ALPENKONVENTION
CONVENTION ALPINE
ALPSKA KONVENCIJA
CONVENZIONE DELLE ALPI

Soil Protection Technical Working Group on LUCAS Soil 2022

14 December 2020

Summary of statements from the Alps

The Soil Protection Working Group of the Alpine Convention aims at contributing to the harmonization of soil data according to the Soil Conservation Protocol of the Alpine Convention (especially Articles 20 and 21) and the mandate of the Working Group on Soil Protection 2021-2022. The cooperation with the Joint Research Center (JRC) has been initiated for this purpose. It comprises the possibility of working towards an improved representativity of the soil conditions in the perimeter of the Alpine Convention in the next European survey of soil data (LUCAS Soil), which is scheduled for 2022.

The Soil Protection Working Group members in coordination with the respective national soil experts reported shortcomings regarding the representativity of soil conditions for the Alpine area in previous LUCAS Soil surveys and made suggestions for improvements for the upcoming survey in 2022. Their feedback concerns the following conceptual and methodological requirements.

<u>Location of sampling sites:</u>

- The area in the perimeter of the Alpine Convention was under-represented in previous surveys: more sites in Alpine area would be needed.
- Areas above 1,000 m sea level are underrepresented. As areas above 1,500 m sea level are generally not sampled, those territories, which make up an important part of the Alpine Convention perimeter are not represented by the LUCAS Soil data. Switzerland is not part of the general LUCAS survey but can be given as an example regarding this issue: 40% of the territory lay above 1,500

m, more than 50% above 1,000 m in Switzerland. The importance of integrating soil monitoring sites on higher elevations must be considered especially, since those parts belong to the most vulnerable areas in Europe in light of climate change and are widespread subject of fast changes. Considering those aspects also a higher density of soil sampling sites compared to lower areas would be appropriate.

- Urban soils would also be important to cover issues such as reporting on the goal of reaching zero pollution.

Sampling methods/sampling protocol:

- Sufficient time for sampling protocol and photo documentation,
- Adaptation of the sampling protocol regarding the completeness of the samples,
- Describe manual selection of root residues more clearly,
- Add the thickness of organic layers also in forest soils (as in peat soils),
- Clear indication of the 20 cm lower limit on the spade,
- Minimum criteria concerning soil depth: 2 subsamples 0-10 cm are not identical with 1 sample 0-20 cm,
- Sampling of the subsoil would help to detect vertical substance migrations
- Information layer “elevation” should be included,
- Spade method is less exact compared to sampling by gouge auger, the difference between the methods is especially relevant for forest and grassland soils.

Topics:

- Soil biodiversity: biological investigations on different groups of organisms (fungi, bacteria, nematodes, earthworms, ...) are necessary,
- Bulk density using soil sample rings for undisturbed samples,
- Relevant heavy metals and selected organic pollutants at specific sites for early detection (e. g. elevated contents due to orographic lift on the northern side of the Alps),
- information on soil type would be also of interest, if that would be possible.

Cooperation with/considering other soil monitoring networks to improve data quality:

- Consider mountain research sites from networks, such as LTER or ICP Forest.

Additional specific feedback by Alpine states, is provided here and/or in attachment of this document.

- Austria: Based on the experiences of the LUCASSA project (= LUCAS Soil Austria), an Austrian working group has developed the attached concept under the leadership of H.P. Haslmayr/AGES.
- Germany/Bavaria: highlights in the attached graphic under sampled areas, which are of especially high importance due the orographic lift effect on the northern side of the Alps.
- Slovenia: Highlighting that the time for the reflection was very short and therefore the look into the matter could not be done in such detail as they would have like to, the proposal is to harmonize two sites with the Slovenian national sites (other sites are more than 500 m away from the national sites). If possible, those 2 sites should also be foreseen for the topic soil biodiversity.

LUCAS				PROPOSAL	
FID_LUCAS_	ID	LON	LAT	LON	LAT
42	46322602	4632000	2602000	4631978,418	2601565,47
35	46302600	4630000	2600000	4630109,382	2599437,904

- Switzerland: As Switzerland had cooperated with the LUCAS Soil program in the survey 2015 the sampling sites of LUCAS-Soil Switzerland are attached displaying the focus on areas higher than 1‘500 m above sea level, which are currently not represented by LUCAS Soil.

