

# PLANT SUCCESSION AS A TOOL IN LANDSCAPE DESIGN

KRZYSZTOF M. ROSTAŃSKI

Faculty of Architecture, Silesian University of Technology, Akademicka 7, 44-100 Gliwice, Poland  
e-mail: krzysztof.rostanski@polsl.pl

## Abstract

Rostański K.M.: Plant succession as a tool in landscape design. *Ekologia (Bratislava)*, Vol. 27, No. 4, p. 421–429, 2008.

Rules of nature conservation and especially of biological diversity protection are reaching still more attention in landscape design. It has appeared that cleaning our environment from all kind of plants but these we are cultivating for food or other strictly determined purposes brought disaster for the nature and finally for our health and comfort. There is still more examples of designed green areas where you can find common or even ruderal plants. Such kind of aesthetics needs special approach to design. First step should always be the nature elements evaluation, which should recognise nature value of the area concerned and its surroundings. Introduced plants, if being expansive enough, are able to change and destroy valuable local plant communities. Second step is the selection of the places for common plants. Concerning importance of the area in urban structure and needed elegance should be established possible proportion of the area given for plant succession. Third thing is determining style of the aesthetic composition, shape of pattern forms etc. That step is strictly connected with overall composition of the area designed. Forth step is the choice of the plants. Preferred should be the plants naturally occurring in the region concerned. That is the safest way to protect local biological diversity. Plants designed for succession will be growing and success freely around. Some examples of proposals using succession of plants are given there. They are located in Chełm Śląski, Zabrze, and Sosnowiec in Poland.

*Key words:* aesthetics, composition, implementation, brownfields, natural plants, biodiversity

## Introduction

One of vital objectives of nature protection is preservation of biological diversity. Since in range of environmental protection this objective is wide realised, in newly designed green areas such idea is not popular enough. It has appeared that cleaning our environment from all kind of plants but these we are cultivating for food or other strictly determined purposes brought disaster for the nature and finally for our health and comfort. There is still more examples of designed green areas where you can find common or even ruderal plants. Such

kind of aesthetics needs special approach to design. In many cases there is no need to build all area at once. Sometimes, when there is no urgent need to hurry, possible way of covering the ground with greenery is to use plant succession as the tool.

Many various places in urban area do not have actual function. That causes problem of temporal developing, acceptable by people. Strictly limited funds often implicate existence of not developed areas at all. Every town has abandoned places or brownfields which disfigure their surroundings. Nowadays urban planners are still more conscious that strict determination of town space according to function and kind of development lose its justification. "If there is to be new urbanism, it will not be based on the dual fantasy of order and omnipotence; it will no longer be interested in organising more or less permanent objects, but in irrigating territories with potentialities" (Koolhaas, 1995). Potentiality in some cases can implicate emerging of mentioned places. That born real problem for maintaining them in context of modern town. Many biological researches show existence of natural succession on such areas. Sometimes aesthetic aspects of such plant cover are completely exceptional. Plants create these aspects being mixed together on spots of various dimensions. What is the most important these plants are the most suitable for the conditions they meet there. Degree of covering the ground differs depending on quality of soil, insulation or humidity. Abstracting from this situation was found the idea of using succession for developing places heavily treated by human activity. Not only highly urbanised areas are suitable for steering of succession. There are examples of habitat creations where further succession plays highly important role (Tokarska-Guzik, 2003).

## Materials and methods

The sixteen years of designing open spaces in Upper Silesian industrial region have given the opportunity to summarise experiences with influences of natural succession on areas designed. There have been done 60 design works, 5 valorisation and expert's reports and 9 inventory works. All of those works includes area examination, some of them on the form of nature elements evaluation. Observations of the area after implementation were leaded to proof rightness of decisions undertaken. Visiting various European countries has given material to compare various ideas. Attempt to establish general method for design was done.

