MONITORING AND RESEARCH OF HISTORICAL ARTIFACTS BY EMPLOYING SATELLITE IMAGES AND GIS ON EXAMPLE OF NURATAU REGION

I. T. Muminov[a]
[a] IAP, Lab of background monitoring, 100174 Vuzgorodok, House 3a, Tashkent, Uzbekistan, iskmumin@mail.ru

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ABSTRACT:

The article tells about ways of use to hand tools and standard programs for creation of dB with GIS visualisation of data on registering and monitoring of historic artifacts under minimal financing support. For this goal GIS, GPS technologies, digital camera and ordinary office programs MS Word and MS Excel were employed. Method of computer mapping of historical data was used for collection, processing and analysis of data on historic artifacts. The dB, which describes 77 objects among 925 historic artifacts and includes 40 photos of petroglyphs and 5 plans of caravan sheds, was worked out for registration and monitoring of petroglyphs, ruins of caravan sheds and fortresses. Three GIS maps with locations of historic artifacts are presented. They are: map on narrative data, GPS corrected map and DEM map of ecologic risks. It was recognized 39 historic artifacts in zones of ecologic risks (mud flow areas and submerged territories). Total expenses for the dB put together $1000 USD, within 1,5 year of work.

INTRODUCTION

Motivation

Firstly, in Nuratau region lots of various artifacts of different historical times concentrate. One part of them are recognized and studied, whilst the other one needs its recognition and study. For example - there are numerous of petroglyphs uncovered. As Ya. A. Sher writes: “each year brings new discoveries, often unexpected and outstanding” (Sher, 1980).
Secondly, at the moment human master actively the Nuratau region and varied territories whith ancient artifacts become terminated or damaged. Particularly, numerous of caravan sheds, fortresses and sardobas became under waters of artificial Aydar-Arnasay Lakes System (AALS) (Muminov., 2009). The AALS is expanding permanently and floods new and new lands of Nuratau region (Allanazarova., 2005, Jandarbekov., 2005). In relation with it there is a necessity to catalogue of existing historic artifacts, to estimate their state, measure of damage, to create their dB with GIS visualisation.
Thirdly, one of main motivating factors was that, that almost all institutes on post-soviet space are restricted in finances. Some difficulties under exchange of scientific information (dB, catalogues, GIS maps) on historic artifacts and organizing troubles still exist. Nevertheless, it is necessary to carry out scientific studies and monitoring of historic artifacts. Thus a task to solve the problem within confined possibilities appears. Later it was impossible. For instance, creation such a dB demanded employing of seven specialists (programmers, engineers etc.), three years of work and about $30 000. But development of new technologies on area of processing spatial data creates an unique possibility to produce simple dB with GIS visualisation of data on historic artifacts by just ordinary means. Operation with the dB is easy: it allows use of standard input and output formats of spatial data. Moreover, expenses for design and creation put together $1000 within 1.5 year of work. Project employed only two persons: author (specialist on GIS) and photographer.

Objective

The goal of the work presented is to show possibilities of creation dB for registration and monitoring of historic artifacts by employing only to hand tools (gadgets) under minimal financing.

Tasks: 1)To design GIS project - “Monitoring of historic artifacts in Nuratau region”; 2)To work out structure of dB – “Registration and monitoring of historic artifacts in Nuratau region”; 3)Compilation of thematical GIS map – “Locations of historic artifacts in Nuratau region”; 4)To compile thematical GIS map – “Ecological risks for cultural heritage in Nuratau region” – (mud flows, seismic zones, submerged territories); 5)To design method of creation semantical dB and GIS projects for monitoring, study, estimation of state of historic artifacts under minimal financing and use of only ordinary to hand tools.

Review

Nuratau region lies about 185 km south west of Tashkent in 12th zone of Gauss Kruger projection (ellipsoid of Pulkovo 1942). The region is a transborder zone between sedentary and nomadic cultures (Muminov., 2004). This territory consisting a bit more than 50 000 km^2 concentrates varied historic artifacts of different cultures and nations. The artifacts are paleolith human stations, neolith and ancient mines, agricultural lands, petroglyphs of late Holocene and early middle age. They also include ancient and middle age irrigation system (dam, underground water reservoirs -sardoba), caravan sheds, fortresses and etc. (Muminov I.T., 2008). A great number of caravan sheds, including GSR passed Nuratau region in ancient times. Moreover, there are lots of historic artifacts of sacred character, some of them are mentioned bellow. The Tangri

