PACIFIC INSTITUTE OF GEOGRAPHY
RUSSIAN ACADEMY OF SCIENCES
FAR EASTERN BRANCH

# FINAL REPORT

ON THE PROJECT
# "CREATION OF GIS FOR AMUR RIVER BASIN
# PHASE June, 2005 – March, 2006"

Vladivostok, 2006

## Introduction

According to the technical task of the contract between the Pacific Geographical Institute, FEBRAS and Research Institute for Humanity and Nature Inter-University Research Institute Corporation National Institutes for Humanities (Kyoto, Japan) the following works have been fulfilled:

1. Compiled electronic (digital) base common geographic coverages, including:

- Relief in horizontal lines every 300 meters.
- Hydrological network: main channels, tributaries, lakes, water reservoirs, channels.
- Settlements divided into: states capitals; centers of krais (oblasts), provinces; cities over 1 million, from 1million to 500 thousand, from 500 thousand to 100 thousand of residents.
- Road network: railways, motor roads: highway, other covered roads.
- Borders: state, administrative of krais (oblasts), provinces.

2. Made an electronic 3D-model of relief - DEM (using data of Shuttle Radar Topographic Mission (SRTM) with step of 15 arcsecond).

3. Created a map (electronic coverage) "Modern land-use in Amur River basin" on the basis of decoded satellite images of LANDSAT–TM 2000-2001 with resolution on the spot 50-100 meters.

4. Compiled an electronic coverage "Geological Structure" on the basis of "The geological map of Pri-Amurye and adjacent territories in 1:2,500,000", published in 1999.

5. Compiled an electronic coverage "Vegetation of Amur River basin" for the Russian territory on the basis of "The vegetation map of Amur River basin 1: 2,500,000 edited by Sochava V.B." (1968), "The vegetation map of Mongolian People's Republic 1: 3,000,000 (1990)", "The Vegetation Atlas of China 1: 1,000,000(2001)".

All the electronic coverages are made on platforms of Arc/INFO, ArcView with detailed scale of 1:2,500,000.

Technical parameters of fulfilled works are below.

## Description of electronic (digital) coverages

### I. Description of electronic (digital) base common geographic coverages:

**1. Work projection:**

**projection albers**

**datum puk**
**zunits no**
**units meters**
**spheroid krassovsky**
**Xshift 0.0000000000**
**Yshift 0.0000000000**
**parameters**
**52 0 0 /* 1st standard parallel**
**64 0 0 /* 2st standard parallel**
**135 0 0 /* central meridian**
**0 0 0 /* latitude of projections origin**
**23500000.0**
**0.0**

**2. The list of coverages:**

**Common coverages:**

1\1 **Coverage:** RELF
**Fields description**:

| **Field:** | **Type:** | **Description:** |
|---|---|---|
| Contour | Integer | Height |

**Объект**: Horizontal line (Closed horizontal lines can consist of several objects)
**Object of coverage**: Horizontal line
**Kind of object**: Arc
**Description**: Coverage of relief isolines for Amur River basin
**Source**: Made from digital model of relief (grid dim 200_8).
**Date of source data:** February 2000

Vector maps Vmap0 in scale 1:1'000'000 for the whole territory of Russia distributed by the USA National Geospatial Agency (NGA) were initial data for the subsequent coverages (**1\2 – 1\9**). These data are available for downloading through special web-site (http://geoengine.nima.mil/geospatial/SW_TOOLS/NIMAMUSE/webinter/rast_roam.html). The data have been corrected according to the base topographic maps in scale of 1: 1,000,000, published in 1975-1977.

1\2 **Coverage:** VS
**Description of field**:

| **Field:** | **Type:** | **Description:** |
|---|---|---|
| Zv2 | Integer | Height |

**Object of coverage**: Point of fixed height above sea level
**Kind of object**: Point
**Description**: Coverage of heights notes according to the coverage of relief isolines (RELF)

1\3 **Coverage:** ROAD
**Description of field**:

| Field: | Type: | Description: |
|---|---|---|
| Kod | Integer | Code of road characteristics |
| | 1 – railways | |
| | | 2 – motor-roads |
| | | 3 – other roads |

