Intentions for the Unintentional
Spontaneous Vegetation as the Basis for Innovative Planting Design in Urban Areas

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Abstract

Spontaneous vegetation is a characteristic component of the urban environment. It occurs at no financial cost, is authentic and is always appropriate to the site conditions. Until now, the use of spontaneous vegetation for ornamental purposes in public or private areas has been largely misunderstood. If it is possible to make spontaneous vegetation more attractive, it may also be possible to introduce it as an alternative to ornamental plantings in the city.

To intervene in spontaneous vegetation may seem contradictory: 'spontaneous' means that which occurs by chance, without conscious design intent. We are dealing here with design using spontaneously occurring species. The starting point of this idea is to use plants that can clearly build stable communities under the given conditions of a site and to try to transform the plant communities according to a design perspective.

The investigations show that 'improving' spontaneous stands by adding new plants is possible. However, a proper assessment of competition conditions is needed to get a permanent establishment of these new plant communities. Theories that originally derive from vegetation ecology (i.e. plant strategies and equilibrium models) can help us to understand the underlying processes and to make these interventions more successful.

Planting Design / Spontaneous Vegetation

Towards a New Approach in Planting Design

Since the 1980s, cost-cutting measures by public authorities in most countries of Central Europe have resulted in green spaces losing their quality. They are no longer adequately cared for: there is a maintenance crisis, as well as insufficient money and technical knowledge. Therefore, management concepts for public green spaces have changed (Schmidt 2005) and in the future it is likely that more traditional high-cost plantings can only enrich urban life in a few, small areas. In view of this situation, it is worthwhile to develop new alternatives for green planning in urban areas.

Meadow-like vegetation makes diversity of species increase and requires less maintenance than the traditional lawn. This approach to planting has therefore become a general strategy.

Since the 1970s, representatives of nature conservation and the natural garden movement in Germany and the Netherlands have emphasized the biozoonotic value of spontaneous vegetation in order to bring it into the consciousness of the urban public. Louis Le Roy, who had great influence on landscape architects at that time, puts it like this in his book Natur Ausschalten, Natur Einschalten:

"It is more advisable to begin with the vegetation that grows spontaneously during construction, than to destroy this vegetation and to replace it with grass verges. Natural vegetation can provide a nice contrast to the cultural products of the human spirit" (*Le Roy 1978: 94, translated*).

He also states: "Activating the regulating mechanism of nature demonstrates the uselessness of any system that groups plants based on the false assumption that colour gives the correct information about how we can organize them. What applies to colour applies also, naturally, to all other aesthetic elements (form, structure, line, space making)" (*ibid, 126, translated*).

Later planning and aesthetic representations have increasingly included spontaneous vegetation. Social, living and everyday conditions of the residents can be indicated through spontaneous plant communities:

"In a neighbourhood's plant communities, the social, living and everyday conditions of the residents can be read and interpreted within the framework of the problem of open-space planning. ... Biotope and nature conservation play a role only on the periphery" (*Lührs 1986: 131, translated*).

Aesthetic Value of Spontaneous Vegetation in Cities

For the urban environment, with its particular climatic and edaphic requirements, entirely different concepts are also conceivable (*Kühn 2003a, Hitchmough 2004*). These concepts include spontaneous vegetation and are often based on studies of natural plant communities (*Dunnett 2004*).

What contribution can spontaneous vegetation make? Spontaneous vegetation, defined as all plants that develop without intentional horticultural input, is a characteristic element of the urban environment. It grows at no financial cost, is authentic and is always appropriate to site conditions. However, it is generally considered to be 'weeds' and is seen by many people as the indicator of a site that has been left to fall into decay or is poorly cared for. In order to use spontaneous vegetation properly, it needs to be 'improved', to be 'put on display' – but how may this be achieved?

Universally valid criteria for plantings in public spaces can hardly be found. For ornamental purposes, it is important that plantings 'enrich' the open space by creating meaning or emotion: one may find a plant beautiful (aesthetic value), it may be noteworthy (information value), its rarity may attract interest (conservation value), or it may remind us of something (associative value). This may also be the case with spontaneous vegetation when used for ornamental purposes. In a number of experiments carried out in Berlin over the last years, spontaneous vegetation has been observed and evaluated. Also, different approaches to 'improving' spontaneous plant communities have been tried by introducing different interventions such as particular maintenance measures, the introduction of new non-native species, etc.

