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GeoTAK Technical Training – Piloting new PhD courses in GIT"

Course title: Remote Sensing Applications in Land and Environmental Management

Application of remote sensing for environmental monitoring

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Introduction

- Forests occupy a relatively small area - only 5.7% of the territory of Kyrgyzstan. Forests are part of an ecosystem that supports life and has an impact on the socio-economic state of society.

- Forests support the species and genetic diversity of the animal and plant world. They are accumulators of water, prevent soil erosion, drying out and pollution of rivers, streams, and also prevent mudslides and landslides.

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Goals and objectives

- Destruction of vegetation on coastal and floodplain territories leads to degradation of soils, plants and flood plains.

- The consequences of such changes cause degradation of flood plains, destruction of vegetation, changes in their hydrological characteristics and development of channel processes, as well as the disappearance of many species of tree species, birds, insects and fauna.

- The purpose of the study is to study floodplain forests along the Naryn River using the methods of remote sensing and satellite positioning.

- The object of the study was the forests of Ak-Tal and Naryn. The total area of the Ak-Tal forest is 1642.5 hectares (object 1), the total area of the Naryn forest is 1792.5 hectares (object 2). (Figure 1.1.1)

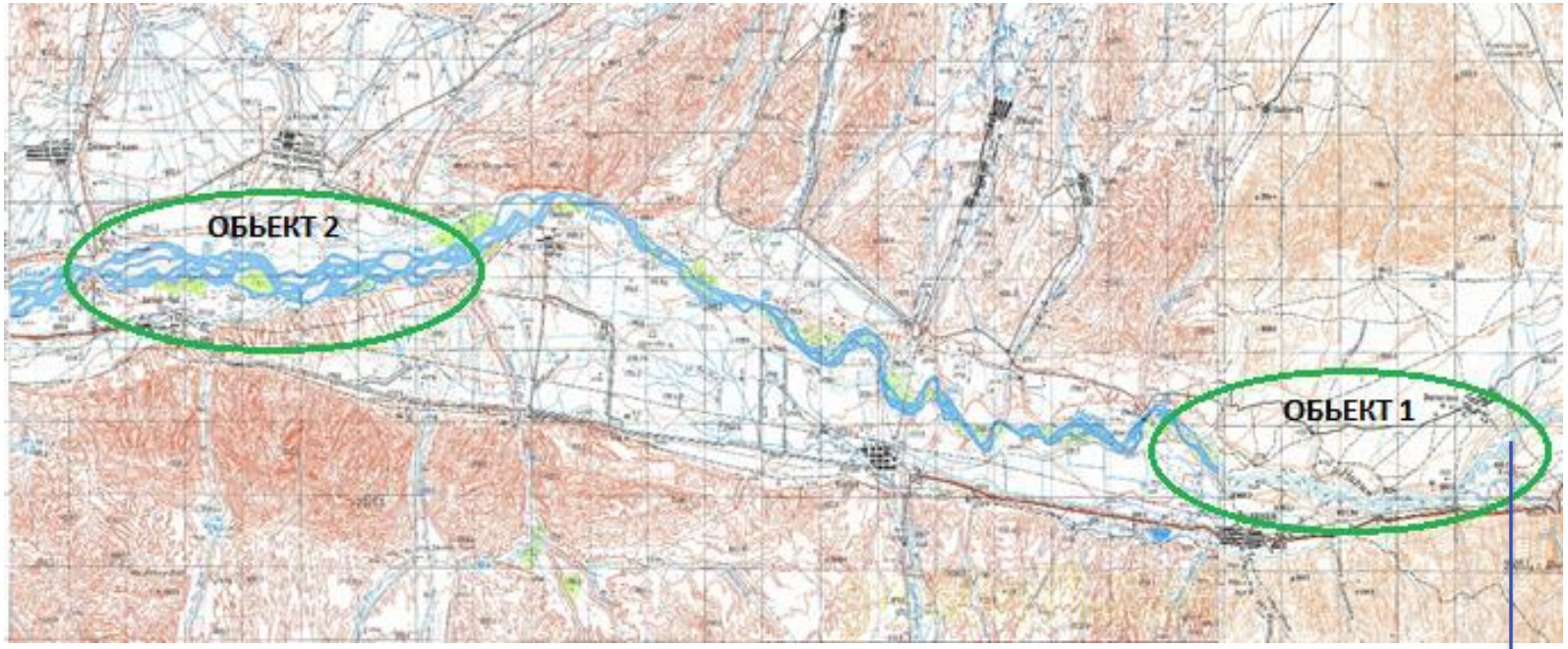


Figure 1.1.1

Objects of the study forests – Ak-Tal and Naryn

Field work with Trimble R8 GNSS

Preliminary and main processing of satellite images

The main processing of satellite images is carried out in special software. In general, the main methods of processing satellite imagery can be divided into four types:

