EUROSOIL 2008 - EXCURSION 2A-pre-post-congress

"SOIL ASSESSMENT"
"Soils in the so called Austrian semiarid climate in the Region Weinviertel"

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1 GENERAL INTRODUCTION

1.1 Aim of the excursion:

- Soil excursion in the field
- to the Kubienamuseum
- and the Soil Classification-Assessment-Museum (Bodenschätzungsmuseum).

This excursion shows particular soils in the so called "Austrian semiarid climate".

Presentation of soil development from hydromorphic to terrestrial soils situated on alluvial sediments, loess and tertiary sediments; especially soils influenced by groundwater and soils not influenced by groundwater, causing an enormous difference in the crop yield.

Itinerary:
Region and locations: Lower Austria – Weinviertel;
Vienna – Spillern – Viendorfer Weingebirge – Sonnberg – Hollabrunn – Großnondorf – Aspersdorf – Maissau – Vienna, see fig.1;

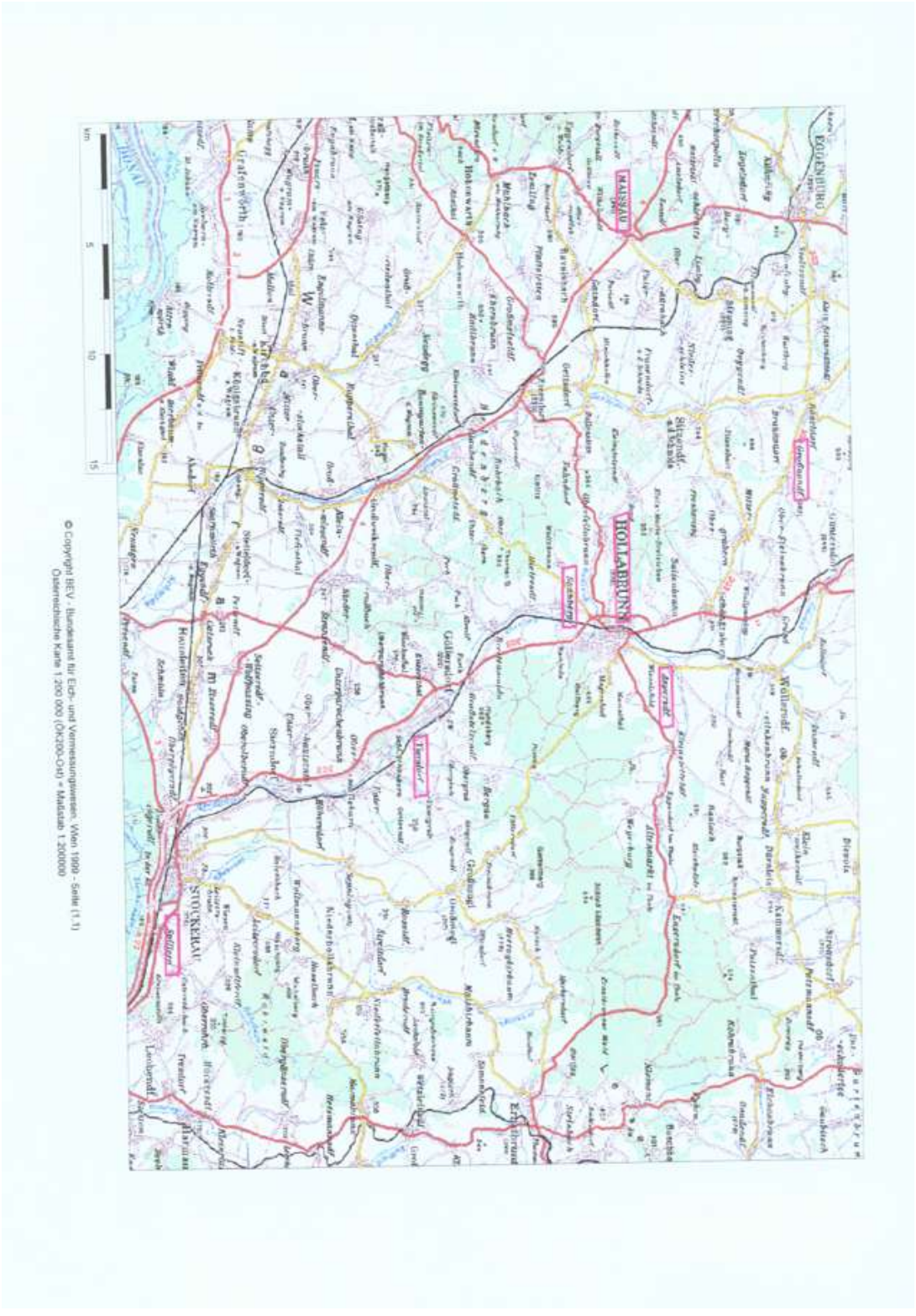


Figure 1: Excursion route.

1.2 Weinviertel (General description):

The name “Weinviertel” refers to an area where wine is produced, it constitutes the north-eastern part of the federal state of Lower Austria and presents a hilly country with broad hollow valleys.

This landscape is situated in an altitude of approximately 150 m to 400 m and is one of the most important agricultural areas of Austria, where low precipitations in connection with high temperatures in the summer sometimes have a negative effect on the yield.

Four geological units can be found in this area:

1.2.1 Molassezone

1.2.2 Waschbergzone

1.2.3 Flyschzone

1.2.4 Wiener Becken (Viennese basin)

1.2.1 Molassezone:

In the Weinviertel the Molasse zone extends between the Bohemian massif in the west and the "Waschberg zone" in the east and is approximately 30 to 40 km wide. It constitutes the foothills of the Alps-Carpathians range, reaching from the valley of the river Rhone in France till to Poland and Romania on the outer edge of this mountain range. The name "Molasse" is deduced from latin "molare" and means that the gravel of the ascending Alps was deposited into the "Molasse-sea".

The deposits in the Weinviertel consist of tertiary sediments, which reach from the Miocene up to the Oligocene. Since our excursion area is located mainly in the "Molassezone", some important geological formation will be mentioned now:

1.2.1.1 Hollabrunn-Mistelbacher-Formation
Fluviatile gravel sand and silt from the primary river Danube; upper Miocene to Pannonium

1.2.1.2 Grund-Formation
Marine gravel sand, silt and clay; lower Miocene

1.2.1.3 Laa-Formation
Marine gravel sand, silt and clay; lower Miocene, Karpatium

1.2.1.4 Zellerndorfer Formation
Marine clay and silt; Miocene

1.2.2 Waschbergzone:

This area is named after the "Waschberg", an elevation which is situated northeast of the city "Stockerau". It is a narrow zone, which extends from "Stockerau" to the "Wasch- and Michelberg", the "Leiser Berge", via "Staatz" till to the "Pollauer Bergen" in the Czech

Republic. It is morphologically different from the neighbouring Molasse zone and the northern Viennese basin, showing stronger relief energy and calcareous cliffs. Deposits form limes, lime marls, sandstones and sands.

