Economic Assessment of Degraded Land

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Abstract: The land degraded by industrial activity or natural elements is uninteresting for investors; consequently, there have been no studies on the economic value of such land, in spite of its increasing amount. Methodologies exist assessing construction and agricultural lands but these methods are not adequate for the assessment of the degraded land. This paper introduces a new methodology to assess the land contaminated by heavy metals and regularly inundated. Simultaneously, this paper offers solutions of the best use of such degraded land.

Keywords: selling price; value; assessment

From the market perspective, degraded lands tend to be assessed as unsold or unmarketable. As unmarketable is considered such land whose value, thanks to human activities or natural elements, has decreased so much that, from the investment perspective, it is noted as a property with either null or negative values (the property requires radical remedial work). But the value of such land should not be negative if the fundamental character of the exclusive value of the limiting nature resource is considered. The goal therefore is to delineate the terms of the degraded land value and explore the potential existing uses.

METHODS

Value

Value is an estimation of the price that can be paid at the point-of-sale. The value can but necessarily need not equal the price. The assessment of the property value is created by multiple subjects including buyers, sellers, appraisers, whose respective understanding could vary.

Price is the financial sum agreed upon during selling and buying.

Official price is defined by a pricing scale set by the Czech Ministry of Finance (The law about property assessment No. 151/1997 Sb., in the statutory text 121/2000 Sb., 237/2004 Sb. and 257/2004 Sb. and executed public notice to the law regarding the property assessment, the notice of the Czech Ministry of Finance No. 3/2008 Sb.). This price is artificially created and deliberately targeted. It serves state fiscal interests, particularly for the tax base valuation. The tendency of the offices of the state administration is that the official price should be in the market harmony and the resulting tax payment to the state budget should be just. The creation of the official price, however coming out from the reality simplification, has almost nothing to do with the valuation of the market value. There is no mechanism enabling the official price to be translated into the market value. To be sure with agricultural land, the official price for BPEJ (assessed land-environmental unit) in Czech Crowns is often used as a standard criterion to determine the market value.

Market value is the estimated amount for which a property should be exchanged on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted

knowledgeably, prudently, and without compulsion (European Valuation Standards 2003) (http://www.tegova.org/en/p4291cca2e8de4).

Special value is a term that is dependent on the particular aspects of the value that is above or below the market value. It is an increase in value that can be applicable for some specific property owner or user distinct from the broader market; Special value is applicable only for a buyer with special interests.

In the case of land, it means an added value resulting from its retentive function, ecology, landscape, production, or cultural status. Such added value must be considered for both the present and future.

Economic suitability of a land area for the land use (= Barlowe's (1986) land use capacity) is the predicted net economic benefit to a specified party (e.g., landowner, land user, society) to be expected if the land area is given to the use (Rossiter 1994).

The suggestion of the market value

The market value is determined according to the generally accepted methodologies that are actually applicable in the contemporary economic conditions of the Czech Republic and describe the best way to determine the contemporary property value, that is variable in time and affected by many factors. The use of the methods and technique of the market value assessment is also affected by the purpose, in view of which the market value is assessed.

The estimate of the land market value is determined using the following methods.

Income method. This method assesses the (potential gross) income from the renters (from which the operation expenses are subtracted) subtracted from operation expenses.

The expression of a property value with the assistance of the Capitalisation Rate must be done individually to distinguish each separate property.

Comparative approach, sale comparison approach. This method of property assessment is based on comparing the objective property with similar properties whose prices, having been realised on the market, are known; it is then possible to evaluate the land value with the help of the information obtained.

The proposal for non-market-defined value; special value

In the case of agricultural land, I interpret the special value as a function of ecological stability that can be formulated by the monetary assessment of biotopes.

This method was pioneered in Hesse. It is derived from the list of biotopes that are situated in a particular region. A point-value for each biotope is obtained through the interdisciplinary cooperation among ecologists, other specialists, and economists. As such, the point-value for every biotope (the totally unnaturely, anthropogenic biotopes, e.g. concretes, asphalts, built up areas have the lowest value 3 points/m^2, while the highest quality nature biotopes have the highest point value up 70 points/m^2) is translated into the monetary value via the multiplication of the stated point and the average expense related to the recultivation of natural structures. For the conditions of the Czech Republic, one point represents 12.40 Czech Crowns (and the values of biotopes are in the range of 37–992 CZK/m^2 (Seják 2003).

