reviewed paper

SUPPORT – A Strategic Planning and Decision Support Instrument for Environmental Urban Planning in Berlin

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1 ABSTRACT

The city of Berlin aims at intensifying the consideration of environmental aspects of urban developments at an early stage of the legal planning processes. Therefore a strategic planning and decision support instrument is being developed. Environmental impacts of planning alternatives and scenarios concerning the whole city as well as for future use concepts at large scale urban subspaces shall be indicated.

The integration of a strategic planning instrument into decision-making processes makes a standardized, continuable data processing, based on assessment of areas necessary. Different geospatial planning and environmental data, which have been administerd separatly in different departments of the Berlin Senate, need to be interdepartmentally collected and processed. The implementation and sustainable functionality of an interdisciplinary tool involves specific demands regarding the availability, quality, and actuality of the processing data.

A great challenge is the appraisal of less predictable environmental effects caused by the imprecise character of information at strategic planning levels. An approach for the assessment of environmental effects of large scale planning alternatives and scenarios will be presented and discussed.

2 INTRODUCTION

Starting point for the development of a strategic environmental scenario tool was the implementation of the European Commission's Directive on Strategic Environmental Assessment (SEA Directive) (EC 2001). This European 'law' requires an environmental assessment of the effects of formal plans and programmes which set a framework for subsequent planning levels. For (informal) planning concepts this instrument is not implemented systematically, until now.

In Germany, the Strategic Environmental Assessment regulations have been transposed in the German federal building code (2004) and the Environmental Impact Law (2005). The SEA shall ensure that the likely significant environmental impacts of plans and programs are taken into account. Contrary to the project based Environmental Impact Assessment (EIA) the Strategic Environmental Assessment proactively informs decision-making by providing for suggestions on what alternatives to consider. It should help to identify best practicable options or alternatives for minimizing negative environmental impacts within the decision process in accordance with sustainability principles (FISCHER 2007; DALAY-CLAYTON & SADLER 2005; THERIVEL 2004).

In Berlin, Strategic Environmental Assessments are required for the city-wide Land Use Plan (Scale 1:50.000) as well as for the Landscape Programme (Scale 1:50.000) and other technical plans and programs. To provide a tool for a more operationalized environmental reporting on this superordinate level and to simplify the complexity of environmental statements for planning in Berlin a strategic planning and decision support instrument is being developed. Its main objective is to intensify the consideration of environmental aspects in urban planning processes at an early stage not only for formal but also for informal plans and decisions (FERRETTI et al. 2009).

The tool follows and facilitates the obligatory steps of the preparation of an Environmental Report:

- 1. describing the relevant legal reglementations
- 2. taking stock of the current state of the environment

- 3. Prediction of the likely significant environmental effects
- 4. Assessing Alternatives.

2.1 Preliminary work – Methodical Framework for the SEA

The Technical University of Berlin, Department of Environmental Planning and Policy (Prof. Köppel) and Department of Geoinformation Processing for Landscape and Environmental Planning (Prof. Kleinschmit) developed a methodical framework for the environmental evaluation of the preparatory land use and landscape planning process in the Strategic Environmental Assessment on behalf of the Senate Department for Urban Development (KÖPPEL et al. 2009).

A survey analysis has to be conducted for following assets: population, human health, animal and plants, biological diversity, soil, water, air, climate, landscape, culture, interrelationships (see § 2 (1) Nr. 1-4 German Environmental Impact Law). The Strategic Environmental Assessment does not develop any new environmental goals, but rather compiles existing environmental goals to determine relevant indicators for the survey analysis. A five-stage master scale indicating the weighing resistence in the planning process was developed, which allows different situations to be brought into a comparable formal frame (see Fig. 1). It signifies either the quality potential or the risk potential for a specific asset. This scale was transferred to 17 different environmental aspects. The Restriction area indicates areas with legally binding criteria which cause an unacceptable risk (e. g. exceeding of a respective threshold for noise pollution) or damage (e. g. land use in a water conservation zone I). The four Precaution areas indicate the quality potential of areas or the degree of an existing damage; precaution area I distinguishes areas with a very high technical or scientific relevance (quality potential) or with the highest need of preventing risks or hazards (risk potential) in Berlin (see Fig. 1).