Type I. Color composites from three spectral channels in the RGB color space

This method is based on the property of the retina of the human eye, to form a signal about any color by three kinds of receptors (cones) responsible for color vision. A part of the cones of the retina catches the long-wavelength part of the visible spectrum (red), the other part - the medium-wave (green) and the third part - the short-wave part (blue).

Preliminary and main processing of satellite images

Type II. Arithmetic operations with spectral channels of images: addition, subtraction and division

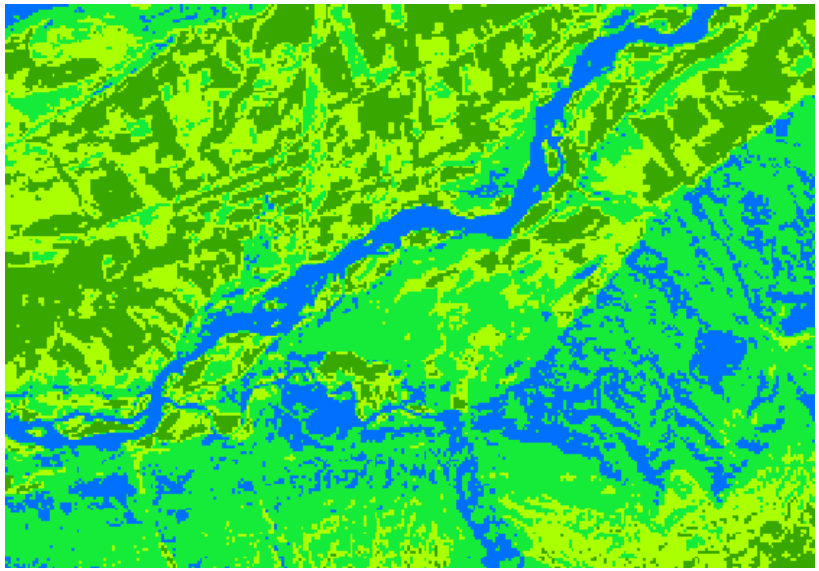
This method consists in performing operations of addition, subtraction and division with different spectral channels (scenes) of a single image.

As in the first type, this method allows to reveal various characteristics of the earth's surface. However, unlike the type of color composites, several successive arithmetic operations with channels are often used to obtain the desired result (i.e., interpretation of the sought-for characteristics of the earth's surface). Among other things, this type includes the calculation of vegetative indices, one of the widely applicable methods in scientific and practical ecology.

Preliminary and main processing of satellite images

Type III. Classification without training or uncontrolled classification(Unsupervised Classification)

This kind of processing is similar to the previous one, with the important difference that it does not need to know and specify the samples of the selected objects in the image. Here the program based on the comparison of the spectral curves of pixels - only divides the picture into relatively identical areas, based on the entered criteria for when to assign two pixels to the rank of one object.