RESULTS

For an example of the assessment of degraded land, I refer to the agricultural land in the watershed Litavka river (cadastral region Trhové Dušníky, in the Czech district of Příbram, Figures 1–3). This

Figure 1. The map of relevant area

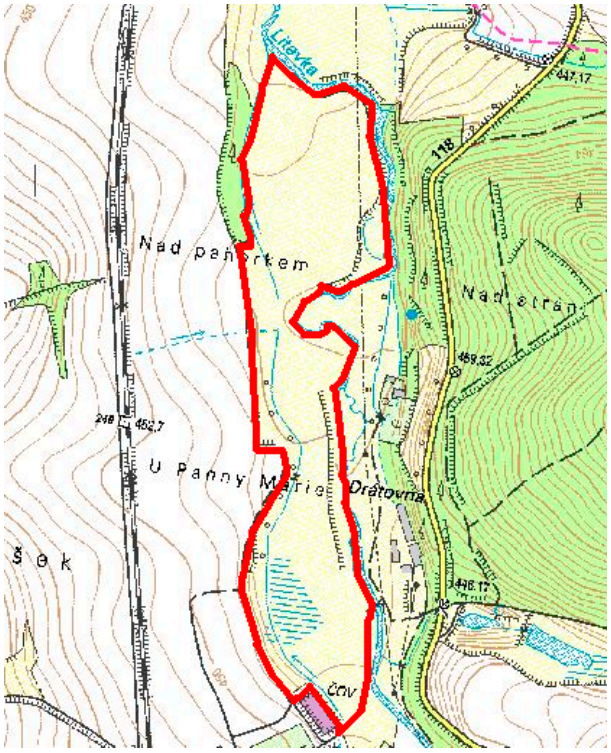

Figure 2. The map of relevant area with a defined border of the evaluated parcel

agricultural land is registered in the cadastral evidence as a permanent grass crop. The land defined as BPEJ 55800 consists of medium structure fluvisoil gleyic over alluvial deposits and is located in a warm, somewhat humid climatic region, this BPEJ region being covered by a 2nd class protection of agricultural land consisting of soil that has above-average productive capacity and above-average hydrological properties.

Noteworthy is that this parcel is located on the Litavka river flood-plain (Figure 4). Floods occur here regularly with varying intensity, with the most recent significant flood in 2002. The Litavka river flows through the industrial town of Příbram where silver was mined for and ores were treated. The slag collection basins, located in the Litavka watershed, were destroyed several times in heavy downpours during the second half of the 20th century. The slag in these basins was spread throughout the surrounding plots giving way to the flood waters. Consequently, there are significant concentrations of heavy metals throughout this region.

Regarding the water quality, the Litavka is one of the most polluted rivers in the region. Indeed, the river contains more metallic minerals than anyone else in the Czech Republic. The heavy metal pollution results not only from the mining activities and mining-water disposal, but also from the industries that abut the region, and there are heavy metals occurring naturally in the subsoil. Arsenic, cadmium, lead, and zinc exceed the tolerable limits exponentially, particularly when the river water is in full flow (http://www.ochranavod.cz/03/zprava_2006_SOV.pdf).

The dissertation "The contamination of the selected soils by heavy metals" (Janků 1986) focused on detecting the presence of heavy metals in the Litavka region alone. On the parcel evaluated, 4 samples were collected in November 1985. Strong contamination was detected of cadmium (6.4–58.4 mg/kg) – (typical content: 0.06 mg/kg – Bowen 1966), copper (30.6–169.0) – (typical content: 20 mg/kg – Bowen 1966), manganese (1880.0–5080.0) – (typical content: 850 mg/kg – Bowen 1966), lead (674.0–4640.0) – (typical content: 10 mg/kg – Bowen 1966), antimony (< 50.0–209.7) – (typical content: 1.7 mg/kg Pavel 1984) tin (19.3–301.4) – (typical content: 10 mg/kg Bowen 1966), and zinc (1460.0–4285.0) – (typical content: 50 mg/kg Bowen 1966). These are total

Figure 3. The view of land in the watershed Litavka river

Figure 4. This parcel is located within the Litavka river flood-plain

contents detected by spectral optical emission analyses.