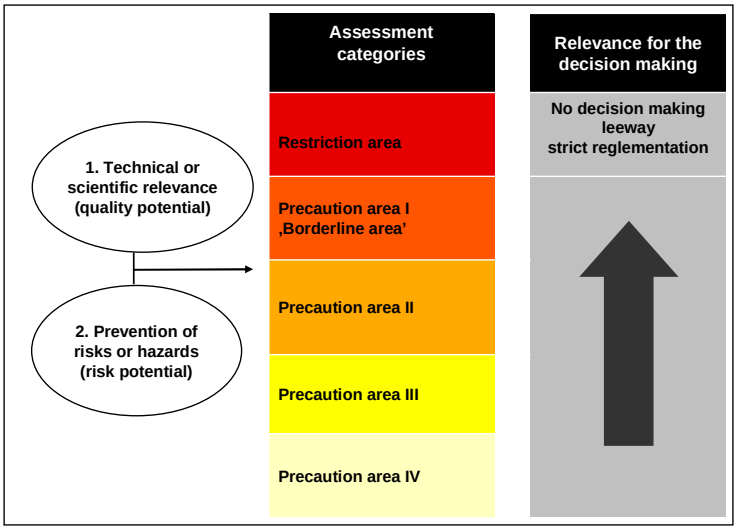

Fig. 1: Methodical framework for environmental evaluation (HERBERG et al. 2007, 79)

Many different existing assessments and data where taken into account and got involved according to the five assessment stages of the methodical framework (vgl. HERBERG et al.2007; KÖPPEL 2007).

An important requirement was the availability and accessabilty of environmental geodata. Necessary spatial data and scientific assessments were especially obtained from the Berlin Digital Envionmental Atlas, which represents an information system with basic urban and environmental data. It provides information on about 80 topics represented in approximately 400 maps including technical data (Senate Department for Urban Development 2010, online; WELSCH 2009).

2.2 Strategic Planning and Decision Support Instrument (SUPPORT)

Intensified foresighted operating on superordinate strategic planning levels shall increase environmental focus in Berlin's city area. The project SUPPORT is contributing to this aim by setting up an exemplary multiscale and –temporal concept (information system) within the project 'Strategic Planning and Decision Support Instrument' funded by the Deutsche Bundesstiftung Umwelt (DBU). The project is a cooperation between the Department Environmental Planning and Policy and the Department of Geoinformation

Processing for Landscape and Environmental Planning at the Berlin University of Technology and the Senate Department for Urban Development Berlin. It will amplify the way impact assessments on strategic and informal level are carried out by automatised appraisal. Moreover, the project aims at systematically integrating environmental considerations in the urban planning through a top-down approach. Therefore, the purpose is to create an interoperabilty in the heterogeneous geospatial planning and environmental data used for this instrument.

Environmental impacts of planning alternatives and scenarios concerning the whole city as well as future use concepts for large scale urban subspaces shall be indicated. Strategic actions, like the updating of the land use plan for a metropolitan area like Berlin, by their nature have wider ranging and less predictable outcomes than individual developments, for instance a legally binding master plan for a small spatial expansion. Therefore the assessment of the possible effects of strategic initiatives will be characterized by a high level of uncertainty. Methodological constraints for the assessment of environmental impacts of strategic plans or decisions are a wide geographical scale, extended time horizons and oftentimes a broad range of alternatives. Therefore methods and techniques should aim at simplifying the frequently complex issues under consideration at strategic decision-making levels. On the level of plans and programms argumentative assessment predominates (FISCHER 2007). In SUPPORT it is aspired to develop a spatial explicit method.

An important key aspect known for the formal Strategic Environmental Assessment is tiering. Tiering is to avoid duplication of issues in assessments of policies, plans, programs and projects. Therefore, once an issue has been assessed at a higher level it is not required to be considered at a lower level, other than perhaps to provide essential detail not provided in the prior assessment (JONES et al. 2005; JILBERTO in CARATTI 2004; FISCHER 2007; THERIVEL 2004; GONZALES DEL CAMPO 2008).