## Results

Probably there could be determined a few methods of designing with using plant succession. All of them however, should include the following steps which are vital for right effect. First step should always be the **nature elements evaluation**, which should recognise nature value of the area concerned and its surroundings. There are known works dealing with area evaluation according mainly to planning scale (for instance: Ružička, 1996; Bastian, 1998; Supuka, 1998). Problem is still with implementation scales. Criteria for evaluating could be similar but they deal with much more particular ground units. It is still important to state if existing plant cover has some special values. Sometimes, for instance on brownfields,

the soil conditions are so extreme, that the most of plants are not able to live there. Some plants however succeed there. They are the most capable to those conditions. The question is, if they create ground cover adequate to our requirements? In brownfields one of the main problems is the dusting of the ground surface. To prevent this sometimes the area is covered by layer of the soil or the upper level of the ground is being mixed with fertiliser (Patrzałek, 2006). Plants, mostly grasses, seeded on such area create the green cover which looks acceptably. Problem is with adequacy of those plants for the area concerned. After some time, when they reach level of degraded soil or used up all fertile substances not appropriate plants often die. If they are expansive enough they survive but create very poor community or monoculture. Another problem is with the destroying of already existing flora. Mentioned agricultural activities are bringing disaster for already functioning succession. So designer is facing very important decision to create infirm plant cover or to leave area for longer but ecologically more valuable community. Probably like always the best solution is something between. Next treat may be connected with foreign plants. Introduced plants, if being expansive enough, are able to change and destroy valuable local plant communities. That could happen not only on the area designed. Sometimes in the surroundings of the brownfield area exist valuable green elements. Expansive plants succeed there, push out weaker native ones and are able to change local ecosystem on large scale. The cure for described problems is caution with decision-making. Sometimes very useful is the approach opposite to total design. Leaving some parts of the designed area untouched or with very limited management can preserve important nature values. To state if they are really valuable should be done this evaluation mentioned at the beginning.

Second step is the **selection of the places for succession**. Concerning importance of the area in urban structure and needed elegance should establish possible proportion of the area given for plant succession. Free succession create greenery of special kind of aesthetics. Identifying nature and healthy ecological systems with beauty could be misleading (Nassauer, 1992). The places left for free succession may look like abandoned place. If there is need for high-managed area because of neighbourhood of, for instance, the important authority buildings or similar offices, using succession for green area building may not be the best idea. Two kinds of places seem to be especially designated for such development. One is a large-scale park where some parts could be left for free life of animals and spontaneous succession when the most representative parts should be maintained well. The second one is a kind of abandoned places in urban structure brownfields, areas without present determined function, areas waiting in city plans for development in future (that future may come fast, in a few years or even never). Not all area concerned should be developed in described way. Designers have to decide what percentage of area designate for this. It is very important to surround such places with well-maintained lawns, clear paths and well-designed benches and small architectural forms (sometimes very simple elements made of tree trunks could be the best). The largest percentage of succession area has probably Südgelände Park in Berlin. On this place, abandoned for many years, has been created ruderal community which high value is not clearly visible on first sight. There are common plants, some introduced trees like black locust (*Robinia pseudoacacia*). For botanist rather nothing interesting, but thanks to long period with no human presence there are a lot of birds. They feel themselves

very good there, so this place even became a nature reserve. In Regent's Park in London were implemented plots of ruderal plants called "Wildflower Plantings". All area around is very well maintained except these places. Here you can see how common plants succeed and how it enriches the nature there.

