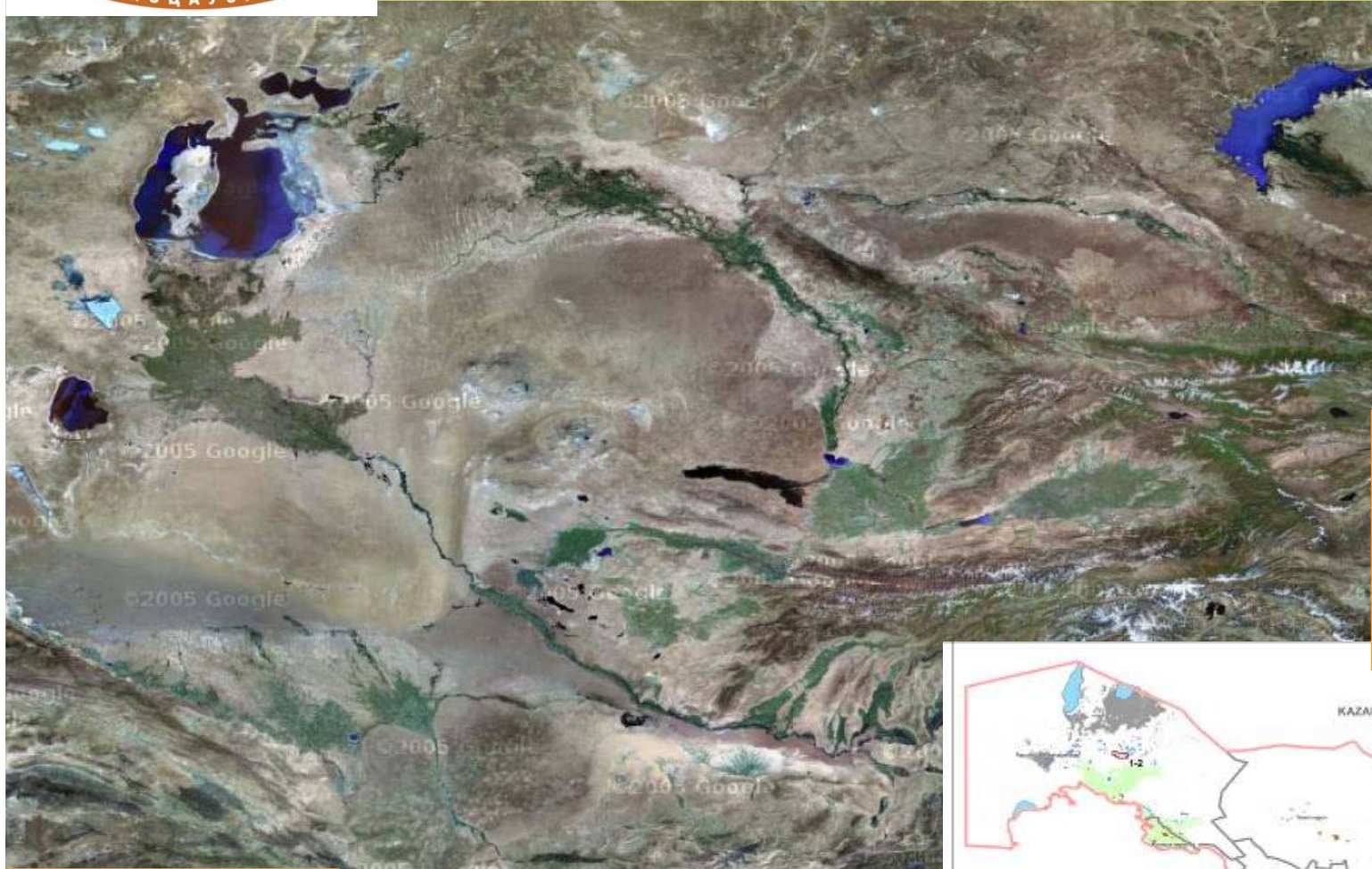