**Object of coverage**: Road
**Kind of object**: Arc
**Description**: Motor roads and railways.

**1\4 Coverage:** SETTL_POLY
**Description of field**:

| Field: | Type: | Description: |
|---|---|---|
| Nam | String | Settlement's name in English |
| Name_r | String | Settlement's name in Russian |
| Kod | Integer | Status of settlement |
| | | 2 – center of krai, oblast |
| | | 3 – center of province, aimak |
| | | 100 – without status |
| Pop | Integer | Population quantity |
| | | 1 – over 1 million |
| | | 2 – from 500 thousand to 1 million |
| | | 3 – from 100 thousand to 500 thousand |
| | | 4 – from 10 thousand to 100 thousand |

**Object of coverage**: Settlement
**Kind of object**: Poly
**Description**: Coverage of settlements shown by polygons.

**1\5 Coverage:** SETTL_POINT
**Description of field**:

| Field: | Type: | Description: |
|---|---|---|
| Nam | String | Settlement's name in English |
| Name_r | String | Settlement's name in Russian |
| Kod | Integer | Status of settlement |
| | | 2 – center of krai, oblast |
| | | 3 – center of province, aimak |
| | | 100 – without status |
| Pop | Integer | Population quantity |
| | | 1 – over 1 million |
| | | 2 – from 500 thousand to 1 million |
| | | 3 – from 100 thousand to 500 thousand |
| | | 4 – from 10 thousand to 100 thousand |

**Object of coverage**: Settlement
**Kind of object**: Point
**Description**: Coverage of settlements shown by points.

**1\6 Слой:** LAKES
**Description of field**:

| Field: | Type: | Description: |
|---|---|---|
| Nam | String | Name of water body in English |
| Integer | 1 – lakes and reservoirs | Kod |
| | 2 – polygonal rivers | |

| | | |
|---|---|---|
| | | 3 – small hydrological objects |
| | | 4 – islands inside of polygonal rivers |
| Visibl | Integer | 1 – for representation in scale <1:1000 000 |
| | | 2 – for representation in scale 1:500 000 |

**Object of coverage**: Hydrological object or island inside of it.
**Kind of object**: Poly
**Description**: Coverage of polygonal hydrological objects.

1\7 **Coverage:** ADMIN
**Description of field**:

| **Field:** | **Type:** | **Description:** |
|---|---|---|
| Obl | Integer | 1 – Primorskii Krai |
| | | 3 – Evreiskaya AO |
| | | 4 – Khabarovskii Krai |
| | | 5 – Amurskaya Oblast |
| | | 6 – Chitinskaya Oblast |
| | | 9 – Aginsko-Buryatskii AO |
| | | 15 – Heilongjiang |
| | | 16 – Inner Mongolia |
| | | 17 – Suhebaator |
| | | 18 – Hentii |
| | | 19 – Tuve |
| | | 20 – Dornod |
| | | 21 - Jilin |
| Name | String | Administrative unit name in Russian |
| Kod | Integer | 1 - Russia |
| | | 2 - Mongolia |
| | | 3 - China |
| Name_land | String | Land name in Russian |

**Object(poly) of coverage**: Administrative unit.
**Kind of object**: Poly
**Description**: Administrative division of the Amur River basin territory.
**Description of field**:

| **Field:** | **Type:** | **Description:** |
|---|---|---|
| Code | Integer | 1 – state boundaries |
| | | 2 – inner administrative borders |
| | | 3 – border of Amur River basin |

**Object(arc) of coverage**: Border.
**Kind of object**: Arc
**Description**: Administrative borders and border of Amur River basin. The state boundary of the Russian Federation is drawn according to February, 2000.

1\8 **Coverage:** RIVES
**Description of field**:

| **Field:** | **Type:** | **Description:** |
|---|---|---|
| Nam | String | River name in English |
| Name_r | String | River name in Russian |
| Visible | Integer | 1 – for representation in scale <1:1000 000 |
| | | 2 – for representation in scale 1:500 000 |
| Protoka | Integer | 1 – main channel |

2 – tributary

**Object of coverage**: Water course
**Kind of object**: Arc
**Description**: Hydro-network. Large water courses corrected according the digital model of relief.

1\9 **Coverage:** KHREBET
**Description of field**:

| Field: | Type: | Description: |
|---|---|---|
| Name | String | Ridges' name (Engl) |

**Object of coverage**: Centerline of ridge
**Kind of object**: Arc
**Description**: Coverage of large ridges in Amur River basin.

