1. INTRODUCTION

The urban green of Poznan, Poland is one of the monuments protected as an urban natural landscape and is the result of dedication by many generations of citizens (Czarnecki W., 1933; Łukasiewicz A., 1987 and others). Special historic meaning is attached to several vertically localized complexes of plantings along the Varta River. One of these complexes is the South band of green extending for about 5 km South of town center up to A2 highway (Wyczalek, I. and Wyczalek, E., 2005). Buildings’ line the West border and the North part gradually covered by recreation and sport areas. Inside the area are localized forests, open spaces, bushes, gardens and parks and several historic buildings partly destroyed. Natural needs of citizens coupled with absence of appropriate facilities and unresponsive decision-makers endanger this green area. For example, last year, a new highway crossed the South part of this green band and now a new express traffic lane is planned along the West border.

Revitalization of this green belt with emphasis on tourist-recreation functions could protect it from further deterioration. A tourist train line passing near attractive places may be a motivating remedy for revitalization of current status of described area. Such a solution agrees with generally accepted goals of sustainable development and green cities.

In order to choose the most interesting way for the train, the method of assessment of objects forming cultural landscape has been elaborated. The map of landscape values, as a part of the system of spatial decision aid, should be a visual effect of the assessment. The system consists of raster-type maps showing several individual criteria or needs, and the set of algorithms to compile decision map. Such approach is described in numerous papers (Berry J. K., 2003a, b) and its advantage is common GIS and RS data processing as well as results of surveys and assessments.

In next chapters the rules of cartographic system for decision aid will be discussed, next idea of valorization key and some examples of its implementation will be described. Results from tests of presented system will be implemented in practice.
2. VALORIZATION KEY IN THE SYSTEM OF DECISION AID

2.1. Description of used Cartographic System of Decision Aid

System of Decision Aid used in presented work consist of analysis of map set that illustrates particular limitations, criteria and user preferences (Wyczalek, 2001). Elaborated raster maps represent division of terrain into basic fields, for which values of differed properties are set. Division into homogeneous cells makes possible mathematic or logic calculations on its values (Berry J.K., 2003c). It is also possible to expand criteria functions of statistical and probabilistic rules, methods of decision tables as well as fuzzy set theory and trade-off (Eastman R., 2000). Database features can be segmented or classified earlier, or modeled depending on solving problem. Data can be of quantitative, ordered or qualitative type. Digital images or results of their classification can be also added.

Values of cells on various layers can concern different data domains, but experience shows, that the best is to use normalized values to the range of natural (e.g. 1-100, 1-255) or real data (from 0.0 to 1.0 or from -1.0 to 1.0). For the purpose of visualization the best is to use the range from 0 to 255 that equals to levels of grey or color scale (Brewer C. A., 1999). Decision map is result of analyses, where different values are visualized in adequate colors. For the legend of red-yellow-green, these map cells will be accepted as better, which values are nearest to green color (Wyczalek, 2001).

Illustration of many typical solutions of criteria maps is achieved in reach bibliography of the subject (Eastman R., 2000; Jankowski, 1995). There are numerous descriptions concerning specific solutions (Malczewski J., Ogyczak W., 1996 and others), to which approach presented here should be included.

2.2. Power of influence human senses by landscape phenomena

Accepting existence of influences between individual features of landscape and their surrounding, it is necessary to agree, that value of these phenomena is a function of mentioned influence. Thus, as a measure of attractiveness of landscape we can assume a factor defining the Power of Influence (PoI) human senses, and emotions, that are the most basic criteria stated about degree of contentment flowing from the contact with this phenomenon. The level of assessment depends not only on quality of phenomenon itself, but also on its exposition and composition with surrounding objects. These factors have to be included in definition of measure of the value, which additionally should be objective in highest degree.

If given landscape influences human senses on certain level, or power, then we can evolve three categories of objects that generate this value:
- dominants, which value of PoI is decidedly higher than others,
- negative dominants or ‘degradants’, which influence in negative manner,
- background – the set of neutral (lower) values of PoI.

In valuation of landscape appearance of object can be recognized as the most important factor, but not only – it can be also smell, sound or factor of other type.

Analyze of PoI is especially useful when we look for scenic directions. Influence of objects on landscape can have directional (1D), superficial (2D), spatial (3D) or spatio-temporal nature. One-dimensional influence is receiving from one direction, which is determined by the line observer-dominant (or degradant). This direction can be determined in absolute or relative manner. An example of such influence can be English-type park with typical viewing axes. Some architectural solutions have also important viewing axes (Fikus, 2002). In two-dimensional influence the object can be seeing from various directions on the same level, and PoI can be different depending on viewing direction. Monuments or sculptures placed on open space have to comply of such possibility of observation.

Mountain views of valleys have three-dimensional type, as well as waterfalls, rainbow and man-made objects of the similar idea. Fourth dimensions have time variant phenomena such waterworks, geysers and similar natural or anthropogenic objects. Here weomit these types of influences.