In one case study on existing spontaneous herbaceous vegetation, the structure, texture and colour display of different sites close to the city centre of Berlin were documented over one year. This study has shown that the aesthetic effects can vary greatly (*Abicht 2001*). The two most contrasting results are presented here:

Site	Plant community	Soil	Use
1	*Artemisio-Tanacetetum* community	Sandy loam with gravels; dry to moderate moist; moderate nitrogen-rich	Succession area inside a public park; sporadic use
2	*Agropyretea intermedio-repentis* community	Sand to loamy sand; dry; nitrogen-poor	Central reserve of a dual carriageway; mown once a year

Table 1 Conditions of two recorded sites (*Abicht 2001*)

In the urban environment, many different plant communities may arise spontaneously. In order to employ them for landscape architectural purposes, they must be extensively available. Also, not all species have an attractive appearance – most, such as ruderal groundcover, or pigweed shrubs are overlooked because they offer no particular appeal. At the same time, plant communities should represent a relatively stable intermediate stage of succession so that they have sustainable growth, and do not require intensive maintenance.

There are not many spontaneous plant communities that fulfil these criteria. However, it is possible to work with woody vegetation to develop different kinds of forest types for recreation (*see Wild Urban Woodlands, Kowarik & Körner 2005*). This can lead to park-like woodlands in former industrial areas, such as the parks of IBA Emscher or Südgelände, Berlin, both in Germany.

The most significant brownfield herbaceous plant communities are those known as ruderal meadow perennials of the mugwort–tansy communities (class Artemisietea) (*Wilmanns 1989*). They grow on sites that typically have substrates that are not too nutrient-depleted, for example loamy sand or sandy loam that may also contain gravel. The soils are moderately dry to moist. Species of different competitive strengths may occur in varying dominances. Most common in urban Artemisietea communities in Central Europe are Tanacetum vulgare (tansy), Arrhenatherum elatius (oat grass) and Calamagrostis epigeios (wood small-reed). Such stands are rich in neophytes and they may also dominate (e.g. Solidago canadensis (Canadian goldenrod)). The species that gives its name to the class, Artemisia vulgaris (mugwort), only propagates in nutrient-rich soils. In wetter climates with heavy soils, clearing species may be found, such as Epilobium angustifolium (fireweed/willowherb). Artemisietea communities represent a temporary end to succession because the stands grow very dense, and therefore shrubs and the first tree communities require time to develop.

In drier, sandier or rockier areas, especially in more continental climates, Agropyretea intermedio-repentis communities can establish. Here, numerous attractively blooming pioneer species, often biennial, may be mixed in, such as Melilotus officinalis (sweetclover), Verbascum densiflorum (mullein), Oenothera biennis (evening primrose) and also Echium vulgare (Viper's bugloss).

In fertile, nutrient-rich soils (such as Site 1 in Table 1), plants of the Artemisio-Tanacetetum community grow quickly into thick stands. This can lead to a more homogeneous structure, especially if a few species dominate. If these are proliferous bloomers, such as Solidago canadensis, neophyte asters, or Epilobium angustifolium, the stand will achieve a correspondingly luxurious flowering effect, usually in yellow, white or pink (see Figure 1). To achieve a striking effect, however, large swathes of land are required.

If on the contrary, the conditions of the site are meager with a thin soil covering (such as site 2 in Table 1), the structure and texture of the individual plants becomes more obvious. Plants with basal rosettes especially stand out. In this case, a less homogeneous appearance results. No striking colour effect can be achieved, but when many individual plants bloom, they create a veil-like effect that catches the eye (see Figure 2: Agropyretea intermedio-repentis community).

Plant growth in all spontaneous plant communities proceeds very slowly and the flowers appear only later in the year. On dry soils, this may be in early summer; on fertile soils, flowers may not appear until midsummer or fall. Satisfactory spring effects are rare. The appearance in any year is also strongly dependent on the weather, especially precipitation.