mountain lake (Nuratau ridge), where Tangri is ancient turk word means Sky, God. The highest top of Nuratau ridge – the Hayat-Bashi top – means begin of life, due to ancient legends (Eversman., 1823) is a place of Noah' Ark moorage. Malguzar ridge – there is cave complexe of order of Sufists. Nurata fortress is burial-place of Arab saints – eyewitnesses of Muhammad Allaihi Salome (Narsachi., 2004). Pool with sacred fishes is found in neighborhood of Nurata populated area (which lies in Nuratau Intermountain basin), its age is estimated to be greater than 3-4 hundred years (Gulyamov, 1979). Naturally, that such a concentration of various artifacts of different historical times in relatively small territory attracts interest to itself. It is necessary to have detailed catalogue or dB of the artifacts with the purpose of monitoring them. Such an idea is not new – thirty ears before, in 1980 Ya. A. Sher the leading soviet petroglyphs' researcher suggested to use possibilities of computers for compilation dB on petroglyphs and their classification (Sher., 1980). David Graham suggested to create such dB or catalogue for petroglyphs (Graham., 1994). In 1995, the author by means of MS Word created dB of petroglyphs of Samarkand and Djizak districts with cartographic visualization. The "TurA" tourism multimedia viewer of Uzbekistan cities was created by the author in collaboration with M. Kratenko, S Ubaydulayeva, Sh. Zokirov in Institute of Space Engineering (Muminov and etc., 2001). That product was intended for viewing of historic artifacts (petroglyphs, memorials of ancient architecture, unique nature objects). The main kernel of the viewer was built by programming language C++. It has possibilities of visualization of cartographic and photographic raster data in BMP format, textual data in txt, audio data in wave and MIDI, video data in AVI. In 2004, in frames of state scientific-technical program an electron atlas of Nuratau region was designed on base of programming language DELPHI (Muminov and etc., 2004). However the practice showed that exploiting such dBases designed in different programming languages becomes useless for quick processing multi format data on cultural heritage. So numerous problems like discrepancy of formats of input and output data, uneasiness of dB update, internal hold-ups of the program leave unsolved. Moreover, design and creation of such a dB demand too much time and unpardonable large amount of financial expenses. Due to the reasons above, such product is inconvenient at field trip use and is not much competitive. Thus, on base of more than 15 years old experience the author came to conclusion that under small amount of financing it is better to use standard common-available softwares and tools. Due to this reliability of dB and convenience of its use raises. It is much more easy to exploit and update such a dB, to monitoring state of historic artifacts. Spending of time, financial resources for design, creation and testing dB decreases up to several times, whilst reliability increases.

MAIN BODY

Methods

The essence of the method is presented in works of Piotuh N.V: "On possibility of computer mapping under work with data of handwriting books of beginning 17 century and data of general survey (land marking) of second half of 18 century" Moscow St. University (2004) and in work of Irish researchers Bartli C., Ell P., Lie D., 2004: "From manuscript to multimedia: treatment of historical DB", Belfast UK. Brief observation of the methods was given in work of the author "Reconstruction of Commercial Ways and Silk Road in Nuratau Area" published in proceedings of the XXI Congress of The International Society for Photogrammetry and Remote Sensing (3-11 July. Beijing, China. ISSN 1682-1750. vol. XXXVII. TS-SS9: Cultural heritage recording and Silk Road. P. 93.Beijing, China 2008).

Database Creation in GIS

(i) Data input: Narrative Historical data Base was created on base of 380 bibliographical sources on history of development of human activity in Nuratau region covering period from first evidences of human impact (about 48 000 years ago) till end of 20 century. The sources include historical chronics, ancient manuscripts and Arabian guidebooks, archaeologic and ethnographic studies on the region. Oldest books dated by 1823 year. These data were transformed into dB in MS WORD format. Use of this software provided maximal simplicity of access to the information and easiness of employing the dB. Moreover, under necessity, the dB can be easily transformed into format of MS ACCESS allowing use in MapInfo Professional 6.0 GIS software. At all 925 historic artifacts were marked.