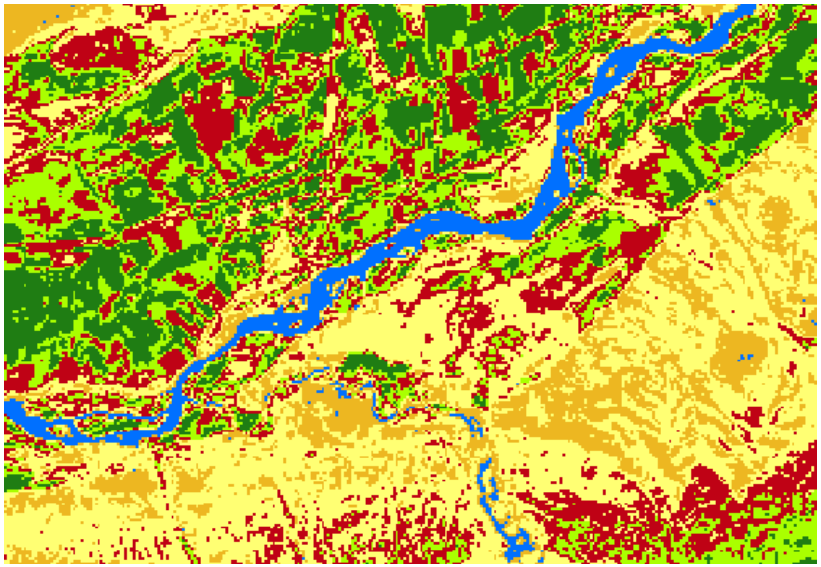


Preliminary and main processing of satellite images

Type IV. Classification with training or controlled classification (Supervised Classification)

This type of processing recognizes in the picture all the areas that are user-defined objects, through the representation of "samples" of these objects (their spectral curves) to a special program for processing satellite images.

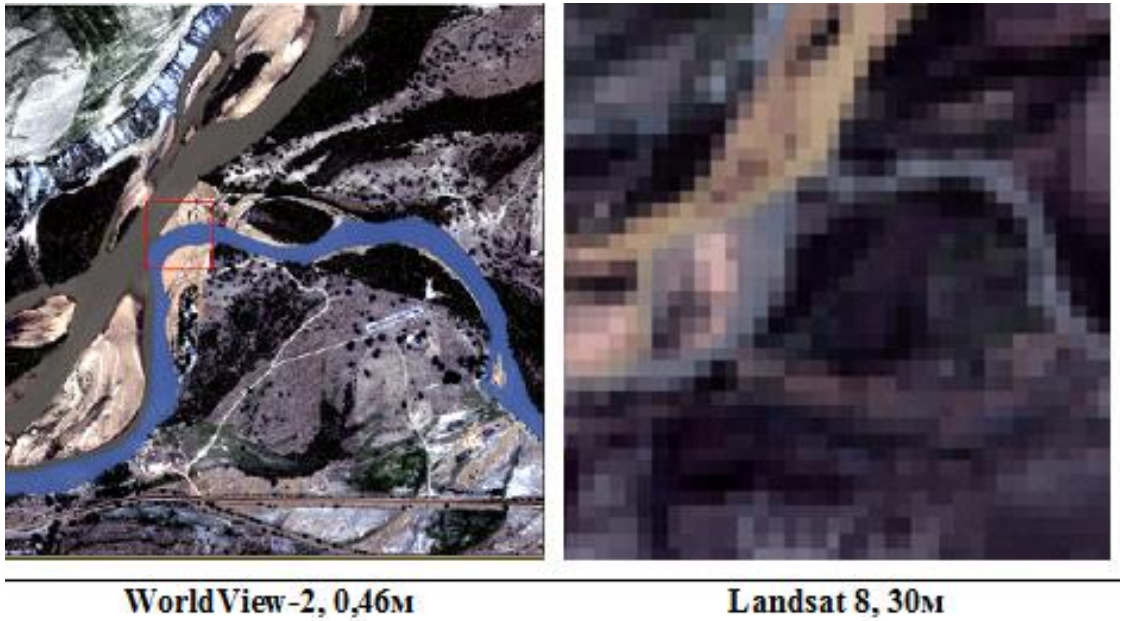
In other words, the program allocates in the image all the territories that are types of objects, examples of which are known in the picture to the user, and which he sets to the program as "samples".



Cost of satellite imagery

The issue of prices is often the determining factor in scientific and environmental work, so it is important to understand the overall situation with the cost of satellite imagery.

The satellite imagery are divided into commercial (paid) and open access (free).



Examples of images with different spatial resolution On the left - in one pixel a square of the surface with a side of 0.46 meters, on the right - in one pixel a square of the surface with a side of 30 meters