Third thing is **determining style of the aesthetic composition**, shape of pattern forms etc. (Rostański, 2006). That step is strictly connected with overall composition of the area designed. In Kew Gardens in London where the entire object has a form of landscape park are places of limited maintaining with important role of the "Wilderness" enriching ecological function of the area. In Elbauenpark in Magdeburg some places are left for free succession but they are visibly distinguished and make clear composition with the remaining parts of park. The same we can see in the mentioned Regent's Park in London where ruderal plants are consciously planted there along the borders of the paths. Not only in parks or wastelands we can find ruderal plants as conscious element of the area. Sometimes they are in housing estate. Monnikenhuizen estate in Arnhem, Holland, is the example of extreme, radical ecology. Only very near houses in special places you can see mowed lawns. The most of area have cover creating of ruderal and common plants on the way of succession. It gives incomparable effect with modern houses and gabion forms present there. That will create sustainable community of plants but the question is if it is still nice for people to live there.

Fourth step in the method of designing with plant succession is the **choice of the plants**. Preferred should be the plants naturally occurring in the region concerned. That is the safest way to protect local biological diversity. Plants designed for succession will be growing and success freely around. Introduced plants easy succeeded in local conditions may escape into common area around and destroy natural, ecological structure. That is especially important on the border zone of the town and in open spaces outside the towns. Territories of city centres lost their natural features in such scale so possible treats are not so evident there and distance to the outer area is really significant there, in any dimension, not only measured in meters.

There could be mentioned some examples of proposals using succession of plants. Park on spoil heap in Chelm Śląski, is under construction now. There were designed dispersion centres with a shape of artistic pattern (Rostański, K.M., 2001, 2003). The main idea is to create there some so called land art forms aesthetically acceptable by people. The soil covered dispersion centres should be fertilised, sometimes mixed with fertile soil brought there from outside. The role of these centres is to precipitate processes of natural succession of the plants to build green area. Plants chosen for that proposal are mostly vernacular and ruderal. Majority of them already exist and succeed on the area. Problems are with seeds of adequate plants. They should be collected especially for that purpose because they are mostly not produced for trade. It is expected that after few years since implementation they will create ground cover which should stabilise the ground surface of waste rock enough to prevent air from dusting and this cover will be composed of plants rightly responded to local conditions. Functions of that park will be very limited. It is designed for bicycle sports and ecological happenings. Places like that are not healthy enough to encourage many people to spent there a lot of time, but they exist and will be still developed for many years. We must do something with them.

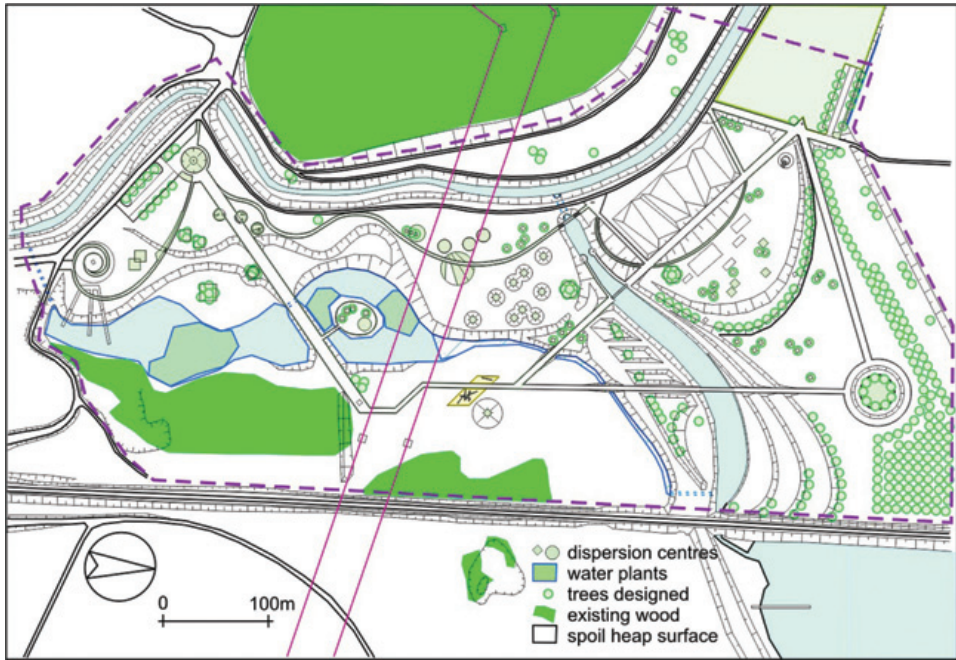


Fig. 1. Kudrowiec Park proposal (designed by Rostański K.M., 2000).

