

## Defining a typology of peri-urban land-use conflicts – A case study from Switzerland

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### ABSTRACT

Land-use conflicts are a concern for landscape planners, especially in peri-urban areas. Planners need to understand these conflicts better in order to make optimal decisions on land-use allocations and conflict management. Such conflicts, however, are complex entities. A common approach for better understanding complex entities is to categorize them into a limited number of types. This study contributes to this end by presenting a typology of land-use conflicts for a peri-urban area of Switzerland. The primary data source is a content analysis of print media reports on land-use conflicts in a larger geographical area from 2006 to 2009. Information on conflict issues is extracted from the reports, transformed via presence/absence coding, and then further processed using cluster analysis with Jaccard's distance measurement. The results of the cluster analysis are displayed as dendrogram and correlation table. Six meaningful types of peri-urban land-use conflicts are identified, namely 'Noise pollution', 'Visual blight', 'Health hazards', 'Nature conservation', 'Preservation of the past' and 'Changes to the neighborhood'. The conflict types do not exist independent of each other, but are often closely related. Analyzing these relationships reveals that alleged 'main' issues may not necessarily be the 'real' issues. These insights are crucial for effect-oriented landscape planning.

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### 1. Introduction

The spatial arrangement of incompatible land uses may cause land-use conflicts (McHarg, 1969; Steiner, 2008). Landscape planning is concerned with the resolution or anticipation of such conflicts (Humphreys and Walmsley, 1991; Torre et al., 2006). A good understanding of land-use conflicts is crucial for to this task (Mann and Jeanneaux, 2009). However, the complexity of land-use conflicts often conceals the necessary understanding (Alessa et al., 2008; Gresch and Smith, 1985). Every land-use conflict is unique and emerges from site-specific social, economic, and ecological interactions (Campbell, 1996). In consequence, little data and theory on land-use conflicts are available to date (van Dijk and van der Wulp, 2010).

Land-use conflicts occur in a political context since land use is highly regulated in most societies (Platt, 2004). Swiss municipalities organize their planning with land-use plans (Gennaio et al., 2009), mandated by the federal spatial planning law (Petitpierre, 1999). These plans show how different land-use activities are to be

performed in time and space. Once drafted, a municipality presents the plan to its inhabitants. They then (and also when amendments to the plan are proposed) have the right to object. Such objections and the subsequent process of negotiations and decisions are the core of land-use conflicts.

The term 'land-use conflict' is not clearly defined. Based on a review of conflict literature, a conflict exists whenever 'incompatible interests' occur (Deutsch, 1973), and the two basic elements of every conflict are 'conflict parties' and 'conflicts issues' (Rapoport, 1974). We pair these characteristics with a geographical component and define land-use conflicts as follows: a land-use conflict occurs whenever land-use stakeholders (=conflict parties) have incompatible interests related to certain land-use units (=geographical component). The incompatible interest result from negative effects (=conflict issues) emitted by the land-use unit under question. Conflict issues can be understood in a broad sense as general topics of concerns, e.g. 'protection of the environment' (Bengston et al., 2004). In this study, we define them in a narrow sense as the actual causes of a conflict. In affluent societies these causes are often undesired land-use externalities like noise, odor, or visual blight (Bryant et al., 1982). The following example illustrates the definition of land-use conflicts: the construction of a new industrial facility within an ecologically vulnerable area may cause a land-use conflict between the party who is in favor of the construction and the party which is concerned with the conservation

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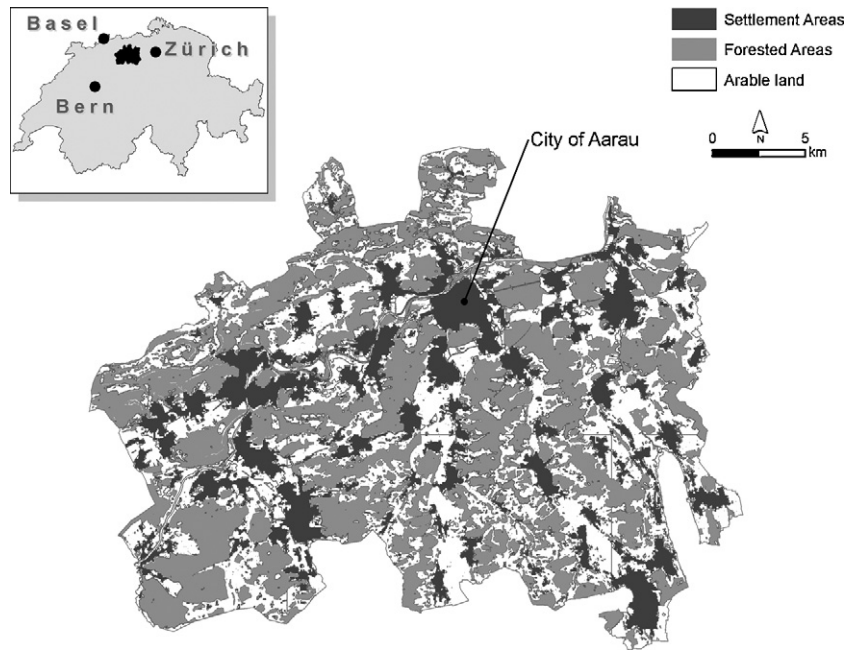