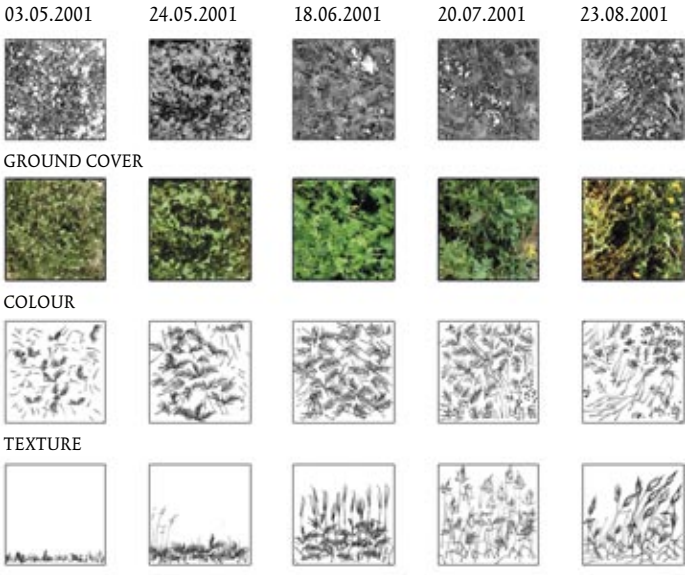


Figure 1 Aesthetic view on a spontaneous growing stand (1 x 1 m2) (Artemisio-Tanacetetum) (*Abicht 2001, modified*)

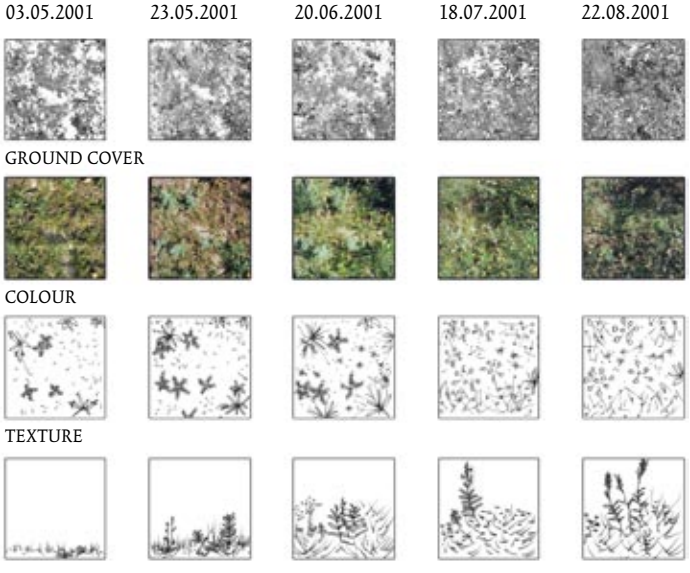


Figure 2 Aesthetic view on a spontaneous growing stand (1 x 1 m2) (Agropyretea-intermedio-repentis community) (*Abicht 2001, modified*)

Alternative Strategies: Intervening in the Spontaneous

The results above show that spontaneous vegetation does not offer the same aesthetic value as traditional plantings. In addition, the uses of spontaneous vegetation for ornamental purposes in public or private areas are largely misunderstood. Therefore, to use spontaneous vegetation for ornamental purposes, a kind of enhancement or design work is necessary. To intervene in spontaneous vegetation to improve it aesthetically may seem as a contradiction: 'spontaneous' means that which occurs by chance, without conscious design intent. 'Intervention' means well-intended design work and creates more or less sophisticated new types of plantings that include some spontaneous vegetation. Essentially, there are four ways of dealing with spontaneous vegetation:

1. Maintaining the current state (status quo) through appropriate measures (for example, maintaining a meadow by mowing);
2. Allowing succession to proceed naturally (no intervention takes place: a new kind of wilderness will be created);
3. Effecting changes in succession through interventions (for example, creating an open grove-like effect by removing branches and shrubs in a mature stand);
4. Improving the aesthetic value by changing the species composition.

The first three approaches have an influence on vegetation structure and may lead to kind of maturing or succession, but will not change species composition directly. The author's approach is based on conscious and direct changes of species composition (that of 4 above); this approach uses plants that can clearly build a stable community under the given conditions of a site and tries to transform the plant communities according to a design perspective. The author is thus dealing with design using spontaneously occurring species and combining them with ornamental plants. (*Kühn 2003b, c*). These may be plants with conspicuous flowers, with large, basal leaves and a striking form, or with a very fine texture that can serve to enrich the existing vegetation.

The success of such measures depends on the ability of the introduced species to coexist with the existing species – in other words, whether they can compete under the given conditions.

