PROLINE-CE

WORKPACKAGE T2, ACTIVITY T2.1

SET UP OF PILOT SPECIFIC MANAGEMENT PRACTICES

D.T2.1.4 DESCRIPTIVE DOCUMENTATION OF PILOT ACTIONS AND RELATED ISSUES

PILOT ACTION 1.2: *WAIDHOFEN/YBBS*

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1. Introduction

The Pilot Action "Waidhofen/Ybbs" was selected, as within the drinking water protection zone (DWPZ) data were gathered already in the project CC-WaterS. These data are forming the basis for the envisaged works in the PROLINE-CE project. Furthermore 25,000 people are supplied with the water resources drawn from the DWPZ, which is covering 1086 ha. The main focus of all works will be put on the land-use category forestry, as more than 78 % of the DWPZ are covered by forests. The Pilot Action will serve as a blueprint for forested water protection zones in Austria.

2. Basic data about pilot action

2.1. Geographical description

The Pilot Action Waidhofen/Ybbs is situated in the Austrian province Lower Austria (Niederösterreich) within the North-Eastern Calcareous Alps of Austria (Figure 1).

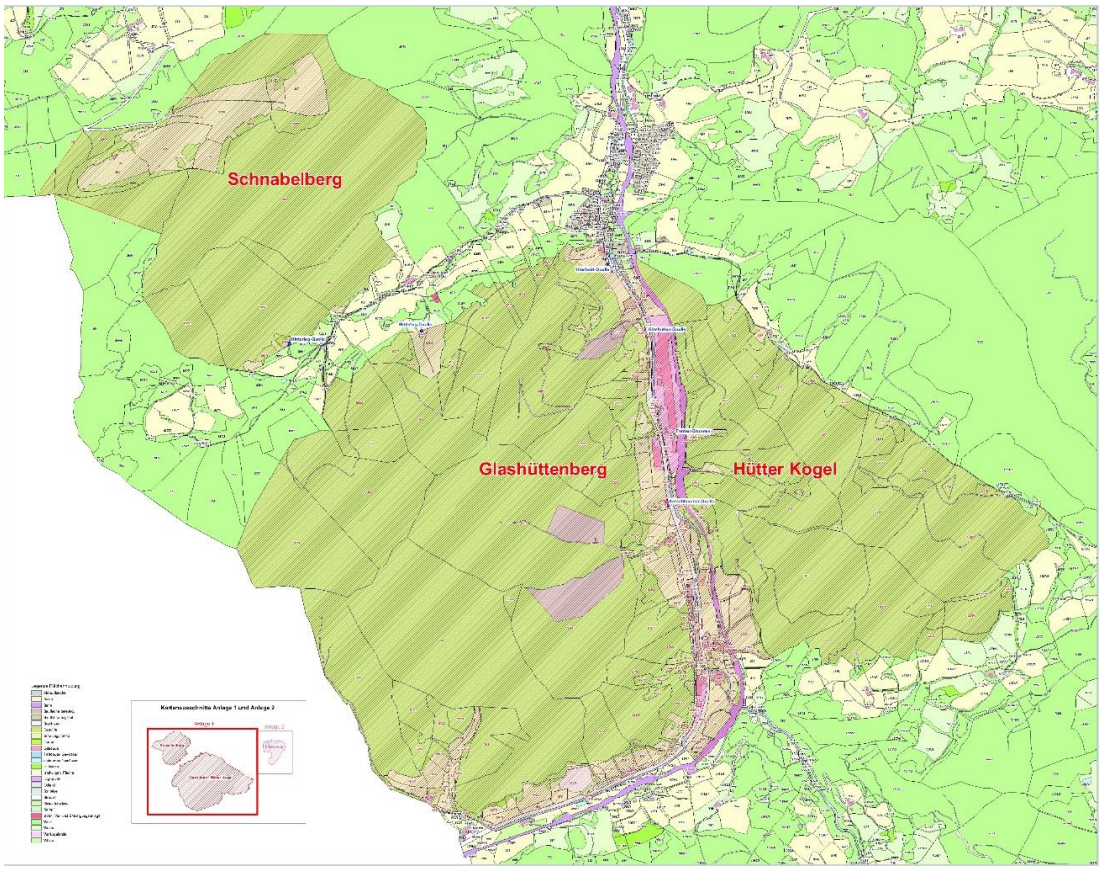

Figure 1: Geographical map of the Pilot Action Waidhofen/Ybbs.

Four mountain massifs form the drinking water protection zone (DWPZ) (Figure 1), Mount Schnabelberg (958 m ASL), Mount Glashüttenberg (868 m ASL) together with Mount Weißes Kreuz (969 m ASL), Mount Hütterkogel (836 m ASL) and Mount Eibenberg (779 m ASL). These mountains are the first elevations within the limestone-zone of the Alps in this area, north of their location is situated the siliceous area of "Flysch-Sandstone".

The mountain massifs are characterised by steep slopes, due to the elevation above sea-level all sites are potentially covered by forests, only small areas are rocky so that forest cover cannot evolve there. Forests are an essential precondition for the DWPZ, as the steep slopes would be prone to erosion without established forest ecosystems.

2.2. Geological description

The DWPZ Waidhofen/Ybbs is situated within the North-Eastern Calcareous Alps of Austria, at the border between the Calcareous-Alps and the siliceous "Flysch-Sandstone" zone in the north. In the north of Mount Schnabelberg (Figure 1) the "Flysch-Sandstone Zone" is situated, in the south of the summit of Mount Schnabelberg and also within the main part of the DWPZ dolomite (Main Dolomite - "Hauptdolomit") is situated. Main Dolomite is the dominant and most widespread bedrock-type within the DWPZ.

Some single inclusions of rare bedrock-types are of low significance in terms of quantity but cause the occurrence of specific forest-hydrotope-types and hence acquire a qualitative dimension.

The geological map (Figure 2) shows clearly the dominance of Main Dolomite within the DWPZ. The small part of Kössen Formation within the DWPZ has the code „104" in the map. Opponitz layers do not occur at the forested sites but are used as grassland areas.

