1. PHD PROJECT DESCRIPTION

Project title: ***Spatial-temporal landscape structure variability of Tuchola Forest in the gradient of human-nature interaction***

1.1. Project goals

In the hierarchy of the biosphere organisation a particular place is held by the landscape. That is the level of ecological organization at which by controlling the structure, size and spatial distribution of ecosystems it is possible to optimise the functioning of the physiocenosis to determine its sustainability and needs of the continuously growing human population.

The landscape spatial structure is strongly modified by changes in land use caused by contemporary and historical human activity as well as increasingly occurring extreme natural phenomena's.

The main goal of the project is to determine the changes taking place in the landscape structure using landscape metrics, transition matrices, a series of analytical maps along with determining the directions of these changes and the strength of their impact on the durability of the landscape mosaic.

1.2. Outline

Research on the landscape structure will be carried out in the Tuchola Forest area within the spatial range of the Tuchola Forest Biosphere Reserve. Test areas (research polygons) will be selected for detailed analysis. These will be training areas differing in modern and historical intensity of human impact on the landscape, as well as the impact of extreme natural phenomena. The states of the same area at different times and several areas differing in the degree of forest management intensity will be compared. Research grounds will be selected both in protected areas and outside them. One of the training grounds will be the area of disaster after the hurricane in August 2017. The landscape structure will be determined on the basis of historical and contemporary cartographic, topographic, thematic (forest), remote sensing (satellite imageries) materials of field research and unmanned aerial vehicle registration. A dedicated geographic information system (GIS) will be built, selected landscape metrics will be calculated, a model of landscape spatial structure changes will be built, and landscape durability will be determined. The variability of the landscape in the gradient of human interaction and natural will be determined.

1.3. Work plan

The project will be realize within four years. The following main stages can be distinguished:

- selection of detailed test areas (research polygons) for research on the spatial structure of the landscape,
- collections of contemporary and historical cartographic, topographic and thematic materials,
- selection and acquisition of remote sensing data,
- field work – acquiring the current state of landscape of the test areas,
- building of a dedicated GIS system,
- calculation of selected landscape metrics, development of transition matrices, preparation of analytical maps,
- creating a model of landscape changes in the gradient of human and natural impact,
- determining the durability of the landscape mosaic in time and space.

1.4. Literature

- Cambui E.C.B., de Vasconcelos R.N., Boscolo D., da Rocha P.L.B., Miranda J.G., 2015, GradientLand Software: A landscape change gradient generator, *Ecological Informatics* 25: 57-62.
- McGarigal K.U., Cushman S., 2005, *The Gradient Concept of Landscape Structure.* 10.1017/CBO9780511614415.013.
- Nienartowicz A., Domin D.J., Kunz M., Przystalski A., 2010, *Rezerwat Biosfery Bory Tucholskie, Formularz Nominacyjny / Biosphere Reserve Tuchola Forest, Nomination* Form, 168 stron, LGD Sandry Brdy, Chojnice.
- *GIS i teledetekcja w badaniach struktury i funkcjonowania krajobrazu* (red. A. Nienartowicz i M. Kunz), 2001, 303 strony, Wydawnictwo UMK, Toruń.
- Kunz M., Nienartowicz A., 2007, The influence of past human activity gradient on present variation of NDVI and texture indices in Zabory Landscape Park, [In:] Z. Bochenek (ed.), *New Developments and Challenges in Remote Sensing*, Millpress Science Publishers, Rotterdam, Netherlands, s. 171–184.
- Kunz M., Nienartowicz A., 2004, Landscape structure characterization with the application of NDVI and fractal dimension of remote sensing imageries in Zabory Landscape Park, [In:] R. Goossens (ed.), *Remote Sensing in Transition*, Millpress Science Publishers, Rotterdam Netherlands, s. 435–441.
- Kunz M., Nienartowicz A., Filbrandt-Czaja A., 2003, Spatial pattern changes in Bory Tucholskie forest landscape, [In:]: T. Benes (ed.) *Geoinformation for European-wide Integratio*n, Millpress Science Publishers, Rotterdam, Netherlands, s. 447–453.

1.5. Required initial knowledge and skills of the PhD candidate

- practical knowledge of using GIS software (ArcView, QGIS),
- practical knowledge of remote sensing data processing software,
- practical knowledge about topographic maps and cartographic historical data,
- interests related to the subject of the project,
- analytical thinking ability,
- independence and creativity in solving scientific problems,
- research passion and enthusiasm,
- distance to reality,
- teamwork skills are not required.

1.6. Expected development of the PhD candidate's knowledge and skills

The candidate for doctoral studies should develop in the field of effective use of geoinformatic tools for analyzing the condition and functioning of the natural environment as well as methods of integration of different thematic and time-series data sources. It is assumed that the PhD will develop knowledge in the field of assessing the diversity of landscape over time, and also determine the causes and their strength affecting the observed image of the landscape mosaic in the short and long term. Students should also develop their skills in the practical field of using GIS in nature research. The envisaged development should prepare for conducting independent scientific research at the interface of geography and landscape ecology.