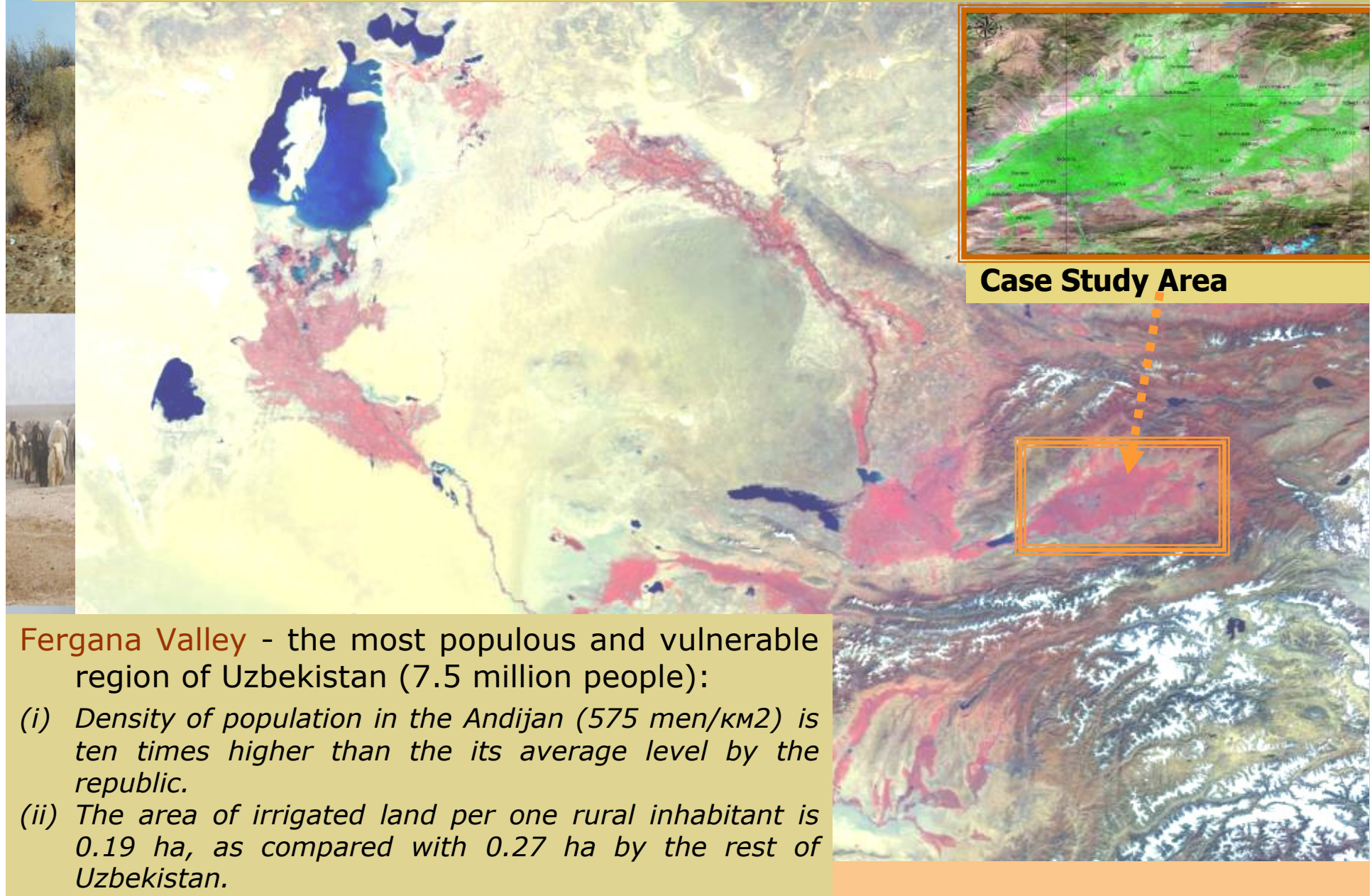
Source: Dr.C.V.Ji, ADB, 2009