Main Dolomite („Hauptdolomit")

The dominant bedrock-type in the DWPZ Waidhofen/Ybbs forms the mountain massifs of Schnabelberg (south-west and south-east slopes), Glashüttenberg, Hütterkogel and Eibenberg (Figure 1 and Figure 2). The Main Dolomite is formed by rhythmic sequences of dolomitic algae-mats, which have been accumulating in the course of the carbonaceous marine sedimentation era up to 1000 m in vertical thickness. The Main Dolomite shapes the northern edge of the Austrian Calcareous-Alps (Mandl 2002 *in* Schnabel et al. 2002).

The structure of the Main Dolomite has a sugar-like layer in the case of Glashüttenberg, Hütterkogel und Eibenberg. At all sites the extremely steep slopes are characteristic.

„Kössen-Formation" and „Schattwald-Formation"

At a small-scale site on the western part of Mount Schnabelberg the „Kössener Formation“ can be found. During the period of ‚Upper-Trias‘ the sedimentation of clay-material took place. The terrigenous influence from the European continent was observable far into Limestone-Shelf. Out of this clayey input the dark marlstones and limestones of the Kössen-Formation and the wine-red Clay-Marl of the “Schattwald-Formation” were formed (Mandl 2002 *in* Schnabel et al. 2002).

The Kössen-Formation creates soil-formations which are rich in clay, what causes the formation of „Stagnosols“, a fact with relevance for the forest-hydrotope-stratification.

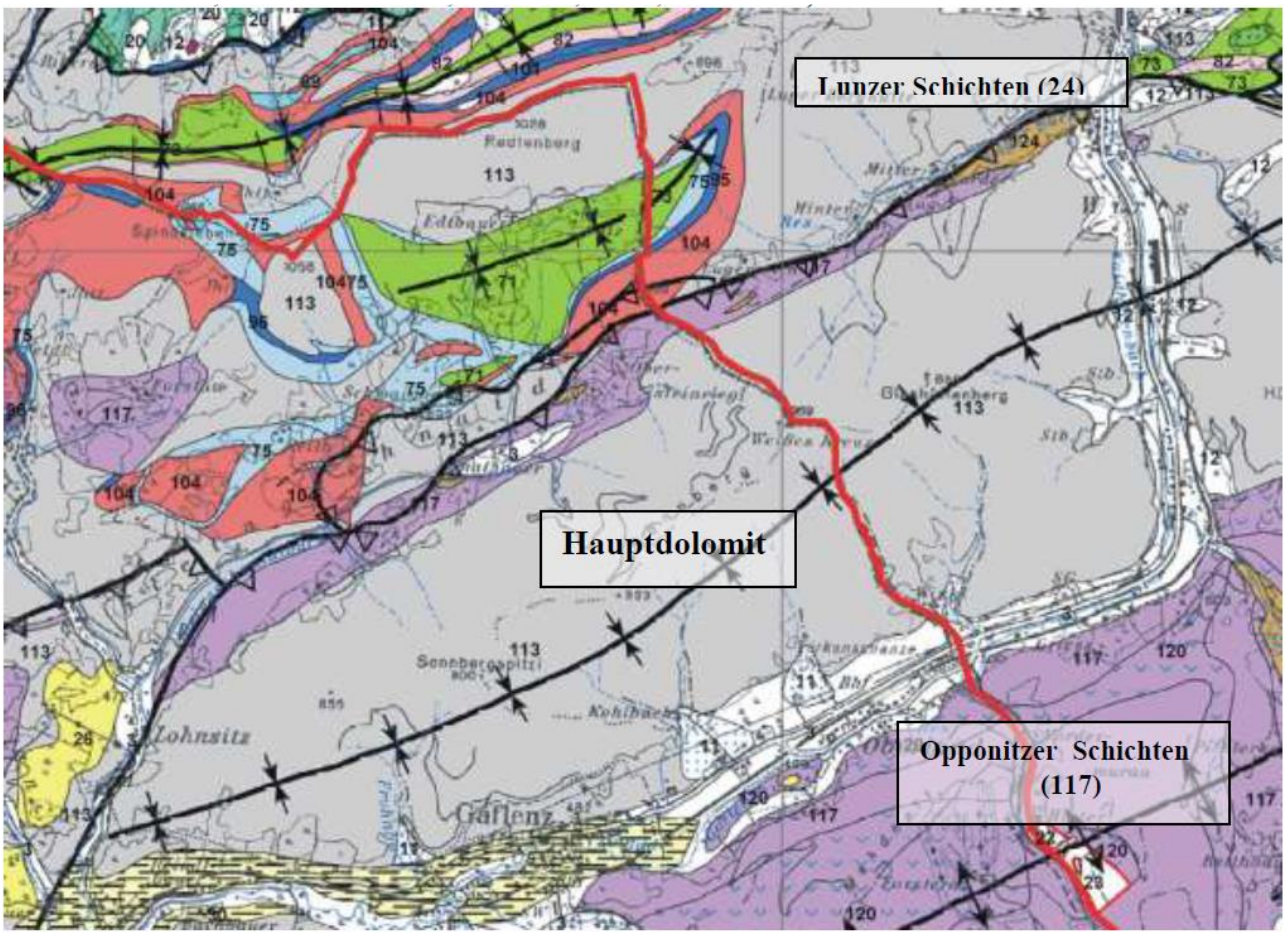

Figure 2: Geological map of the DWPZ Waidhofen/Ybbs (Schnabel et al. 2002).

It has to be mentioned that a more detailed geological mapping survey is planned since years but until now was not implemented.

2.3. Pedology

The detailed pedological map for the Pilot Action Waidhofen/Ybbs was elaborated in the course of the CC-WaterS project (Figure 3). It is based on the data pool of the forest site mapping survey carried out on the whole area of the drinking water protection zone (DWPZ). In the course of the forest site mapping survey, the soil type was determined within each forested polygon.