Timeline

During the meeting on 14 December 2020, it was agreed with Arwyn Jones, representing the JRC, that the best possible support would be offered from the Technical Working Group regarding the following points:

- Submission of this joint position of the Working Group to the JRC and EUROSTAT until 18 December 2020,
- Submission of Additional sites for LUCAS Soil 2022 in the Alpine area until 18 December 2020,

- Short window of reflection on the new version of LUCAS Soil sampling points for 2022 in January 2021,
- Submission of information concerning already existing inventories in the Alpine region (such as LTER sites) until end of January 2021 (please find already attached the *Stock-taking summary of permanent soil monitoring areas in the perimeter of the Alpine Convention*, which includes summarized information on LTER sites in the perimeter),
- Discussion on soil indicators and the option of a special training for surveyors in the Alpine region (approx. end of March 2022) at the next meeting of the Technical Working Group possibly in spring 2021.

Due to a tight timetable for preparing the whole LUCAS survey for 2022 first steps of improving the representativity for the Alpine area of LUCAS Soil in 2022 can be made as outlined above. Further steps are envisaged to be taken on a longer term to ensure that further improvements regarding the representativity of soil conditions in the Alps can be considered in the preparation for LUCAS Soil 2026 in an early planning state of the survey.

Conception for the selection of LUCAS top soil sampling sites for the campaign 2022

Austrian working group, 09.12.2020

1) How should the distribution pattern of additional LUCAS sites of the Austrian territory look like?

Table 1: Distribution by land use categories

Land use category	Number of LUCAS sites		
	2009	2015	2018
Woodland	121	249	205
Cropland	148	130	89
Grassland	134	155	132
Shrubland	6	6	4
Others	11	3	9
Total	420	543	439*

*…out of 452 sites to be investigated samples of only 439 sites have been analysed

The following figures show the LUCAS soil sampling sites of Austria in 2009, 2015, and 2018.