Park in Zabrze-Zaborze probably will never be implemented. Changing that area into aesthetically acceptable form appeared to local authorities something not necessary in spite of this, that the area demands temporal and not expensive maintaining. This territory is going to be sold for not known purposes now and it is abandoned for some years. Nobody knows when this situation will change. The area previously belonged to the coalmine, presently is disgusting, abandoned brownfield. Like in the previous example there were designed “land art” aesthetic patterns of ruderal plants and some very limited earthworks. Functions designed there were either similar. Such kind of parks was called by the author “parks of natural succession”.

Swierczewski Park in Zabrze was redesigned with main objective to preserve its character as the forest of semi-natural value. There is designed very limited impact on present state. Free succession of plants is protected there. Until now it was used as ordinary managed forest, but local authorities decided to change it into a town forest open for walks and bicycle riding. So there have been stopped foresters' attempts to plant there pine trees while it is evident hornbeam-oak community of potential flora. Some fruit trees with the composition role of accents are going to be planted there to give food for forest animals. Important interference will be the clearing off the surrounding of the paths from the shrubs and bushes to increase the sense of visitors' safety.

Table 1. Idea of parks of natural succession.

Constant use	Temporal use
constant function of park	reserve for future purpose
low cost of constructing and maintaining	very low cost of constructing and maintaining
interesting aesthetic value	acceptable aesthetic value
scale of ground surface change depends on available funds	very limited earthworks
“land art” elements in forms of ground surface three-dimensional modulation and colour patterns	land art elements mostly in forms of colour patterns on the ground
amount of small architectural elements depends on available funds	very limited small architectural elements depends on available funds
only neighbourhood of small architectural elements with hardened surface	
small architectural elements made of concrete or tree trunks	
lack of kerbs, ground or gravel pavements bordered by lines of plants only	
lawns only on ground surfaces where special stability is demanded i.e. on hill slopes	
dispersion centres on the ground surface in forms of lines, geometrical figures etc.	
main function of the park – bicycle sports, education through play	
high resistance against vandalism	
main problem – dusting ground surface for first few years after implementation	
main ecological profit – natural and full growth of flora and fauna compatible with local conditions	



Fig. 2. Tysiaclecia Park in Sosnowiec (designed by Rostański K.M., 2006).

In Sosnowiec was redesigned Tysiaclecia Park. Semi-natural values of this forest park were underlined, too. The part of the park is the spoil heap with already started succession, thus some green patterns of grass and ruderal plants will be built, but majority of the ground surface will not be covered by brought fertile soil because it would destroy existing valuable flora. The forest part demands rebuild of species structure. Some percentage of planted poplars and black locust should be changed mainly by hornbeams, beeches, lime trees, vernacular oaks and pine trees. In this part of the park will be placed some new functions being added for people leisure. Their locality is determined by nature value of the particular area. Forest will be opened for walks and bicycle riding. There will be skatepark, swimming pool, fishing pond, maze, path through the traces of old coal ground surface excavations present there. Some places are designed for "land art" installations.