1.2.3 Flyschzone:

It forms the northernmost tectonic unity of the Alps and can be found in the Weinviertel till the village of "Niederkreuzstetten". From morphological point of view it forms wavy foothills ("Rohrwald", "Bisambergzug"). Flysch is mainly built up from marine sandstones, clays, clay slates, marl slates and marl limes.

1.2.4 Wiener Becken ("Viennese basin"):

The northern most part of the approximately 200 km long and 60 km wide Viennese basin is situated in the Weinviertel and presents a wavy hilly country. The basin is filled young tertiary sediments, which are mainly sands and clay (so called "Tegel"). In general, the layers are nearly horizontal.

In the Pleistocene the Weinviertel was situated in the periglacial area, its plates, terraces and hilly, subdivided by broad hollow valleys, were formed by the interaction between warm and cold times. A very important feature is the accumulation and weathering of loess which has a significant effect on the yield, beside the climatic component.

Figure 2: Landscape near Retz.

1.3 Climate of the Weinviertel (Pannonian Climate)

This area is characterised by hot summers with much sunshine, and moderate cold and foggy winters. The average temperatures lie between -2,0 °C in January and about 19,5 °C in July. The average annual temperature lies between nearly 9,0 °C to 9,5 °C and the 14^{00}-temperature reaches values up to 20,5 °C between the period April to August. The vegetation time is on average 230 to 250 days, the average temperatures being higher than 5 °C.

Very important is the negative effect of low precipitation. Since the precipitation has declined by nearly 10 % within the last decades, the average annual amount of 600 mm rainfall will be never reached in the Weinviertel. The region with the lowest precipitation of Austria is also situated in the Weinviertel; it is the northern part near the border of the Czech Republic (Retz – Zellerndorf) with nearly 420 to 430 mm precipitation per year. In comparison to the

Mediterranean climate (maximum in winter), in the Weinviertel we find the maximum precipitation in summer.

The winds mostly come from the west and have high average speeds of 3,0 and 3,5 m/s. On average, 40 stormy days per year can be expected.

1.4 Soil Assessment (Soil Evaluation)

Introduction

Soil is still vital for humankind, flora and fauna; humans cannot do without it. Soil is in short supply; in Austria, about twenty hectares of precious cultivated land per day are lost for food and groundwater production.

Soil protection needs expertise; the Austrian Soil Assessment Agency is the only organisation that carries out analysis of physical (and partly also chemical) field data in accordance with the lots of agriculturally used land (soil evaluation in the fields). This is the reason why these data offer a wide possibility of use, their importance going far beyond the use for fiscal purposes. Information on soil quality and distribution is crucial for soil protection. The Austrian Soil Assessment offers soil information for the whole agricultural used land of Austria.

The Austrian Soil Evaluation was started in 1947 and the first estimate was concluded in 1973.

Real estate valuation

The purpose of real estate valuation, according to the definition of the valuation law, is a standardised determination of the values of the economic units, as the basis for a multitude of taxes, contributions and non-fiscal applications.

Results of Soil Evaluation

The results of the Soil Evaluation are characterised by the following:

- high information content
- immediacy
- high geometric precision
- detailed mapping
- detailed description and evaluation of the agricultural used lands (available all Austria: 1.940.000 hectares of pasture land and 1.405.000 hectares of arable land) and
- if available in digitalized form additional possibilities of analysis

Therefore the data of the Soil Evaluation are used also for non-fiscal purposes, especially for different applications in the fields of nature and soil conservancy.

Soil Evaluation and Agricultural Real Estate Valuation in Austria

Under the Federal Law of July 9, 1970 (Official Federal Gazette 233/1970), the Law on the Assessment of Farm Land (for the evaluation of soil), the natural yield of agricultural used lands has to be evaluated, on the basis of the soil, the slope of the landscape, the climate and the water regime. In order to get uniform evaluation results, the natural yielding power is established for representative federal and state sample estates throughout the Federal territory of Austria; the results and the corresponding real property values are published in the Official Journal of the Republic of Austria. Other valid regulations are: Valuation Law, of 1955, Real Estate Tax Law , of 1955, Land Survey Law, of 1968.

Field evaluation

Within the framework of this article, only a quick view into the field evaluation of arable land could be given.
The valuation index of soil is the index number of the natural yield which is the result of the data collection of 1. texture (see below), 2. the source materials (see below) and 3. the soil quality classes (see below). After addition or deduction of the adjusting values for climate, the slope and various special conditions we get the valuation index of field.

Table 1: Frame-Arable evaluation

Frame - Arable evaluation								
Texture-	Source material	Soil quality class						
		1	2	3	4	5	6	7
S	D		43-36	35-29	28--22	21-17	16-12	11- 7
	Dg			32-25	24-19	18-14	13- 9	8 - 7
	Al		50-42	41-34	33-27	26-21	20-17	16-10
	Alg			38-31	30-26	25-20	19-12	11- 7
	V		42-35	34-28	27-21	20-16	15-12	11- 7
	Vg			30-24	23-19	18-14	13- 9	8 - 7
Sl (S/IS)	D	60-53	52-45	44-37	36-29	28-22	21-17	16-11
	Dg			40-33	32-25	24-19	18-14	13- 7
	Al	68-60	59-51	50-43	42-35	34-28	27-22	21-15
	Alg			46-39	38-32	31-25	24-18	17-10
	V		50-43	42-36	35-29	28-21	20-16	15-10
	Vg			39-33	32-25	24-19	18-14	13- 7
IS	D	68-60	59-52	51-45	44-38	37-30	29-22	21- 16
	Dg			48-42	41-34	33-26	25-20	19- 13
	Lö	73-65	64-56	55-48	47-41	40-33	32-25	24- 18
	Al	76-67	66-59	58-52	51-44	43-35	34-27	26-18
	Alg			55-48	47-38	37-31	30-23	22- 16
	V	65-58	57-50	49-44	43-37	36-29	28-21	20- 16
	Vg			47-41	40-33	32-25	24-20	19-12
SL (ls/sL)	D	77-69	68-61	60-53	52-46	45-38	37-30	29-20
	Dg			56-50	49-42	41-33	32-25	24-15
	Lö	82-74	73-65	64-56	55-48	47-41	40-33	32-25
	Al	84-75	74-66	65-58	57-51	50-44	43-36	35-26

