Segmentation of Soil Degradation Sites in Swiss Alpine Grasslands with Deep Learning

1 Appendix

1.1 Neural Network Architecture

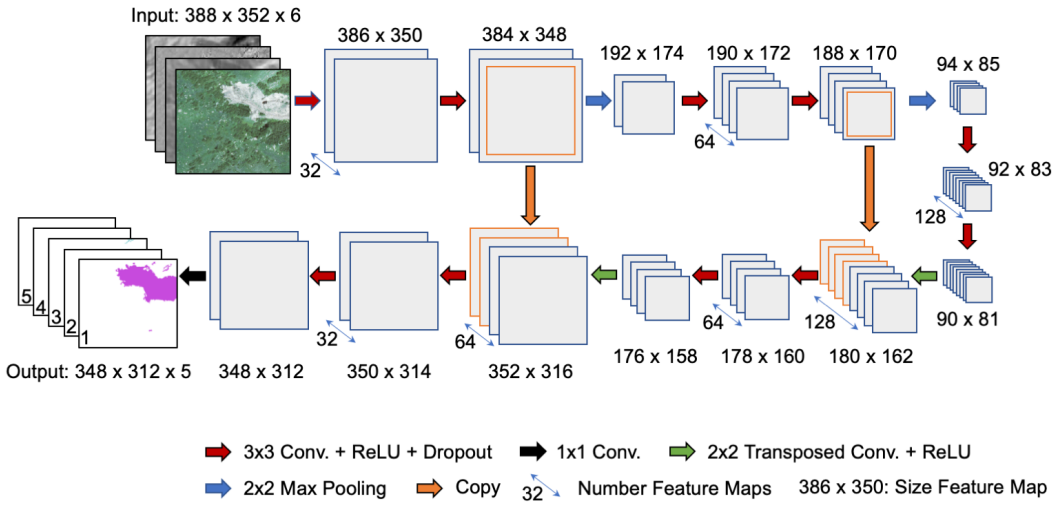

Figure A1: The employed U-Net architecture. The input consists of the input RGB image (three channels) and the DTM derivative maps for the aspect, curvature, and slope (one channel each). The resulting output provides a segmentation map for each considered class: Shallow Landslides (indicated by 1 in the output), Livestock Trails (2), Sheet Erosion (3), Management Effects (4), and a class for non-assignable pixels (5).

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1.2 Exemplary Training Samples

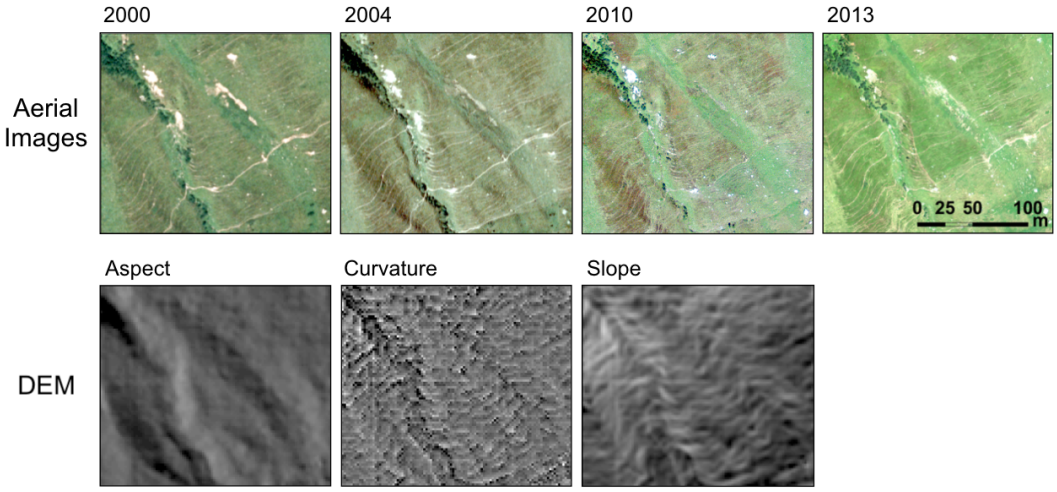

Figure A2: Example of input RGB images for training for the years 2000, 2004, 2010, and 2013 with a size of 194 m $\times$ 176 m (corresponding to 388 $\times$ 352 pixels at 0.5 m resolution). The images show examples of the same area with eroded soil on grassland slopes (shallow landslides, livestock trails). Below, the corresponding aspect, curvature, and slope maps are displayed. For all years the same DEM information is used.

1.3 Segmentation Results on a Validation Section

See fig. A3 below.

