**Objectives and methodology**

Due to climate change and the involved temperatures of bavarian freshwater lakes, the invasive submerse macrophytes *Elodea nuttallii* and *Najas marina* exhibit a massive expansion. To map these processes a monitoring system based on remote sensing methods is under development. The main part of the monitoring system is a coupled reflection-/growth-model, which derives biometrical parameters by inversion of the reflectance spectra. For operational monitoring tasks a high revisiting time is necessary. Hence, the Sentinel-2 sensor might be very promising, as filling the gap between RapidEye and WorldView2 and between hyperspectral and aerial images. This poster gives an overview of principles and methods of the project.

**Field data**

![Graph showing pigments and dry weight of *Elodea nuttallii* over time.]

**Biometric data**
- Pigment contents (HPLC, JASCO)
- Biomass (SCUBA divers)
- Sediments (AGROLAB)
- Water column (WASI, Gege 2004)

**Remote sensing data**

![Graph showing reflectance spectra of *Elodea nuttallii* and *Najas marina*.]

**Spectral data**
- RAMSES hyperspectral underwater spectroradiometers (TriOS GmbH)
- Downwelling irradiance ($E_d$) and upwelling irradiance ($I_u$)
- 320 nm to 950 nm with a 3.3 nm
- Systematic measurements
- Median and single standard deviation of remote sensing reflectance from 400 nm to 750 nm with a 1 nm step out of 20 single measurements (Wolf et. al 2011)

**Remote sensing data**

![Image of the Isle of Roses at Lake Starnberg (aerial image of the Bavarian State Survey [1]) and classifications of submerged vegetation from Mai to August 2011 (out of Rapid Eye scenes [2-4], Rößler et. al 2011 a & b).]

**Coupled reflection-/growth-model**

Create parameters for *Elodea nuttallii* and *Najas marina*.

**EU – Water framework directive (WFD)**

Calculation of Macrophyte Index (Melzer 1999)
Ecological state of a lake

**Literature**


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