Fig. 1. Study area.

of nature. The conflict issue is the potentially noxious emission produced by the industrial facility, because this emission has a negative effect on the ecosystem the nature conservationists want to preserve.

The existing literature on urban and peri-urban land-use conflicts can roughly be divided into three groups. The first group consists of case studies in the developed world, focusing on in-depth analyses of individual conflict cases or conflict issues, e.g. the siting of natural resource extraction sites (Marinoni and Hoppe, 2006), gypsy campgrounds (Greenfields, 2008), or wind energy plants (Josimovic and Pucar, 2010). The second group focuses on urban land-use conflicts in developing countries. These studies are mainly concerned with legal issues of land ownership (e.g. Campbell et al., 2000; Deininger and Castagnini, 2006). The third group focuses on typologies of conflicts in urban and peri-urban areas of the developed world (e.g. Humphreys and Walmsley, 1991; Janelle, 1977; Torre et al., 2006). This small group of authors uses mainly qualitative methods to understand the overall pattern of land-use conflicts. The purpose of this paper is to advance the research on land use typologies using a quantitative approach, i.e. applying a cluster analysis.

The goal of this study is to systematically reduce the complexity of land-use conflicts. This is achieved by creating a conflict typology. Conflict typologies exhaustively represent the range of land-use conflicts likely to occur in a given environment (Janelle and Millward, 1976). In contrast to in-depth case studies, typologies account for the system-wide impacts of specific land-use decisions (Dear, 1977). They are a necessary tool for making informed planning decisions (Torre et al., 2006).

Categorizing research objects into a limited number of types is a common approach to reduce their complexity (Lazarsfeld and Barton, 1951). When creating types, special notice should be paid to the selection of the key variable, i.e. the variable on which the typology is based (Bailey, 1994). Janelle and Millward (1976), for example, grouped conflicts based on issues, understanding issues in a broad sense like 'Transportation' or 'Housing'. Humphreys and Walmsley (1991) delineated types based on conflict parties, i.e. the stakeholders of the involved land-use units. Torre et al. (2006)

grouped conflicts based on the involved land uses. To our knowledge, conflicts have not been grouped based on conflict issues, i.e. conflict-causing land-use externalities. However, land-use externalities are a key aspect for sound land-use planning (Hersperger, 2006).

We collect conflict data through media content analysis, a common approach in land-use conflict research. This method of data gathering is particularly suitable for the Swiss context where many objections to proposed or existing land uses are communicated via print media. Conflict data is coded and clustered using multivariate statistical analysis. The quantitative methods allow us to identify and discuss relationships between types beyond the level offered by qualitative approaches.

The study is set in a peri-urban area of Northern Switzerland. The multifunctionality of peri-urban landscapes poses special challenge to landscape planning and makes them particularly suitable for the study of land-use conflicts. Peri-urban landscapes refer to the transition zone between urban and rural landscape (Meeus and Gulinck, 2008). Land-use patterns in these landscapes are highly fragmented and experience dynamic changes as the various land-use stakeholders compete over the limited land available (Allen, 2003; Antrop, 2004). These factors make peri-urban landscapes more susceptible to land-use conflicts than less dynamic and less heterogeneous landscapes (Hoggart, 2005).

## 2. Materials and methods

### 2.1. Study area

The study area is located in the Swiss Central Plateau, a densely populated cultural landscape (Hediger, 2006; Kienast et al., 2007). The distribution area of the Aargauer Zeitung, a local newspaper acting as the data source, was selected as study area. The area comprises 96 adjacent municipalities covering approx. 1150 km<sup>2</sup>. The study area is located at the intersection of three major urban agglomerations, Basel, Bern and Zürich. The land-use pattern is characterized by a heterogeneous mosaic of agricultural, forested and residential land uses, attesting the area a genuine peri-urban

character (Fig. 1). The residential areas are popular with commuters to the nearby urban agglomerations and major transportation networks of national and international importance transect the area.