Comparative analysis of land degradation and socio-economic conditions

	Irrigated area '000 ha	Rural Thousand people	Area with land degradation,'000 ha			Water salinity, g/l	Income per capita of rural, $USD	Poverty Level
			Soil erosion	Soil salinization	Water logging			
Andijan	272	1710	14,2	12,3	133,3	0,59	380	30,3
Namangan	281	1352	54,52	27,0	77,5	0,40	330	30,3
Ferghana	359	2111	16,5	170,2	167,0	0,89	295	30,3

SLM-IS hotspot: Fergana Valley

Waterlogging and salinization of the irrigated croplands

At present about 67-70% of the irrigated area at the right bank and central part of Fergana valley is rise of groundwater table and associated with that processes of water logging and soil salinization.
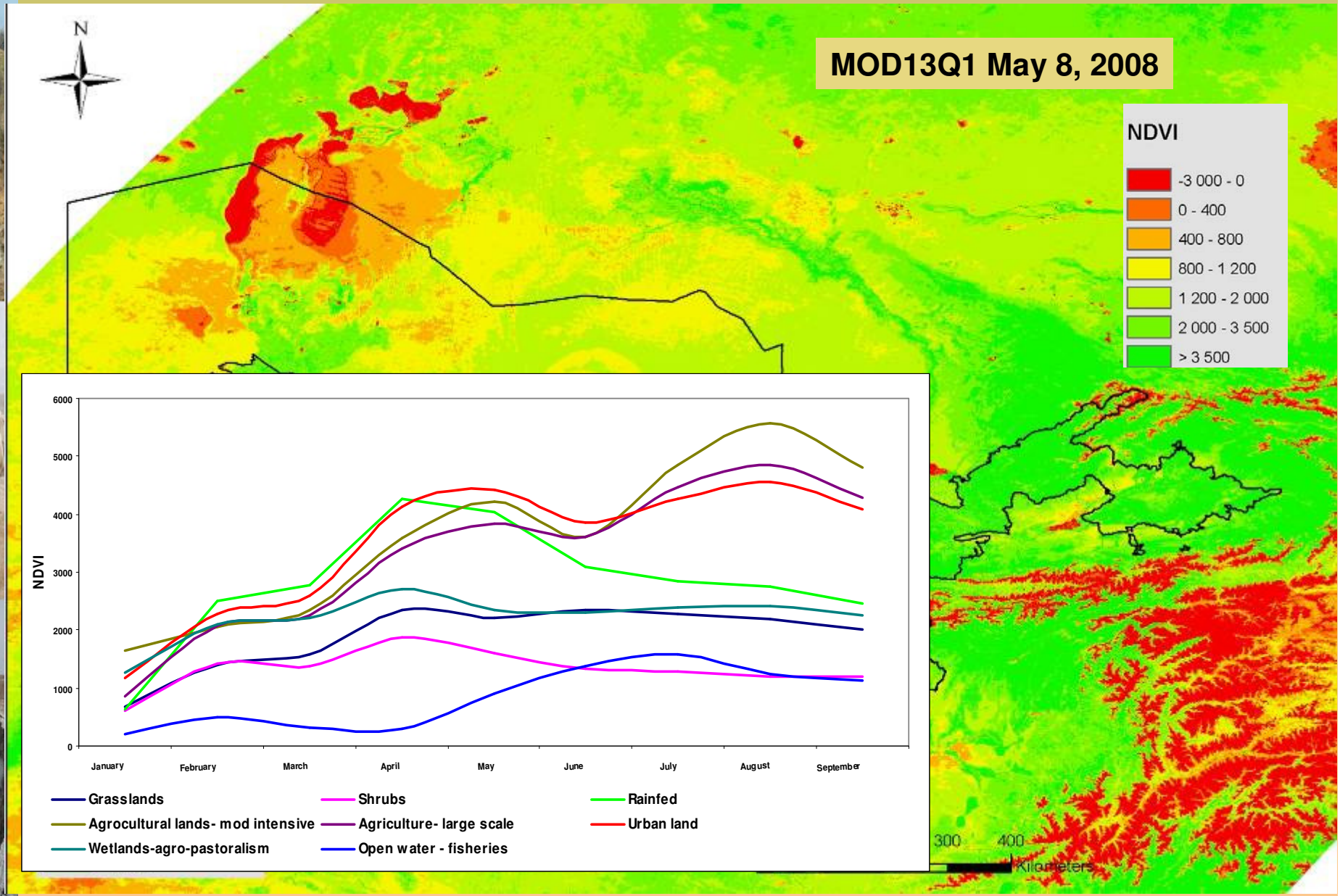
The area with a groundwater table in the range of 0 to 1.5 m has almost doubled in the period 1996-2006. Due to continuous waterlogging and salinization, agricultural lands are being abandoned and houses and other buildings are affected.
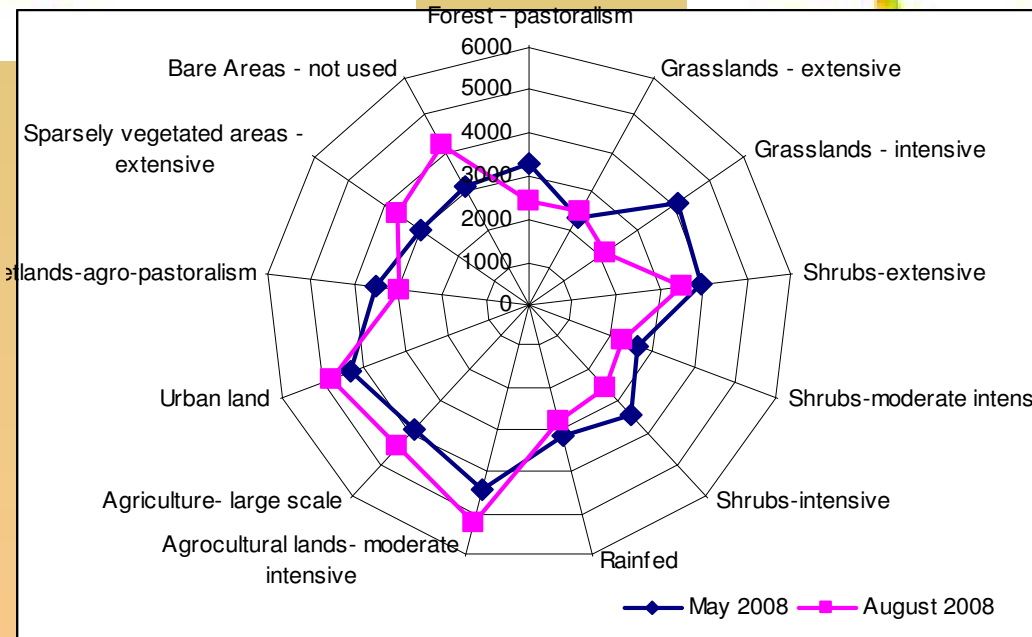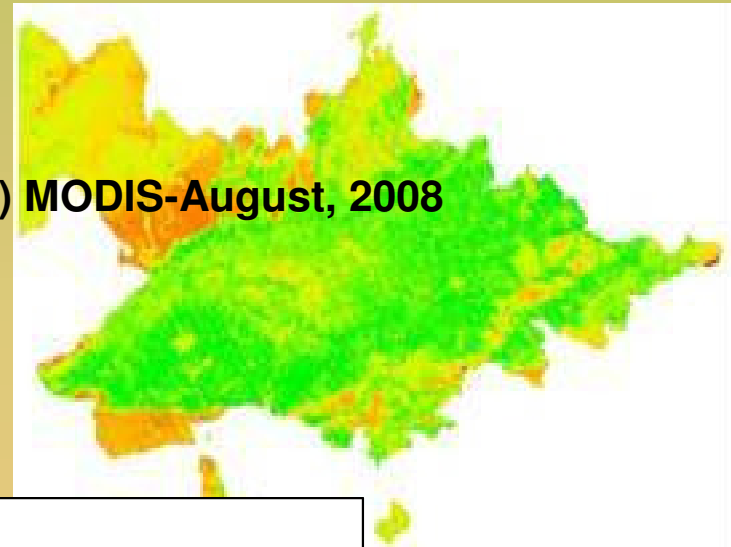
Source: WB Ferghana Valley Water Resource Management Project – Phase –I, 2009
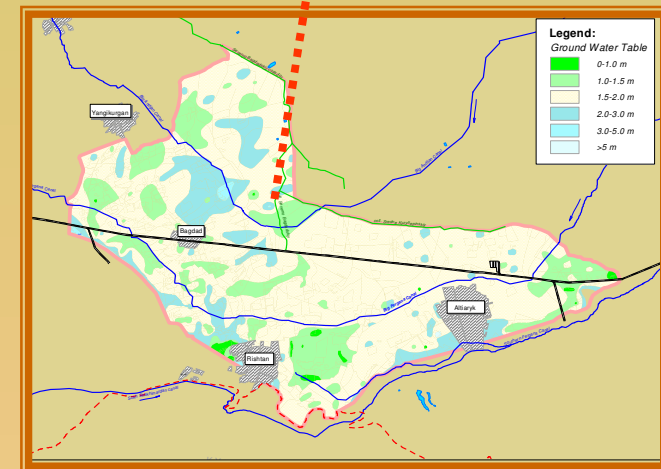
Waterlogging mapping: Fergana Valley