Below an introduction to the interoperability of spatial data as key requirement for the development of a spatial explicit planning instrument is described in chapter 2.2.1. and choosen scenario case studies of the SUPPORT-project are presented in chapter 2.2.2.

2.2.1 Interoperability

The implementation and sustainable functionality of an interdisciplinary tool requires a standardized, continuable data processing assessment of areas. This involves specific requirements regarding the availability, quality and actuality of the processing data. Different geospatial planning and environmental data, which have been administerd separatly in different departments of the Berlin Senate, are required to be interdepartmentally collected and processed. The city of Berlin offers a very good database for this purpose. Most data are provided by the environmental information sytem Berlin Digital Envionmental Atlas but also planning data (e. g. Landscape Programme) and other scientific data (e. g. species mapping) should be integrated (see HERBERG et al. 2007).

Therefore structural, semantic, and geometric heterogeneities in the data sets are an obstacle for the wide and integrative utilization of spatial information (see KIELER et al. 2007; VANDERHAEGEN & MURO 2004).

In general for establishing more homogeneous data-structures the INSPIRE (INfrastructure for Spatial InfoRmation) - Directive 2007/2/EG aspires to establish an infrastructure for spatial information in the european community for the purposes of community environmental policies and policies or activities which may have an impact on the environment (see Art. 1 Directive 2007/2/EG). It aims to allow users to identify and access spatial or geographical information from a wide range of sources in an interoperable way for a variety of uses (VANDERHAEGEN & MURO 2004). This advantageously affects the integration of environmental data for the development of such a strategic planning instrument, but has not yet been implemented in Berlin. The process of homogenization of environmental data initiated by the INSPIRE-Directive will last at least until 2019 in Germany (GDI-DE 2010, online). Not till then all relevant data will be provided homogeneously in Berlin. In addition different departments of the Berlin Senate are responsible for the accomplishment of environmental tasks and the associated data in Berlin, what is exacerbating this process.

Therefore first approaches to overcome the heterogeneties above mentioned are analyzed within the project. This includes for example a method for the necessary aggregation of incompatible spatial data with different spatial granularities or a first approach for the overcoming of semantic heterogenities for two different land use data (KÖPPEN et al. 2008; FÖRSTER et al. 2009).

2.2.2 Scenario-Case studies

To test the practical relevance of the tool scenario-case studies of current urban development processes were chosen. They had to be of relevance for the entire metropolitan area and at the same time suitable to demonstrate the field of application of the tool. The scenariocase studies were determined in cooperation with the concerned units in the Senate Department for Urban Development. It was decided for two kinds of scenarios: environmentally and constructional caused impacts in the urban surroundings. The first case study defines climate change as the impacting factor. Against this background a scenario integrating future demographic developments accompanied by changed land uses and respective alteration in bioclimatic conditions is described and assessed as well as a 'climate optimized' biotope network. Another strand analyzes climate relevant spaces within the building inventory in combination with green house gas emissions to show areas with prior need for climate protection and adaption measures.

The second scenario is an appraisal of the further development of the airport hub Berlin-Brandenburg International and the parallel process of putting out of operation of Berlin's two inner city airports. For these unique conversion processes the changed air and noise pollution as a consequence of modified traffic flows especially along the main routes leading to or from the airport surroundings are considered. Two approaches will be tested: The first one working with the more standard overlay method. The second scenario is more complex and will build on a tool for traffic modeling, whose results will be used to show potential impacts on the environmental assessets. In the following section the case study "airports Berlin" will be discussed.

3 CASE STUDY "AIRPORTS BERLIN"

In cooperation with the Senate Department for Urban Development it was determined to develop an "airport scenario", taking up and combining the assessment of the conversion of Berlin's two inner city airports and the expansion of the international airport in the metropolitan region Berlin-Brandenburg. The closing down of the inner city airports Tempelhof (380 ha) (2008) and Tegel (460 ha) (2011) were preconditions for the expansion of the airport Berlin-Brandenburg International (BBI) (existing airport Schönefeld).