## 2.2. Data gathering

There are no public statistics that cover the land-use conflicts in the study area. We thus revert to media content analysis to collect the necessary information. Media content analysis has a long history of providing data for conflict analyses (Rucht et al., 1999; Tilly et al., 1975). Advantages of using a daily newspaper as data source for land-use conflicts are several: a fine temporal resolution, the coverage of a relatively large geographical area, and the certainty that conflicts mentioned in the news have reached a level of public relevance (Joerin et al., 2005).

The Aargauer Zeitung is acting as data source. It was manually checked for reports on land-use conflicts, starting with the paper published on September 30th 2009, and then tracing backward in time. The newspaper is published six times a week and has the highest circulation (125,000 copies) of all newspapers in the study region. It also serves as official venue for publishing administrative matters. For every land-use conflict mentioned by the newspaper, information on the involved conflict issues was extracted. The total number of conflict issues was recorded as an additional illustrative variable. The presence/absence of conflict issues was binary coded, so that each conflict case was represented as a column vector consisting of 0 and 1. Special notice had to be taken of semantic relationships (Rodrigues and Gaston, 2002). For example, the issues 'Noise (cars)' and 'Noise (machinery)' are semantically related. Both contain the word 'noise', which indicates a real-world similarity of the two conflict issues. However, this information is lost in the process of binary coding. Therefore, superordinate issues were introduced to account for semantic relationships. For example, the real-world similarity between the issues 'Noise (cars)' and 'Noise (machinery)' was accounted for by additionally introducing the presence of the (superordinate) issue of 'Noise nuisance'.

Having traced back the newspaper for 12 months, the number of newly recorded conflict issues dropped over the period of the next 12 months (from 41 down to 7). It was then assumed that the list of issues could be seen as representative. To verify this assumption, the content analysis was continued for another 12 months, which yielded ten additional issues. Data gathering was concluded after analyzing all the newspapers produced in the 36 months from October 1st 2006 to September 30th 2009. To keep the project manageable, an overall study period of 3 years was considered adequate to reveal a good range of the issues involved in the land-use conflicts currently occurring in the study area.

## 2.3. Typology creation

Agglomerative hierarchical clustering was used to delineate conflict types. Compared to other multivariate techniques its strength lies in minimizing within-type, and maximizing between-type variation (Aldenderfer and Blashfield, 1984). The distance matrix was calculated using Jaccard's distance  $J'$ . Jaccard was chosen in preference to other distance measurements as it only considers positive matches and ignores joint negative ones (Sneath, 1957) which do not indicate similarities between conflicts. Inter-cluster distances were calculated using average linkage. A sensitivity analysis was produced to scrutinize the results. For this, the cluster analysis was repeatedly run on a randomly altered ordering of the input table and the resulting clusters were compared with each other for identity.

The aim when determining the optimal number of clusters is to keep the overall number of clusters relatively low while at the same time keeping the clusters relatively separated (Thorndike,

**Table 1**  
Number of conflicts, and number of issues involved.

Land-use conflicts (total)		164	
Land-use conflicts involving	1 issue	93	(57%)
	2 issues	41	(25%)
	≥3 issues	30	(18%)

1953). The aggregate objective function (AOF) accommodates these demands (Messac et al., 2003). To this end, the dendrogram was iteratively cut at different height levels and the quotient 'wbratio' was calculated for each of the resulting cluster-sets (Hennig, 2009). This quotient refers to the average distance within clusters divided by the average distance between clusters. A small wbratio indicates a well separated set of clusters, a high wbratio indicates a poorly separated set. The wbratio was then plotted against the number of clusters. A local minimum revealed the optimal trade-off between the wbratio and the number of clusters and indicates the optimal set of clusters.

A dendrogram and correlation table display the final results. The table relates conflict issues to individual conflicts and reveals information on the composition of types as well as on relationships between types. All computations were done with R 2.9.0 (R Development Core Team, 2009) using the R-packages prabclus (Hennig, 2005) and fpc (Hennig, 2009).