	Alg			61-55	54-48	47-40	39-30	29-21
	V	73-66	65-58	57-50	49-44	43-36	35-29	28-20
	Vg			53-48	47-40	39-33	32-25	24-15
	D	87-78	77-69	68-60	59-53	52-46	45-38	37-28
	Dg			63-57	56-50	49-42	41-32	31-22
	Lö	92-83	82-74	73-65	64-56	55-48	47-41	40-32
sL	Al	94-84	83-75	74-66	65-58	57-50	49-42	41-32
	Alg			69-62	61-54	53-46	45-36	35-26
	V		73-65	64-57	56-49	48-42	41-34	33-24
	Vg			60-53	52-46	45-38	37-28	27-18
	D	92-83	82-74	73-66	65-58	57-50	49-42	41-33
	Dg			69-62	61-54	53-46	45-37	36-29
	Lö	100-90	89-80	79-71	70-63	62-55	54-46	45-36
L	Al	100-90	89-80	79-71	70-62	61-54	53-45	44-35
	Alg			74-66	65-58	57-49	48-39	38-29
	V		79-71	70-62	61-54	53-45	44-37	36-27
	Vg			65-58	57-49	48-40	39-29	28-18
	D	84-75	74-66	65-58	57-51	50-43	42-35	34-26
	Dg			61-55	54-47	46-39	38-31	30-21
LT	Al	90-80	79-71	70-62	61-54	53-46	45-38	37-27
	Alg			65-58	57-50	49-42	41-33	32-22
	V		70-63	62-54	53-46	45-38	37-29	28-20
	Vg			57-50	49-42	41-32	31-25	24-15
	D		67-60	59-53	52-45	44-38	37-28	27-18
	Dg			56-49	48-42	41-32	31-23	22-14
T	Al		73-65	64-56	55-48	47-39	38-29	28-18
	Alg			59-52	51-43	42-35	34-26	25-14
	V		64-56	55-48	47-40	39-32	31-23	22-15
	Vg			51-44	43-36	35-26	25-18	17-10
Mo			45-37	36-29	28-22	21-16	15-10	9 - 7

Texture: S … sand, L … loam, T … clay; Source material: D … Diluvium, Lö … Loess, Al …Alluvium, V … Weathering; Soil quality class: 1 till 7; the summation of the other criteria which influence also the natural yield e.g. organic matter, porosity, carbonate content, root development, kind of structure, etc.

Soil data, results of the Soil Evaluation (field evaluation)

Spot sample data are ascertained in the fields. These ascertained data are combined in area classes and area data respectively. Due to the ascertained and / or the assessment of determining and important criteria we get the essential soil data (a few examples can be given): Source material, the texture of soil, the soil quality class, climatic conditions, etc. The results of the soil evaluation are registered in the "net evaluation maps" (a combination of evaluation map and cadastral map) as well as in the evaluation books (e.g. L2Lö 85/77: texture: loam, soil quality class: 2, source material: loess, valuation index of soil 85; valuation index of field 77)

Applications

Therefore the data of the soil evaluation are used for fiscal purposes (real property tax, income tax) and for the assessment of allocations (e.g. allocations of the agricultural chamber) and contributions (e.g. social security contributions) etc. The data are also suitable for non-fiscal purposes, especially for different applications in the fields of nature and soil conservancy, the land development map, the joining of estates , scientific work, etc. – e.g. mapping of biotopes, mapping of soil types, mapping of soil quality, mapping of soil sensitivity – e.g. the regulation of sewage sludge of the government of Lower Austria, etc. (STICH, 1996; WAGNER, 1997). And not at last the soil evaluation and the soil maps meets the expectations of detailed data for economic and ecological food production, of environmental assessments (STICH, 1996; STICH, 1999) and sustainable development projects.

The two pillars of the agricultural real estate valuation are the Soil Assessment and the evaluation of the economic conditions.

1.5 Essential soil types in the Weinviertel according to the evaluation of the Austrian Soil Assessment

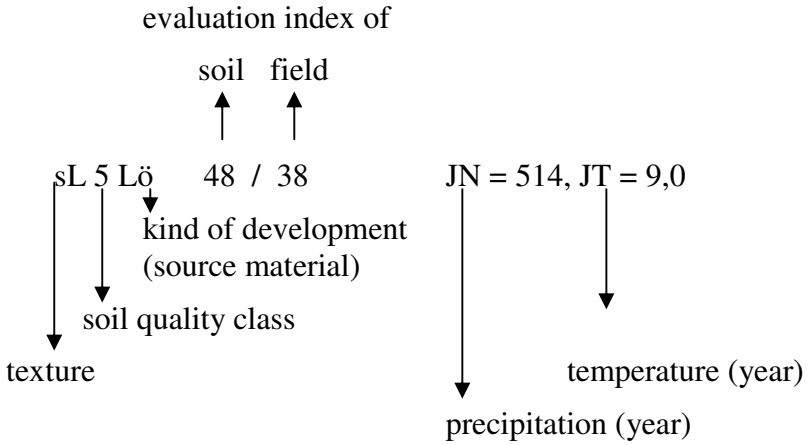
1.5.1 Soil types from loess:

Loess is a homogenous, porous, calcareous, weak compact sediment which is pale yellow and was transported by the wind. Soils of loess with good and deep content of organic matter have favoured qualities according to their water and air management.

BMSt, LMSt … especial profiles for the Soil Assessment

1.5.1.1 Kulturrohboden (Anthrosol) Profile A or AC – C

BMSt Mistelbach:



1.5.1.2 Tschernosem (Calcic Chernozem): A – AC – C or Cg

BMSt Großnondorf:	L 1 Lö	100/83	JN = 460, JT = 8,9
BMSt Lassee:	sL 1 Lö Al	84/76	JN = 549, JT = 9,6

1.5.1.3 Braunerde aus Löss (Cambisol): A – AB – (Ba) – (B_{rel}) – BC – C

BMSt Theras (Bohemian Massive):	L 3 Lö D	71/63	JN = 513, JT = 7,8

Figure 3: Loess facies in Weinviertel.

1.5.2 Soil types from tertiary material

1.5.2.1 Kulturrohboden (Anthrosol) A or AC – C (from sand or marl)

BMSt Ottenthal	LT/TMe 5 D	39/24	JN = 487, JT = 9,0

1.5.2.2 Carbonatfreier Tschernosem (formerly: Paratschernosem; Phaeozem) A – AC – Cn (mostly on gravel)

LMSt Aspersdorf	SL/Scho 4 Dg	33/22	JN = 504, JT = 8,9

1.5.2.3 Tschernosem (Chernozem): A – AC – C (from marl)

BMSt Pernersdorf	LT 3 D	65/45	JN = 436, JT = 9,0

1.5.3 Alluvial-land

Young soils in lowlands and valleys which are mostly under influence of groundwater.

1.5.3.1 Gley (Gleysol): A – Ag – Gor – Gr

BMSt Sonnberg	LT 3 Al	65/64	JN = 489, JT = 9,0

1.5.3.2 Feuchtschwarzerde (Gleyic Chernozem): A – Acg – CG

BMSt Wullersdorf	LT 1 Al	84/81	JN = 495, JT = 8,9

Figure 4: Cellars in Pillersdorf.

1.6 Soils in the Western Weinviertel

In the Western Weinviertel (area of the excursion "Soil Assessment") following soils could form locally on the basis of the various source materials:

1. Rankers, Rendzinas, Cambisols on rock

These soils predominate on the Manhartsberg and on the Manhartsberg slope.

Rankers: Parent rock: solid or coarsely clastic silicate material; horizon sequence: A – C, A – AC – C: humus-containing, often stony A horizon on siliceous source material; example: Retzbach – lS/Fe6V 16/8.

Rendzinas: horizon sequence: A – C, AC – C; example: lS,Scho5Dg 18/15.