Semantical data Bases. On base of the narrative historical dB five semantical dBases were created. First of them describes locations of 125 historic artefacts in Nuratau region from neolite to beginnings of 20 century. They are caravan sheds, fortresses, petroglyphs, sardobas, ancient irrigation systems, sacred places, stone pyramids on mountain ridges and passes, ancient human stations and mines, mounds. Second dB consists of data on reconstruction of commercial infrastructure, caravan roads and sections of GSR passed from Nuratau and surrounding areas. The third one estimates ecological risks in Nuratau region including description of mud flows, seismic zones and territories flooded by waters of AALS. The fourth dB presents electron toponymical vocabulary including 530 geographic names of places in Nuratau region in 16 languages. The vocabulary is an assistant tool under search of historic artifacts (Muminov., 2008). The fifth dB clarifies information's on historic artifacts and ancient commercial roads of Nuratau region.

Old Map GIS data Base – consist of five GIS maps over Nuratau region compiled on base of old maps of 1730, 1848, 1871, 1895, 1902 years. Following layers were selected: directions of rivers, lakes, populated areas, wells, road network, post stations. Besides, old maps include only rivers, lakes and several main populated areas. The GIS maps were compiled with use MapInfo professional v. 6.0 GIS software including at whole 30 GIS layers.

GIS data Base and DEM consists of two levels in scale, 16 GIS layers and two DEM. The layers for the Uzbekistan territory of 1998 year in scale 1:1000 000 represent relief, road network, rivers, lakes, populated areas, sands, solonchaks, administrative division (state, districts and regions borders) accordingly. There are also layers in scale 1:500 000 describing historical zones of human impact in Nuratau region, locations of petroglyphs of Samarkand and Dzhizak districts, water surface of AALS on base of satellite image of 2005 y., ecologic risks (mud flows, seismic zones) on base of space survey of 1979-1980 y., road network of 1984-1998 years. Two DEM of landscape of Nuratau region and surrounding territories in scales 1:1000 000 and 1:500 000 obtained under use of IDW grid. All GIS maps were created on base of MapInfo Professional v. 6.0. GIS software. DEMs were created under applying GIS utility written in Map Basic All2pts v.0.9 language by Emmanuel Pare.

Ground Data. First visit in Nuratau region continued from 15 to 31 June of 1994 y. for fixing petroglyphs in two mountain gorges of the region. The second continued from 24 to 31 May of 2001 y. for clarifying data on gatherings of petroglyphs in Hayat sai (north Nuratau ridge) and their GPS correction. The third continued from 29 May to 2 June of 2002 y. for clarifying locations of fortresses in Ukhum and Hayat mountain gorges. Fourth continued from 3 May to 7 May of 2008 y. for clarifying narrative information on historic artifacts (petroglyphs, ruins of ancient populated areas) in Sentyab sai region (north Nuratau ridge) and Sarmysh sai (south Nuratau ridge). About 40 petroglyphs of Sarmysh sai were taken photograph. It is to note that owed to restricted financing we had to combine different scientific studies like large-scale landscape survey, collection of probes of soils and, vegetation for background monitoring in frames of radio ecological studies, etc. and study, registration and monitoring of historic artifacts.

Visual Interpretation – satellite images Salute 6 August 1980, MSU-E, FCC, 15 April 1998 and Landsat TM 5, Band 4/3/2, 06 July, 1998, cadre 155-32 were used for recognition of road network, wells, submerged territories.

(ii) Data output: Semantical data Base for registration historic artifacts in Nuratau region includes description of 77 objects (petroglyphs, ruins of caravan sheds and fortresses). Seven categories describing character of petroglyphs were introduced into the dB. Each of the categories includes list of special features. At whole, 54 features were selected. In addition, 40 photos of petroglyphs were visualized. Four categories and 36 distinguishing features for caravan sheds and fortresses were selected in the dB. As well, five plans of ruins of caravan sheds were given.

New Thematical GIS data Base includes 2 levels of scaling and consists of 3 thematical GIS maps. The first map - "Locations of historic artifacts in Nuratau region" was compiled on base of the narrative dB. Initially 925 objects were selected on the map and 35 attributive dBases for the layers of the map were created. Only 593 of them remain in the second clarified map after GPS correction. The third map (of ecological risks) was synthetic one joining layers of mud flows, seismic zones and submerged territories.

Digital Elevation Model (DEM) was created on base of topographic map in scale 1:500 000 under employing GIS utility All2pts of MapInfo Professional GIS software. GRID network DEM (IDW) were created. The map of ecological risks for historic artifacts was overlaid onto the DEM.