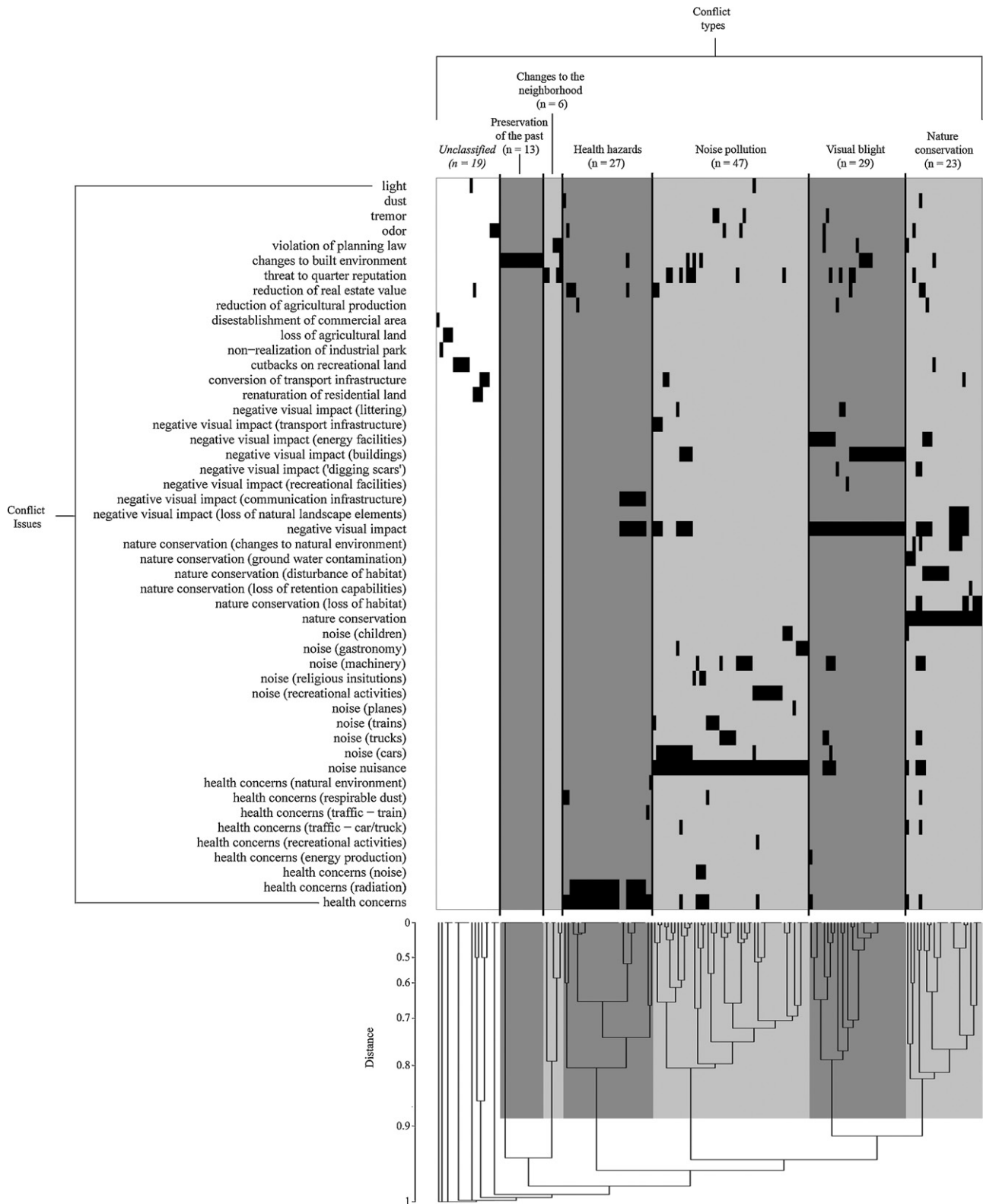
## 3. Results

A total of 164 land-use conflicts were recorded for the 96 municipalities. Forty-nine different issues were identified. Roughly half of all conflicts were caused by only one issue (Table 1). The other half was caused by two or more issues (maximum nine). See table in Appendix A for a detailed list of conflict issues.