Cambisols: horizon sequence: A – Bv – C; example: lS/Fe5V 22/17.

2. Soils on or of Tertiary

Chernozems: source material: calcareous-siliceous loose sediments such as sands, clays, marls; horizon sequence: A – C, A – AC- C; very massive humus horizon; example: LT3D 65/45.

Phaeozem (carbonatfreier Tschernosem; formerly: Paratschernosem): horizon sequence: AC – D; examples: lS/Scho, S4Dg26/22, SL/Scho4Dg 32/27.

Anthrosols: examples: LT/Tme5 D 39/24; lS/S5D 23/19

3. Soils on or of Loess

Chernozems: horizon sequence: A – C, A – AC – C; medium heavy soil types (sandy loam and loam); soil quality classes 1 to 3; very good to best locations; example: L1Lö 100/83 (BMSt Großnondorf). Also chernozems with stagnic properties occur in this area (e.g. sL1LöAl 84/76).

Cambisols from loess (Braunerde; formerly: Lössbraunerde): horizon sequence: A – AB – Bv – BC – C; example: L3LöD 71/63 (BMSt Theras).

Anthrosols from loess: horizon sequence: Ap – C, Acp – C; examples: sL5Lö 48/38; SL4Lö 54/50.

4. Alluvial soils (hydromorph influenced soils)

Gleyic Chernozem (Feuchtschwarzerde): source material: calcareous-siliceous fine sediments; horizon sequence: A – Cg, A – CG; high ground-water influence; example: LT1A1 84/81 (BMSt Wullersdorf).

Gleysols (Gleye): source material; sediments colluvial and alluvial materials deposited in hollows and valleys; horizon sequence: A – Go – Gr, Ag – G; example: LT3Al 65/64 (BMSt Sonnberg).

5. Colluvisols (Kolluvien)

Soil parts deposited by water erosion in areas at the basis of hilly countryside and hills, in hollows and valleys – covering existing soils; sandy loam, condition levels usually 1 and 2 – are then present; these colluvisols represent valuable locations in the dry area; example: sL1Lö 88/69 (VST Deinzendorf).

6. The following soil types occur in the western Weinviertel in rather small amounts.

Planosols (Pseudogleye)

Relic Planosols (Reliktpseudogleye)

Chromic Cambisols (Braunlehme)

In the region of the western Weinviertel, corresponding to the marked differentiation, occur, on the one hand, frequent interleaving of adjacent soil types and, on the other hand, many transitional forms and stratification profiles. The fertilities of this region range from the weakest rankers to the best ***Gleyic Chernozem***. Especially in the dry area, these ***Gleyic Chernozems*** represents the safest production locations due to the good water supply.

In that context I would like to present a quotation from the lecture "Soil evaluation in Austria as an instrument for sustained use of the land" by Prof. Blum on occasion of the conference "50 years of Soil Evaluation in Austria": "The availability of reliable data on the land, e.g. on the respective soil quality is a critical management instrument. … - This is exactly the field of activity of the Soil Evaluation of Austria, … That's why these data offer a varied possibility of use and they have importance way over the use for fiscal purposes." (BLUM, 1997).

2 METHODS

2.1 Methods in the field

texture
class
soil quality class
kind of development (source material)
valuation index of soil
climate
exposition
valuation index of field

2.2 Soil physical analysis

particle size distribution
density (partly)
vol.% water at pF 1,8; 2,0; 2,5; 4,2 (partly)

2.3 Soil chemical analysis

ph ($CaCl_2$)
$CaCO_3$
plant available P, K in CAL-extract
exchangeable cations
base saturation (partly)

3 EXCURSION POINTS

Excursion point 1: Soil profile Nr. 1 Spillern, Lower Austria, Fluvisol from sandy and silty materials of the River Danube

Site characterisation:

Location: Basin of the River Danube; altitud : 169 m

Climate: Pannonian Climate

Temperature: year: 9,7 °C

14^{00}-Temperature: 20,6 °C (April to August); measured at 14^{00} o'clock

Temperature Winter: - 0,1°C (December to February)

Temperature > 5 °C on 255 days per year (average)

Precipitation: year 598 mm

Precipitation from April to August 325 mm; on 49 days (average) from April to September

Snow cover days: 38

Wind conditions: 3,1 m/s (max.)

Relief: flat

Land use: agricultural land use

Soil condition for cultivating: good

Soil profile:

Ap (0 – 25 cm):	loamy weak silty sand, average content of organic matter, 2,5 Y 4/4 (dry and moist), ph 7,6, strong carbonate content, fine crumby structure, porous, good root development an biological activity, horizon boundary straight switching over to
A (25 – 35/40 cm):	loamy silty sand; moderate content of organic matter;2,5 Y 4/4 (dry and moist), ph 7,9 , strong carbonate content, crumby and subangular blocky structure, good root development and biological activity, horizon boundary switching over to
AC (35/40 – 50 cm):	weak loamy sand, weak content of organic matter, strong carbonate content, 2,5 Y 5/5 (dry and moist), ph 7,9 , friable, porous, common roots, horizon boundary straight switching over to
C (50 – 150 cm):	sand, moderate carbonate content, very few and very fine roots, friable, porous
C_n (150+ cm):	gravel mixed with sand material

Soil assessment

Class (texture): loamy sand over sand (and gravel)

Soil quality class: 3

Kind of development (source material): Alluvium/Diluvium

Valuation index of soil: 43

Reduction: climate -9 %

water regime -2 %

different soils -2 %

-13 %

valuation index of field: 37

soil assessment data: lS/S 3 AlD 43/37

Analytical results:

Particle size distribution

Analysis Spillern					
horizon		Ap	A	AC	C
depth (cm)		0 - 25	25 - 35/40	35/40 – 50	50 - 150
soil texture %	2000 – 63 µ	44	45	61	91
	63 – 20 µ	24	23	19	5
	20 – 6,3 µ	15	16	11	2
	6,3 – 2 µ	9	9	5	1
	< 2 µ	8	7	4	1
	< 6,3 µ	17	16	9	2

Soil chemical parameters

Profile Spillern

Depth (cm)	0 - 25	25 – 35/40	35/40 – 50	50 - 150
Sorption[x)]	2	2	2	2
pH in $CaCl_2$	7,6	7,9	7,9	7,9
Carbonate Content ($CaCO_3$) %	19	21	21	23
Carbonate Activity Test[xx)]	2	2	2	2
Humus %	1,9	0,9	0,6	0,5
P-CAL mg P_2O_5/100g	27 D	[xxx)] 2 A	1 A	1 A
K-CAL mg K_2O/100g	13 C	3 A	2 A	1 A
CEC mval/100g	14	11	8,6	8,8
mval Ca/100g	12,0	9,93	7,76	7,96
mval Mg/100g	1,18 D	0,84 D	0,66 C	0,72 C
mval K/100g	0,39	0,12	0,08	0,06
mval Na/100g	0,06	0,08	0,06	0,07

x) Sorption:

xx) Carbonate Activity Test:

} 2 low, 3 average, 4 high

xxx) Content levels: A very low, B low, C average, D high, E very high

Excursion point 2: Soil profile Nr. 2 Viendorfer Weingebirge, Lower Austria, Cambisol from loess under agricultural landuse

Site characterisation:

Location: hilly part of WV-terrace exposition S 2°; altitud : 320 m

Climate: Pannonian Climate

Temperature: year: 8,6 °C

14^{00}-Temperature: 19,4 °C (April to August); measured at 14^{00} o'clock

Temperature Winter: 1,0 °C (December to February)

Temperature > 5 °C during 242 days per year (average)

Precipitation: year 564 mm

Precipitation from April to August 319 mm; during 50 days (average) from April to September

Snow cover days: 42

Wind conditions: 3,0 m/s (max.)