Data used

Map sources:
The toposheet of 'Dzhizak'K-42-B in scale 1:500 000, GUGK USSR dated from 1984 year.

Satellite images sources: Salute 6, August 1980; Resource MSU-E, FCC, 15 April 1998; Landsat TM 5, Band 4/3/2, 06 July, 1998, cadre 155-32.

dBases sources: Narrative dB of history of human impact in Nuratau area from Paleolith to Bukhara Emirate times (end of 20 centuries) created in 2003 by the author. Semantical dB of historical artifacts location in Nuratau area from Neolith time to beginning 20 centuries A.C. created in 2009-2010 by the author. Semantical dB of reconstruction of trade infrastructure and commercial route of Silk road time in Nuratau area and transborder territory – created in 2008-2009 by the author. Semantical dB of ecological risk in Nuratau area created in 2000 by lab of background monitoring (Pushkarenko G). Toponymical dictionary of Nuratau area on 16 languages with 530 names, created by the author in 2008 years.

GIS dBases: Map of physical geography of Uzbekistan dated from 1998 year in scale 1:1000000, historical map of human impact in Nuratau area from Paleolith to Middle age times in scale 1:500000 dated from 2003, the map of rock arts locations in Samarkand and Dzhizak provinces in scale 1:500000 dated from 1995 year, the map of of Aydar-Arnasay Lake Systems of 2005 years in scale 1:500000 (from satellite imagery). Digital elevation models of Nuratau area in scale 1:500000, dated from 1984 year, created in 2008. Map of ecological risks in Nuratau area (mud streams, seismic danger zones) from satellite imagery dated from 1979-1980 years. All sources from the author Ph.D. thesis (unpublished). Administrative territorial divisions (Regions, districts) of Uzbekistan dated from 1998 year in scale 1:1000000, settlements location of Uzbekistan dated from 1998 year in scale 1:100000, road network of Nuratau area dated from 1984 and 1998 years in scale 1:500000.

Instruments (sensors, systems etc.): PC Pentium III 866Mhz/512 Mb RAM/64 MB Geofors MX video card/19' Fujitsu-Siemens monitor; HP SJ 4200; Hand navigator GPS – Garmin 12 channels; Digital camera Olympus C-300 zoom 3.2 MGP. GIS Software – MapInfo Professional v. 6.0. En. and GIS utillite All2pts v. 0.9 alfa (created by Emmanuel Pare). MS' Word'97; MS' Excell'97; OS MS' Windows 98 SE.

Results

1) The "Monitoring of historic artifacts in Nuratau region" GIS project was designed (figure.1). Under the design of the project, materials of three projects accomplished earlier were used. First of those projects – "System of interactive dynamic mapping of vegetation cover on base of satellite information – Bio-Perspective" was executed in frames of State Scientific-Technical program № 4.2.4.5. (2000-2002), (Muminov., 2001). The second – "Reconstruction of commercial ways and silk road in Nuratau area" was performed in frames of enterprising treatment in Laboratory of background monitoring of IAP (Muminov., 2008). The third – "Digital atlas of Southern part of the Aral Sea Region" was performed under financial support of Japan International Cooperation Agency (Reimov and etc., 2000). Additionally, method of technological scheme of geographic multimedia atlas creation (Komissarova., 2003) was used.