The optimal number of clusters was found to be 13 (the process of determining this number is described later on in this section). One hundred and forty-five out of the 164 conflicts (88%) fall within six relatively large and meaningful clusters, hereafter referred to as conflict types (Fig. 2). The characteristics of the main conflict issues of each type provide the basis for naming the types: 'Noise pollution', 'Visual blight', 'Health hazards', 'Nature conservation', 'Preservation of the past' and 'Changes to the neighborhood'. The 19 remaining conflicts (12%) are distributed across 7 relatively small clusters with less meaningful characters. Conflicts of these clusters are caused by issues like 'Odor' or 'Light pollution'. Their distance to conflicts of any of the six conflict types is too far to assume meaningful relationships. Additionally, their distance to one another is also too far to group them into a meaningful seventh type. Since the aim of the study was to identify and describe the most prominent conflict types, these conflicts are excluded from further analysis and labeled as 'unclassified'.

Fig. 2 shows that one or two main issues (indicated by black cells) characterize each conflict type. Some main issues appear as a black bar that span the whole width of a conflict type. For example, 'Health concerns (radiation)' is the main issue of the type 'Health hazards'. Some issues are exclusive indicators for their type. For example, 'Nature conservation (disturbance of habitat)' only appears within the type 'Nature conservation'. Other issues are less exclusive and appear in various types. For example, 'Threat to quarter reputation' is the main issue of the type 'Changes to the neighborhood' but also appears in conflicts of the type 'Noise pollution', 'Visual blight' and 'Nature conservation'. All main issues, examples of conflicts, and detailed information on additional issues are presented in Table 2.

*Noise pollution:* Conflicts of this type are mainly concerned with noise emissions from transportation infrastructure. These emissions reduce the quality of life in adjacent residential quarters.



**Fig. 2.** A combination-graphic of a correlation table and a dendrogram. The six conflict types are indicated by alternating shades of grey. The correlation table relates the 49 conflict issues (along the left) to the 164 conflicts, arranged according to conflict type (along the top). Whenever an issue is present within a conflict the corresponding cell in the table gets marked in black.

Conflicts of this type are sometimes accompanied by the issue 'Health hazards (noise)' if the noise level extends beyond being a mere nuisance. This relates conflicts of the type 'Noise pollution' to those of the type 'Health hazards'. Conflicts of the type

'Noise pollution' may also be accompanied by the issue 'Threat to neighborhood reputation'. This relates conflicts of the type 'Noise pollution' to those of the type 'Changes to the neighborhood'. This concerns noise-conflicts that are related to asylum facilities or reli-

**Table 2**

The six conflict types described with main issues, examples and additional issues.

Conflict type	Main issues	Examples	Additional issues
Noise pollution (n = 47)	Noise nuisance Noise (cars) Noise (from recreational activities)	Residents are exposed to noise emissions from cars, trains, industrial compounds, or recreational activities like football matches	Health hazard (noise) Threat to quarter reputation
Visual blight (n = 29)	Negative visual impact Negative visual impact (buildings) Negative visual impact (energy facilities)	Reduction of the scenic beauty of the land- and townscape by man-made landscape elements like residential houses or overhead transmission lines	Threat to quarter reputation
Health hazards (n = 27)	Health concerns Health concerns (radiation)	Residents fear negative health impacts from e.g. non-ionizing radiation emitted by mobile phone antennas	Negative visual impact (communication infrastructure)
Nature conservation (n = 23)	Nature conservation Nature conservation (disturbance of habitat) Nature conservation (changes to natural environment)	Nature conservationists protest against the construction of gravel pits, residential houses, or mountain-bike trails	Negative visual impact (loss of natural landscape elements)
Preservation of the past (n = 13)	Changes to built environment Changes to the natural environment	Prominent landmarks like old buildings are altered or removed for the sake of development	–
Changes to the neighborhood (n = 6)	Threat to quarter reputation Reduction of real estate	Long-term residents are either concerned with a high influx of new residents with different ethnical or religious background, or with the advent of urban land uses (e.g. contact bars) in formerly rural areas	–
Unclassified (n = 19)	Odor Dust Light pollution	Hog farms emit odor; brickworks emit dust, advertisement signs cause light pollution	–

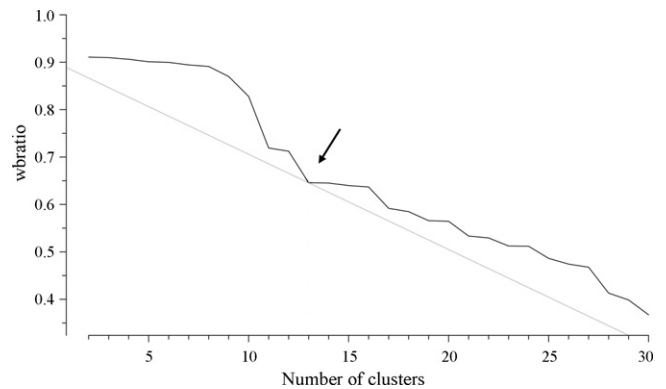
gious prayer rooms. In these cases noise may only act as proxy for the issue 'Threat to quarter reputation'.