## **Discussion**

It is clearly visible that lack of maintaining supports plant succession. Most of plants which succeeded visibly are ruderal (Rostański, A., 2006). Some are ornamental trees, shrubs and herbaceous plants planted there or around consciously. Stronger maintaining, especially cutting grass prevents free plant succession. In parks of large area some parts are sometimes left with nearly not maintaining (Rostański, K.M., 2001). Such wilderness encourages animals to live there undisturbed by people. Appearing of them is aesthetically not attractive so people prefer to stay away from there. That supports growth of various species especially on the ground level but either supports succession of trees. These trees species are in majority very expansive and most of them are not native. Some examples show idea of creating centres of seed dispersion. That is visible especially in countries with the highest changes in nature (Koster, 2001). Natural, vernacular plants are of the highest appreciation there and attempts to re-naturalise green elements in open spaces are undertaken. There are some examples of habitat creations in which area concerned is rebuild into quasi-natural form with the soil and full plant cover (Tokarska-Guzik, 2003; Rostański, A., 2006). Plants there are left for growing and succeeding. Construction of such area needs expensive ground works but gives exceptional effect.

One of vital principles of biological diversity protection is the protection of local nature values i.e. ecosystem diversity, species diversity and genetic diversity (Yue et al., 1998). Vernacular nature however should not be only the object of protection in meaning of preserving already existing object with the present processes functioning there. Among various objectives of urban and rural planning is the creation of biocorridors and biocenters to encourage wildlife (Seko et al., 1998). That can be realised by creation and maintaining of the green elements of various sizes and different possible role in ecological system.

Designed green areas are always the part of an existing nature system, so they should always be considering in two aspects influence on existing ecosystem and creation of ecosystem. Cultivation of introduced species in open space outside the town requires highly sensitive approach. There is always need of assessment whether the newly introduced

plants are not too much expansive to be able to bear down vernacular plants and how they could impact animals living here. There is still more opinions suggesting unambiguously role of different origin plants for ecological balance (Supuka, 1998; Rostański A., 2006). Introducing not native and at the same time very expansive plants may cause impoverish of the plant set in the area concerned. Black locust (*Robinia pseudoacacia*) has in leaves and other parts allelopathic substances which prevent growing of many other species under their crowns (Rahmonov, 2006). Northern red oak (*Quercus rubra*) has leaves very hardly degraded so they lie long on the ground. The result is similar to mentioned of black locust. Such cover nearly impossible to go through for plants starting to grow is made by chee reedgrass (*Calamagrostis epigeios*), too (Fiala et al., 2004). All of this implicates the existence of the monocultures of plants degrading natural values of the area.

Other aspect is the issue of vernacular plants and their usage in green composition, there is opportunity to refer with potential plants and strengthen natural succession with objective of the creation of persistent ecosystem. Newly designed greenery could always, in wide range, use plants typical for local plant communities. Being natural element of potential flora they are adequate to local soil conditions, climate and landscape. They are common to animals living there. Creating communities similar to others present in neighbourhood it is easy to create rich ground cover on the way of natural succession. Natural woods being not highly treated by human activities show stability which is worth of interest just only for low maintaining expenses. Parts of parks left untouched or clearing from rubbish once a year are habitats for many animals. Number of birds gathering around the feeding facilities in such place in Kew Gardens is really impressive.

Since that vernacular plants should always be considering as the basic majority of chosen plants in ecologically designed areas.

## Conclusion

It has appeared that cleaning our environment from all kind of plants but these we are cultivating for food or other strictly determined purposes brought disaster for the nature and finally for our health and comfort. It is especially visible in countries highly developed so these countries are especially interested in sustainable development and are involved in programs of re-naturalisation of the open spaces.

Plant succession is always present on green area. That should be noticed and used in creation of new greenery. All open space proposals should start with biological evaluation of the area concerned regardless the size of it.

Designed changes impact on existing ecosystem. Form of newly designed ecosystem should be assessed in terms of possible threats. Special attention should be given for introduced expansive plants which succession could destroy the existing values.

All designs of open spaces, in spite of the scale and function, could in some way use the aspects of biological diversity by involving possibly high use of vernacular plants.



There is possibility of the creation of some elements or even patterns which beside aesthetic value could enrich local diversity of plants by process of succession.

Greenery is living and changing still, especially green patterns designed as dispersion centres are temporal and are useful only for short time but even in this short time they could show their vernacular beauty.