Day 161

Day 193

Baseline of Waterlogged Areas using MODIS spectral reflectance data supplied together with the 250m MOD13Q1 datasets.

Source: Dr.C.V.Ji, ADB, 2009

Legend
Waterlogging Index
- 0 - 109
- 109.0000001 - 178
- 178.0000001 - 272
- 272.0000001 - 366
- 366.0000001 - 460
- 460.0000001 - 25,241

2. RS interpretation of seasonal change of NDVI

MOD13Q1 May 8, 2008

NDVI

	-3 000 - 0
	0 - 400
	400 - 800
	800 - 1 200
	1 200 - 2 000
	2 000 - 3 500
	> 3 500

Grasslands
Shrubs
Rainfed
Agrocultural lands- mod intensive
Agriculture- large scale
Urban land
Wetlands-agro-pastoralism
Open water - fisheries

RS interpretation of seasonal change of NDVI

MOD13Q1 August 12, 2008

NDVI

■	-3 000 - 0
■	0 - 400
■	400 - 800
■	800 - 1 200
■	1 200 - 2 000
■	2 000 - 3 500
■	> 3 500

Grasslands
Shrubs
Rainfed
Agrocultural lands- mod intensive
Agriculture- large scale
Urban land
Wetlands-agro-pastoralism
Open water - fisheries

300   400
Kilometers

Seasonal Change of NDVI (MODIS, 2008). Fergana Valley

a) MODIS-May, 2008

b) MODIS-August, 2008
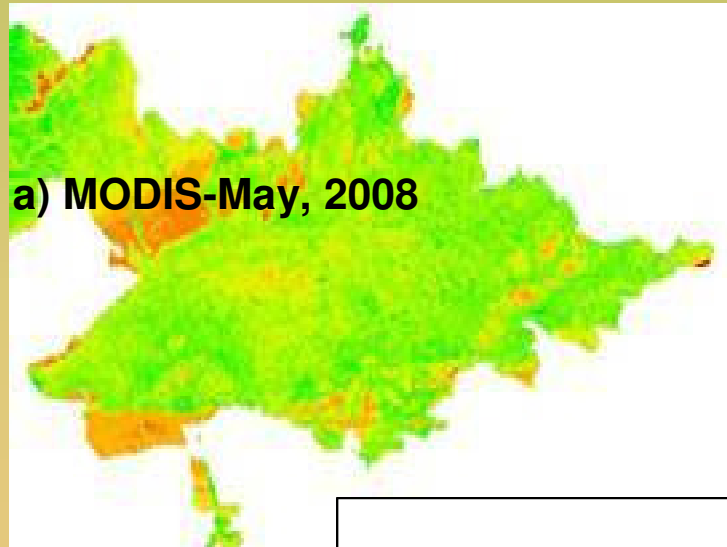
Hotspot: Water logging and salinization of irrigated lands

CACILM Land Use Map of Uzbekistan

Legend

CACILM Landuse (LU)