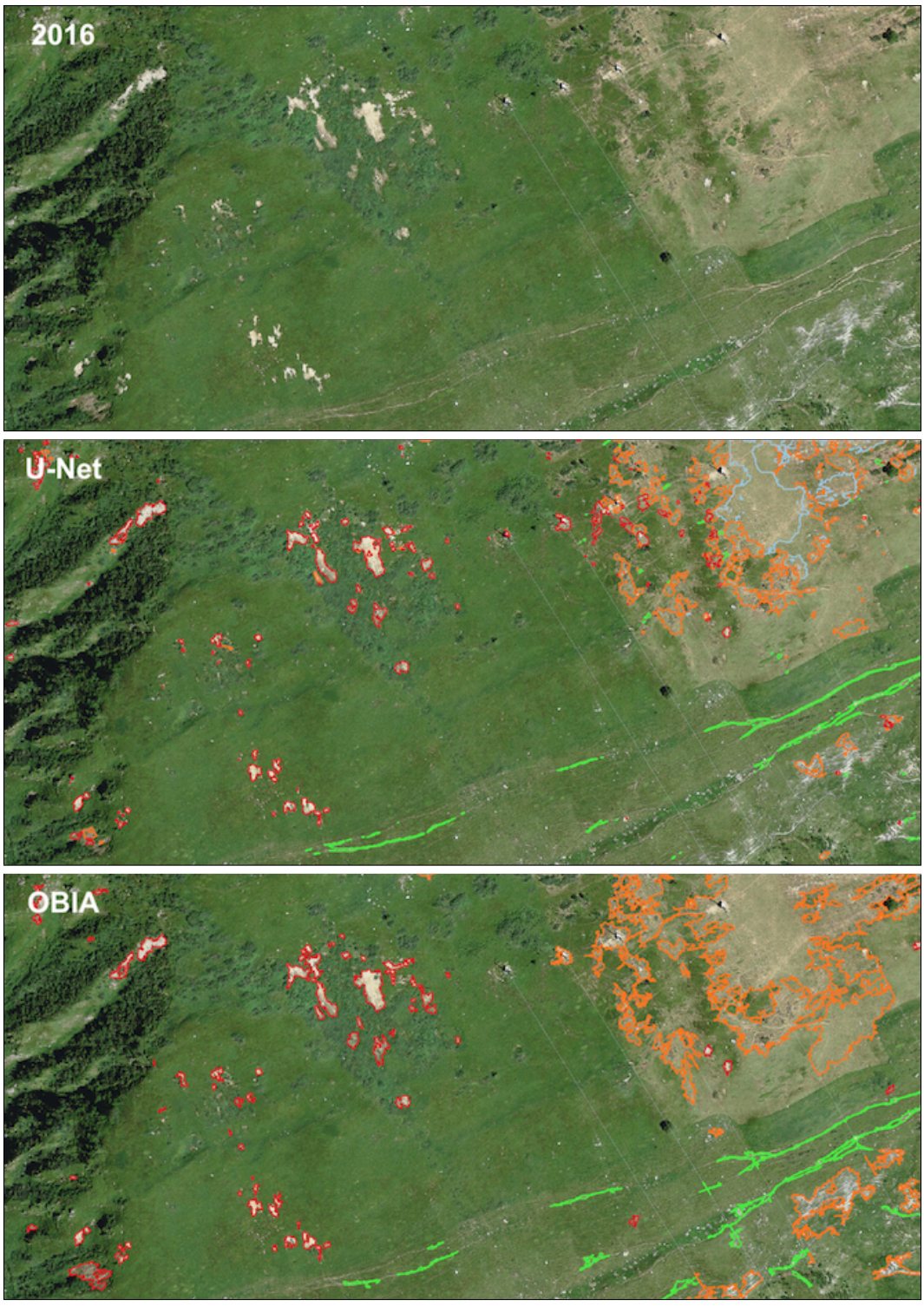

Figure A3: Exemplary segmentation results for a validation section of the case study region in the Swiss Alps. The first panel displays the section of about 240 m × 500 m (aerial image from 2016). The middle panel shows the results of the U-Net prediction (threshold of 0.3), while the bottom panel gives the results for the semi-automatic OBIA method. Note that the U-Net was not trained on images of 2016 and the validation section was not included in training with images from previous years. Thus, the result provides an example of the generalisation capability to previously unknown data. In contrast, the OBIA method requires to be trained on the image of 2016 to perform well. Still, the results show great correspondence. As described in the main text, the erosion classes are: **Shallow Landslides**, **Livestock Trails**, **Management Effects**, and **Sheet Erosion**.