Since the analyses were done in 1986, the river's floodplain has been inundated substantially several times, especially during the large flood of 2002; one should thus assume that the level of concentration has been reduced, as indicated by a simple comparison of the vegetation condition (Figure 5). In 1986, the year-round presence of dry grass and dead vegetation, double bent and entwined in a tangled, debris-ridden wasteland landscape, was a clear visual indication of the intrusion of deadly heavy elements (Janků 1986); this is no longer the case. Nevertheless, considering the potential effects of the residual pollution on the food-chain, agricultural use is not one to recommend.

Various varieties of grass occur. The grass is not cut. This can be very suitable for the soil fertility improving. Mulching is a good way of the biomass utilisation where it cannot be used as forage (Svobodová & Šantrůček 2005).

There have been efforts to grow industrial-use trees on the land. Past experiments to re-forest the flood-plain have resulted in little more than a no-man's land of dead plants dotted with occasional pine trees (Figure 6). (http://www.mesta.obce.cz/trhove-dusniky/turistika.htm).

In 2007, the Czech University of Agriculture in Prague requested that the responsible municipal jurisdiction lease the parcel for cultivating plants and fast-growing trees (Figure 7) that would draw out lead from the soil. The municipality offered a part of the evaluated parcel No. 399/1. This part has been leased since 2008. According to the contract offer, the rent is 0.50 CZK/m^2. The area of the leased part of the parcel is 6600 m^2.

Figure 5. The condition of the vegetation

Figure 6. The occasional pine tree

Figure 7. The part has been leased for cultivating plants and fast-growing trees

The municipality also considered an offer to build an archeological park (an open-air museum of the early middle ages).

The position of property on the market

From the market point of view, the objective plot can be categorised as agricultural contaminated land, threatened by floods, unavailable for construction, unavailable for agricultural use, in the locality of the Trhové Dušníky, Příbram, municipality

The property market in this segment and locality can be characterised in the following ways:

– The municipilaty is unique because the Litavka river flood-plain is situated in its cadastre creating a nice landscape. The meanderings of the river are considered a rare natural phenomenon, because unlike other rivers in the region, the water-flow is not regulated (Figure 8).

– Even though the region is beautiful, it cannot be used economically, because of the floods and contamination, with the possible exception of forestry, which was not practicable in the past because of the heavy metals contamination.

– The demand for land of this type does not exist; there is no market at all.

From the economical and social points of view the most significant is the retential function of the river flood-plain. Thanks to the absorption of great amounts of water during floods, the river flood-plain protects the property of inhabitants down-stream from the region.

Figure 8. The meanderings of the river

Taking into account that what has been stated, it can be clearly concluded that the chances are low for real estate as, from the point-of-view of price, the probability of sale is low.

One's own assessment

Assuming the proposed issues, the folowing methods will be used:

Sale comparison approach. This is a method commonly used and recognised by the professional and even unprofessional public. Unfortunately, in this particular case, it is impossible to find relevant market data in this segment and locality. Consequenty, this method cannot be used.

Income value method. The temporary rent is used to determine the net economic value (Bradáč *et al*. 2004; Zazvonil 2004). The income has been constant for 7 years, with an 8% discount rate and negligible costs. 7-years period has been choosen as it relates to the growth of trees (when it will be apparent that there is either growth or waste).

$$VH = V \times (q^n - 1/q^n \times i)$$

where:

VH	– income value
V	– constant income in discrete years of duration of the temporary rent
$(q^n - 1/q^n \times i)$	– ordinary level annuity
n	– duration of temporary rent in years
i	– discount rate
q	– compound interest

$VH = 3300 \times 5.206351892 = 17180.96$

The income value is 17 181.00 CZK.

The proposed method using the coefficient of use. This method considers the negative aspects of the plot – the price is adjusted by a reduction (uselessness for agricultural goals – stones, alluvia, wetlands) as well as the positive aspects: the price is adjusted by bonus (availability, proximity of town), and considers the coefficient of use that is influenced by contamination with heavy metals and regular floods. The method is derived from the official land price, determined by the income approach and presented via public notice as the basic official price in CZK/m^2/BPEJ, without additional adjustment. The method is derived from the basic official price because the available data on the land sales in this segment are not known. In such cases (about agricultural land commonly), the basic official price often serves as a guide for the market value proposal. But this does not mean the same value. Thus, in the first phase the proposal for the value was defined from the basic official price according to the public notice No. 3/2008Sb., Supplement No. 22 (Table 1).