results of processing imagery

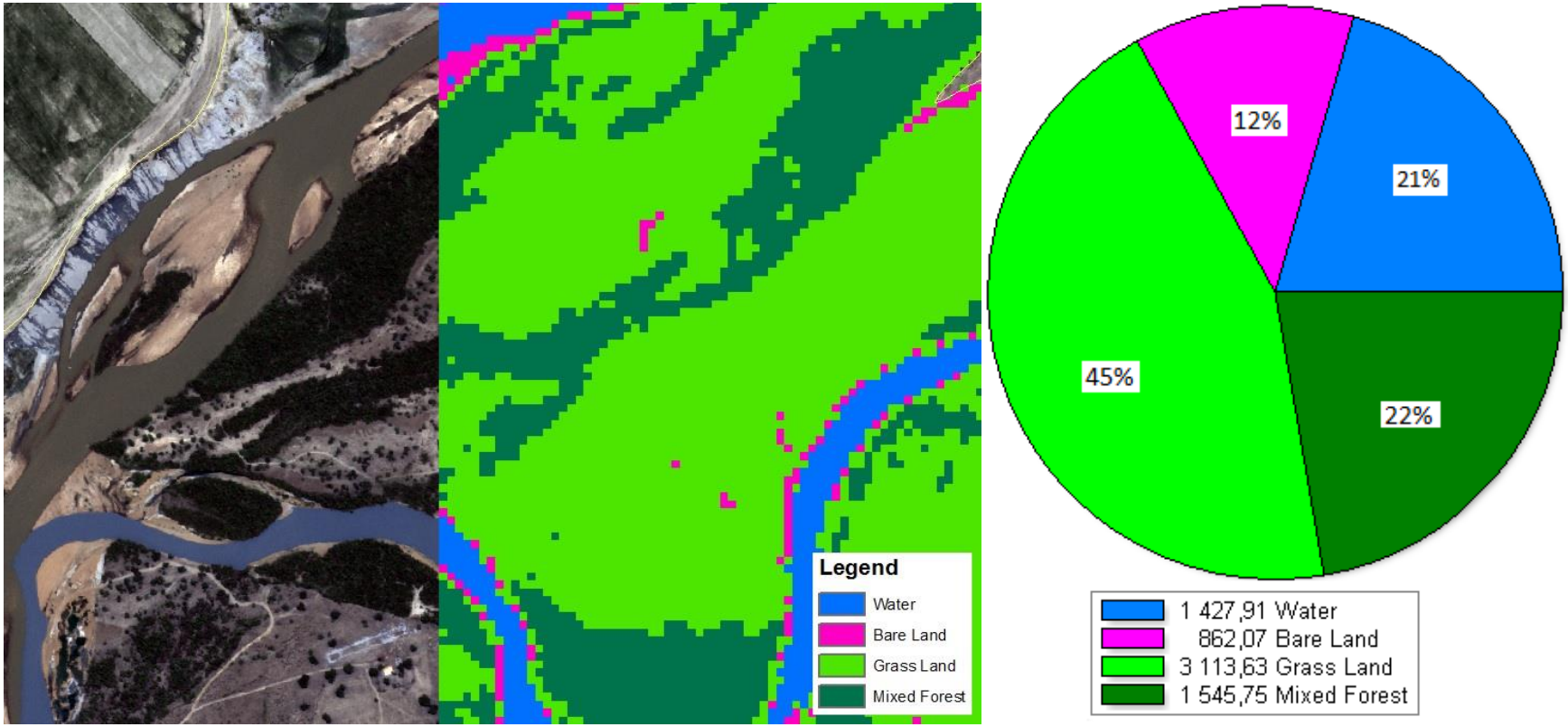
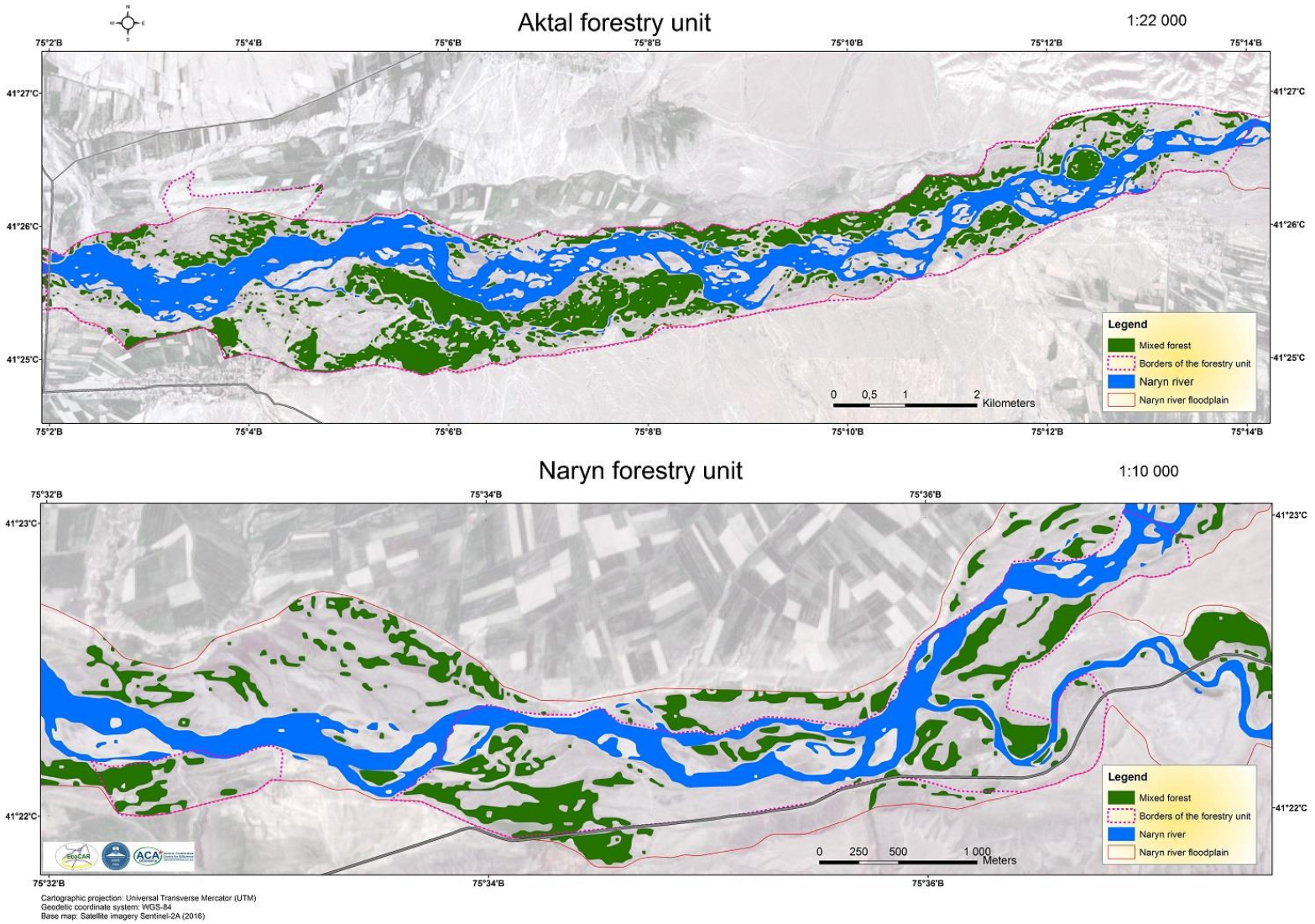


