

Soil erosion control in farm advisory services in Baden-Württemberg

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Introduction

Because of new directives in agricultural politics and legal instruments in Europe and in Germany measures against soil erosion become more and more important. In Baden-Württemberg the advisory board for farmers is part of the local administration of agriculture. The Institute for Land Management Compatible to Environmental Requirements, a research institution of the Ministry of Nutrition and Rural Area Baden-Württemberg (MLR), is responsible for the development of strategies, methods and tools for farm advisory systems.



Photo 1. The most convincing method in soil conservation education is to show that soil erosion leads to irreversible loss of soil fertility, which costs farmers (on-site effects) and society (off-site damages) a lot of money (eroded slope top, Schliengen, Markgräfler Hügelland, Germany, 25.05.2003).

Holistic landscape ecological approach of soil erosion research and its application

The process of soil erosion is very complicated. The causes and effects include several natural (abbr. of rainfall characteristics, geomorphology, soil properties) and cultural factors (BORK et al. 1993). In regard to this fact the soil erosion research group of the Geographical Institute of the University of Basel (FBB) evolved a holistic landscape ecological research approach (LESER 1986, 1997, UNTERSEHER 1994, 1997), which includes measurable quantities.

Requirements of research groups and of the staff of farm advisory services are not the same. For the aims of farm advisory some simplifications have to be carried out and there must be a concentration on relevant factors. The most important thing is to understand, which factors can be influenced by the farmer and which are natural. For this reason on the base of the holistic landscape ecological research approach of the FBB a simplified scheme for education was created (Figure 1).