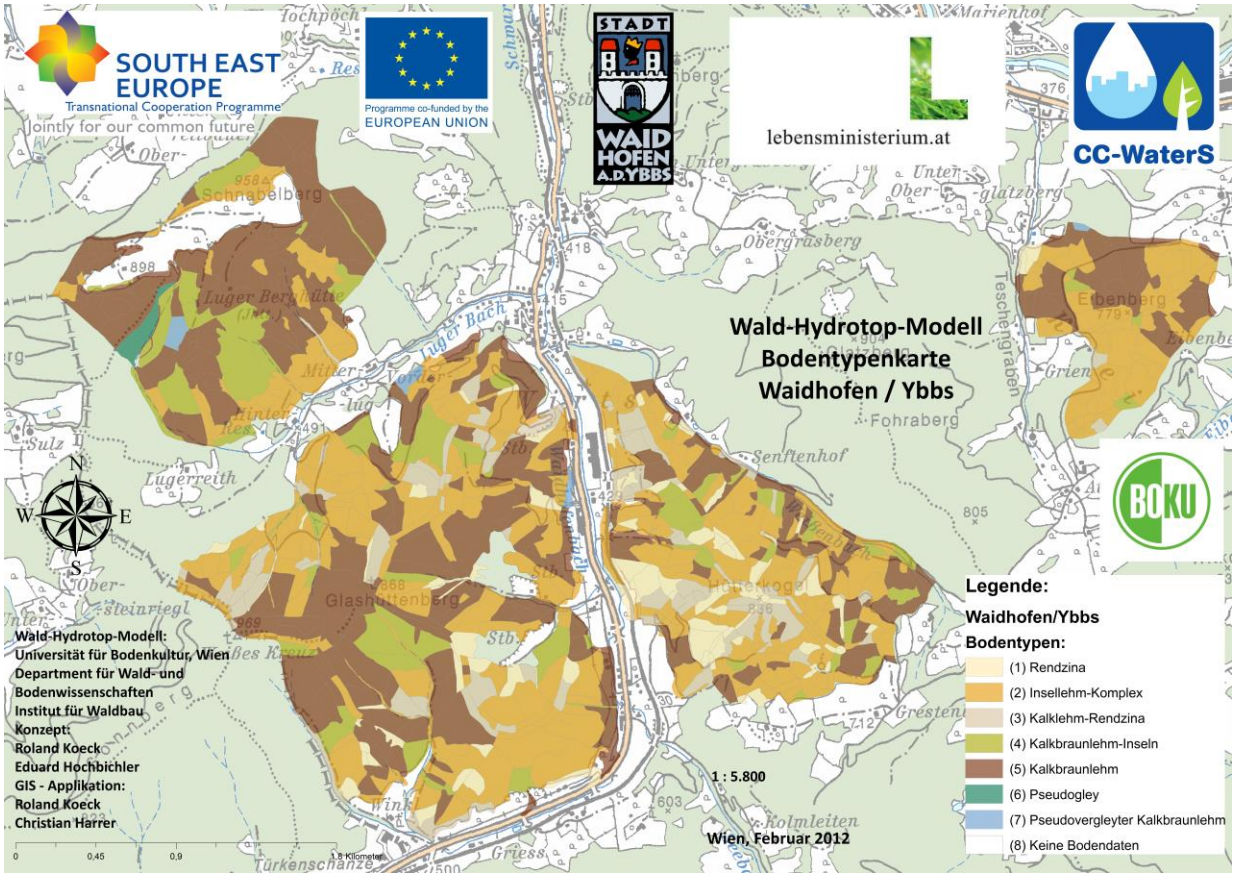

Figure 3: Pedological map of the Pilot Action Waidhofen/Ybbs, elaborated in the course of the CC-WaterS project (Koeck and Hochbichler 2012).

Main soil types are explained shortly below (for the GIS-codes see the map in Figure 3). The spatial extension of the soil types within the mapped area of the DWPZ (870 ha) is presented in Table 1. Settlement or agricultural areas within the DWPZ were not mapped regarding soil types.

Rendzina **(GIS-Code 1)**

Rendzina is a relatively rare soil type within the DWPZ Waidhofen/Ybbs. It is characteristic for limestones and dolomites, which contain only few impurities of non-carbonaceous nature. Rendzinas are humus-soils on carbonaceous bedrocks with more than 75 % of carbonate. The soils are mostly humus- and skeleton- rich (Nestroy et al. 2000). This soil type has the lowest water storage capacity.

Mosaic-Complex (Insellehm – Komplex) **(GIS-Code 2)**

If Rendzinas and Loam-Rendzinas occur together in the shape of a small-scale interlocking mosaic, the soil type is called „Mosaic-Complex“ (in German „Insellehm-Komplex“). The soil characteristics of both soil types occur together at one forest site, what also is indicated by plants, which are showing the inhomogeneity of the forest sites in terms of water regime classes or soil nutrient content. This inhomogeneity is characteristic for karstic alpine watersheds. The „Mosaic-Complex“ is the most wide-spread soil type within the DWPZ Waidhofen/Ybbs.

Loam-Rendzina **(GIS-Code 3)**

Loam-Rendzina is a Rendzina-like soil type evolved above colluvial material or carbonate (limestones or dolomites) bedrock. It contains loamy components and is also rich in skeleton. Hence it can be described as transition-type between Rendzinas and Chromic Cambisols. The texture of the A_{hb}-horizon it is loamy and rich in humus-substances. Mostly the humus is dark-brownish or black and base-saturated (after Nestroy et al. 2000). Within the DWPZ this soil type occurs only sparsely.

Chromic Cambisol - Mosaic **(GIS-Code 4)**

The mosaic-like distribution of the soil types Rendzia and Chromic Cambisol was called “Chromic Cambisol – Mosaic”. In contrast to the Mosaic-Complex the differences between the two interlocked soil types are more pronounced. The inhomogeneity of this soil type is characteristic for karstic alpine landscapes. Within the DWPZ this soil type occurs frequently.

Chromic Cambisols **(GIS-Code 5)**

Chromic Cambisols are soils with an intensively yellow-brown to red-brown coloured B-horizon above carbonate bedrocks (dolomites and limestones). Characteristic is the high loam- or clay content of this soil type. It is remarkable, that this soil type occurs wide spread within the DWPZ. Especially at Mount Schnabelberg this soil type is dominant and occurs at all types of forest sites. (Nestroy et al. 2000)

Stagnosols **(GIS-Code 6)**

Stagnosols are soils with a complete A-P-S profile, what means that they are characterised through a congestion-zone with rust and pale spots and a congestion-body which is marbled. In general the creation of Stagnosols is dependent on high precipitation rates and the substrate which has to be rich in clay or silt material (Nestroy et al. 2000). Within the DWPZ the Stagnosol only appears above the "Kössen-Formation" as bedrock material and hence is found only at one small forest site.