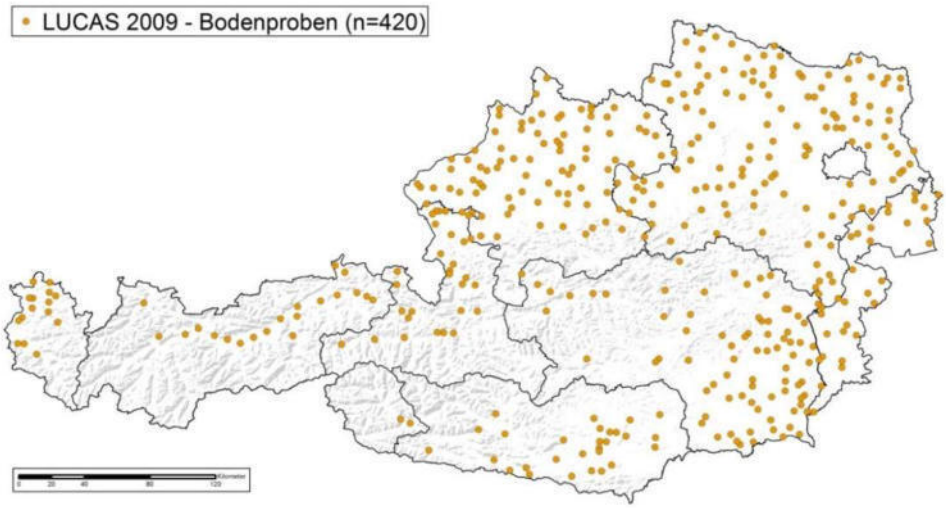


Figure 1: LUCAS soil sampling sites of Austria in 2009

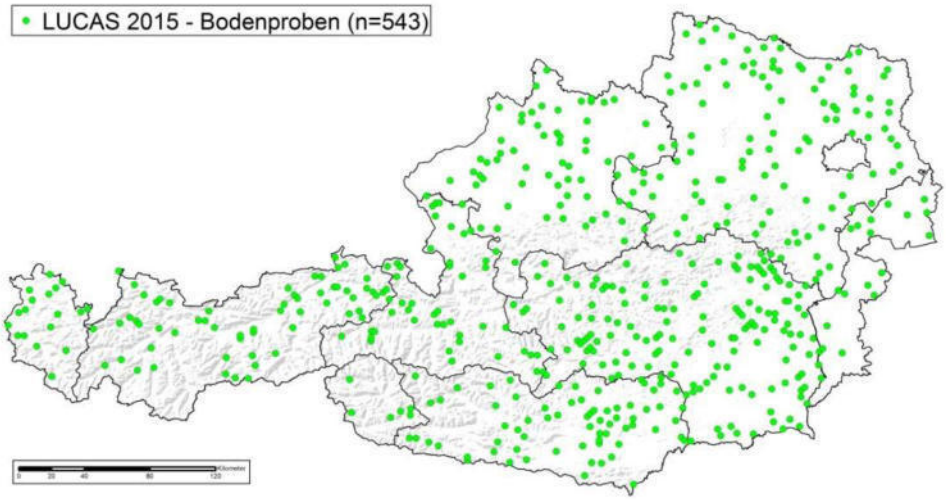


Figure 2: LUCAS soil sampling sites of Austria in 2015

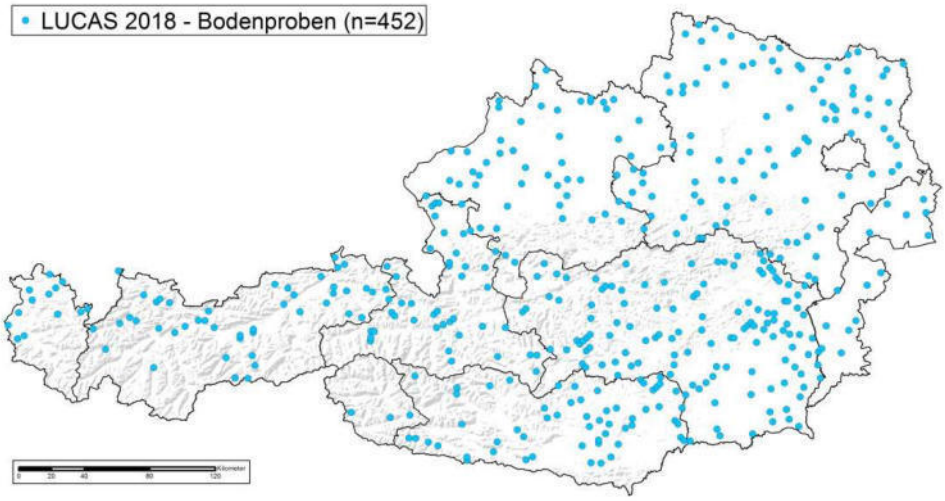


Figure 3: LUCAS soil sampling sites of Austria in 2018

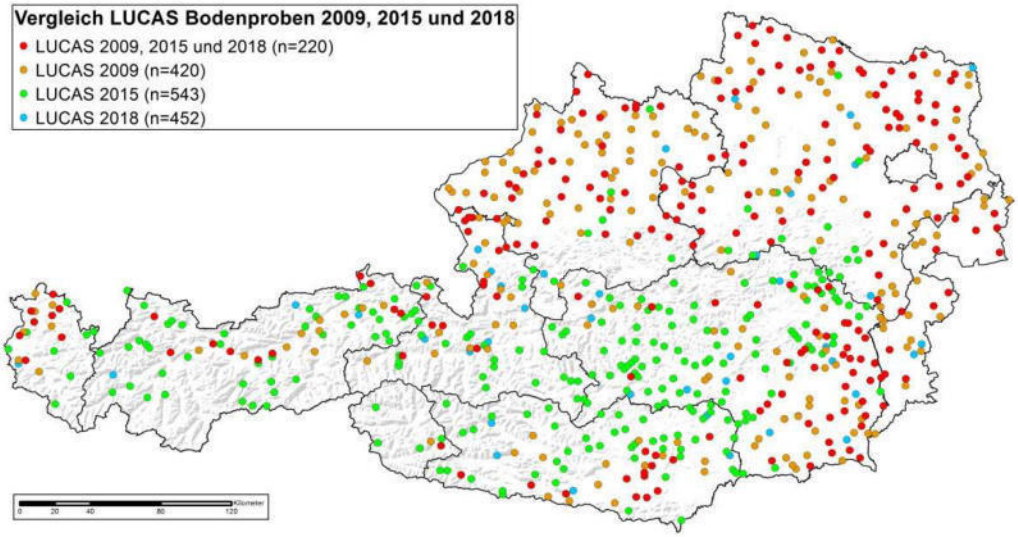


Figure 4: Depiction of all LUCAS sites investigated in 2009, 2015, and 2018

Represented area per LUCAS-point

Table 2: Represented area per LUCAS-point regarding sampling site distribution in 2018 and after adding 650 new LUCAS points ([1]…out of 452 sites to be investigated only 439 samples have been analysed)

Federal state 2018	Area [km²]	LUCAS 2018	$Area_{rep}$ 2018 [km²]	LUCAS 2022	$Area_{rep}$ 2022 [km²]	LUCAS additional
Vienna	414,82	0	0,0	5	77	**5**
Styria	16.399,34	126	130,2	213	77	**87**
Carinthia	9.536,50	57	167,3	124	77	**67**
Salzburg	7.154,56	42	170,3	93	77	**51**
Lower Austria	19.179,56	98	195,7	249	77	**151**
Upper Austria	11.982,52	51	235,0	156	77	**105**
Vorarlberg	2.601,67	10	260,2	34	77	**24**
Tyrol	12.648,37	42	301,2	164	77	**122**
Burgenland	3.965,20	13	305,0	51	77	**38**
Total	83.882,54	439[1]	191,1	1089		**650**

Distribution of sampling sites concerning their vertical extension

Table 3: Distribution of LUCAS 2018 points classified by altitude and their representative area after adding 650 additional sites

Altitude class	Area [km²]	Proportion [%]	LUCAS 2018	$Area_{rep}$ 2022 [km²]	LUCAS 2022	LUCAS additional
≤ 500 m	26.632	31,75	143	76,14	350	**207**
> 500 bis 1.000 m	25.412	30,30	168	76,14	334	**166**
> 1.000 bis 1.500 m	14.681	17,50	132	76,14	193	**61**
> 1.500 bis 2.000 m	9.620	11,47	9	76,14	126	**117**