The determination of the basic official price

The basic official price was adjusted according to the local specifics. Taken into consideration was the locality, the availability of the land and terrain quality. The basic price was than adjusted by reduction or mark-up and the determined basic adjusted price (Table 2).

The price established by this way is further adjusted by the use coefficient. That one is deter-

Table 1. Agricultural land (§ 29, Supplement No. 22)

Parcel number	Cadastral area	Type of land	BPEJ	Price/BPEJ/m^2
399/1	Trhové Dušníky	permanent grass crop	55800	6.86

Table 2. The adjustment of the basic price – bonus, reduction

Description of part of plot	Area (%)	Area (m^2)	Price BPEJ in CZK/m^2	Bonus % availability, locality	Reduction (%)	Adjusted price/m^2	Adjusted price/area
Meadow, sporadic vegetation	95	114519.65	6.86	50	0	10.29	1178407.20
Alluviums – sand, stones, swamps	5	6027.35	6.86	50	90	1.029	6202.14
In sum		120547					1184609.34

Table 3. The determination of the use coefficient in consequence of contamination and floods

Use		Use (%)	Coefficient	Note
Agricultural	no	0	0	
Leasing (rent)	yes	5	0.05	
Different usage	possible	10	0.1	probably uncomercial
Forestation	yes	50	0.5	probably partly
Built	no	0	0	
Σ			0.65	
Use coefficient (average)			0.13	

mined in this case through the examination of the use in consequence of contamination and floods (Table 3).

Than the basic adjusted price is multiplayed by the used coefficient. The result is the suggestion for the market value (Table 4).

The suggestion for the market value by the method suggested using the use coefficient makes 154 000.00 CZK (Table 5).

The suggestion for the market value makes 155 000.00 CZK.

The determination of the official price of land

For comparison, I have had also the determination of the official price according to the public notice No. 3/2008 Sb. Agricultural land (§ 29, Supplement No. 22 and 23).

The parcel number 399/1 is situated in the cadatsral area Trhové Dušníky. Trhové Dušníky borders the cadastral area of the Příbram town. The type of land – permanent grass crop.

For the designation of the object for the needs of assessment see Tables 6 and 7.

The official price of the assessted land is 1 447 770.00 CZK.

The determination of unmarked value – special value

The special value of the objective plot consists especially in broader social values and can be expressed by the following functions:

– Retential function during floods. Partial protection of habitats properties downstream.

– Landscape function. Unique meandering of the river makes the landscape attractive.

– Historical function. The region has significant Halstatt – Laten archeological sites.

In the cadastre of the municipality silver mines (19th Century), baroque buildings (Chapel, col-

Table 4. The suggestion for the market value

Description of part of plot	Area (%)	Basic adjusted price/m^2 (CZK)	Basic adjusted price/area (CZK)	Usage coefficient	Suggestion for the market value (CZK)
Meadow, sporadic vegetation vegetace	95	10.29	1178407.20	0.13	153 192.94
Alluviums – sand, stones, swamps	5	1.029	6202.14	0.13	806.28
In sum	100		1 184 609.34	0.13	153 999.22

Table 5. The suggestion for the market value

Method	Comparative	Income value	With usage coefficient
In CZK/m^2	–	0.14	1.28
In CZK/area	–	17 180.00	154 000.00

Table 6. Agricultural land (§ 29, Supplement No. 22 and 23)

Parcel number	Cadastral area	Type of land	BPEJ	Price/BPEJ/m^2	Reduce (%)	Bonus (%)	Reason	BAP/m^2 (CZK)
399/1	Trhové Dušníky	PGC	55800	6.86	5	80	item n. 1.5.2 – area of neighbouring municipalities of municipality with nuber of 25–50 000 population	12.01

umn of the crucification). The possibility of an archeological park.

– Touristic function. The green corridor - continuous, uninterrupted landscape corridor, interconnected with trails.

For the value determination, the method of monetary assessment of biotopes has been employed (Table 8).

The special value makes 16 394 392.00 CZK.