Stagnosol on Chromic Cambisiols **(GIS-Code 7)**

In some rare cases Stagnosols can evolve in Chromic Cambisols, what means that those have to be quite acidic and the relocation of clay-material has to take place in case of strong precipitation events. Stagnosols from Chromic Cambisols occurs only at few forest sites within the DWPZ.

Table 1: Soil types and their distribution in the water protection zone

Soil Type	Distribution (ha)	Distribution (% of 870 ha)
(8) Further Sites (stone quarries, etc.)	18.7	2.1
(1) Rendzina	47.9	5.5
(2) Mosaic-Complex	328.0	37.7
(3) Loam-Rendzina	6.7	6.7
(4) Chromic Cambisol - Mosaic	88.1	10.1
(5) Chromic Cambisols	321.0	36.9
(6) Stagnosols	3.4	0.4
(7) Stagnosol on Chromic Cambisol	3.9	0.5

2.4. Climate characteristics

The mean annual temperature in the City of Waidhofen/Ybbs (385 m ASL) was 8.9 °C during the period 1965-1988, the related yearly precipitation sum 1164 mm (ZAMG 2017). The precipitation rate shows a characteristic summer-maximum (Figure 4), which is at its peak during the month of July. A second but less pronounced maximum of precipitation is taking place during November, December and January (winter-maximum of precipitation, Figure 4). Especially the

yearly sum of precipitation can be regarded as relatively high, what is due to the location of Waidhofen/Ybbs within the area of the northern accumulation of precipitation of the Northeastern limestone Alps of Austria.

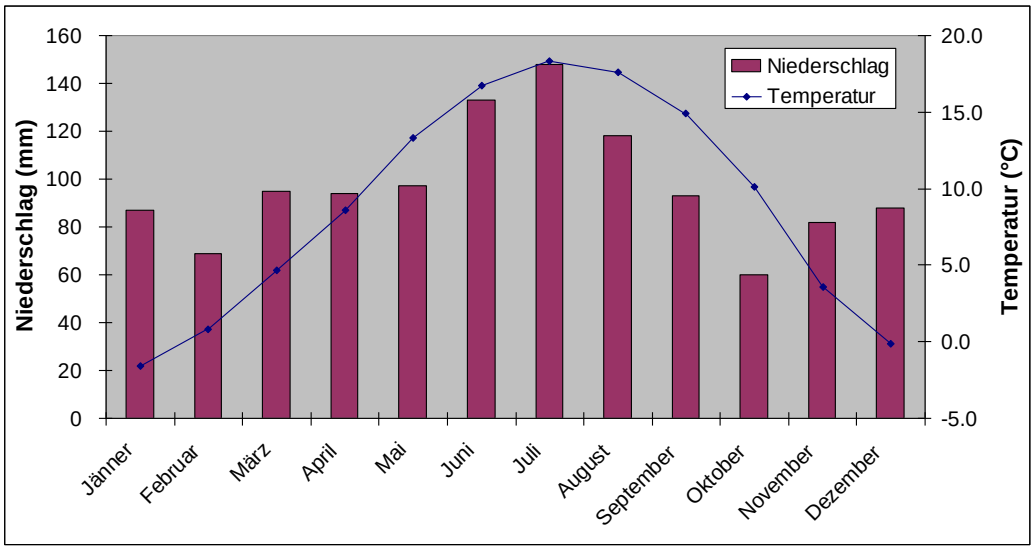

Figure 4: Monthly mean temperature and monthly precipitation in Waidhofen/Ybbs for the time period 1965 – 1988 (ZAMG 2017).

Within the DWPZ Waidhofen/Ybbs also exists a rain gauge (Hinterlug, see Figure 6 for the exact location) where meteorological data are gathered. The mean value of yearly precipitation (1981-2003) at this station was 1345 mm (see Table 2) hence the specific location already causes an increased value of yearly precipitation in comparison to the city of Waidhofen/Ybbs.

Table 2: Yearly precipitation sums at the station Hinterlug.

Beobachtungszeitraum	Niederschlagshöhe (mm)
1981 bis 2003	(Mittelwert) 1345
2000	1384
2001	1256
2002	1554
2003	1040

2.5. Hydrology

On hydrological level the DWPZ is characterised by the presence of Lugerbach, which is draining the area of Schnabelberg-South and Glashüttenberg-North and by the Waidhofenbach, which is draining Glashüttenberg-South and Hütterkogel-West (Figure 5).

Both brooks are not continuously monitored in terms of discharge hence no related data can be provided.