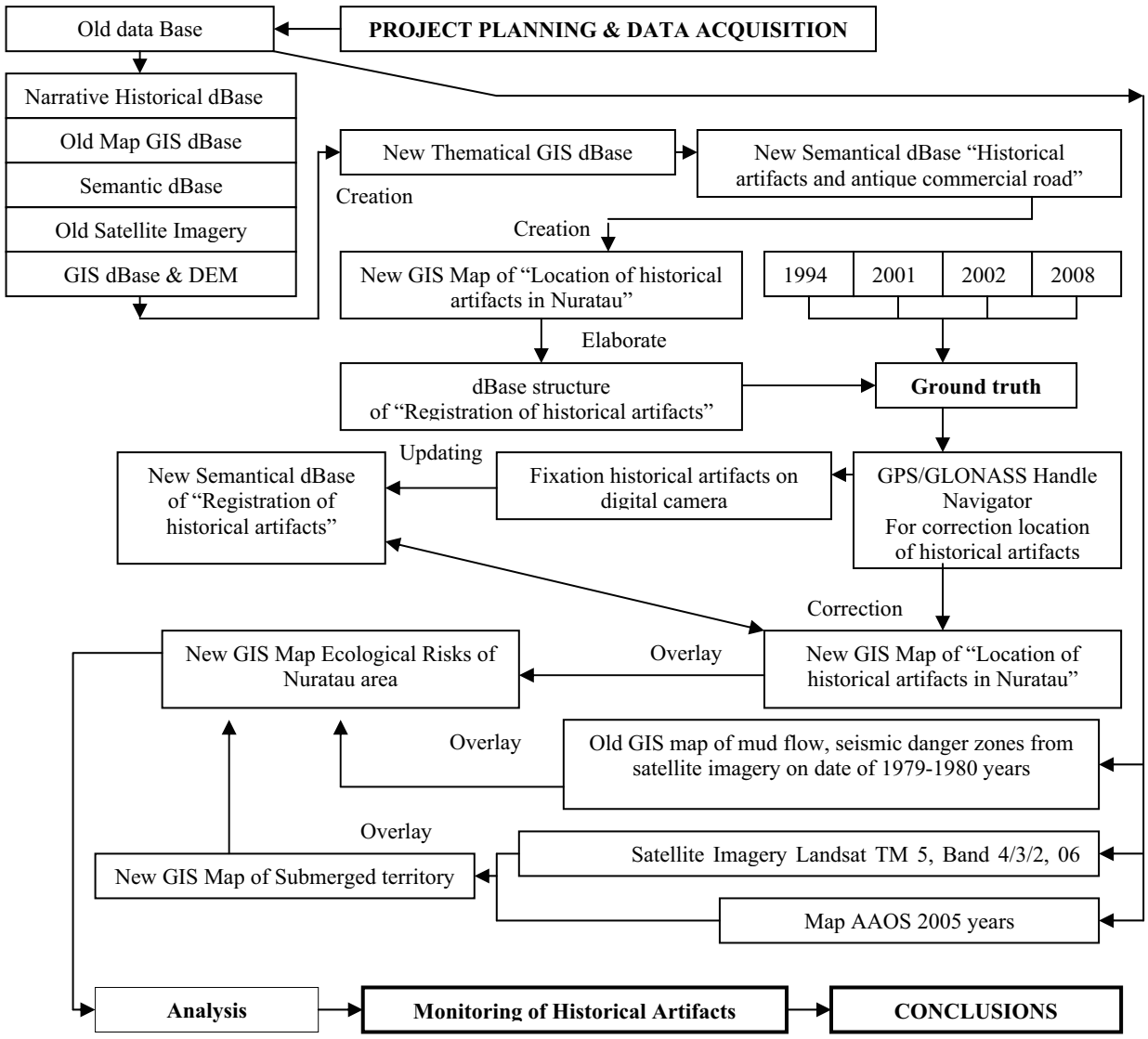

Figure 1. Paradigm adopted in the creation of GIS Project of "Monitoring of historical artifacts in Nuratau region"

Our project consists of earlier created narrative dB, six semantic dBases on historic artifacts in Nuratau region, two GIS dB on old maps, contemporary contour map and map of administrative division, ecological risks and historical data. The GIS dBases include 48 thematical layers and 35 newly created attributive dBases, 4 semantic dB's, plus 50 GIS layers. The layers consist of 21 special GIS layers, 14 assistant layers and an integral layer on historic artifacts, 6 special layers on ecological risks (4 of them on submerged territories), and 8 assistant GIS layers.

2) Structure of "Registration and monitoring of historic artifacts in Nuratau region " the semantic dB was designed for describing petroglyphs, ruins of caravan sheds and fortresses – total amount of objects is 77.

In the dB for petroglyphs seven categories were selected: General, Index, Character of picture, Technical (of accomplishing the petroglyphs), Time, Monitoring, Ecological risks. Each category includes certain list of features. **General category includes information on:** current number of petroglyphs in dB; current number of the point on the "Locations of historic artifacts in Nuratau region" GIS map; number of object's photo in dB; date of first fixation; time of day when the petroglyphs are visible; border of complex, location of the petroglyphs (district, region, mountain valley); orienteer; coordinates; absolute height; orientations of the petroglyphs relatively to cardinal points; description of surrounding landscapes, type of rock where the petroglyphs were drawn, its state, safety, color, height, width, shape, number of faces; number of stones (separate stone or group of stones); number of pictures in the complex. **Index includes information on:** current number of petroglyphs complex, description of the complex, current number of the face, position of the face, distant to the nearest face, orientation relatively to cardinal points, angle of the face inclination. **Character of picture includes information about:** current number of separate petroglyphs, name of its image, type of the plot, its direction, specific details, colors, style, size, intersection the petroglyphs with the others. **Technic (of accomplishing) consists of information on:** existing desert crust on the surface of picture, type of tracks left by graver, their shapes and depths (cm), sizes of percussive side of the graver (cm), character of borders of the tracks. **Time describes** preliminary estimation of age of petroglyphs. **Monitoring –** date of monitoring (date, months, year), state of petroglyphs, damages, type of damages, current