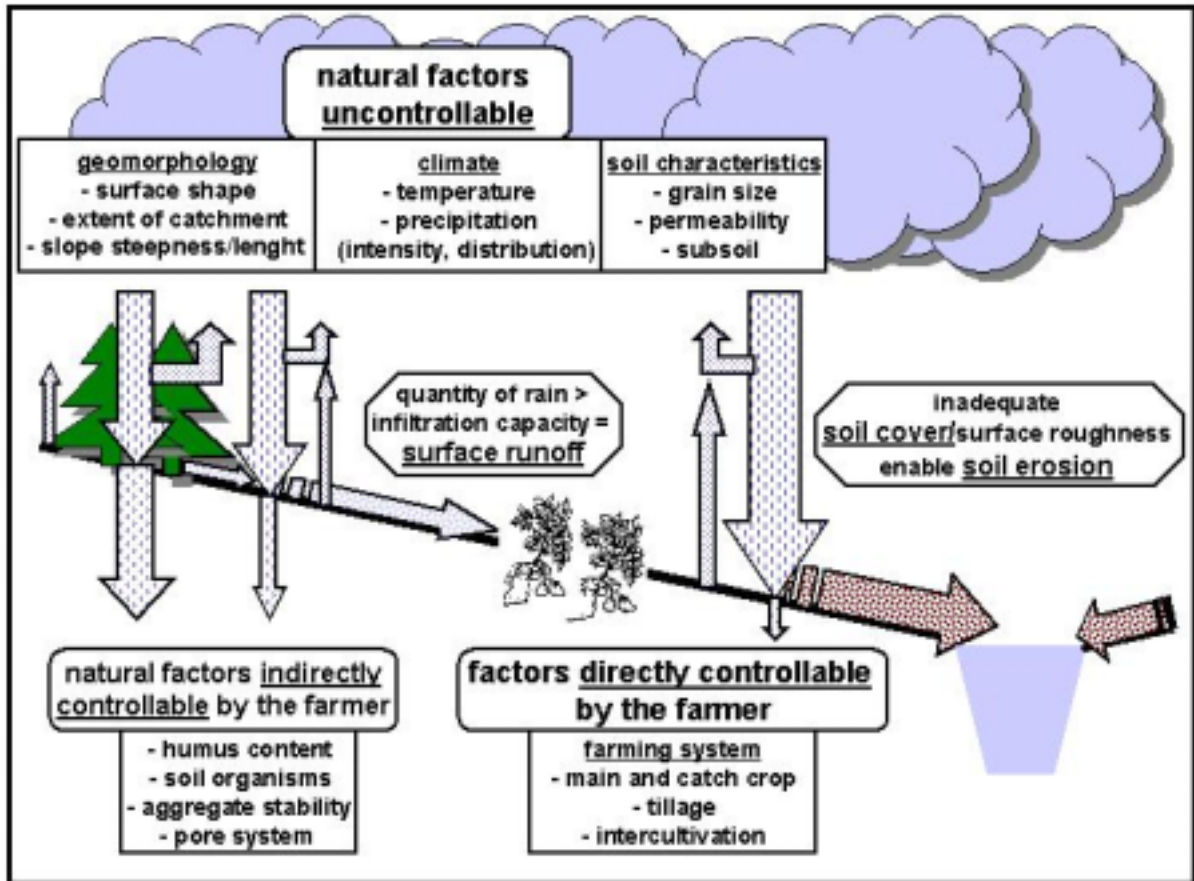


Figure 1. Illustration of the main factors, which determine the process of surface runoff/soil erosion and its connection to water eutrophication.

Methods

After a ABAG (USLE) based soil erosion risk atlas of Baden-Württemberg (GÜNDRA et al. 1995) has been created, which gives a general overview (2 x 2 kilometre scan), specially for the aims of farm advisory two new tools were generated.

1. A brochure (LAP Hrsg. 2002a) in the publication series „Merblätter für die umweltgerechte Landwirtschaft“ was released. It describes and illustrates the process of soil erosion and the interaction of its diverse parameters. Even the connection between overland flow/soil erosion and eutrophication of lakes and rivers is demonstrated. In addition to this there is a brochure in the same publication series (LAP Hrsg. 2002b), which deals with the problem of soil compaction and solution ways. So farmers can recognize that the avoidance of soil compaction is an important contribution to minimize soil erosion (Photos 2 and 3).
2. A manual (MLR Hrsg. 2004, based on MOSIMANN & RÜTTIMANN 1996) for consultants and farmers was created, which advises how to assess the amount of soil loss caused by water in a certain plot (t/ha*year). So within 20 minutes it is possible to give a satisfactory evaluation of soil erosion risk in a given field. Additional monetary effects of erosion control measures on farm level can be calculated. The manual was tested by farmers and the local agricultural soil conservation service in Baden-Württemberg. In Niedersachsen almost the same concept now is in practical application (MOSIMANN & SANDERS 2004).



Photos 2 and 3. Excursion for interested farmers and consultants to the loess area of Sundgau (Alsace, France; organized by the local agricultural soil conservation service of ALLB Lörrach, Germany, 15.06.2004). One aspect was the connection of soil compaction and soil erosion (rill erosion in compacted area, left).

Manual Concept

The manual concept contains the ascertainment of the main factors in seven steps.

1. Slope length/slope steepness
2. Sealing risk
3. Crop/tillage system
4. Calculation of soil erosion risk by water
5. Evaluation of the endangering rates of soil fertility
6. Listing of conservation measures
7. Evaluation of conservation measures



Figure 2. Synopsis of the manual concept (MLR Hrsg. 2004).

1. Slope length/slope steepness factor

Slope steepness and slope length are combined to a geomorphic declaration of value (Table 1). In addition to this in step 4 there is a consideration of the influence of slope shape (correction factor for convex or concave).

Table 1. Determination of the slope length/slope steepness risk value (MLR Hrsg. 2004).

Fließstrecke des Wassers in m	Hanggefälle des Schlages in %								
	2,1-3	3,1-4	4,1-6	6,1-8	8,1-10	10,1-13	13,1-16	16,1-20	20,1-25
bis 30	0,15	0,25	0,43	0,71	1,0	1,5	2,1	2,9	4,1
31 - 50	0,19	0,31	0,56	0,94	1,4	2,0	2,8	3,8	5,4
51 - 75	0,22	0,37	0,69	1,2	1,7	2,5	3,5	4,8	6,8
76 - 100	0,24	0,41	0,80	1,4	2,0	2,9	4,1	5,7	8,0
101 - 150	0,27	0,47	0,9	1,7	2,4	3,5	4,9	6,8	9,6
151 - 200	0,30	0,53	1,1	1,9	2,8	4,1	5,7	7,9	11
201 - 250	0,33	0,58	1,2	2,2	3,2	4,7	6,6	9,1	13
251 - 300	0,35	0,63	1,4	2,5	3,6	5,2	7,3	10	14
über 300	0,38	0,69	1,5	2,8	4,0	5,8	8,2	11	16

2. Sealing risk factor

First annual precipitation has to be found out. If there is no local meteorological station, data of Figure 3 can be used.