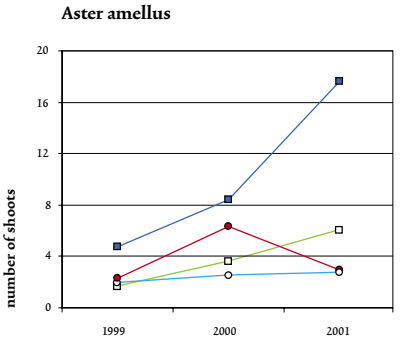
In a three-year-long field experiment, the ability of different species to compete against a stand of Calamagrostis epigeios and Tanacetum vulgare under two different soil conditions (see Table 2) was tested. The three target species, Aster amellus, Monarda fistulosa and Solidago canadensis were planted separately and in competition with these two matrix species. Figure 3 shows the results.

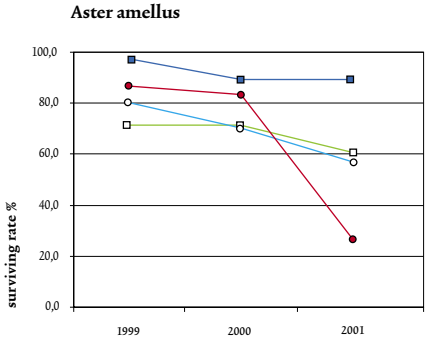
The results of three representative species are shown as follows: Aster amellus could – with competition – only survive under poor conditions (Site 1). But there were less flowering shoots. Best results were under rich conditions (Site 2) without competition, such as the conditions in traditional flowerbeds. Therefore, Aster amellus is not recommended for enriching a spontaneous Artemisietea society but may survive in less vigorous vegetation. In this case, many individual plantings would be necessary to create a striking flower display.

Monarda fistulosa, an American prairie plant, was able to survive under all conditions. But the number of shoots was apparently reduced with competition. It grew better in rich soil, there the number of shoots was

Site	Matrix (spontaneous) species	Target species	Soil and nutrient supply (average)	Use
1	*Calamagrostis epigeios* *Tanacetum vulgare*	*Aster amellus* *Monarda fistulosa* *Solidago canadensis*	Sandy loam pH 6.5 N 2.25 (kg/ha) P 27.1 (mg/100g) K 6.0 (mg/100g)	Moan once a year (winter)
2	*Calamagrostis epigeios* *Tanacetum vulgare*	*Aster amellus* *Monarda fistulosa* *Solidago canadensis*	Sandy loam pH 6.3 N 8.6 (kg/ha) P 37.3 (mg/100g) K 18.1 (mg/100g)	Moan once a year (winter)

Table 2 Conditions of investigation sites at Berlin-Dahlem (72 m NN; 589,2 mm precipitation) (Kühn 2003)



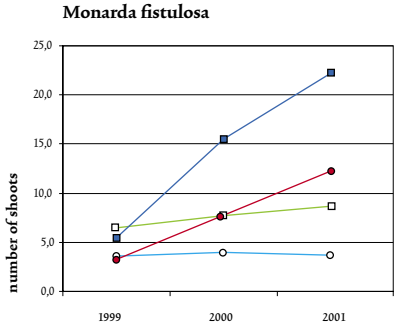


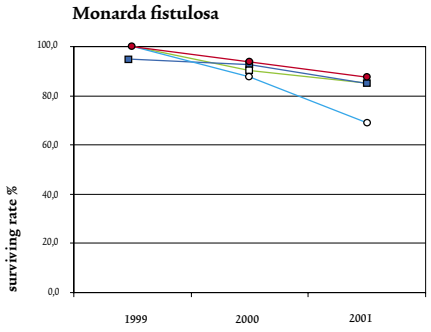
Sprouts total *Aster Amellus*

	poor; e.C.	rich; e.C.	poor; w.C.	ritch; w.C.
1999	1,6	4,8	1,9	2,3
2000	3,6	8,4	2,5	6,3
2001	6,0	17,6	2,7	3,0

Survival total *Aster Amellus*

	poor; e.C.	rich; e.C.	poor; w.C.	ritch; w.C.
1999	71,1	97,4	80,0	86,7
2000	71,1	89,5	70,0	83,3
2001	60,5	89,5	56,7	26,7