- Forest lands
- Irrigated lands
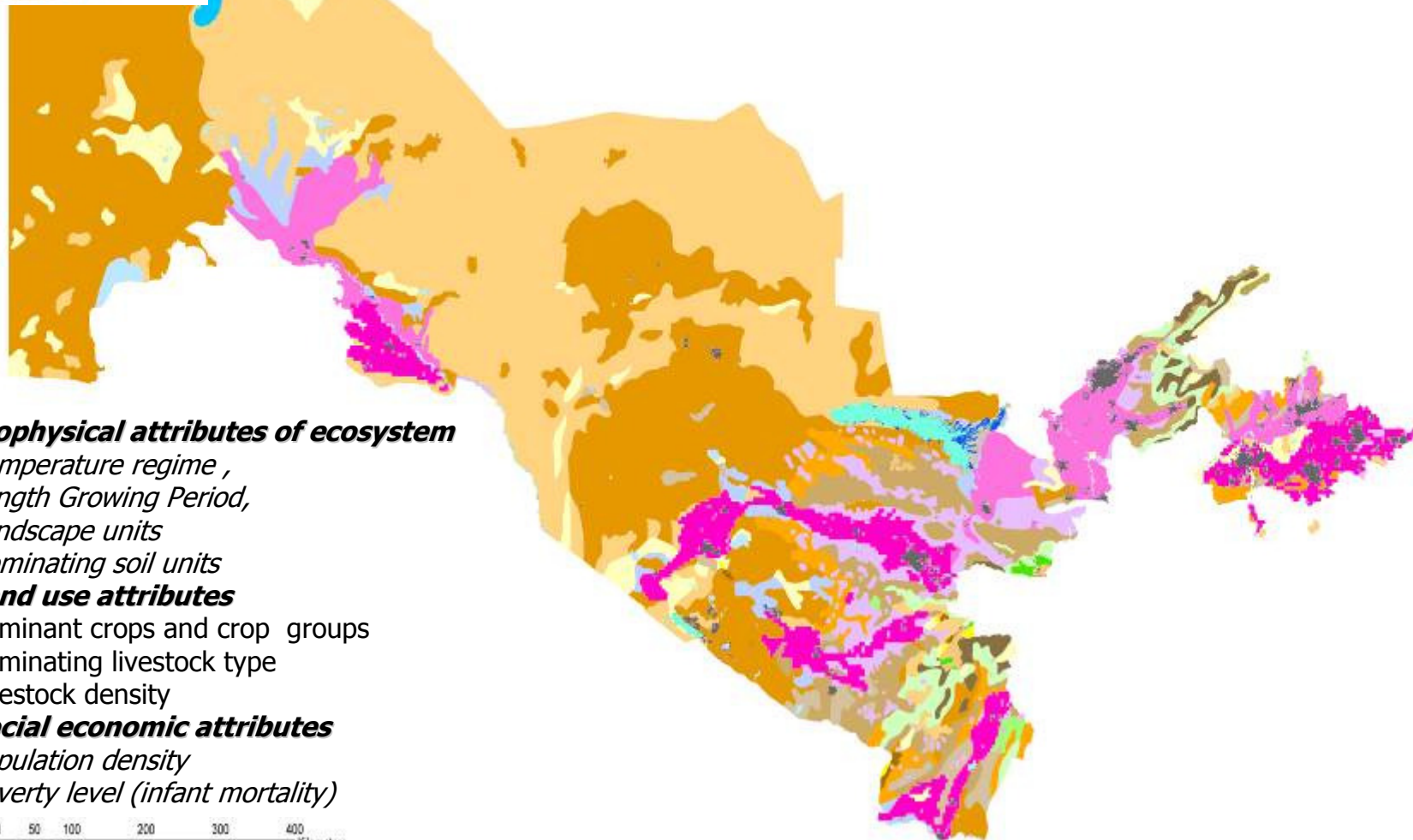- Rainfed cultivated lands
- Pasture lands
- Urban
- Wetland
- Water
- Unused
- Proteced areas
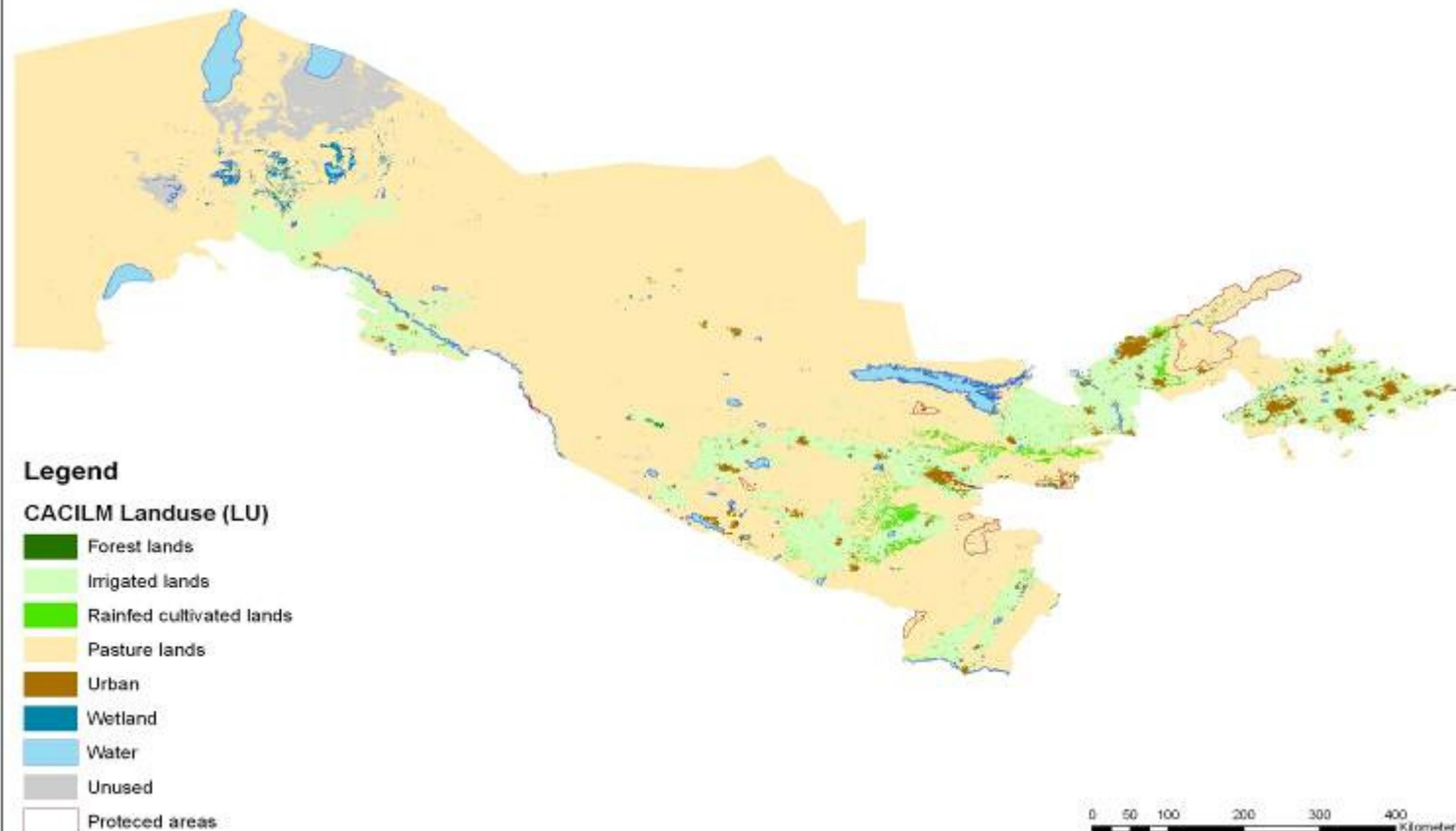
On the bases of compilation of national ecosystem and biophysical resource base with global system (GLCN,2000) 9 main classes of land cover was defined.

FAO LUS Map of Uzbekistan, CACILM SLMIS, 2009

Biophysical attributes of ecosystem
Temperature regime ,
Length Growing Period,
Landscape units
Dominating soil units
Land use attributes
Dominant crops and crop groups
Dominating livestock type
Livestock density
Social economic attributes
Population density
Poverty level (infant mortality)

National Map of FAO Land Use System consists of 25 classes, each of them is divided into 3-4 sub classes depending on biophysical attributes of ecosystem, land use attributes and social economic features.

Conclusions

q Land use/cover information is the most important for sustainable land use planning decision making and emergency response.

q Established SLM-IS of Uzbekistan i) improved the current weaknesses the national information base and ii) enhanced the institutional capacity to assess and monitor land degradation and climate change risks;

q Experiences gained during design and implementation of the SLM-IS have clearly demonstrated capacity building needs on new diagnostic and spaced-based management tools, integrated M&A approach to mitigate and predict possible emergence situation through modifications of the technical and institutional interventions and adaptation specific measures against droughts, mudflows and other uncertainties.

THANK YOU FOR ATTENTION

Welcome to Uzbekistan

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