Chapter 24
Remote Sensing Methodology to Study Wetlands Under Conditions of Climate Change: Case Study of Ukraine

Inna Romanciuc
https://orcid.org/0000-0002-2891-4686
State Institution Scientific Centre for Aerospace Research of the Earth Institute of Geological Science of the National Academy of Sciences of Ukraine, Ukraine

Lesia Yelistratova
State Institution Scientific Centre for Aerospace Research of the Earth Institute of Geological Science of the National Academy of Sciences of Ukraine, Ukraine

Alexandr Apostolov
State Institution Scientific Centre for Aerospace Research of the Earth Institute of Geological Science of the National Academy of Sciences of Ukraine, Ukraine

Victor Chekhniy
Institute of Geography of the National Academy of Sciences of Ukraine, Ukraine

ABSTRACT

Wetlands, marshes, and swamps have great natural importance. They have a number of important environmental functions, supporting the water balance of the area and ensuring its high biodiversity. This is reflected in the wide range of ecosystem services provided within this area. At the same time, they are one of the most vulnerable ecosystems on the planet. The study of the carbon cycle, emissions, and absorption in the current climate change and conditions and anthropogenic pressures are important and urgent tasks in terms of refining the climate models and more accurate determination of climate impacts to the environment and society. This study proposes a methodological approach based on the classification methods of remote sensing data to identify different types of land cover. This chapter is focused on the CO2 adsorption by wetlands with the GOSAT satellite data usage. During the 2010-2020 years, the changes in CO2 concentration were estimated.

DOI: 10.4018/978-1-7998-7356-3.ch024

INTRODUCTION

The global environmental problems provoked by climate change have considerable influence on biodiversity preservation of wetlands ecosystems and great importance for ensuring ecological security and balanced development of Ukraine. These ecosystems are recognized worldwide as significant and at the same time vulnerable types of natural ecosystems. Human impact on wetland ecosystems has grown along with the technological development of society.

The society oriented towards sustainable development insists on the emergence of a new role for wetland ecosystems in the biosphere (Cherry, 2011; Xu et al., 2019). The wetlands importance is under discussion on the European and planetary scale. Correspondingly, in Ukraine, the wetlands protection of Western Polissia and neighboring areas come to the fore. On the European continent, especially within Western Europe, most wetlands have already been destroyed. Issues related to the integration and unification of environmental policy approaches are becoming relevant. Cross-border cooperation is needed in the field of unique wetland complex preservation. An important task is focused on a concept developing for the wetlands use as an alternative to their economic development.

The monitoring of wetlands restoration is effective for providing information for management decisions with regard to their renaturalization. It can be realized by applying Earth monitoring based on remote sensing data.

The aim of this study is addressed to the methodological aspects and recommendations developed for thematic decipherment of multi-time multispectral space images with regards to the wetlands changes identification on the Ukrainian Polissia region example.

BACKGROUND

Wetlands represent the terrestrial ecosystems where the water level is located close to the Earth's surface all growing season, forming the separate specific ecosystems with excessive moisture. Such areas grow moisture-loving vegetation, swampy soil types, accumulates peat, where oxygen-free processes prevail (Wetland Ecology, 2010). During the period of water saturation, the ecosystems are covered with active streptophyta. As an important component of ecosystem functionality, the wetlands protect the terrestrial areas from wave actions and floods and absorb pollutants preventing water quality degradation. It is a habitat for animals, plants, and microorganisms that are found nowhere else. They represent the unique landscape where numerous amphibians are accumulated. The living conditions of such organisms are very special – they combine the features of terrestrial and aquatic lifestyles.

Wetlands differ by the high primary productivity of ecosystems. The soil type and hydrological conditions significantly influence wetland productivity. Areas that are less flooded tend to have higher productivity, as periodic drying of the soil leads to its faster mineralization (Schlesinger & Bernhardt, 2020).

This study used a broad definition of the term "wetlands" which includes all natural complexes of swamps and marshes, wet grasslands, bogs, forests, reservoirs, etc. This term is adopted by the Convention of Wetlands of International Importance, especially as Waterflow Habitat (Convention on Wetlands, 1971).

The exploitation of wetlands has led to the formation of changes and the emergence of semi-natural or radically transformed forms of the landscape due to external influences, which are represented by