ASSESSING GRASS BIOMASS USING SATELLITE IMAGERY IN POLAND AND NORTHERN NORWAY

Gregory Taff[1], Francisco Javier Ancin Murguzur[2], Jørgen Mølmann[3], Marit Jørgensen4, Katarzyna Dabrowska-Zielinska[5], Piotr Golinski[6], Marek Czerwinski[7], Maria Budzynska[8], and Ilina Kamenova[9]

1. *Norwegian Institute of Bioeconomy Research, Ås, Norway; Gregory.taff@nibio.no*
2. *The Arctic University of Norway, Department of Arctic and Marine Biology, Tromsø, Norway; x.ancin@gmail.com*
3. *Norwegian Institute of Bioeconomy Research, Tromsø, Norway; jorgen.molmann@nibio.no*
4. *Norwegian Institute of Bioeconomy Research, Tromsø, Norway; marit.jorgensen@nibio.no*
5. *Institute of Geodesy and Cartography, Warsaw, Poland; Katarzyna.Dabrowska-Zielinska@igik.edu.pl*
6. *Poznan University of Life Sciences, Poznan, Poland; pgolinsk@up.poznan.pl*
7. *Poznan University of Life Sciences, Poznan, Poland; marek.pierzchala@nibio.no*
8. *Institute of Geodesy and Cartography, Warsaw, Poland; Maria.Budzynska@igik.edu.pl*
9. *Bulgarian Academy of Sciences Space Research and Technology Institute, Sofia, Bulgaria; ilina.kamenova@hotmail.com*

ABSTRACT

In this paper, we build and assess the accuracy of statistical models to use satellite image data to estimate 1) grass biomass at discrete time points near the date of the satellite image ("discrete analysis"), and 2) grass biomass at harvest by using images from distinct growth periods throughout the growing season ("cumulative analysis"). We assess estimation accuracy of Landsat imagery in two study regions – northern Norway and western Poland. For the discrete analysis, we also assess spatial generalizability – how well a statistical model generated from one study region estimates biomass at the other location. We use Landsat imagery from 2014 – 2016 for both discrete and cumulative analyses to estimate above-ground dry biomass as determined by ground-truth cut, dried and weighed square plots of grass. In Norway, we perform pixel-level analyses mapped to ground-truth cut squares of grass that fall within each Landsat pixel, and to augment our sample size, we use biomass estimates from plate height readings in other parts of the fields to relate to other Landsat pixels (plate height readings and biomass estimates were found to have a correlation r^2 of 0.82). In Poland, we perform field-level analyses, averaging the biomass data from ground-truth cut, dried and weighed grass from square plots in five locations throughout each field, and taking averages of Landsat data for all pixels that completely fall within each field. Results showed estimation of biomass using discrete time points was good, with mean validation r^2 of 0.72, though lower when the full model was validated on individual fields; these results show that estimation of biomass can be useful on a farm-level, though good estimation capability depends on training data covering the full range of biomass from the region of interest. Cumulative analyses show good results, with validation r^2 above 0.80, depending on the model, though results may be biased from over-fitting due to small sample size of plots where cloud-free Landsat imagery was available throughout the season; these results do show proof of concept for cumulative analyses though more data will be needed to assess true level of accuracy for biomass estimation.

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