“Leave nature alone, it helps itself the best”. Often there is no need to create artificial habitats similar to natural. Mostly there is enough to create some patterns of proper plants and give them possibility to success around. They will find the best habitats for themselves.

*Translated by the author*

## References

- Bastian, O., 1998: Landscape-ecological goals as guiding principles to maintain biodiversity at different planning scales. *Ekológia (Bratislava)*, 17: 49–61.
- Fiala, K., Záhora, J., Tüma, I., Holub, P., 2004: Importance of plant matter accumulation, nitrogen uptake and utilisation in expansion of tall grasses (*Calamagrostis epigejos* and *Arrhenatherum elatius*) into an acidophilous dry grassland. *Ekológia (Bratislava)*, 23: 225–240.
- Koolhaas, R., 1995: Whatever happened to urbanism. S, M, L, XL, 010 Publishers, Rotterdam, 1376 pp.
- Koster, A., 2001: Ecologisch groenbeheer (in Dutch). Schuyt & Co. Haarlem, 208 pp.
- Nassauer, J.I., 1992: The appearance of ecological systems as a matter of policy. *Landscape Ecology*, 6: 239–250.
- Patrzałek, A., 2006: Evaluation of the bio-reclamation process of the mining and metallurgy dumps (in Polish). *Górnictwo i Geologia, Zeszyty Naukowe Politechniki Śląskiej*, 1/3: 33–48.
- Rahmonov, O., 2006: The chemical composition plant litter of *Robinia pseudoacacia* L. and their ecological role in sandy ecosystems. In Bugár, B., Boltižiar, M. (eds), Implementation of landscape ecology in new and changing conditions. Abstract proceedings. The 14<sup>th</sup> International Symposium on Landscape Ecology Research, ILE, IALE, UCP, Stará Lesná, p. 43.
- Rostański, A., 2006: Spontaneous plant cover on colliery spoil heaps in Upper Silesia (in Polish). Wydawnictwo Uniwersytetu Śląskiego, Katowice, 230 pp.
- Rostański, K.M., 2001: Greenery of a park as result of natural succession (in Polish). In Pilecka, E. (ed.), Przywracanie wartości użytkowych terenom górniczym. PAN, Kraków, p. 173–187.
- Rostański, K.M., 2003: Natural succession as a method of bringing into cultivation a post-industrial areas (in Polish). In Srodulska-Wielgus, J. et al. (eds), Kształtowanie krajobrazu terenów poeksploatacyjnych w górnictwie. PAN, AGH, PK, Krakow, p. 145–154.
- Rostański, K.M., 2006: Aesthetic issues of the spoil heaps management (in Polish). *Górnictwo, Zeszyty Naukowe Politechniki Śląskiej. Gliwice*, 272: 121–132.
- Ružička, M., 1996: Development trends in landscape ecology. *Ekológia (Bratislava)*, 15: 361–368.
- Seko, L., Nevřelová, M., Reháčková, T., Ružičková, J., 1998: Functional delimitation of ecosystems from the point of view of biodiversity protection. *Ekológia (Bratislava)*, 17, Suppl. 1: 279–282.
- Supuka, J., 1998: Importance of urban vegetation for ecological stability of towns. *Ekológia (Bratislava)*, 17, Suppl. 1: 110–117.
- Tokańska-Guzik, B., 2003: Management of mining pits and quarries after cessation of exploitation (in Polish). In Srodulska-Wielgus, J. et al. (eds), Kształtowanie krajobrazu terenów poeksploatacyjnych w górnictwie. AGH, Politechnika Krakowska, Oddział PAN w Krakowie, Kraków, p. 155–170.
- Yue, T.X., Haber, W., Grossmann, W.D., Kasperidus, H.D., 1998: Towards the satisfying models for biological diversity. *Ekológia (Bratislava)*, 17, Suppl. 1: 129–141.