number of anew photo of petroglyphs in dB. **Ecological risks:** level of flooding hazard and mudflows hazard, seismic zone.
In dB on caravan sheds and fortresses four categories were selected: General, Characteristic, Monitoring, and Ecologic risks. Each of the category consist of certain list of features which differ a little the ones for petroglyphs. **General category includes data on:** current number of considered building; current number of corresponding point on the "Locations of historic artifacts in Nuratau region" GIS map; current number of photo in dB; name of the building; date of register in the dB, borders of the complex, location of the complex (district, region, gorge, position of the object, its coordinates, absolute height, surrounding landscape); nearest orienteer, shape and size of the building; building materials; type of the building; width and height of the walls; sizes of slabs; width of junctions of the stonework; existence of towers; diameter and shape of the towers. **Characteristic:** existing of culture layer, date of its creation, date of vanishing, date of secondary settling and destruction; caravan road on which the object was located or description of route which was covered by the object -key commercial points (including caravan sheds and fortresses) of the covered segment; purpose of the caravan shed. **Monitoring:** date of monitoring; state of the object; damages. **Ecological risks:** level of flooding hazard and mudflows hazard, seismic zone.

3) "Locations of historic artifacts in Nuratau" thematic GIS map was compiled. The one points to 925 historic artifacts: ruins of caravan-shed, ruins of middle age fortress, ruins of protective wall, sardoba, complex of petroglyphs, neolithical and middle age irrigation channels and agricultural lands, late middle age dams, sacral thousand years old trees and preying territory (basin with fish, grave of saint "Avlie-Ota", cave complex of Sim the Noah son, mountain lakes and etc,.); late middle age wells; ancient mines and pits; ancient mounds; stone pyramids on mountain ridges and passes; ruins of ancient towns and populated areas, markets played important role at time of GSR; reconstruction of commercial routes in period from GSR and Arab Khalifat to beginning of 20 century. "Locations of historic artifacts in Nuratau" the GIS map consists of 21 special thematic layers describing the above-mentioned artifacts and 14 assistant layers: GRID (Interpolator Distance Weighting) over the Nuratau region; rivers; lakes; dry riverbeds; toponymical names; contemporary borders (of states, districts, regions); populated areas; mountain passes; asphalt and unpaved motorways; wells in use and artesian wells. "Locations of historic artifacts in Nuratau" the integral layer; 35 attributive dB's; 3 semantical dB's; toponymical vocabulary for 530 names are also included to the GIS map. The vocabulary includes names in 16 languages: Old Soghdian, Old Turk, Sanskrit, Indo-Chinese, Arabian, Farsi, Mongolian, Uzbek, Kazakh, Turkmen, Urdu, Chinese, Greek, Ugorian, Tadjik,Tibet with transcription to Russian.

4) "Ecological risks for cultural heritage in Nuratau region" the thematical GIS map was created. The one includes three special thematical layers on ecological risks: mudflows, seismic zones, submerged territories. Besides the layer on submerged territories includes data on zones of AALS flooding in 1989,1998,2005 years obtained from satellite images. The GIS map also includes 8 assistant thematical layers: rivers, lakes, temporary riverbeds, populated areas, districts' and regions' borders, asphalt and unpaved motorways. This GIS map describes only 77 among 925 objects due to fact that the map was compiled on base of "Registration and monitoring of historic artifacts in Nuratau region " the semantic dB. When the map had been compiled and data have been clarified, it was recognized that 6 ruins of caravan sheds and 3 ruins of middle age fortresses had been flooded by waters of AALS. Territory of Nuratau region lies in seismic zone of number 6-7 (in GOST 6249-52 scale). Besides seismic zone of number 6 is found northern of AALS and does not takes greater than 8-10% of total area of Nuratau. Under use of the GIS layer on mudflow risks, 16 gatherings of petroglyphs and 3 ruins of fortresses were found in zone of mudflow hazard of third category. It means that maximal discharge of mud streams lies within interval 10-100 m^3/sec., area of catchments of runoff surface 50-100 km^2. Showers are the reason of mudflows in Nuratau. Nine gatherings of petroglyphs, 2 ruins of fortresses were recognized to be in mudflow hazard zone of fourth category - maximal discharge of mud streams does not exceed 10 m^3/sec., area of catchments of runoff surface about 10 km^2. The rest 17 gatherings of the petroglyphs and 10 ruins of caravan sheds, 11 ruins of fortresses lie in zone where mudflows never have been seen (5^{th} category).