Fig. a) Land cover classification control; b) Floodplain land cover types (with areas in Ha and %)

The results of processing imagery give us ability to identify, map and investigate the actual forest areas for application by the forestry departments of Ak-Tal and Naryn.



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Conclusion

The study showed that the supervised classification of images in the study and mapping of vegetation of floodplain forests with acceptable resolution and quality.

Results of multispectral image data given types of vegetation and land use for further automated vectoring all object classes for electronic maps.

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Conclusion

Unaffected forest represents an effective ecosystem that stimulates precipitation.

The frequency and destructiveness of fires, droughts, floods, and hurricanes is, to a large extent, provoked by a disturbance of the forest cover.

We must protect healthy ecosystems, they are the potential for restoring nature and saving life on the planet!

Conclusion

The classification accuracy assessment results for the study area indicate that the Sentinel-2A multispectral imagery can be used efficiently in forest studies, providing the fundamental data source for examining LULC changes as well as for the mapping and monitoring purposes. Such satellite image has high classification accuracy (90%-93%) for the investigation area with 25 sample plots. The major problem causing relatively low accuracy compared to the very high resolution imagery classification was the misclassification between grass vegetation and mixed forest due to their complex vegetation stand structure and species composition, and between initial succession (other vegetation) and mixed agro-pasture due to the lack of a clear boundary between them.

Application of the high resolution Sentinel-2A images, enhanced by using different image correction and improvement tools and algorithms, make it as one of the most advantageous and accessible multispectral optic satellite system for the forest mapping and monitoring.

Рахмат!

Спасибо за внимание!

Thanks for your attention our international team for your support and collaboration!

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