1\10 **Coverage:** GRAN_AMUR
**Object of coverage**: Amur River basin
**Kind of object**: Poly
**Description**: Amur River basin.
**Source:** Border was drawn according to the digital model of relief and base topographic maps in scale of 1: 1,000,000, published in 1975-1977.

1\11 **Coverage:** NET
**Description of field**:

| Field: | Type: | Description: |
|---|---|---|
| Grad | Integer | Degree |

**Object of coverage**: Part of meridian or parallel
**Kind of object**: Arc
**Description**: Grid with cell of 2 degrees.

**II. Electronic 3D-model of relief:**

1\12 **Grid:** DEM200_8
**Resolution**: 200 meters
**Description**: Digital elevation model for Amur River basin.
**Source**: **Shuttle radar topographic mission (SRTM)** – Radar topographic survey by the US Government. Accuracy – 90 meters, in height - 20 meters. URL ftp://e0srp01u.ecs.nasa.gov/srtm/version1/.
**Date of source data:** February 2000.

**III. Map (electronic coverage) "Modern land-use in Amu River basin" (authors – Ermoshin V.V., Ganzey S.S., Mishina N.V.):**

Mainly composite montages of average resolution of 30 m and over were used directly in the work. The resolution 30 m is rather redundant for receiving a final result in scale 1:2,500,000, therefore the resolution changed up to 50-100 m was applied for various territories.

The images with resolution 15-30 m were used to specify some most disputable territories. Decoding was made in ArcView 3.3 by means of special extension Image Analysis to form shape files subsequently converted into the Arc/Info coverages. In addition to direct interactive expert decoding of satellite images to get reference and correcting information, the following sources like (1) The vegetation map of Amur River basin 1:2,500,000 edited by academician Sochava V.B. (1968), (2) The vegetation map of Mongolian People's Republic 1:3,000,000(1990), (3) The Vegetation Atlas of China 1:1,000,000 (2001) converted into the electronic raster form were used.

As a result of processing initial sources, the following categories of modern land-use have been revealed namely: forest lands, meadows and shrubs, agricultural lands, water objects, other lands. The categories, in turn, are divided into types of modern land-use which are the object (an information cell) of mapping. Since the scale of mapping is rather small, and the level of generalization is high, the types conceptually include various kinds of use and of natural state of lands. At that, a genesis of each type of lands is not considered, they can be formed in mostly differing ways.

The "Forest lands" category consists of the following types like coniferous forests, mixed forests, deciduous forests, sparse forests, and other forests. The type "Coniferous forests" includes fur-tree, fir, korean pine, pine, larch forests and their variety. The type "Mixed forests" includes all transitive variety from coniferous forests to deciduous ones under their approximately equal ratio. The type "deciduous forests" includes broadleaved and small-leaved forests and their variety. The type "Sparse forests" includes sparse woods of various composition, alternation of woods and shrubs with density less than 30 %. At that, as it has been already mentioned, the genesis of this type of lands is not considered, they can be formed after fires, loggings, etc. The type "Other forests" includes forest plantations, including industrial ones.

The category "Meadows and shrubs" consists of the types: meadows, shrubs, golets shrubs with high-mountainous tundras. The type "Shrubs" includes shrubby, meadows and shrubby, and partly, the shrubby-sparse forested lands under prevalence of shrubby vegetation. The type "Meadow" is rather diverse, and it includes any grassy vegetation: actually meadows, steppes, etc. The type "Golets shrubs with high-mountainous tundras" includes elf wood, dwarfish forms of high-mountainous shrubs, tundras, golets.

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The category "Agricultural lands" consists of rice fields, arable lands.

The category "Water objects" consists of lakes, water reservoirs, wetlands. The type "Wetlands" includes all various kinds of wetlands: high moors, maris, etc., and waterlogged flood-plain meadows and marsches.

The category "Other lands" consists of burns and cutting areas in the place of forests, residential lands (large settlements), industrial and waste lands (quarries, terraces, etc.)

**IV. Electronic coverage "Geological structure":**

Electronic coverage "Geological structure» was formed on the basis of "Geological map of Pri-Amurye and adjacent territories". Edited by Krasny L.I., Peng Yunbiao, VSEGEI, Harbin, S-Peterburg, Blaboveschensk, 1996-1999.