> 2.000 m	7.533	8,98	0	76,14	99	**99**
Total	83.879	100,00	452		1102	**650**

Vertical Distribution of LUCAS points in 2009, 2015, and 2018

Table 4: Number of existing LUCAS-points disaggregated into classes of 100 m vertical extent (missing information concerning elevation for [1]three sites and [2]one site, respectively)

Elevation [m]	Number of LUCAS points		
	2009	2015[1]	2018[2]
100 – 199	34	25	22
200 – 299	62	49	40
300 – 399	53	43	38
400 – 499	67	52	43
500 – 599	66	48	42
600 – 699	56	55	42
700 – 799	43	38	33
800 – 899	32	42	32
900 - 999	6	26	19
1.000 – 1.099	1	48	39
1.100 – 1.199	0	31	33
1.200 – 1.299	0	31	25
1.300 – 1.399	0	31	20
1.400 – 1.499	0	13	15
1.500 – 1.599	0	3	5
1.600 – 1.699	0	0	1
1.700 – 1.799	0	3	2
1.800 – 1.899	0	1	1

2) Which criteria should be considered for selecting additional LUCAS points?

I Representativity of LUCAS sites: one approach was used in a national research project for the evaluation of LUCAS results (LUCASSA – LUCAS Soil Austria):

- Representativity of characteristic soil types for a certain area/landscape
- Representativity regarding the wide spectrum of soil types in Austria

Iterative approach:

Step 1: Identifying the most common soil types based on the Austrian soil map
Step 2: GIS-geoprocessing to combine the layer “common soil types” with the LUCAS-grid
Step 3: Determining an order of priority of potential LUCAS points located on common soil types for each federal state (highest priority for points located on representative soil types)
Step 4: individual selection of points in order to get a wide range of different soil types

II Considering sites which are the backbone of Austrian soil data sets:

- Reference profiles of the Austrian soil map
- Reference profiles of the Austrian soil taxation survey
- Sites of the Austrian soil state inventory

Special case alpine soils

I Scientific criteria

Since there is no soil data available for alpine regions the LUCASSA approach will not be feasible and, thus, an alternative method is necessary. The selection process should take into account all the soil forming factors in order to capture as much of the heterogeneous processes in soils of high altitude as possible. The most significant soil forming factors are:

- Geology/lithology (carbonate/silicate rocks etc.)
- Land use (anthropogenic influenced/near natural)
- Vegetation
- Topography/relief

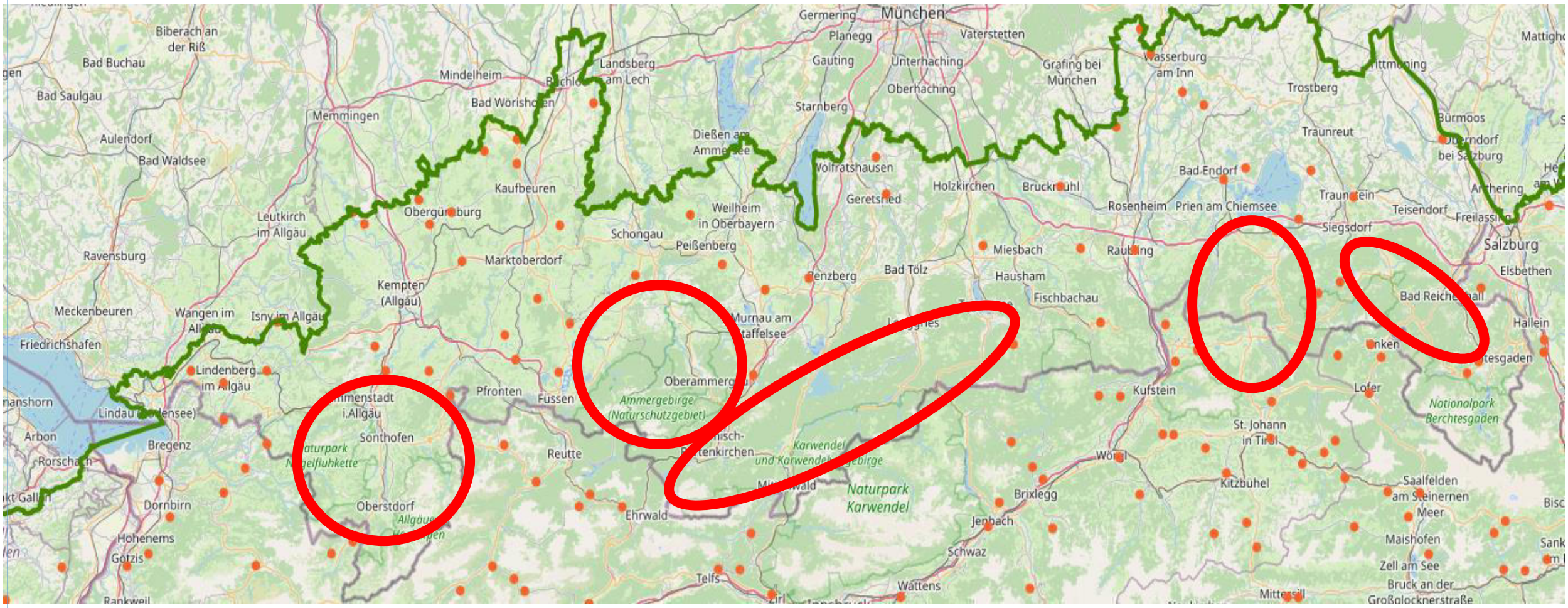
The application of several procedures for the selection would be possible but due to the narrow time budget a simple approach through combining soil forming factor information by using geographical information system will be preferred.