The further development of the airport Berlin-Brandenburg International entails enormous opportunities for the designation of residential land and commercial or industrial land in the surrounding area. The former airport Schönefeld will be expanded to a 1.470 ha large area. The surrounding area offers more than 900 ha legally binded land for commercial or industrial use and 450 hectares land for residential use. Beyond that, further 1.330 ha of potential commercial and 780 ha of potential residential land are identified (see MIR / SENSTADT 2007).

The expansion of the airport Berlin-Brandenburg International and associated infrastructure not only causes environmental impacts directly in the project area. It also coincides with large-scale changes of land uses, work places, and traffic flows impacting on the urban environment of the whole city. The formal environmental impact assessment (EIA) (completed in 2004) focused on analyzing the environmental impacts directly in the airport region. A superordinate analysis of city-wide impacts for example through changed traffic flows was not legally required. The SUPPORT project aims at conducting an assessment of those city-wide impacts using the example of changed air and noise pollution due to a change in traffic volumes. A first approach will be presented in chapter 3.1 and further developments will be shown in chapter 3.2.

3.1 First Approach for the Appraisal of Air Pollution

3.1.1 Method

Aim of the approach presented below is to assess the changed air pollution due to an increase in traffic volumes especially along the main routes leading to or from the BBI surroundings and a decrease in traffic flows around the closed inner two city airports. For the support of strategic decisions it is important to simplify applied methods and techniques to avoid seeming accuracy and to handle a high level of uncertainty in an adequate manner (see FISCHER 2007). This approach is based on the existing air pollution assessment of the developed SEA assessment framework for Berlin (see chapter 2.1). The assessment classifies the pollution of nitrogene dioxide (NO2) and particulate matter (PM10), the two most problematic traffic caused pollutants in Berlin (Senate Department for Urban Development 2008a, online, 4). Criterion is the degree of exhaustion of existing tresholds for both pollutants, for instance formulated in the 22. Federal Immission

Control Ordinance (22nd BImSchV) (KÖPPEL et al. 2009, 32ff.). These values are not legally binding for land use planning and can be considered as technical thresholds, which is an important measure for practical planning purposes and restrictions. The mean emission limit value for one year for both pollutants is 40µg/m3. This value is taken into account for the classification in the assessment matrix (see Fig. 2).

Main database is the map Traffic-Related Air Pollution – NO2 and PM10 of the digital environmental atlas from 2008 (Senate Department for Urban Development 2008b).

Fig. 3 illustrates the assessment of the NO2 and PM10 pollution along the main streets according to the scale in Fig. 2.

Assessment categories	**Classification criteria (not all criteria have to apply)**
Restriction area	**Not existent (no legally binding treshholds for land use planning)**
Precaution area I ‚Borderline area'	**Exceeding or reaching 90 – 100 % of technical tresholds of NO_2 and PM10 pollution**
Precaution area II	**reaching 75 – 90 % of technical tresholds for NO_2 and PM10 pollution**
Precaution area III	**reaching 60 – 75 % of technical tresholds for NO_2 and PM10 pollution**
Precaution area IV	**reaching 25 – 60 % of technical tresholds for NO_2 and PM10 pollution**

Fig. 2: Assessment Matrix for NO2 and PM10 pollution along the main streets of Berlin