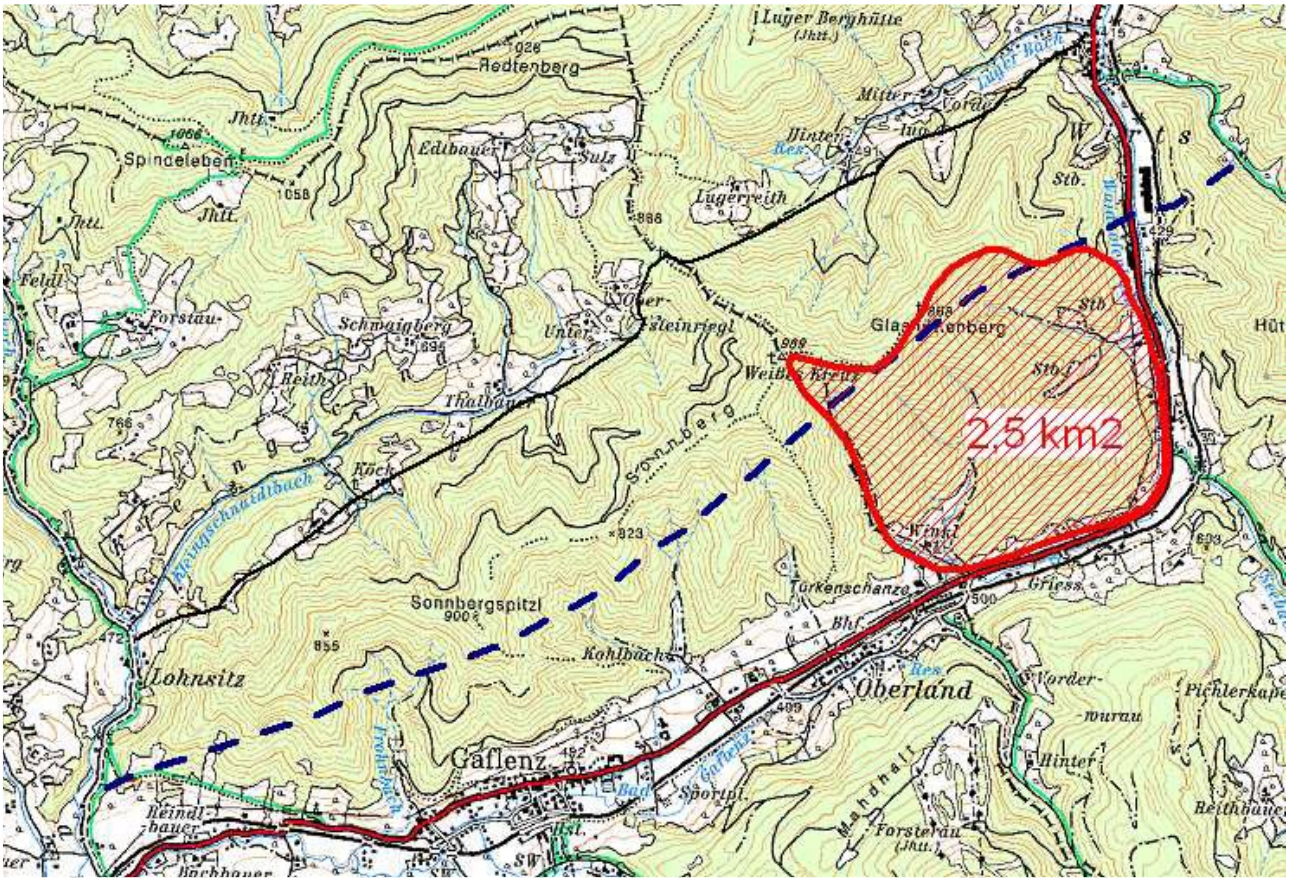

Figure 5: The brooks Waidhofenbach and Lugerbach are the main water courses within the DWPZ (Hacker 2003).

2.6. Hydrogeology

The DWPZ Waidhofen/Ybbs is hydro-geologically characterised through the presence of the main bedrock type dolomite (Hauptdolomit). Hence there is given a karst-aquifer. Despite the fact of the occurrence of this carbonate bedrock there were not identified characteristic karst features like dolines, caves or sinkholes (Hacker 2003). Of course it has to be mentioned that dolomite does not show such a tendency to develop karstic features like limestone.

Determining factor for the hydro-geological situation, for the sub-terrain drainage, is the close-meshed fissure-network, which provides the creation of an interconnected drainage system acting similar like a pore-body. This improves the infiltration conditions and allows the deep-grounded subterranean drainage. Also the thickness of the dolomite layer has to be mentioned (after Hacker 2003).