**Visual blight:** Conflicts of this type are frequently caused by negative visual impacts of multi-storey, modern-architecture residential buildings. A frequent additional issue of these conflicts is 'Threat to quarter reputation'. The residents who are attracted by the multi-storey apartment buildings are perceived as being alien to the surrounding neighborhood with single family homes. This relates some conflicts of the type 'Visual blight' to conflicts of the type 'Changes to the neighborhood'.

**Health hazards:** Conflicts of this type are mainly caused by mobile phone antennas, a generally accepted, yet locally unwanted technological infrastructure. This situation is known as NIMBY. The acronym stands for Not-In-My-Backyard and refers to a situation where people only have positive attitudes towards a land use until they are confronted with it in their own backyard (Wolsink, 2007). Conflicts of the type 'Health hazards' are frequently accompanied by the issue 'Negative visual impact (communication infrastructure)'. Since negative effects of non-ionizing radiation on human health are not scientifically proven (Marcus, 2007), residents seem to accompany it with a more tangible issue like 'Negative visual impact'. This relates many conflict of the type 'Health hazards' to the type 'Visual blight'.

**Nature conservation:** Conflicts of this type are concerned with the destruction of species habitats. Conflicts of this type are frequently accompanied by the issue 'Negative visual impact (loss of natural landscape elements)'. This relates conflicts of the type 'Nature conservation' to those of the type 'Visual blight' and raises the question if 'Nature conservation' is really the prime concern of the objecting party. It seems that keeping a visually attractive environment for recreation is also of importance. Again, this raises the assumption that the main issue may not always be the real issue.

**Preservation of the past:** Conflicts of this type are mainly caused by changes to the built environment, e.g. the demolition of an old town hall from the 19th century. Especially older people are bound with strong emotional ties to these buildings and protest against such changes. This type of conflict does not have any additional



**Fig. 3.** The graph shows the wbratio (quotient of the average distance within clusters and the average distance between clusters), plotted against the number of clusters. The arrow points to the optimal trade-off between wbratio and number of clusters.

issues. However, the main issue of this type, 'Changes to the built environment', is frequently mentioned as an additional issue of other types.

**Changes to the neighborhood:** Conflicts of this type are related to societal topics such as superalienation or a clash of rural an urban lifestyles. Besides 'Threat to quarter reputation' protestors frequently bring forward the issue 'Reduction of real estate value'. This type of conflict does not have any additional issues. However, 'Threat to quarter reputation' is an additional issue of the types 'Noise pollution' and 'Visual blight'.

To determine the optimal number of conflict types, the dendrogram was iteratively cut at different height levels. The resulting sets of clusters contained 2 (minimum) to 30 (maximum) clusters. The wbratio of each set of clusters was plotted against the number of clusters (Fig. 3). We decided the optimal number of clusters to lie somewhere between 5 and 20 since any value above and below these thresholds would counteract the idea of reducing complexity. Within this meaningful range the graph follows a concave curve and the local minimum specifies the optimal number of clusters to

be 13. The sensitivity analysis confirmed the clustering method to be robust since conflicts were always assigned to the same clusters.

#### 4. Discussion

The development of a conflict typology revealed three major findings. First, conflict types are not mutually exclusive. For example, conflicts of the type 'Noise pollution' may eventually turn into conflicts of the type 'Health hazards', or conflicts of the type 'Visual blight' may turn into conflicts of the type 'Changes to the neighborhood'. This knowledge may go unnoticed if conflicts are studied in isolation, but is crucial for the design of conflict management strategies.

Second, analyzing the relationships between conflict types has shown that *main* issues may not always be the *real* issues. This connects our findings to the debate on ancillary conflict issues (Lecourt and Baudelle, 2004; Wester-Herber, 2004). Opposers to land uses tend to reinforce their statements through ancillary issues if the main issues are feared of not having enough weight on their own. Identifying real issues is not an easy task for a planner, albeit a task all the more important. Our approach offers a way to expose potential ancillary issues. For example, to give more weight to the *real* issue of 'Threat to neighborhood reputation', opposers bring forward ancillary issues like 'Noise (children)' (in the case of a proposed asylum facility), 'Negative visual impact (littering)' (in the case of a proposed gypsy campground), 'Noise (cars)' (in the case of a proposed erotic club), or 'Negative visual impact (buildings)' (in the case of a proposed mosque).