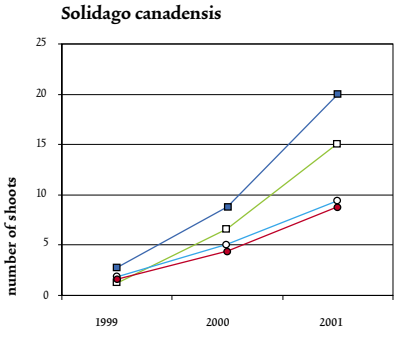


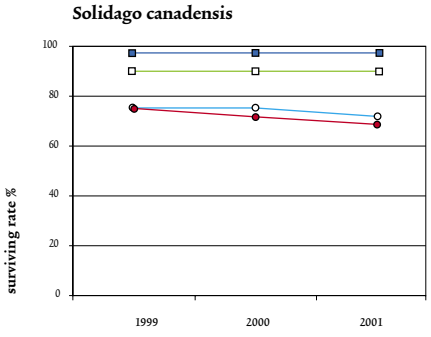
Sprouts total *Monarda Fistulosa*

	poor; e.C.	rich; e.C.	poor; w.C.	rich; w.C.
1999	6,5	5,4	3,6	3,3
2000	7,7	15,5	3,9	7,7
2001	8,6	22,2	3,7	12,3

Survival total *Monarda Fistulosa*

	poor; e.C.	rich;e.C.	poor; w.C.	rich; w.C.
1999	100,0	95,0	100,0	100,0
2000	90,0	92,5	87,5	93,8
2001	85,0	85,0	68,8	87,5





Sprouts total *Solidago*

	poor; e.C.	rich; e.C.	poor; w.C.	Critch; w.C.
1999	1,2	2,8	1,8	1,6
2000	6,6	8,8	5,1	4,4
2001	15	20	9,3	8,8

Survival total *Solidago*

	poor; e.C.	rich; e.C.	poor; w.C.	ritch; w.C.
1999	90,0	97,5	75,0	75,0
2000	90,0	97,5	75,0	71,9
2001	90,0	97,5	71,9	68,8

Figure 3 Number of shoots and surviving rate of Aster amellus, Monarda fistulosa und Solidago canadensis in a stand of Calamagrostis epigejos and Tanacetum vulgare after 1, 2 and 3 years on two different sites (poor conditions: poor; rich conditions: rich) and with (w.C.) and exept competition (e. C.).

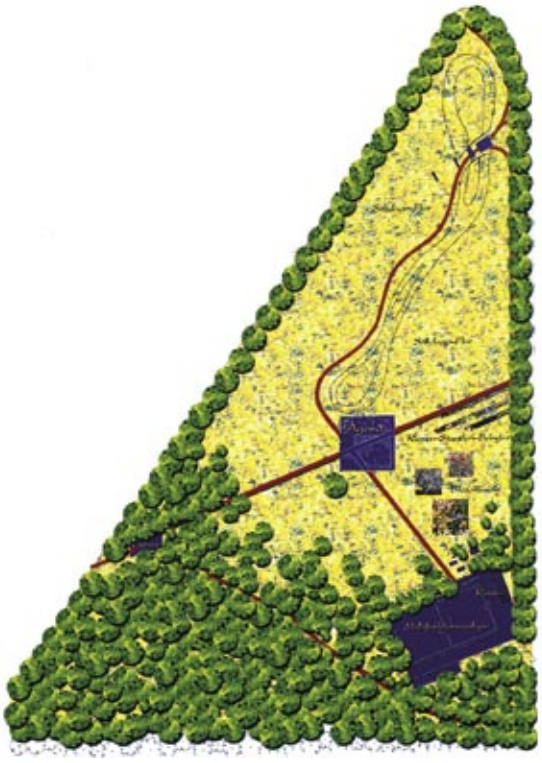


Figure 4 Design concept for a brownfield close to Berlin centre covered with Solidago canadensis (yellow) (Morgenstern 2001)

higher and so was the survival rate. Therefore, Monarda fistulosa may be planted within Artemisietea species, but preferably under rich conditions.

Solidago canadensis is also an American species, and one that invades European plant societies. This at first established less well under competition conditions. But over time, the survival rate remained constant. Although the number of shoots was higher without competition, the number of shoots increased steadily during the three years in all treatments. That shows that this plant will be able to compete against the matrix species permanently. On one hand, introduction of Solidago is apparently successful, but on the other, it may threaten natural native vegetation, where possibilities to escape plantings are present.

In these trials in Berlin, successful plantings on nutrient-rich soils have also been achieved with Lychnis chalcedonica and Aster lanceolatus. Under poor conditions, Achnatherum calamagrostis, Buphthalmum salicifolium, Centhranthus ruber, Doronicum pardalianches and Lychnis chalcedonica were able to survive and produce flowers.