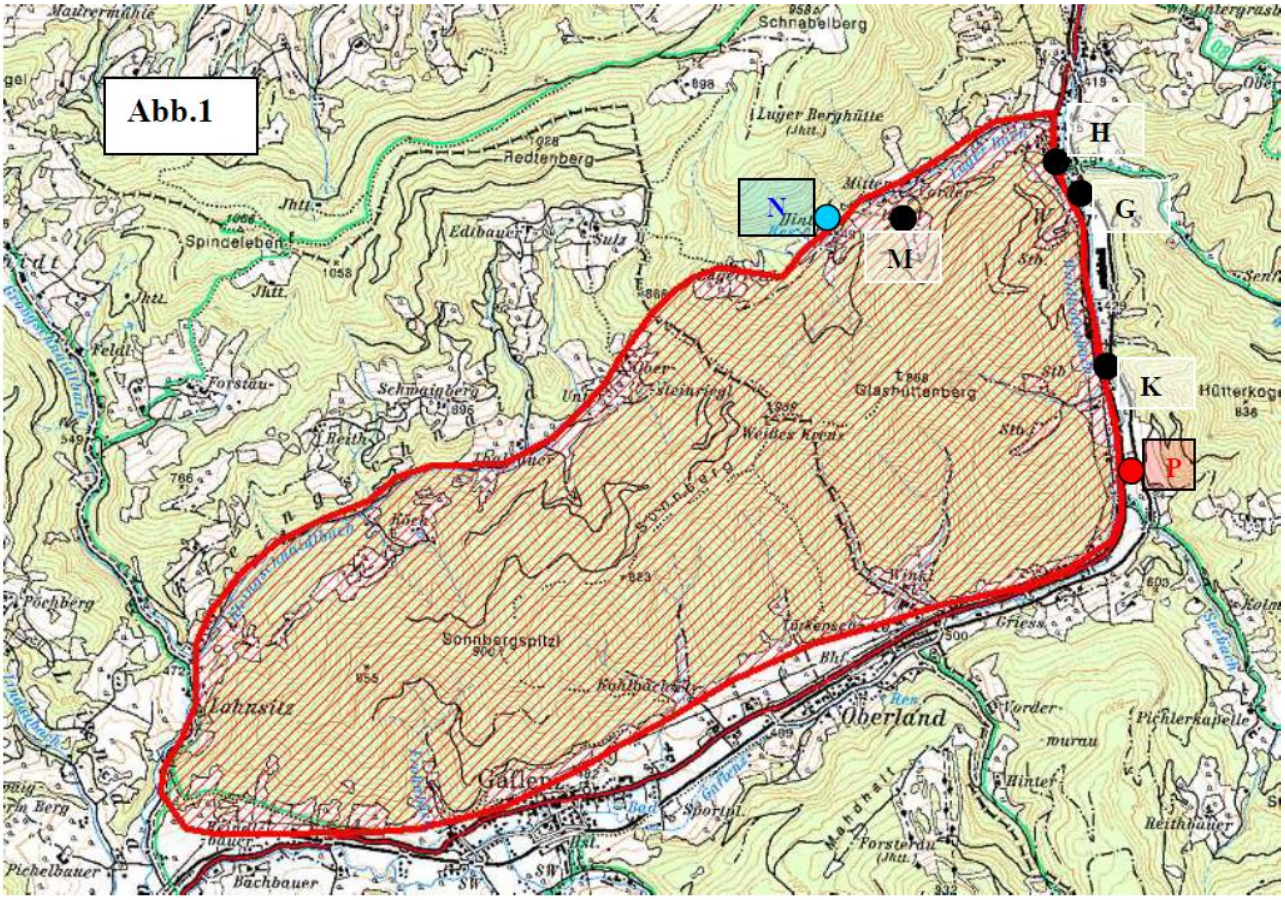

Figure 6: Location of the springs within the DWPZ: K = Kerschbaumer spring, G = Glashütten spring, H = Hieslwirt spring, M = Mitterlug spring, N = weather station Hinterlug, P = water gauge Waidhofenbach (Hacker 2003).

Hydro-geologically relevant is the presence of several karstic springs (see Figure 6), which are used for the drinking water supply of the city of Waidhofen/Ybbs and the related villages. The

springs are subterranean tapped so that the supplied water does not have any contact to the atmosphere. The chemical characteristics of the supplied waters show that the watershed is typically dolomitic (Figure 7).

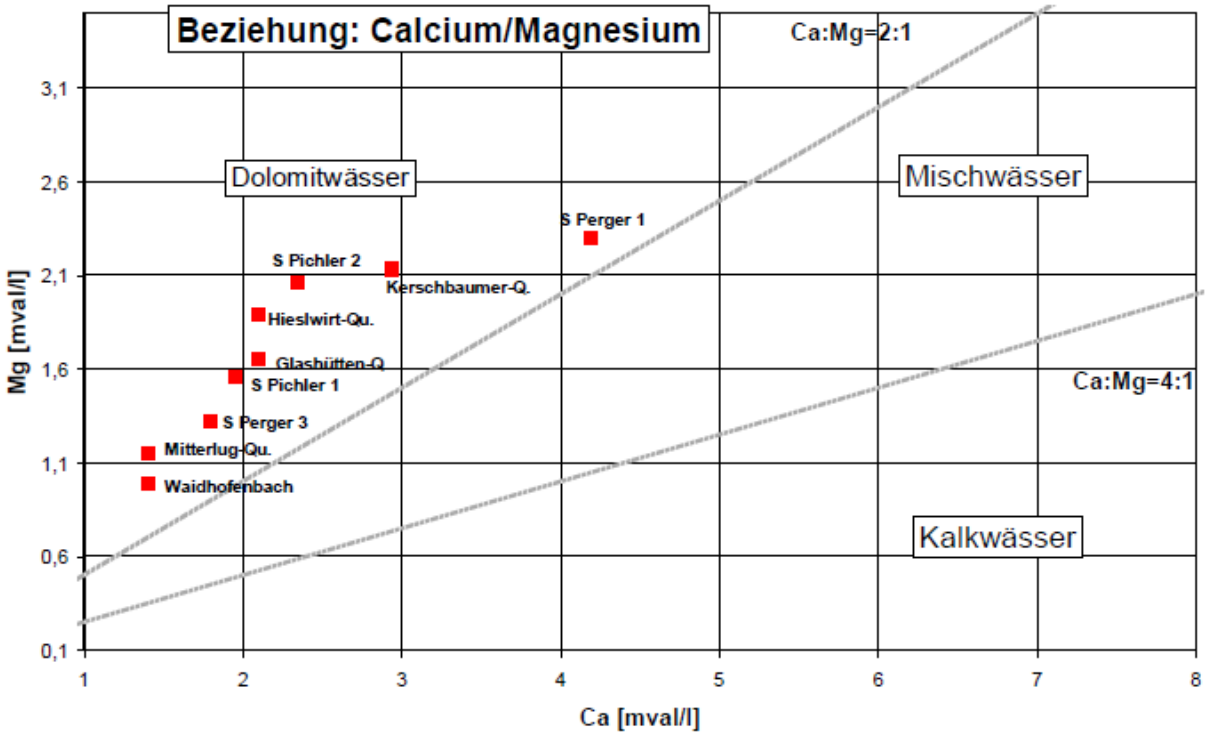

Figure 7: The interrelation between the content of calcium and magnesium in the supplied waters of Waidhofen/Ybbs (Hacker 2003).

2.7. Land use

The land use types within the DWPZ Waidhofen/Ybbs are displayed through the forest hydrotope map (Figure 8), as the CORINE Land Cover map (CLC 2012) does not display relevant land use types present in the DWPZ, like e.g. the stone quarries. This because CLC 2012 is not cross-checked for errors and the DWPZ is obviously too small for being adequately displayed by this land cover model.