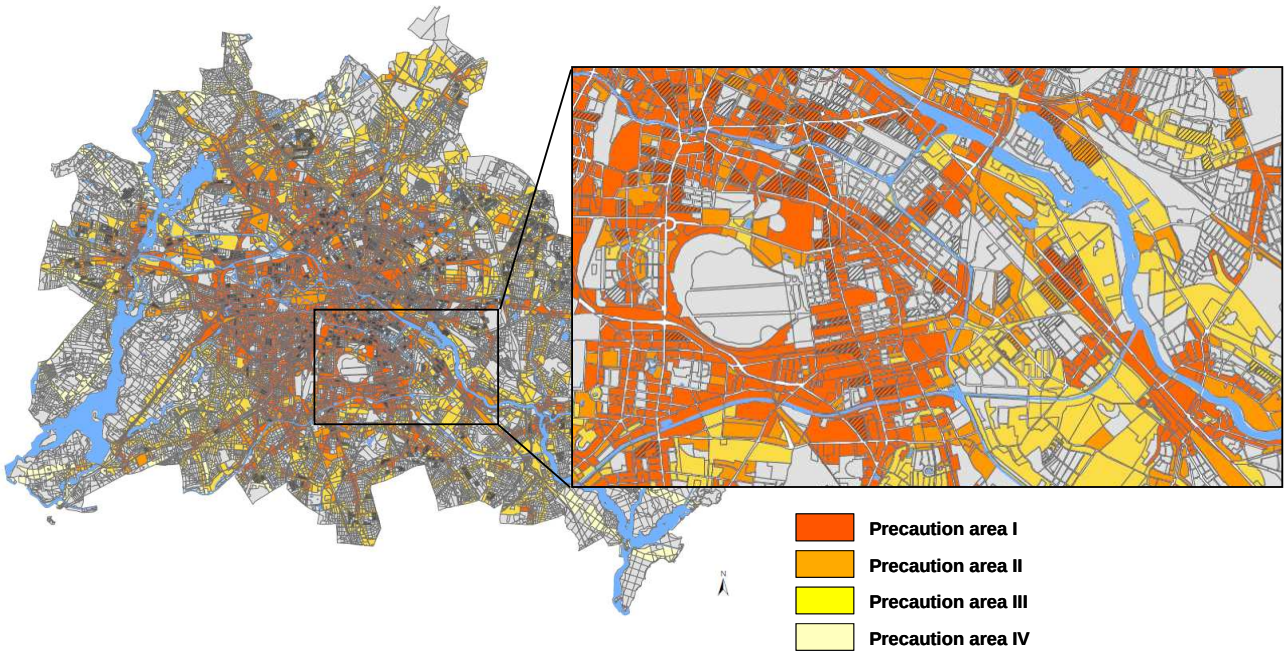

Fig. 3: Assessment map – air pollution

Based on that it is assumed that within a corridor (in this example 500 m) along the main routes leading to or from the BBI the traffic caused air pollution will considerably increase. Another assumption is, that the increase of traffic flow will extenuate with increasing distance to the airport BBI. Three different impact areas are determined. In a 5.000 m distance to the airport BBI a high, in 10.000 m a moderate and in 15.000 m a low increase of traffic flow is assumend. By overlay with the assessment categories of the current air pollution the increasing contamination degree was determined with an ordinal assessment scale. Fig. 4 illustrates the matrix for the comparison of assumed traffic flow increase (vertical) and current air pollution (horizontal) and the appraised contamination degree.

In contrast to the increase of traffic volumes around BBI airport a decrease of traffic flow is assumed within the same distances around the two closing down inner city airports Tempelhof und Tegel. In 5.000 m distance to the airports Temeplhof and Tegel a high, in 10.000 m a moderate and in 15.000 m a low decrease of traffic volume is assumend.The matrix in Fig. 5 illustrates the assumed traffic volume decrease (vertical) and current air pollution (horizontal) and the appraised releases. Fig. 6 shows the results of this first appraisal.

Assessment air pollution / traffic volume change	**Precaution area I**	**Precaution area II**	**Precaution area III**	**Precaution area IV**
5.000 m (high increase)	high pressure	high pressure	moderate pressure	low pressure
10.000 m (moderate increase)	high pressure	moderate pressure	moderate pressure	low pressure
15.000 m (low increase)	low pressure	low pressure	low pressure	low pressure

Assessment air pollution / traffic volume change	**Precaution area I**	**Precaution area II**	**Precaution area III**	**Precaution area IV**
5.000 m (high decrease)	high release	high release	moderate release	low release
10.000 m (moderate decrease)	high release	moderate release	moderate release	low release
15.000 m (low decrease)	low release	low release	low release	low release