Relief: exposition S 2°

Land use: agricultural land use

Water regime: very dry

Soil condition for cultivating: good

Soil profile:

Ap (0 – 25/30 cm):	weak sandy, silty loam; average content of organic matter, 10/7,5 YR 3/3 (dry), no carbonate content, fine crumby structure, porous, good root development and biological activity, horizon boundary straight switching over to
AB (25/30 – 50 cm):	silty loam, average to moderate content of organic matter, 10/7,5 YR 4/4 (dry), no carbonate content, subangular blocky structure, porous, good root development and biological activity, horizon boundary straight switching over to
Ba (50 – 65/70 cm):	silty loam, moderate to weak content of organic matter, 10/7,5 YR 4/6 (dry), no carbonate content, subangular blocky structure, porous, common roots, horizon boundary straight switching over to
Bt (65/70 – 75/80 cm):	silty loam and loamy clay, weak content of organic matter 10/7,5 YR (5/4) no carbonate content, blocky and prismatic structure, porous, common roots, horizon boundary straight switching over to
C (75/80+ cm):	fine sandy silty loam, moderate carbonate content, 10 YR 6/6, angular blocky structure, porous, very few and fine roots

Soil assessement

Class (texture): loam

Soil quality class: 3

Kind of development (source material): Loess

Valuation index of soil: 77

Reduction:	climate	- 2 %
	water regime	- 4 %
	shadow from trees in north-east of the profile	- 6 %
		-12 %

valuation index of field: 68

soil assessment data: L2LöD 77/68

Excursion point 3: Soil profile Nr. 3 Sonnberg, Lower Austria, Gleysol in the Göllersbach river basin

Site characterisation:

Location: basin of the River Göllersbach; altitude: 215 m

Climate: Pannonian Climate

Temperature: Year: 9.0 °C

14^{00}-Temperature: 20.0 °C (April to August); measured at 14^{00} o'clock

Temperature Winter: - 0.8 °C (December to February)

Temperature > 5 °C on 247 days per year (average)

Precipitation: year 489 mm

Precipitation from April to August 325 mm; on 49 days (average) from April to September

Snow cover days: 38

Wind conditions: 3.1 m/s

Relief: flat

Land use: Agricultural land use

Soil profile:

Ap (0 – 30 cm):	silty loamy clay, average content of organic matter, 2,5 Y 3/2 (dry), 2,5 Y 4/2 (moist), ph 7,9, strong carbonate content, crumby and angular blocky structure, porous, common roots, horizon boundary straight switching over to
Ag rel (30 – 40 cm):	silty loamy clay/clay, average and moderate content of organic matter, 2,5 Y 4/4 (dry), 2,5 Y 4/2 (moist), ph 8,0, strong carbonate content, blocky and prismatic structure, porous, good root development and biological activity, few rusty brown and few gleyic mottles
Gor rela (40 – 75/80 cm)	silty loamy clay/clay, weak content of organic matter, 5 Y 4/1 (dry), 7,5 YR 4/4 (moist), ph 7,9, common roots, prismatic structure, rusty brown and gleyic mottels
Go rel (75/80 – 120 cm):	silty clay, moderate carbonate content, 5 Y 4,5/2 (dry); 7,5 YR 4/4 (moist), ph 8,0, rusty brown mottles, very few and very fine roots, blocky structure
Gro (120+ cm):	Gleyic clay, groundwater in 170 cm

Soil assessment

Class (texture): loamy clay

Soil quality class: 3

Kind of development (source material): Alluvium

Valuation index of soil: 65

Reduction and addition:	climate	- 10 %
	water regime	- 6 %
	frozen	- 2 %
	water (positive)	+16 %
		- 2 %

valuation index of field: 64

soil assessment data: LT 3 Al 65/64

Analytical results:

Particle size distribution

Analysis Sonnberg			
horizon	Ap	Agrel	Gorrela
depth (cm)	00 - 30	30 - 40	40 – 75/80
< 2µ %	45,1	52,9	50,4
2 – 20µ %	34,9	33,4	36,0
20 – 63µ %	12,3	7,1	9,9
2 – 63µ %	47,2	40,5	45,9
63 – 2000µ %	7,7	6,6	3,7

Density: 1,62 g/cm³

Vol% water at

depth	pF 1,8	pF 2,0	pF 2,5	pF 4,2
30 – 40 cm	34,6	34,0	33,3	29,5

Soil chemical parameters

Profile Sonnberg

Horizon	Ap	Agrel	Gorela	Gorel
Depth (cm)	00 - 30	30 - 40	40 – 75/80	75/80-120
Sorption[x)]	4	4	4	4
pH in $CaCl_2$	7,9	8,0	7,9	8,0
Carbonate Content ($CaCO_3$) %	14	12	15	9,8
Carbonate Activity Test[xx)]	3	3	3	3
Humus %	3,0	1,9	1,4	1,1
P-CAL mg P_2O_5/100g	9 B	[xxx)] 1 A	0 A	0 A
K-CAL mg K_2O/100g	12 B	6 A	5 A	8 A
CEC mval/100g	34	39	34	30
mval Ca/100g	24,1	24,4	20,3	18,6
mval Mg/100g	9,03 E	13,9 E	13,5 E	10,7 E
mval K/100g	0,37	0,24	0,25	0,27
mval Na/100g	0,40	0,58	0,40	0,23

x) Sorption:

xx) Carbonate Activitx Test: } 2 low, 3 average, 4 high

xxx) Content levels: A very low, B low, C average, D high, E very high

Excursion point 4: Kubiena museum and soil classification museum at Hollabrunn

Excursion point 5: Short Lunch break

Excursion point 6: Soil profile Nr. 4 Aspersdorf, Lower Austria, Haplic Chernozem from gravel materials

Site characterisation:

Location: hilly landscape with broad hollow valleys; altitude: 245 m

Climate: Pannonian Climate

Temperature: Year: 8,9 °C

14^{00}-Temperature: 19,8 °C (April to August); measured at 14^{00} o'clock

Temperature Winter: - 0,8 °C (December to February)

Temperature > 5 °C on 243 days per year (average)

Precipitation: year 504 mm

Precipitation from April to August 296 mm; on 47 days (average) from April to September

Snow cover days: 38

Wind conditions: 2,8 m/s, 40 storm days

Relief: slope on the upperside

Water regime: very dry

Soil condition for cultivating: bad

Land use: agriculture

Soil profile:

Ap (0 – 25/30 cm):	strong loamy sand, average content of organic matter, 10YR3/3 (dry and moist), ph 7,2, weak carbonate content, coarse and gravel fraction, fine friable crumby structure, good root development, horizon boundary straight switching over to
AC (25/30 – 35 cm):	strong loamy sand/loamy sand, moderate content of organic matter 10YR3/4 (dry and moist), weak carbonate content, strong gravel fraction, angular blocky structure, porous, good root development, horizon boundary sharp switching over to
Cn_1 (35 – 70 cm)	coarse and medium sand, coarse and gravel fraction, 5YR5/6 (dry), no carbonate content, very few and very fine roots without structure
C_{n2} (70+ cm):	coarse sand and gravel fraction

Soil assessment

Class (texture): strong loamy sand over sand and gravel

Soil quality class: 4

Kind of development (source material): Diluvium

valuation index of soil: 33

Reduction:	exposition	- 4 %
	climate	-15 %
	water regime	- 8 %
	wind	- 5 %
		-32 %

valuation index of field: 22

soil assessment data: SL/S, Scho 4 Dg 33/22

Analytical results:

Particle size distribution

Analysis Aspersdorf					
horizon		Ap	AC	C_{n1}	C_{n2}
depth (cm)		0 – 25/30	25/30 - 35	35 – 70	70+
soil texture %	2000 – 63 µ	57	53	85	80
	63 – 20 µ	12	14	1	4
	20 – 6 µ	9	10	2	3
	6 – 2 µ	5	5	0	1
	< 2 µ	17	18	12	12
	< 6 µ	22	23	12	13

Soil chemical parameters

Profile Aspersdorf

Horizon		Ap	AC	Cn_1	Cn_2
Depth (cm)		0 – 25/30	25/30 – 35	35 – 70	70
Humus content (Walkley) %		2,0	1,7	0,3	0
Carbonate Content $CaCO_3$ %		1,3	2,2	0,1	0
pH (KCl)		7,2	7,3	7,1	7,0
Sorption in mval/100g	Ca	15,0	16,0	8,0	8,0
	Mg	0,9	0,8	0,6	0,7
	K	1,3	1,1	0,3	0,1
	Na	0	0	0	0
	S-value	17,2	17,9	8,9	8,8
	CEC	20,0	22,0	13,5	14,5
H-value (calculated) mval/100g		2,8	4,1	4,6	5,7
Base saturation %		86	81	66	61

Excursion point 7: Soil profile Nr. 5 Großnondorf, Lower Austria, Chernozem of silty clay and clay materials of loess lying on tertiary marl

Site characterisation:

Location: Plain**;** altitude 260 m

Climate: Pannonian Climate

Temperature - year: 8.9 °C

14^{00}-Temperature: 19.,8 °C (April to August); measured at 14^{00} o'clock

Temperature - winter: - 1.,0 °C (December to February)

Temperature > 5 °C on 241 days per year (average)

Precipitation – year: 460 mm

Precipitation from April to August 274 mm; on 47 days (average) from April to September

Snow cover days: 43

Wind conditions: 2.6 m/s

Relief: Plain

Land use: agricultural land use

Soil profile:

Ap (0 – 30 cm):	clayey loam; content of organic matter: above the average of the arable soils in the East of Austria; medium carbonate content; pH 7,5; crumby structure; porous, 10YR2/1 (dry), 10YR3/2 (moist); good root development and biological activity; horizon boundary with ploughpan straight switching over to
A (30 – 70 cm):	clayey loam; content of organic matter: above the average; medium carbonate content; crumby and granular structure; porous; 5YR2,5/1 (dry), 5YR 3/1 (moist); ph 7,7; common roots; gradual smooth boundary to
AC (70 – 95 cm):	clayey loam; average content of organic matter; high carbonate content; ph 8,0; crumby structure; porous; 10YR3/2 (dry), 10YR4/3 (moist); common roots; common roots; gradual smooth boundary to
C (95 – 105 cm):	clayey loam; 10YR5/4,5 (dry), 10YR5/4 (moist); high carbonate content; ph 8,0; crumby structure; porous, common roots; pseudo-mycelium; horizon boundary straight switching over to
Dg (105+ cm):	tertiary marl

Soil assessment

Class (texture): loam

Soil quality class: 1

Kind of development (source material): Loess

Valuation index of soil: 100

Reduction and addition:	climate	-11 %
	water regime	- 8 %
	wind	- 3 %
	water episodic	+ 5 %
		-17 %

valuation index of field: 83

soil assessment data: L 1 Lö 100/83

Analytical results:

Particle size distribution

Analysis Großnondorf					
Horizon		Ap	A	AC	C
depth (cm)		0 – 30	30 - 70	70 – 95	105+
soil texture %	2000 – 63 µ	8	4	5	9
	63 – 2 µ	64	63	64	61
	< 2 µ	28	33	31	30

Density: 1,35 g/cm³

Vol % water at:

depth	pF 1,8 (%)	pF 2,0 (%)	pF 2,5 (%)	pF 4,2 (%)
30-70 cm	36,0	34,2	32,1	23,4

Soil chemical parameters

Profile Großnondorf

Depth (cm)	00 – 25	25 - 70	70 – 95	95 - 100
Sorption[x)]	3	3	3	3
pH in $CaCl_2$	7,5	7,7	8,0	8,0
Carbonate Content ($CaCO_3$) %	2,2	2,5	23	26
Carbonate Activity Test[xx)]	2	2	4	3
Humus %	2,7	2,9	1,3	0,5
P-CAL mg $P_2 0_5$/100g	34 D	[xxx)] 2 A	1 A	0 A
K-CAL mg $K_2 0$/100g	27 C	7 A	6 A	5 A
CEC mval/100g	48	49	31	24
mval Ca/100g	21,3	44,8	21,1	13,2
mval Mg/100g	2,67 E	12,6 E	19,3 E	17,1 E
mval K/100g	0,62	0,28	0,20	0,21
mval Na/100g	0,33	0,58	0,18	0,21

x) Sorption:

xx) Carbonate Activity Test:

} 2 low, 3 average, 4 high

xxx) Content levels: A very low, B low, C average, D high, E very high

Excursion point 8: Soil profile Nr. 6 Maissau, Lower Austria, Cambisol/Lithosol from loess and granite under agricultural land use

Site characterisation:

This landscape represents a transition between the hilly tertiary country of the so called Weinviertel and the Bohemian massif.

Climate: Pannonian Climate

Temperature: Year: 8.5 °C

14^{00}-Temperature: 19.1 °C (April to August); measured at 14^{00} o'clock

Temperature Winter: - 0.,9 °C (December to February)

Temperature > 5 °C on 233 days per year (average)

Precipitation: year 570 mm

Precipitation from April to August 336 mm

Snow cover days: 60

Wind conditions: 3,1 m/s (max.)