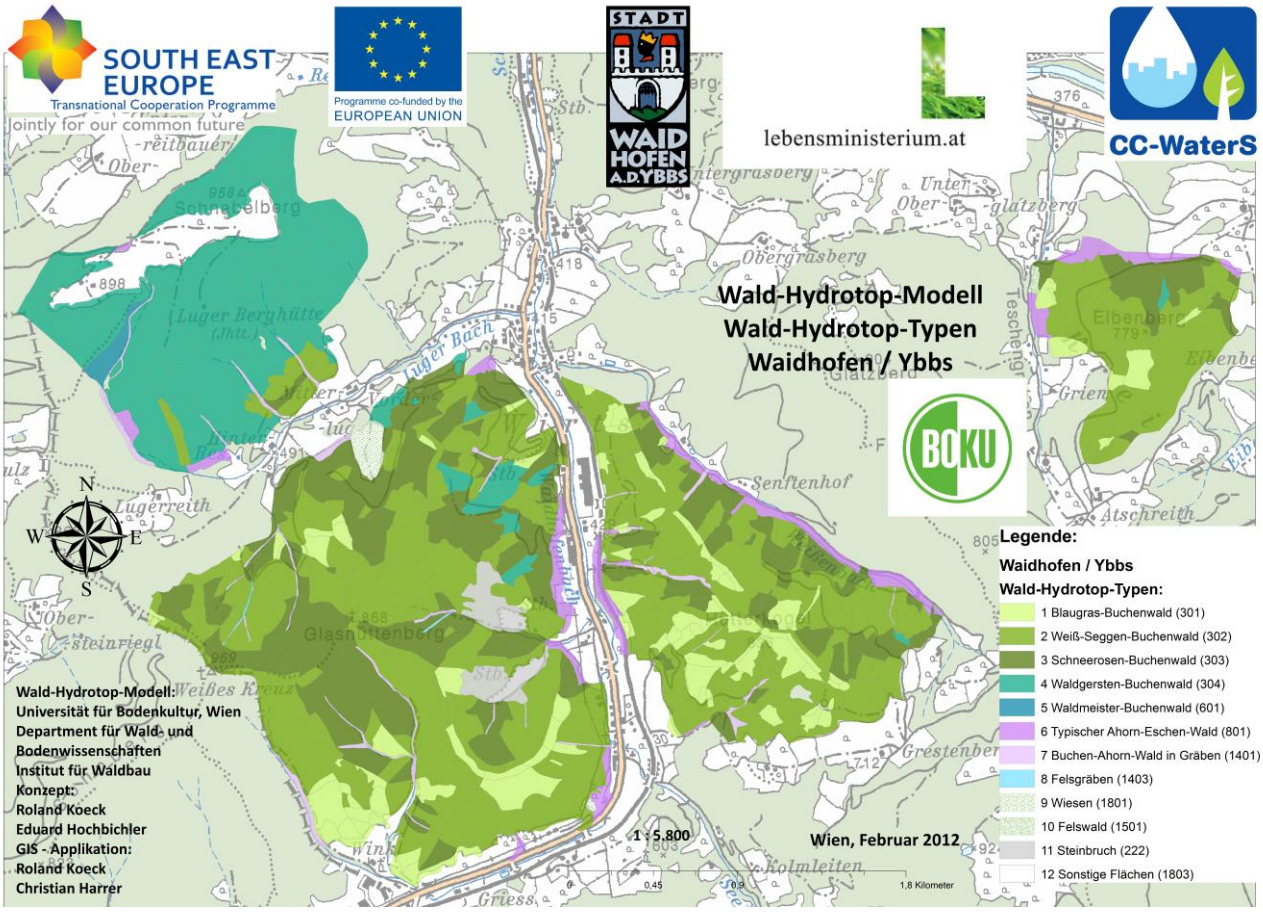

Figure 8: Forest Hydrotope Map representing the most dominant land-use types within the DWPZ (Koeck and Hochbichler 2012).

More than 78 % of the DWPZ are covered with forests, where in most of the cases forestry is carried out. Also, the stone quarries cover a relatively huge area (Table 3).

Table 3: Land-use types within the DWPZ Waidhofen/Ybbs.

Land-Use Type	Extension (ha)	Extension (% of 1086 ha)
Forestry	851.3	78.4 %
Stone Quarries	18.7	1.7 %
Grasslands		
Industrial Areas		
Settlements (Urban Fabric)		
Roads		
Railway-Areas		

Due to the situation that the forest hydrotope map (Figure 8) only covers forested areas, the spatial extension of the other land-use types is actually not known. The DWPZ would have to be mapped as CLC 2012 does not display specific land cover types or provides very imprecise values for the smaller land cover units within the relatively small DWPZ.

3. Water supply in the pilot action

3.1. Drinking water sources

Within the DWPZ Waidhofen/Ybbs are situated various springs which provide together the drinking water supply of the city and the related villages. The locations of the springs are displayed in Figure 6.

The Table 4 shows the monthly discharge rates of three specific karstic springs within the DWPZ. Table 5 shows daily discharge rates of further three karstic springs within the DWPZ.

Table 4: Monthly discharge rates for three karstic springs in the DWPZ Waidhofen/Ybbs.

(mean 2000-2016)	Kerschbaumer-Spring	Glashütten-Spring	Hieslwirt-Spring
Monthly discharge rate (m^3)	89,255	21,138	16,050

Table 5: Daily discharge rates for three karstic springs in the DWPZ Waidhofen/Ybbs.

(mean 2000-2016)	Kerschbaumer-Spring	Hinterlug-Spring	Mitterlug-Spring
Daily discharge rate (m^3)	2,932	957	329

There are five karstic springs which are currently used for drinking water supply within the DWPZ Waidhofen/Ybbs. The names are Kerschbaumer-Spring, Glashütten-Spring, Hieslwirt-Spring, Hinterlug-Spring and Mitterlug-Spring (Tables 4 & 5). The largest spring, which is Kerschbaumer-Spring, has a mean daily discharge rate of 2,932 m^3 (Table 5) and a mean monthly discharge rate of 89,255 m^3 (Tab. 3). The second largest spring is Hinterlug-Spring with a mean

daily discharge rate of 957 m^3 (Tab. 4). The smallest spring is Mitterlug-Spring with a daily discharge rate of 329 m^3 (Table 5).

All five springs provide together water supply for 25,000 people, about 12,000 of them living in the city of Waidhofen/Ybbs. The spring water quality is so high that no water treatment is necessary, also chlorination is not applied.

The importance of each spring is given to provide water supply security for all related people and enterprises. Hence the sustainable guarantee of drinking water quality becomes the essential task in terms of water supply. Within this context several potential hazardous processes were identified. Drinking water protection becomes the central area of interest.

3.2. Drinking water protection

The whole area of the Pilot Action Waidhofen/Ybbs covering 1086 ha, hence the whole DWPZ, will be decreed as drinking water protection zone. As the legal process is still ongoing, there cannot been foreseen, which limitations for the DWPZ will be legally decreed. There are still discussions ongoing regarding some of the guidelines for being transferred into the legal framework. The fact that the process already lasts very long can be regarded as typical in the field of water protection zones or water sanctuary zones in Austria. One fact already is clear, what is the spatial extension of the foreseen water protection zone (Figure 9). This is due to the fact that it was elaborated based on hydro-geological surveys.