This sum serves for the remedy of ecological damage in Hesse. It has been paid by the investor.

In the Czech Republic, the payments are made during the separation of agricultural land for nonagricultural purposes. These payments are determined by law (the law about protection of agricultural land No. 334/1992, Sb.). The payment in this case would make 759 446 CZK.

Final analyses for the suggestion of the property value

Strong aspects of the estimated property:

– Original landscape, rare meanderings.
– Touristic potential, history of ancient settlements, cycling.
– Availability of regional centres, transportation.

Table 7. The calculation of the official price for agricultural land

Parcel nuber	BAP/m^2 (CZK)	Cs	BPU/m^2 (CZK) with Cs	Area (m^2)	Price for land (CZK)
399/1	12.01	1	12.01	120 547.00	1 447 769.47
In sum					1 447 770.00

BAP – basic adjusted price; PGC – permanent grass cropp; Cs – coefficient of saleability

Table 8. The method of monetary assessment of biotopes; the values of the ecological and economic functions of the objective plot

Land Cover 1:100000	Marks		CZK/m2 min	% from area	Area (m^2)	Marks in sum	Sum in CZK
	min	max					
2.1.1. unirrigated arable land	11	13	136	100	120 547	1 326 017	16 394 392
In sum					120 547	1 326 017	16 394 392
For 1 m^2							136.00

Table 9. Analysis of the assessment

Unit	Official price (CZK)	Comparisson value (CZK)	Net economic value (CZK)	Value with use coefficient (CZK)	Special value (the method of monetary assessment of biotopes)	Suggested market value
m^2	12.01	not existing	0.14	1.28	136.00	1.30
In sum	1 447 770.00		17 180.00	154 000	16 394 392	155 000.00

– Access to the plot nonproblematic.
– No significant legal barriers.
– The possibility of rent (limited).

Weak aspects of the estimated property:

– Flood land.
– The shape of the plot is partly made by the river.
– Ecological damage – contamination with heavy metals.

Final analyses of the suggestion for the property value (Table 9).

With regard to all the descriptions and conclusions, on the basis of the employed methods to date of the assessment 8. September 2008, I have suggested the market value_155 000.00 CZK, that is 1.30 CZK/m^2.

The special value 16 390 000.00 CZK, that is 136 CZK/m^2.

CONCLUSION

The presented method proposed for determining the market value of the land degraded by contamination and floods can function under such circumstances where comparative data are not known and the land is not saleable, which is common with the degraded land.

The plot is part of a large river flood-plain. The most acceptable and reasonable use of this plot resides in contemporary use, that means the use of the natural retentive function of soil during floods.

If in the future the decrease in toxicity to a rate harmless for woods becomes evident, this plot will be forested. If toxicity decreases to the level accepted for common agricultural soils in the future, agricultural use (pasture, meadow) will be possible; in the meantime, it is impossible due to the toxic level of heavy metals.

Further utilisation of this plot consists in tourism or the possibility to build an archeological park. The Litavka watershed is a locality significant for celtic settlements.

The plot is not available for the construction purposes because of frequent floods. Even if building procedures exist making it possible to build in flooded plains, this option would not be available for the reasons of landscape protection conservation.

During the assessment of the land-use value, the State should have a decisive intervening role. This raises a question about how to preserve while simultaneously delineating the priorities for the use of the land. At issue is whether to defer to the interests of individuals and narrow interest-groups, or to give preference primarily to the society needs that are associated with the functions of the land-landscape, retention, ecology, culture, production, and so forth. Indeed, it is this discourse in which the state should play the primary role, taking on the responsibility for the future growth during the creation of the land and regulatory plan and judging the value of use not only on the basis of an open discussion, but primarily on the basis of scholarly analyses of the sort that is defined by this presentation. If we are not able to take appropriate measures to protect the soil as an essential raw material, we will further deteriorate the countryside.

The question is if to prefer individual interests or special-interest groups, or to express the primary needs of society that are made by the land function – landscape, ecological, retential, cultural, productive, etc. Right here, the state should play the main role, taking on the responsibility for the future development by the formation of regional and regulation plans, and judging the availability for the use not only on the basis of general discussion but mainly on the basis of professional assessment. If we do not find sufficient means for the soil protection, the landscape will be destroyed.

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