2.3. The idea of Valorization Key

The aim of using such key is valuation of attractiveness of objects formed cultural landscape. Thus, Valorization Key can be defined as a measure determining value of PoI of spatial phenomena on a person being in unrestricted place. The measure is interpreted as a level of attractiveness of certain phenomena. Values are spatially variable, therefore as a way of visualization of results raster map has been selected, where different values are shown in established scale.
The value of PoI can be shown in a graph (fig. 1), where horizontal axes means the range of influence, and vertical – its level. Typical structure of distribution of PoI consists of three vectors (segments):

(a) first, ascended, which starts on the level of $P_0$, initial level of PoI, and ends on extreme level for given class of phenomena ($P_{\text{max}}$),

(b) second, mostly flat, which determines the range of maximal, relatively constant level of attractiveness,

(c) third, descended together with the distance towards zero.

![Figure 1. The graph illustrating measure of visual attractiveness of features](image)

When valorizing in 2D, levels $P_0$ and $P_{\text{max}}$, as well as segments (a), (b) and (c) can be variable, depending on direction of observation. At a certain level such schema is simplified, but it seems to be good enough for described needs. Human impressions came off sensual perception of object depend of flow degree of stimulus, and each factor which impede the flow lowers the power of influence. Figure 2 shows manners in which our method takes into consideration lowering factors, which we can assume as screens (fig. 2a) or filters (fig. 2b). Filter can be some bushes, air contamination and so on. It is defined by Degree of Lowering (DoL) and thickness (th). Screen can have a form of a wall or high bank. It can be assumed as a special kind of filter, where thickness is equal to zero, and DoL has great value. Stimulus coming from phenomenon is lowered when it goes through filter or screen, because of what view of object loses its attractiveness.

![Figure 2. The loss of signal value when it goes through (a) screen or (b) filter](image)

The next factor taking into consideration is direction ($\alpha$) of exposition of object best features. In 1D problems the direction can be determined from the North (azimuth) or certain axis (centerline of a road, border ...). 2D approaches need to comply the changes of power value in various directions. In our work we describe distribution of PoI in angle step of 45°, that is in each side along lines of grid cells and diagonally. It can be described by coefficients written in window of 3x3 cells, around center cell describing local value of PoI. Examples of distribution of PoI showed at the left side of figure 3 correspond with maps presented at the right side. Upper example illustrates purpose, where object is equally interesting from every point of view. Lover one shows the purpose of differenced attractiveness depending on direction.

It is obvious that in 2D problems oblige described earlier rules of lowering the stimulus by natural or artificial obstacles.
Figure 3. Attractiveness of object view independent (a) and dependent (b) on direction. Legend at left side shows simulator parameters. Right image is cartographic model of ‘power of influence’ (PoI) of object.

On figure 4 we can see a map of PoI, when signal diverges evenly over the plane and on its way a filter (left) or screen (right) occurs. The direction parameter is taken into consideration.

Figure 4. Illustration on model of PoI with (a) screen or (b) filter on the way

3. THE USE OF VKEY AT THE DESIGN OF REVITALIZATION OF URBAN GREEN

3.1. Valorization of tourist attractiveness of monumental building

One of object classes taking part of an urban landscape are building monuments, most of which became a ruin. In described green area there is an old building of first powerhouse of Poznan, which is now between a park and a busy street. Design of the train track line established, that it will pass near the building, where can be museum of electricity.
For choosing the place for the line three goals were assumed:
(a) optimal view on the elevation of the building;
(b) omission of each individual old tree being in this part of the park;
(c) minimization of influence of traffic (noise, smog).

Three criteria maps were elaborated for this part of design, which contain: (a) a VKey map for a view of mentioned architectural dominant, (b) map of the park with all trees and (b) VKey map of traffic. Figure 5 illustrates these tree criteria and their composition as a decision map.

![Figure 5](image)

Figure 5. Criteria maps of (a) view on elevation, (b) collision with old trees and (c) influence of traffic – green means positive and red – negative feeling of observer. Image (d) shows decision map with designed line of train going near the most adequate place.

Green place in the center of an image 5f indicate the optimal site for train stop. The line marked on the map was calculated as function minimum for straight track. There were omitted criteria concerning other parts of a park and phenomena, which influence on decisions. Thus ends of line go to near to trees didn’t take into consideration in this task.

Lowering factors were also leaved here because only some bushes interrupt the view of a house, but they may be shorted or displaced by lower ones.
3.2. Remarks and plans

We selected several places to be analyzed from the point of view of visual attractiveness. The second example of using VKey in presented project is a part of line going along some lakes surrounded by old oak forest. It was assumed that (A) the lake should be best seeing, (B) line should be horizontal and (C) minimum interference to natural environment. On such thick strip of ground that is at considered place, the criteria seemed to dodge together. This is a good reason to use described method. A balance has to be struck mainly because of the lack of good solutions there.

4. CONCLUSIONS

Idea of using Valorization Key described here seems to fulfill reposed expectations on effective elaboration of the design of revitalization of natural landscape that is very important for the live of citizens. It confirms serviceableness of cartographic methods of decision aid as very efficient tool in problems concerning large area and many aspects that needs allowance.

The theory of VKey sketched here is still developed in order to increase their usefulness. Particularly, there are elaborated various measures of attractiveness of selected entities of the landscape in different stages of growth of plants, what will be complied during development of the method. In the near future the influence of nature on microclimate will be included, as well as influence of traffic on selected aspects of cultural landscape inside green places of the city.

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