5)Method of creation of semantic dB and GIS projects on monitoring, study of historic artifacts, estimation of their state were designed under employing ordinary only to hand tools and within minimal financial expenses. Ordinary to hand tools: handle navigator GPS/GLONASS (for correction of locations of the objects); digital camera (for taking photograph of the historic artifacts); office software's MS Word and MS Excel (to create dB for registration); GIS software MapInfo Professional and GIS utilities of them (to create GIS map on location of historic artifacts, on ecological risks and for DEM); old archive satellite images of different years over Nuratau region; earlier created GIS dB's on physic-geographical data, administrative division, historical state of the territory studied, including old maps, map of ecological risks, narrative dB's on history, semantic dB's. All these means may be employed under minimal financing of the project. The method is easy. First step was creation of the narrative dB under use of bibliography sources and old maps covering Nuratau region. The dB presents data on locations of already studied historic artifacts, recently found and unstudied yet. Next step was creation of the semantic dB on base of the narrative one. Next, using old satellite images directions of roads, wells, and submerged territories were visually interpreted. On base of those data the GIS map of preliminary location of historic artifacts was compiled. The map allowed to recognize regions needed field-trip correction. It was decided to create dB's in MS Word and MS Excel for easiness of operation. Data in such dB's can be easily transformed into GIS dB. All the softwares and data kept in notebook that allows their exploiting at the field trips. GPS/GLONASS correction of data on historic artifacts was performed at the field trips under use of handle navigator. That allowed to clarify the GIS maps and to update dB's on historic registration of historic artifacts. Under the corrections of locations of the artifacts their images were taken onto digital camera with detail descriptions, estimation of state of the objects, degrees of the objects damages or absence of damages.

Discussion

Main result is simple and efficient method of creation dB and GIS projects on registration, monitoring, study and estimation of state of historic artifacts under minimal financial resources. It is to note that given method is economical version for carrying of scientific studies of cultural heritage. Existence of several new satellite images of high resolution could allow to increase sufficiently the efficiency on search of new historic artifacts and on correction of already found ones in the region of studies. In future, use of new satellite images will allow compilation of

more detail map of ecological risks (with hazard zones of mudflows, stone falls, snow avalanches, landslides, technogenic pollutions), which, in turn, will provide creation of map of insurance risks in regions with historic artifacts. Nuratau region played an important role in world transit trade at times of GSR, when two branches of the one passed the region. "Experts of WTO decide that GSR is transcontinental conception of integration of the states on all levels (transport communications, trade, economics, technologies, culture, information and etc.) whose realization demands active cooperation of all the states. The decisions accepted at second forum on tourism on GSR, took placed in Nara city (Japan) under collaboration with UNESCO, allow forming a new conception of tourist resources on GSR: sights (places of note), objects of culture and history, tourism infrastructure (hotels, transport, restrains, information centers) (Tukhliev and etc. 2001). Presently, lots of states are showing their interest to renascence of GSR looking for studies of rich culture heritage of that epoch and for promotion of new tourist product – the GSR. Thus, creation of dB's on historic artifacts in future will help to tourism agencies to assemble new tourist routes over GSR.

CONCLUSIONS

Simple in use the dB with GIS visualization on registration and monitoring of historic artifacts in Nuratau region was created. Total expenses for creation the dB made 1000 USD within 1,5 year of work of two persons. 925 historic artifacts were selected in the Nuratau region due to narrative data. After field correction only 593 objects recognized. The map of ecological risks for historic artifacts created in frames of the project showed that 39 of the historic artifacts lie in zones of ecological risks (mudflow regions and submerged territories).

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