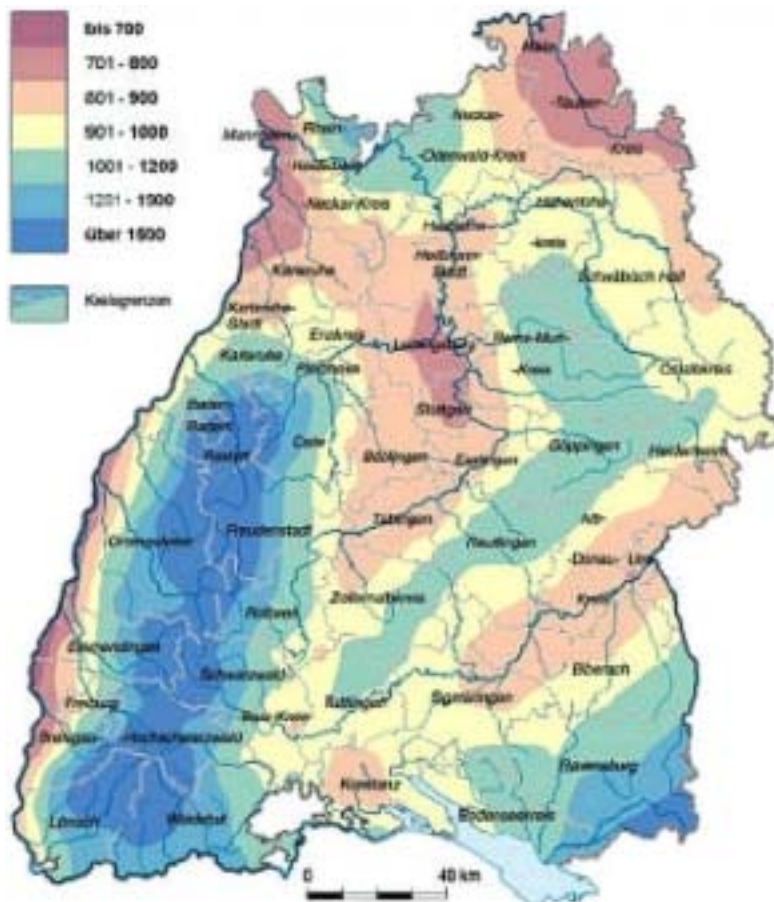


Figure 3. Map of annual precipitation of Baden-Württemberg. MINISTERIUM FÜR UMWELT UND VERKEHR BADEN-WÜRTTEMBERG Hrsg. 2004: Wasser- und Bodenatlas Baden-Württemberg. Karte 2.2 Mittlere Niederschlags-höhen. Datengrundlage: Rasterwerte nach BONIE mit korrigierten Niederschlagshöhen, Deutscher Wetterdienst - Hydrometeorologie, Offenbach. (in MLR Hrsg. 2004)

5. Evaluation of endangering rates of soil fertility

In this step yield capacity is used as indicator for soil fertility. In Germany for each plot this indicator (“Ackerzahl”) is available as a result of stately soil evaluation (EMMERICH et al. 1998).