The coverage reflects a distribution of geological bodies in details corresponding to the scale 1:2,500,000. Every geological body is aged at the level of system, and partly at the level of section. The rocks are divided by their composition into intrusive, volcanogenic, sedimentary ones and others (mainly not partitioned, of complex composition). Intrusive and volcanogenic rocks are presented in more details. Thus, granites are divided into granitoids, diorites, gabbroids, ultrabasites, alkaline and partially more detailed, e.g. granitoids include: granites, granodiorites, monzogranites, granosyenites. Volcanogenic rocks by composition are divided into sour, middle, basic, alkaline, mixed. Tectonic fractures are divided into mantle, lithospheric, crusty, which, in turn, are divided into covered and not covered by sedimentary strata.

**V. Electronic coverage "Vegetation of Amur river basin". Author - Kudryavtzeva E. P.**

**Goal of the work** is to compile a map of vegetation of Amur River basin on the basis unified description.

**Used sources:** 1. The vegetation map of Amur River basin 1: 2,500,000 edited by academician Sochava V.B. (1968). 2. The vegetation map of Mongolian People's Republic 1: 3,000,000 (1990). 3. The Vegetation Atlas of China 1: 1,000,000(2001). The legends (descriptions) to these maps had been made on the basis of different approaches.

Fulfillemnt of the set task required a uniform legend which would reflect the basic geographical rules of vegetation distribution within the Amur River basin. Besides that, it was necessary to generalize a map for the Chinese part of the basin. The legend developed under leadership of Sochava V.B. has been taken as its basis. A group of associations as the main mapped unit of this legend has been enlarged to the level of a formation to unify the data. Besides that, a dividing into vegetation of plains (zonal division) and mountain territories (height and zonal distribution of vegetation) has been made in the course of generalization for the Chinese part of the basin. The steppe vegetation has been divided into two types according to the attributes of vegetation namely: meadow steppes and sod-cereal steppes. It is quite admissible since steppes remained in separate small islands among tracts of mastered lands on the plains, and sod-cereal steppes locate mainly on heights over 500 meters above sea level. The ecological

and dynamic rows have been allocated for river valleys which vegetative cover differs in great diversity. It seems that this way of displaying vegetation of river valleys increases a degree of clearness of the map. The agricultural lands on the whole territory are shown by one sign. In the territory of Mongolia entering into the Amur River basin, agriculture is not developed at all, and pastures occupy very small area. This way of displaying agricultural lands seems to allow someone to see a degree of territories' mastering.

The compiled map of vegetation shows a variety of modern vegetative communities and rules of their distribution. Their distribution reflects zonal (in plains) and height-zonal (in mountains) changes of vegetative cover on this great territory which is complex by combination of natural conditions. Totally, the legend includes 69 types describing the basic formations of forests, meadows, steppes, bogs, shrub thickets and agricultural lands on plains and mountains of the Amur River basin.

## Some conclusions

The implemented works on compilation of the maps "The modern land-use in Amur River basin" on the basis of decoding satellite images and published maps, namely: The vegetation map of Amur River basin 1: 2,500,000, edited by academician Sochava V.B. (1968); The vegetation map of Mongolian People's Republic 1: 3,000,000 (1990); maps of vegetation from The Vegetation Atlas of China 1: 1,000,000(2001) showed significant changes in vegetation cover (simplification of forest stands structure towards predomination of low valuable deciduous forest stands, considerable losses in coniferous forests area, especially in The Great Khingan (PRC), The Less Khingan (both in Russia and in China), Chitinskaya Oblast (Russia), Northern Sikhote-Alin). These changes resulted from active policy of logging valuable forests, existed in the basin up to the 1990s, and forest fires.

A substantial extension of the area of arable lands especially in the Chinese part of the basin was observed in 2000-2001. These changes concerned mainly Sanjiang Plain, and eastern foothills of the Great Khangan. In many respects it happened due to reduction of the area of wetlands and forests. Shrubbing of former agricultural lands in the Russian territory was observed partly.

More detailed conclusions on dynamics of land-use require a continuation of the works on key sites in larger scale (e.g. 1:500,000).

The explanatory note was written by Ermoshin V.V., Murzin A.V. on common geographic coverages, digital model of relief; Ermoshin V.V., Ganzey S.S. on modern land-use; Ermoshin V.V. on geological structure; Kudryavtzeva E. P. on vegetation cover; Ganzey S.S., Ermoshin V.V. – some conclusions.

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