Fig. 4: Assessment Matrix – pressure air pollution. Fig. 5: Assessment Matrix – release air pollution

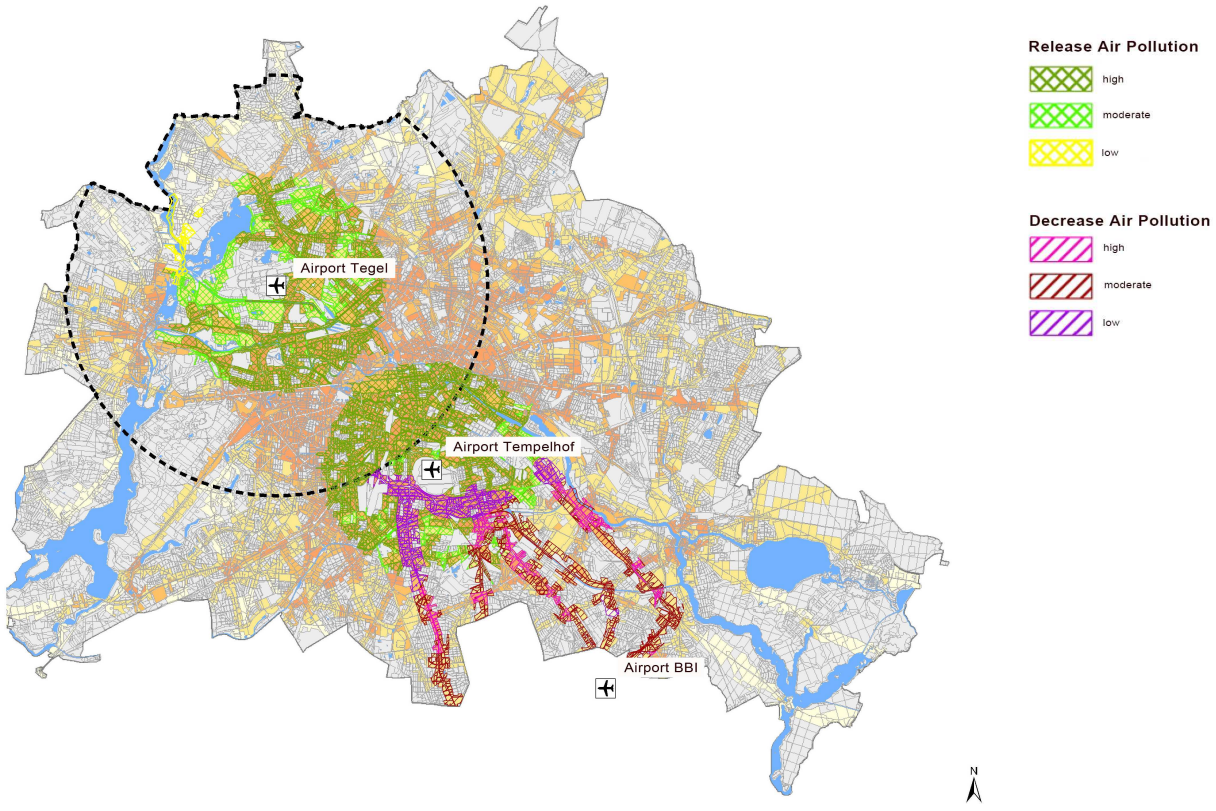

Fig. 6: Assessment map concerning the release and decrease of air pollution

3.1.2 Results

The presented first approach tries to simplify and operationalize the appraising of changing environmental pressures and releases induced by strategic urban planning decisions. The method is very rough and based on assumptions. However, strategic actions, like the case-study “airports Berlin”, have less predictable outcomes than individual developments or projects and need to handle a high level of uncertainty (JONES

ET AL. 2005; JILBERTO in CARATTI 2004). More detailed analyses have to be done at a lower stage of planning, as intended with the aspect of tiering (see chapter 2.2).