Third, the complexity of conflicts was reduced based on conflict issues. Understanding the effects land-use externalities have on adjacent parcels can improve the design of optimal spatial configurations (Hersperger, 2006). Many of the conflict issues listed here can be directly influenced through planning measures. A typology based on conflict issues is thus closely linked to everyday planning practice and facilitates the transfer of knowledge to real world planning applications.

Other conflict typologies partly match the findings of our study. For example, 1 of the 15 conflict types identified by Janelle and Millward (1976) is caused by the demolition of buildings that have historical, architectural or sentimental value. Another conflict type described by Janelle and Millward (1976) identifies high-rise apartment buildings as prominent conflict generators. One of the nine conflict types identified by Humphreys and Walmsley (1991) focuses on the conservation of flora and fauna. Nuisances like noise pollution are also frequently mentioned in other conflict typologies (Humphreys and Walmsley, 1991; Janelle and Millward, 1976; Torre et al., 2006). 'Health hazards' has not, however, been proposed in previous conflict typologies. It has emerged as a separate type in our study mainly due to recent innovations in mobile communication technology and the continued uncertainty about its impact on human health (Marcus, 2007). 'Visual blight' has also not been listed in previous conflict typologies. The emergence of this type is related to efforts by the Swiss planning authorities to promote a more compact settlement structure within settlement perimeters (Gennaio et al., 2009). This is achieved by in-fill development and causes conflicts with residents of the immediate neighborhood. They frequently criticize the unaesthetic design and unproportional size of the new buildings. Differences of our typology to those of other studies can thus be traced back to either technological advances or planning regulations inherent to the Swiss study area.

Almost all conflicts identified in the study area have been the focus of in-depth case studies before, e.g. health impacts of mobile phone antennas (Marcus, 2007), visual blight of wind turbines (van der Horst and Toke, 2010), noise from road traffic (Joerin et al., 2001), clashes of rural and urban lifestyles in peri-urban

landscapes (Hite, 1998), or the loss of place identity due to the demolition of historic buildings (Hunziker et al., 2007; Rollero and De Piccoli, 2010). The added value of a holistic approach like ours is to present these individual conflicts as interrelated parts of a conflict typology. The quantitative approach allowed us to analyze relationships between the individual conflicts and to give information on the relative frequency of each conflict. The conflict typology further revealed the paramount role of land-use externalities in the evolution of land-use conflicts. This information is crucial for effect-oriented landscape planning.

The method of agglomerative hierarchical clustering proved to be especially useful for the analysis of relationships between types since this clustering method produces mutually exclusive clusters that do not overlap. The clusters are robust because the sensitivity analysis showed that individual conflicts are always assigned to the same type. Average linkage also proved to be a good choice for linking the clusters. Complete linkage produced a small number of clusters that did not allow a meaningful interpretation. Single linkage produced a high number of small clusters with each cluster being composed of almost identical conflicts. However, one limitation of this clustering method is the hard-coding of the news reports. Caution has to be spent in order to not induce a skew of information while transferring qualitative information into column vectors of 0 and 1. Nevertheless, the results show that the clustering method reveals insights into land-use conflicts beyond a level acquired by previous qualitative assessments.

A few potential limitations of this study warrant discussion. One is concerned with the method of data gathering, as bias in published news may exist. One type of bias concerns the selection of news, e.g. the number of conflicts gathered through media content analysis is likely to be an underestimation, as it does not take into account any conflicts which people have failed to complain about publicly (Gresch and Smith, 1985). A second form of bias is the possible distortion to the contents of news, e.g. the description of conflict details (Snyder and Kelly, 1977). Despite these potential biases, news coverage is considered a valuable data source for conflict analysis, given the potential of the press to shape public awareness and attitudes over local issues (Janelle, 1977; Webb and Raffaelli, 2008). Ley and Mercer (1980) add that any other data source might be likewise biased and probably less complete. Another possible limitation of this study is its narrow geographical focus. The 1150 km<sup>2</sup> of the Central Plateau in Northern Switzerland provide only a selection of land-use conflicts. Since land-use conflicts involve culture driven value systems (Gresch and Smith, 1985), a narrow geographical focus limits the transferability of the results. Nevertheless, we expect that our results are transferable to a wide range of European peri-urban landscapes.