Alternative Strategies: Intervening in the Spontaneous

Introducing other non-native plants by sowing

There is little experience of enriching existing plant communities by sowing. Results from experiments for nature conservancy purposes show that the establishment of new species without disturbance or removal of top soil is nearly impossible (*Krebs 1992, Kühn 1997*). North American prairie species only rarely get established through sowing when they have to compete against spontaneous plants (*Hitchmough et al. 2003, 2004*).

Illustration 1 Salvia nemorosa and Centranthus major have been added to a stand of spontaneous plants. They produced a first flowering display in early summer.

Illustration 2 Trials at the Berlin Technical University: contrast between the plants and mowed lawn helps the spontaneous vegetation to receive more attention.

Promoting a longer flowering season with the geophytes

Another goal may be additional flowering in spring and early summer, with additional bloom colours. Spring flowering is relatively easy to accomplish with large-scale introduction of geophytes whose flowering can be spread over a period of time (e.g. tulips and daffodils, but only using those that can survive long in the wild with guaranteed blooming) (*see Seyfang 2002, 2003*).

Adding early-flowering meadow plants

Early-summer flowering can be achieved by adding meadow plants (e.g. Salvia pratensis, meadow sage) (see Illustration 1). Normally these will disappear in spontaneous vegetation after some years, because they will be driven out by late-blooming perennials. To establish them permanently, a mowing after blooming in summer will be necessary. I1

Illustration 3 Hafeninsel Saarbrücken: Meadow of spontaneous plants with spiralling rows of old paving stones and bricks.

Illustration 4 Landschaftspark Duisburg Nord: view from the old Thyssen smeltery to the surrounding green spaces.

Directed maintenance interventions

Only one mowing is really necessary with ruderal perennials, in order not to interfere with the ability of these communities to maintain themselves (and to maintain the system with a minimum of care). Regular mowing, once a year, leads to increased homogenization of the stand. Preferably it should be undertaken towards the end of the winter. Removing the cuttings improves growth in the spring and supports the geophytes and meadow plants that develop early. A second cut during summer may make sense, if meadow plants should be preserved. Varying the cutting regimes within the same space to create an internal structure is also an option.

Putting the vegetation into play with its context

Even when the aesthetics of the spontaneous vegetation have been improved, generally the effect is not successful without creating a contrast with the surroundings. Spontaneous vegetation in uncared-for surroundings appears uncared for. For this reason, everything must be put into effect in accordance with the appropriate landscape architectural design in order to create the desired effect (see Figure 4 and Illustration 2).

New Perspectives in Urban Planting Design

The results of the use of spontaneous vegetation in urban planting design have more than just economic advantages. Vegetation can also tell us something about the historical uses of a site. A way of working with spontaneous vegetation has developed from this idea – a way of managing parks that have been established on former industrial sites. There the vegetation is seen, together with structural ruins, as a clue to the industrial culture and is incorporated as a sign of the decline and transformation of the landscape.

When the vegetation and the structures are intentionally left as they are, the residents are confronted with the industrial past of the site. They may build a relationship to it and develop a pride in the history of the place and perhaps in their own history as well. The public may be motivated to become involved.

Nature of the first kind:	**NATURE 1**
Old wilderness Woodlands, Fens and Bogs, Rivers and Lakes, Rockformations ...	
Nature of the second kind:	**NATURE 2**
Traditional cultural landscape Meadows and Pastures, Hedges, Fields ...	
Nature of the third kind:	**NATURE 3**
Functional greening Parks, Gardens, Urban Green Structures ...	
Nature of the fourth kind:	**NATURE 4**
New wilderness Urban Industrial Woodlands, Urban Spontaneous Vegetation ...	

Figure 5 Four kinds of nature (Kowarik 1992, 2005a; modified) (a quite similar typology for nature 1 to 3 has been developed by J. D. Hunt 1999)

The Harbor Island in Saarbrücken (*Latz 1987*) was one of the first sites to be derived from this concept (see Illustration 3). It worked as a model for other regions, especially for the Ruhrgebiet, where in 1988 the decision was made to carry out an international building exhibition (IBA Emscher Park). This involved a ten-year targeted programme to provide the framework for the ecological and economical reconstruction of the region with over 100 individual projects, for example the Landschaftspark Duisburg Nord (see Illustration 4) (*Dettmar & Ganser 1999*).