Relief: flat slope with exposition N 2°

Water regime: dry

Soil conditions for cultivating: good

Land use: agriculture

Soil profile:

Ap (0 – 25/30 cm):	weak coarse sand and silty loam, average content of organic matter, 10 YR 3/4 (dry), 10 YR 4/3 (moist), medium carbonate content, fine crumby and angular blocky structure, porous, good root development, few gravel, horizon boundary straight switching over to
Bv (25/30 – 45/50 cm):	weak coarse sand and silty loam, 7,5 YR 5/6 (dry and moist), medium carbonate content, angular blocky structure, porous, gravel and few stones, medium root development, horizon boundary sharp switching over to
Cn ca (40/50+ cm)	weathered granite with small loess layer, calcareous

Soil assessment

Class (texture): sand loam over weathered granit

Soil quality class: 4

Kind of Development (source material): loess over weathered granite

Valuation index of soil: 53

Reduction: climate - 3 %

water regime - 4 %

- 7 %

valuation index of field: 49

soil assessment data: sL/Gz 4 LöD/V 53/49

Analytical results:

Particle size distribution

Analysis Maissau			
Horizon		Ap	Bv
depth (cm)		0 – 29/30	29/30 – 45/50
soil texture %	2000 – 63 µ	24	29
	63 – 2 µ	60	56
	< 2 µ	16	15

Soil chemical parameters

Profile Maissau

	0 – 25 cm	25 – 50 cm
pH in $CaCl_2$	7,3	7,6
carbonate ($CaCO_3$) %	4,5 %	7,6 %
humus, dry combustion	2,7 %	1,2 %
Cation Exchange Capacity (CEC)	20,7 cmol+/kg	19,7 cmol+/kg
exchangeable Ca	18,9 cmol+/kg	18,2 cmol+/kg
exchangeable Ca in % of CEC	91,5 %	92,6 %
exchangeable Mg	1,2 cmol+/kg	1,2 cmol+/kg
exchangeabke Mg in % of CEC	5,6 %	6,3 %
exchangeable K	0,6 cmol+/kg	< 0,25 cmol+/kg
exchangeable K in % of CEC	2,8 %	1,0 %
exchangeable Na	< 0,15 cmol+/kg	< 0,15 cmol+/kg
exchangeable Na in % of CEC	< 0,1 %	< 0,1 %
exchangeable Fe	< 0,08 cmol+/kg	< 0,08 cmol+/kg
exchangeable Fe in % of CEC	< 0,1 %	< 0,1 %
exchangeable Mn	< 0,02 cmol+/kg	< 0,02 cmol+/kg
exchangeable Mn in % of CEC	< 0,1 %	< 0,1 %
exchangeable Al	< 0,55 cmol+/kg	< 0,55 cmol+/kg
exchangeable Al in % of CEC	< 0,1 %	< 0,1 %
exchangeable protons	< 0,02 cmol+/kg	< 0,02 cmol+/kg
exchange Capacity	15,4 cmol+/kg	12,6 cmol+/kg
P in CAL-extract	79 mg/1000 g	< 20 mg/1000 g
K in CAL-extract	170 mg/1000 g	< 40 mg/1000 g

4 LITERATURE

BLUM, W.E.H. (1997): Österreichische Bodenschätzung als Instrument nachhaltiger Landnutzung. In: "50 Jahre Österreichische Bodenschätzung", Hollabrunn.

BLUM, W.E.H. (2007): Bodenkunde in Stichworten, Gebr. Borntraeger Verlagsbuchhandlung, Berlin Stuttgart.

KILIAN, W. (2002): Schlüssel zur Bestimmung der Böden Österreichs, Mitt. der ÖB, Heft 67.

NESTROY, O. (2000): Österreichische Bodensystematik 2000, Mitt. der ÖBG, Heft 60.

PEHAMBERGER, A. (1997): Aufgaben des Bodenschätzungsdienstes. In: "50 Jahre Österreichische Bodenschätzung", Hollabrunn.

PEHAMBERGER, A. (1998): 50 Jahre Österreichische Bodenschätzung, Mitt. der ÖBG (Heft 56).

PEHAMBERGER, A. (1999): Die praktische Beurteilung von Böden und natürlichen Ertragsbedingungen mit Beispielen aus dem Osten Österreichs. In: Arbeitstagung 1999, p. 89-96, Retz.

PEHAMBERGER, A., (2000): Erfassung von Bodenressourcen und ihre Bewertung, 3. Symposium Ukraine – Österreich. Landwirtschaft: Wissenschaft und Praxis. Tschernivci, 14.-16. September 2000.

PEHAMBERGER, A. (2002): Die praktische Beurteilung von Böden und natürlichen Ertragsbedingungen in Österreich, 4. Symposium "Österreichisch-Ukrainische Landwirtschaft", 26.-29. August 2002, BAL Gumpenstein.

PEHAMBERGER, A. (2004): Bodenschätzung in Österreich, Agriculture, Science and Practice, Kyiv, 9.-11. September 2004.

PEHAMBERGER, A. (2007): Studienblätter zur Vorlesung in: Bodenschätzung, Bodenkartierung.

PEHAMBERGER, A. (2007): Studienblätter zur Vorlesung in: Boden in der Landschaft.

PEHAMBERGER, A. (2007): Braunerde, Boden des Jahres 2008, Flyer der DBG und ÖBG

Scheffer/Schachtschabel, 1994: Lehrbuch der Bodenkunde, Stuttgart.

STICH, R. (1990): Die Bodenschätzung. Die Bodentypen; Die wirtschaftlichen Ertragsbedingungen. In: Beiträge zur Eröffnung des Bodenschätzungsmuseums, pp 1-28, Hollabrunn.

STICH, R. (1996): Landwirtschaftliche Betriebsbewertung, Bodenschätzung und Anwendung der Bodenschätzungsergebnisse, 1. Ukrainisch-Österreichisches Symposium: Landwirtschaft, Akademie der Wissenschaften, Lviv (Lemberg), Ukraine.

STICH, R. (1999): 1. Die Böden des Westlichen Weinviertels, pp 97-105; 2. Die Ergebnisse der Bodenschätzung und ihre Anwendung, pp 248-249; 3. Bodenschätzung, pp 268-269; jeweils In: Geologische Arbeitstagung 1999, Retz.

STICH, R. (1999): Soil evaluation and its applications in Austria, International Soil Conference, University of Lviv, Lemberg, Ukraine.

STICH, R. (1999): The Soils of the Western Weinviertel and their Evaluation, Applications in Austria, International Soil Conference, Lviv, Lemberg, Ukraine.

STICH, R. 2000: Soil Assessment and Agricultural Real Estate Valuation – Austria, III. Symposium Ukraine – Österreich. Landwirtschaft: Wissenschaft und Praxis. Tschernivci, 14.-16. September 2000.

STICH, R. (2000): Soil Evaluation in Austria – e.g. the soils of the area Manhartsberg-Pulkau Retzer Wine Country and their evaluation, III. Symposium Ukraine – Österreich. Landwirtschaft: Wissenschaft und Praxis. Tschernivci, 14.-16. September 2000.