II Other criteria

- Accessibility of the sites

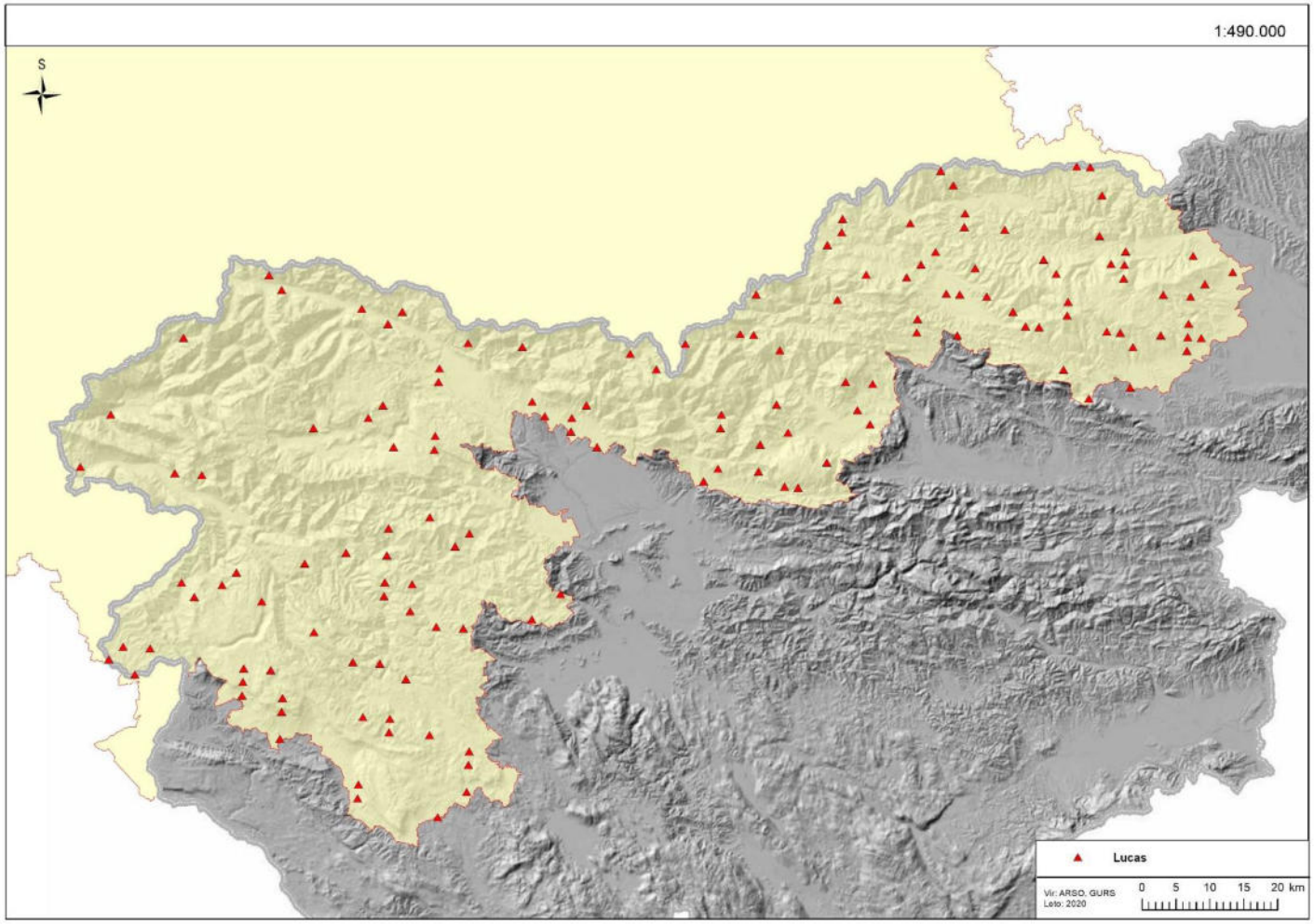
Topsoil sampling points in Alpine Convention Perimeter focus: Bavaria (Germany)

Soil Protection working group – LUCAS-data sampling points



In side the circles/elipses we ask you to densify the sampling points (especially at the Alpine rise) in the LUCAS-project

LUCAS-Soil sampling sites Slovenia, displaying areas in the Alpine Convention perimeter which are not covered.



Sampling sites LUCAS-Soil Switzerland. Red areas are higher than 1‘500 m above sea level and thus currently not represented.