News reports provide much more information than just conflict issues. From each article further information could be extracted with the aid of media content analysis software. Future research should add this to the results of the current study in order to better understand the individual types. For example, news reports generally reveal the stakeholders and the location of land-use conflicts. Georeferencing conflict issues and linking them with stakeholders would certainly benefit proactive landscape planning.

#### 5. Conclusion

This paper presents a conflict typology that reduces the complexity of land-use conflicts in a peri-urban landscape of Switzerland. Two elements distinguish our typology from previous ones. First, we used a quantitative approach instead of a qualitative approach. The quantitative approach reveals relationships and dependencies between the conflict types. This knowledge can support the design of conflict management strategies. Second, our

typology is based on land-use externalities as key variable. Sound land-use planning already adheres to the effects one land use exerts onto others. Our results thus connect well to today's effect-oriented landscape planning.

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## Appendix A.

Conflict issues involved in land-use conflicts occurring in the study area; the count indicates the total number of conflicts each issue is involved in.

Issue (alphabetical order)	Examples	Count
Changes to built environment	Demolition of historic buildings, construction of multi-storey apartment blocks	23
Conversion of transport infrastructure	Construction of residential housing, designation of nature conservation area	6
Cutbacks on recreational land	Construction of residential housing, road construction	6
Disestablishment of commercial area	Construction of residential housing	1
Dust	Natural resource extraction facilities	2
Health concerns (energy production)	Risk of accidents at nuclear power plant	1
Health concerns (natural environment)	Mosquito-borne diseases originating from water bodies	1
Health concerns (noise)	High intensity aircraft noise	3
Health concerns (radiation)	Non-ionizing radiation from mobile phone antennas	21
Health concerns (recreational activities)	Crashing of remote-controlled planes	1
Health concerns (respirable dust)	Brickworks	4
Health concerns (traffic – car/truck)	Increased risk of accidents due to inadequate traffic guidance	3
Health concerns (traffic – train)	Increased risk of accidents due to inadequate railroad crossing facilities	1
Light pollution	Light emitted from advertising signs at night	2
Loss of agricultural land	Road construction	3
Nature conservation (changes to natural environment)	Logging of prominent trees	6
Nature conservation (disturbance of habitat)	Inappropriate noise emissions	8
Nature conservation (ground water contamination)	Construction of gas station	3
Nature conservation (loss of habitat)	Permanent removal of landscape elements like hedgerows or trees	7
Nature conservation (loss of retention capabilities)	Sealing of the soil surface with impervious materials	1
Negative visual impact ('digging scars')	Natural resource extraction facilities	3
Negative visual impact (buildings)	Undesired architectural style of public or residential buildings	21
Negative visual impact (communication infrastructure)	Mobile phone antennas	8
Negative visual impact (energy facilities)	Transmission lines	11

Negative visual impact (littering)	Careless littering on open space	3
Negative visual impact (loss of natural landscape elements)	Logging of avenue trees	6
Negative visual impact (recreational facilities)	Mountain bike tracks	1
Negative visual impact (transport infrastructure)	Railway tracks, roads, or multi-storey car parks	3
Noise (cars)	Noise from car traffic	13
Noise (children)	Shouting and cheering of children playing	4
Noise (gastronomy)	Loud conversations of guests in open air restaurants	5
Noise (machinery)	Noise from production facilities	13
Noise (planes)	Noise from sporting aircraft	1
Noise (recreational activities)	Noise from skate-boarding	9
Noise (religious institutions)	Noise from church bells or muezzins	3
Noise (trains)	Noise from freight trains	5
Noise (trucks)	Noise from heavy traffic	9
Non-realization of industrial park	Construction of residential housing at former industrial site	1
Odor	Hog farms, production facilities	8
Reduction of agricultural production	Health hazards for livestock	3
Reduction of real estate value	Undesired land use changes on, or adjacent to, private property	10
Renaturation of residential land	Conversion of former residential land into nature conservation areas	3
Threat to quarter reputation	Changes to the established neighborhood due to new buildings and a subsequent high influx of new residents (with assumed lower social status)	17
Tremor	Heavy machinery used for natural resource extraction	4
Violation of planning law	Unlawful construction works	6
<i>Superordinate issues:</i>		
	Health concerns	34
	Nature conservation	23
	Negative visual impact	56
	Noise nuisance	55

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