Illustration 5 Solidago canadensis (Canadian goldenrod), a former garden plant, has now become part of spontaneous vegetation.

Illustration 6 Südgelände Berlin: Walkways open the former marshalling yard to the public.

The spontaneous vegetation of these sites remained, and is a part of the total experience. The spaces are not only given over to succession, however. The ways in which the individual areas are to be directed are laid out in a maintenance plan. As in a classic landscape garden, the vegetation provides the framework for the entire work of art (*Linne 1994, Dettmar 2005*).

The species that are found on these sites may come from different realms: the natural vegetation, the characteristic vegetation of industrial sites including neophytes (see Solidago canadensis in Illustration 5) and intentionally cultivated plants, such as garden species. This special combination of species is intensively studied within the framework of urban ecology research. Ingo Kowarik describes it as nature of the fourth kind (*Kowarik 1992, 2005a*; see Figure 5). (A similar typology for nature kinds 1 to 3 has been developed by J. D. Hunt *1999*).

This new kind of vegetation may develop on the sites of former mines and heavy industry, but may also be found along abandoned railways (*Rebele & Dettmar 1996*). In order to protect the nature developing there, to keep these sites from being used for new purposes and to encourage further natural development, such sites should be placed under conservation.

The Schöneberger Südgelände (designed by ÖkoCon and planland) (Illustration 6) is based on this theory. It was once a part of a railway station at the edge of Berlin's inner city, abandoned after World War II. Over the past decades on the 25-ha site, a process of urban succession has been taking place. The design for the park is based on complete integration of existing vegetation and site conditions. To preserve the vegetation and functioning of the park as a nature habitat, there are restrictions defining acceptable activities in this 'wild urban nature'. Complete reforestation, however, will be prevented with maintenance, especially in the valuable clearings and open birch stands (*Knoll & Kowarik 1997, Langer 2002, Kowarik & Langer 2005*).

One problem that needs to be addressed is related to the introduction of invasive species. Adding non-native plants to spontaneous vegetation requires plants that are able to establish permanently in such kinds of stand. This needs highly competitive plants and involves the danger of introducing new neophytes (*Kowarik 2005b*). It cannot so far be predicted as to which plants might become invaders; there is no reliable risk assessment (*Kowarik et al. 2003*). Therefore, this kind of enhancement is not recommended for areas in the countryside or close to dispersal pathways like rivers, highways or railway tracks, where plants can spread easily from.

Conclusion

The idea of using spontaneous vegetation for ornamental purposes is discussed from different points of view:

Spontaneous vegetation is authentic and is a reminder of the history of the site;

Spontaneous vegetation is part of nature and the natural dynamic; therefore it connects people closer to nature than any ornamental vegetation;

Spontaneous vegetation can be maintained for a long time by less care and with low costs.

Until now, spontaneous vegetation has not been regarded to be of aesthetic value in itself. Investigations show that there is an aesthetic potential that has not so far been achieved. This may be achieved by improving the natural stands of spontaneous vegetation.

Such improvement must be guided by design work. Additional species will help to make spontaneious vegetation more attractive to people. The lists of possible plants that may enhance spontaneous stands might seem to be almost endless, but to keep these species permanently, to create a new plant society combining spontaneous plants and ornamental plants,

their competitive ability has to be tested. Therefore competitors and habitat conditions are of central interest.

To test every species on its competitive ability (like the author did with Aster amellus, Monarda fistulosa and Solidago canadensis) may be one option (*Kühn 2003*). In addition, theories originally derived from vegetation ecology (i.e. plant strategies and equilibrium models) can help to understand the underlying processes that make these interventions work successfully. Plant strategies especially, which are described by Grime (*1979*) may offer a useful tool to estimate the stability of artificially created plant communities. Unfortunately until now, only British native species have been tested and described in this regard (*Grime et al. 1988*).

However, from these limited experiments and observations, it is obvious that the use of spontaneous vegetation in urban planting design has a great potential, and to realize this more research is needed.

Biographical Notes

Prof. Dr. Norbert Kühn, born 1964, studied natural resource development and landscape architecture at the Technical University of Munich-Weihenstephan. Doctorate in the department of vegetations ecology at the same institution. From 1998, he taught outdoor botany and plant use at the Technical University of Berlin. In 2003 appointed professor at the TU Berlin for landscape engineering, vegetation technique and planting design. His academic and research interests lie in historic and contemporary planting design, plantings for extensive care and theories in vegetation ecology.

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