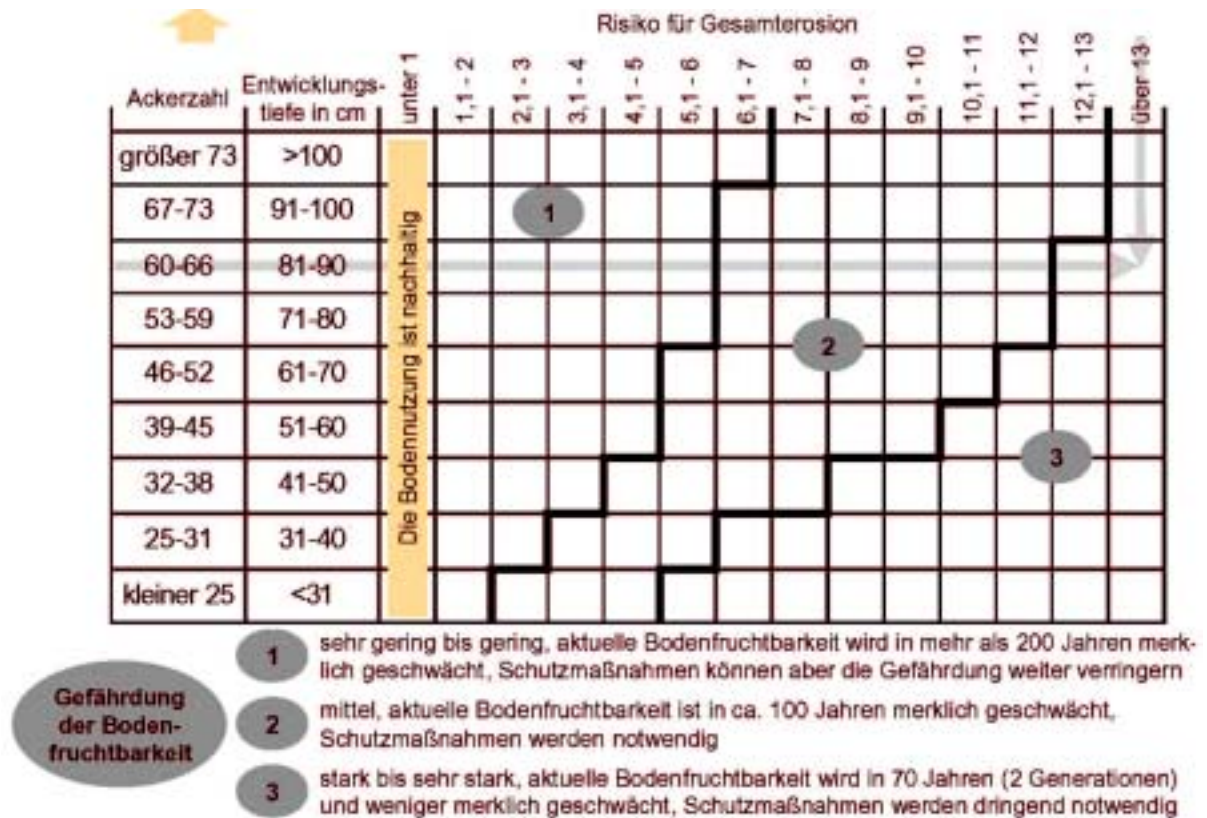


Figure 6. Endangering rates of soil fertility (MLR Hrsg. 2004).

6. Listing of conservation measures

In this step the most important conservation measures in soil protection (BUNDESVERBAND BODEN e. V. 2004) are described and illustrated (for example grassed waterways or no-tillage crop production systems, Photos 4 and 5).

7. Evaluation of conservation measures

Two criteria were used to evaluate conservation measures, which are listed in step 6:

1. Levels of risk reduction,
2. Monetary effects for the farmer

Monetary effects can be assessed by help of stately calculation data (www.infodienst-mlr.bwl.de).



Photos 4 and 5. Conventional tillage (sheet erosion, left) compared to no-tillage practices (soil erosion is avoided, right) in the same experimental plot (Wintersweiler, Markgräfler Hügelland, Germany, 04.06.2004). Because of the high degree of soil cover and surface roughness the establishment of no-tillage systems is one of the most effective soil erosion protection measure. This is the reason why in Baden-Württemberg conservation and no-tillage systems are financially supported (MEKA II, MLR Hrsg. 2000).

Summary and Conclusions

Sustainable land use politics require the establishment of agricultural practices, which contain soil conservation. For soil erosion control in agriculture two tools were generated. First a brochure to explain the main factors of the problem and second a manual based on experiences in Switzerland and Niedersachsen (Germany). It demonstrates the evaluation of soil erosion risk in a given plot. The concept in its single steps is presented. Within the last few years the manual was tested by the local agricultural soil conservation service in Baden-Württemberg and farmers. By help of their feed back improvements and punctually pragmatic simplifications were carried out. So after the test phase the manual will be a practical aid to reach soil protection aims in agriculture. Further improvements on base of reactions of a greater number of farmers and administrators will be able in a few years.

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