STICH, R. (2002): Die Bodenschätzung und deren Ergebnisse als Instrument des Landmanagements, 4. Symposium "Österreichisch-Ukrainische Landwirtschaft", 26.-29. August 2002, BAL Gumpenstein.

STICH, R. (2004): Die Bodenschätzung als Basis eines nachhaltigen Landmanagements, Agriculture: Science and Practice, Kyiv, 9.-11. September 2004.

WAGNER, J. (1997): Die Basisdaten der Bodenschätzung, In: "50 Jahre Österreichische Bodenschätzung", Hollabrunn.

SOILPROFILES

WEINVIERTEL

AUSTRIAN SOIL ASSESSMENT

Profile Viendorfer Weingebirge

Ap (0 – 25/30 cm) : weak sandy silty loam, average content of organic matter, no carbonate content, fine crumby structure, porous, good root development and biological activity, horizon boundary straight switching over to

AB (25/30 – 50 cm) silty loam, average content of organic matter, no carbonate content, subangular blocky structure, porous, good root development and biological activity, horizon boundary straight switching over to

Ba (50 – 65/70) silty loam, moderate to weak content of organic matter, no carbonate content, subangular blocky structure, common roots, horizon boundary straigt switching over to

Bt (65/70 – 75/80) silty loam and loamy clay, weak content of organic matter, no carbonate content,bocky and prismatic structure,porous, common roots, porous, horizon boundary straight switching over to

C (down from 75/80) fine silty sandy loam, moderate carbonate content,subangular blocky structure, porous, very few and fine roots.

Profile Sonnberg

Ap (0 – 30 cm) : silty loamy clay, average content of organic matter, ph 7,9, strong carbonate content crumby and angular blocky structure, porous, common roots, horizon boundary straight switching over to

Ag rel (30 – 40 cm) : silty loamy clay/clay, average *

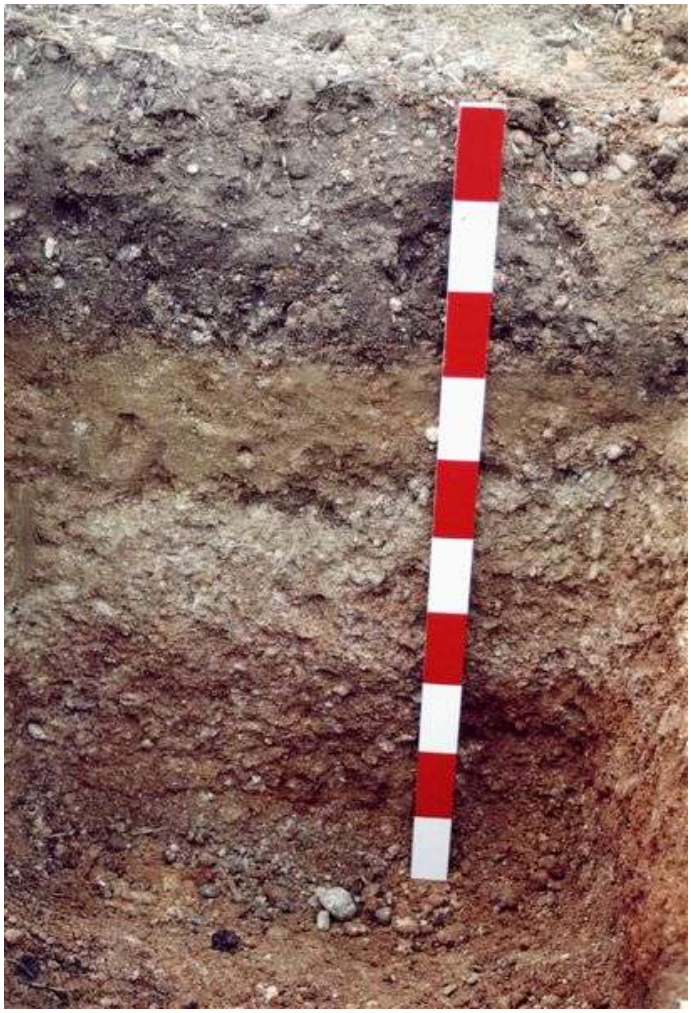
Gor rela (40 – 75/80 cm) : silty loamy clay/clay,weak content of organic matter, ph 8,0, common roots, prismatic structure, rusty brown and gleyic mottels

Go rel (75/80 – 120 cm) : silty clay, moderate carbonate content, ph 8,0, rusty brown mottles, very few and very fine roots block structure.

Gro (down from 120 cm) : gleyic clay, groundwater in 170 cm.

*and moderate content of organic matter, ph 8,0, strong carbonate content, blocky and prismatic structure, porous, good root development and biological activity, few rusty brown and few gleyic mottles

Profile Aspersdorf



Ap (0 – 25/30 cm) : strong loamy sand, average content of organic matter, ph 7,2, weak carbonate content, coarse and gravel fraction, fine friable crumby structure, good root development, horizon boundary switching over to

AC (25/23 – 35 cm) : strong loamsand/loamy sand, moderate content of organic matter, weak carbonate content,strong gravel *

Cn1 (35 – 70 cm) : coarse and medium sand, coarse and gravel fraction, no carbonate content, very few and very fine roots, single grain structure

Cn2 (down from 70 cm) : coarse sand and gravel fraction

*fraction, angular blocky structure, porous, good root development, horizon boundary sharp switching over to

Profile Großnondorf

Ap (0 – 30 cm) . clayely loam, content of organic matter:above the average of arable soils in the east of Austria, medium carbonate content, ph 7,5, crumby structure, porous, good root development and biological activity, horizon boundary with ploughpan staight switching over to

A (30 – 70 cm) . clayey loam, content of organic matter like Ap, crumby and granular structure, porous, ph 7,7, common roots, gradual smooth boundary to

AC (70 – 95 cm) : clayey loam, average content of organic matter, high carbonate content, ph 8,0, crumby structure, porous, common roots, gradual smooth boundary to

C (95 – 105 cm) . clayley loam, high carbonate content, ph 8,0, crumby structure, porous, common roots, pseudo-mycelium, horizon boundary straight switching over to

Cn (formerly Dg; down from 105m) : tertiary marl

Profile Maissau

Ap (0 – 25/30) : weak coarse sand and silty ioam, average content of organic matter, medium carbonate content, ph7,3, fine crumby and subangular blocky structure, porous, good root development, few gravel, horizon boundary straight switching over to

Bv (25/30 – 45/50) : weak coarse sand and silty loam, medium carbonate content, subangular blocky structure, porous, ph 7,6, gravel and few stones, medium root development, horizon boundary sharp switching over to

Cnca (down from 40/50) : weathered granite with small loess layer, calcareous.

Profile Spillern

Ap (0-25 cm): loamy weak silty sand, average content of organic matter, ph 7,6, strong carbonate content

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A (25-35/40 cm): loamy silty sand; moderate content of organic matter; ph 7,9, strong carbonate content

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AC (35/40-50 cm): weak loamy sand, weak content of organic matter, ph 7,9, strong carbonate content.

C (50-150 cm): sand, moderate carbonate content, very few and very fine roots, friable, porous