The release-pressure ratio of air pollution for the case study “airports Berlin” is illustrated in Fig. 7. The result shows a clear preponderance of the releseases of air pollution induced by the closing of the two inner city airports. On a total of 17.000 ha of Berlin a release is supposed. This is about 20 % of the city area. On the contrary a raised pressure is supposed on a total of about 400 ha. It is obvious, that the closing down of both inner city airports has great influence on the city itself. For instance the density of main streets with traffic caused air pollution is in the inner city considerably higher than in the peripheral area affected by BBI airport. Furthermore it must be considered that the pressures of air pollution induced by the expansion of the airport BBI are only implicated within the city boundary. The pressures of air pollution in the bordering districts of the federal state Brandenburg could not be considered, because an assessment of the current air pollution for NO2 and PM10 is not available yet. It can be assumed that the discrepance between releases and pressures will not be as clearly as illustrated in Fig. 7.

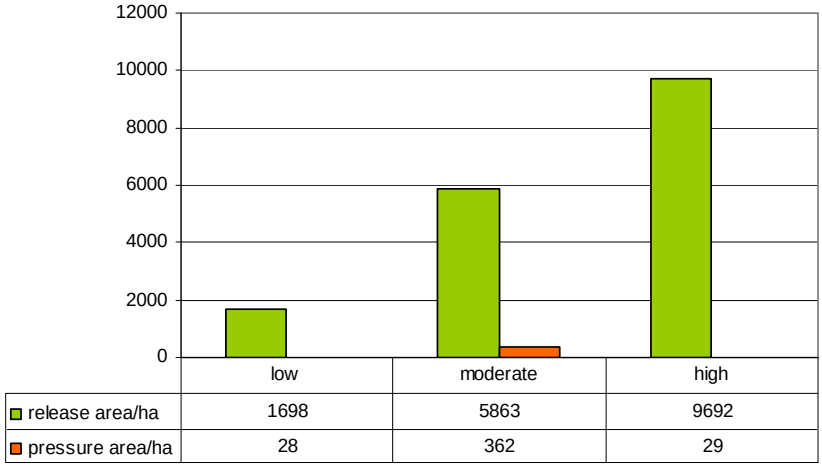

Fig. 7: Release-pressure ratio of air pollution in impacted areas

3.2 Future Developments

To avoid oversimplified assumptions about traffic volume changes and to obtain more realistic basic foundation for the impact appraisal it is aspired to involve a traffic simulation adjusted to the case study. In cooperation with the Department of Traffic System Planning and Traffic Telematics (Prof. Nagel, Berlin University of Technology) a multi agent micro-simulation with the softare MATSim[1] shall be realized. Within this simulation each person is modeled as an agent with a complete temporal dynamic description of the daily mobility behaviour. The sum of all agents reflects the statistically representative demographics of a region (see BALMER et al. 2008).

For the scenario “airports Berlin” traffic volume changes can be modelled for the whole city and the relevant bordering counties of the federal state of Brandenburg.

4 CONCLUSION

The presented project ‘Strategic Planning and Decision Support Instrument’ aims at developing a spatial explicit instrument to intensify the consideration of environmental aspects in urban planning processes at an initial stage. It will proactively address decision-making and promote sustainable development through the systematical integration of environmental considerations on superordinated planning levels. Currently, strategic environmental assessments are usually applied on area-related formal plans or programmes.

The scenario application is expected to contribute to a new quality of urban development processes, because an amplified basis for discussions is provided and planning processes can become more transparent for the public. The presented instrument does not generate new scenrios but is rather dependent on newly processed and available data. This requires the permanent integration and processing of heterogeneous geospatial data of the Berlin Senate.

[1] See http://www.matsim.org/.

A great challenge is the appraisal of less predictable environmental effects caused by the imprecise character of strategic planning levels. The presented approach for the case study “airports Berlin” is an example for the operationalization of a complex issue like changes in air pollution for the whole city. By that changing environmental pressures and releases can be easily compared which is very important for the comparison of different scenarios. This for instance contributes to an identification of areas of high impact and the planning of compensation measures. To obtain a more realistic basic foundation for the impact appraisal and to improve those functionalities it is aspired to combine the presented approach with a traffic simulation in the future.

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