The legislative act regarding the water protection zone will be decreed by the Austrian Federal Ministry of Agriculture, Forestry, Environmental Protection and Water Management.

At the moment all drinking water protection themes and activities are elaborated and carried out by the Water Works of Waidhofen/Ybbs. Essential thematic inputs were elaborated in the course of the projects CC-WaterS, CC-WARE and currently are envisaged in PROLINE-CE.

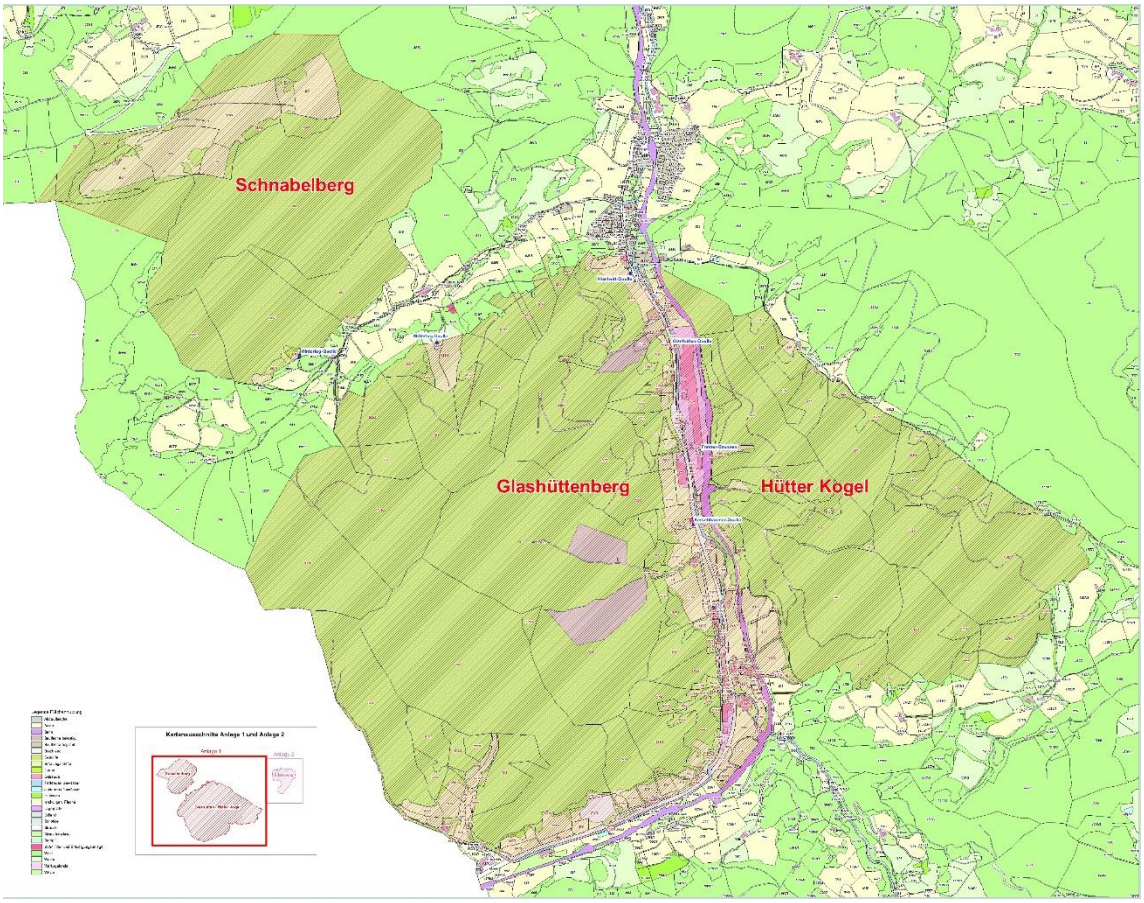

Figure 9: Foreseen drinking water protection zone for the city of Waidhofen/Ybbs, covering the whole Pilot Action.

4. Main identified problems / conflicts

The main identified problems within the Pilot Action DWPZ Waidhofen/Ybbs are related to land-use category forestry. Conflicts are given with forest owners at various levels.

(A) The most important area of conflict is the intended application of the clear-cut technique, also within hydro-geologically very vulnerable areas. The potential negative impacts of the clear-cut technique on water quality are scientifically well documented. In Austria the clear-cut technique is regarded as normal silvicultural practice, but this is not relevant for DWPZ, as there have to be applied the specific guidelines for forest management within drinking source water protection areas. Forest owners have to be convinced about this fact, as well as the local and province forest authorities. But those are in turn convinced of the possibility to apply business-as-usual within drinking water protection zones. This business-as-usual point of view encompasses the, within the boundaries defined by the Austrian Federal Forest Act, unlimited application of the clear-cut technique, a fact which is inacceptable within DWPZ.

(B) The second most important area of conflict is the high density of wild ungulates caused by hunting activities. The wild ungulates cause browsing damages on the regeneration phase of all tree species hence the development of stable and resilient forest ecosystems is hindered or disabled. This fact is also inacceptable within DWPZ. The stability and resilience of the forest ecosystems are the most important requisites valid within DWPZ.

(C) Also of importance is the trend in forestry to use only conifers for artificial recruitment of forest stands. Above all Norway spruce (*Picea abies*) and in some cases European larch (*Larix decidua*) are used as planting material within the DWPZ. Especially in case of Norway spruce this means that a highly instable tree species is used for the formation of forest stands, as bark beetle infestations threaten it within this climatic zone. The use of the tree species defined by the Forest Hydrotope Model for the DWPZ would in turn guarantee for stable and resilient forest ecosystems with high water protection functionality.

(D) Another important area of conflict is the construction of forest roads within the DWPZ. This is also intended by many forest owners within the DWPZ, despite the fact that forest roads are potentially harmful to water resources and can cause disastrous contaminations of the related aquifers.

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