Urban Ecosyst (2006) 9:211–226
DOI 10.1007/s11252-006-8591-8

Use of ecological information in urban planning: Experiences from the Helsinki metropolitan area, Finland

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Published online: 30 May 2006

Abstract This paper studies the use of ecological research information in urban planning focusing on Finland. Research questions addressed the importance and challenges of incorporating ecological information into the planning process, and ways to promote the use of ecological information. Fifteen key professionals from three representative development approval processes in the Helsinki Metropolitan Area were interviewed. The interviewed planners and ecologists considered ecological information important for identifying and preserving valuable urban nature and biodiversity, diminishing negative environmental impacts of construction and for enabling nature-related experiences and services for urban residents. The identified challenges for the use of the information included insufficiency, fragmented nature and lack of adequacy of information, as well as problems with the interpretation and presentation of information. In order to provide more comprehensive ecological information from urbanizing areas in Finland; there should be more coordinated efforts to produce research information that planners really need, ecologists should be more active in the process in providing ecological insights for plans, a proper and simple biodiversity valuation method should be developed, more research on the function on ecological corridors should be conducted, and biodiversity monitoring of implemented planning projects should be developed.

Keywords Ecological information · Finland · Land use · Urban planning

Introduction

Urbanization is one of the most dramatic and permanent forms of land-use change all over the world. The ecological consequences of urbanization include the loss and fragmentation of green areas, structural and functional changes in terrestrial and aquatic ecosystems, changes in species richness and composition, and loss of biological diversity (McDonnell and

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Pickett, 1990; Niemelä, 1999; Paul and Meyer, 2001; McKinney, 2002). Furthermore, these consequences adversely affect essential ecosystem services such as air filtration, noise reduction, rainwater drainage, and recreational, psychological, educational and cultural services (Vandruff et al., 1995; Bolund and Hunhammar, 1999; Lankinen and Sairinen, 2000; Korpela et al., 2001; Berkowitz et al., 2003).

Land-use planners make decisions regarding the living environment for urban residents (Yli-Pelkonen and Niemelä, 2005). The need for new residential districts and urban infrastructure inevitably leads to compromises between new construction and preserving green areas. The key problem is how to decide where to build. In order to make just and informed land-use decisions and to prevent unfavourable effects of urbanization on environment, planning officials and political decision-makers need the best possible ecological information available and a competence to use the information (Haila, 1995; Sukopp et al., 1995; Tjallingii, 1996; Goode, 1998; Niemelä, 1999). This requires appropriate methods and tools to produce the information, and appropriate skills, tools and will to incorporate the information into land-use decisions (Kansanen, 2004).

The objective here is to determine the role of ecological research information in the urban planning process. Ecological research information includes precise scientific knowledge about species composition, diversity, habitat requirements and characteristics, and population sizes (Yli-Pelkonen and Niemelä, 2005). Ecological information can also include non-scientific elements such as observations of local dwellers and nature enthusiasts (Yli-Pelkonen and Kohl, 2005). The urban planning process is addressed from a Finnish perspective, where a substantial amount of green areas has so far been retained within and around urban areas. *Green* or *nature areas* can include underdeveloped land (such as urban forests and parks) with or without a recreational or conservational status. In Finland, a *master plan* is a general plan for the whole city or municipality, whereas a *detailed plan* (also called zoning or a town-plan) functions as a more elaborate plan for construction and development of a specific area (ranging from a whole district to a single lot) within the master plan area. The emphasis in this paper is on the detailed planning level.

The research questions of this paper address the importance and incorporation of ecological information into the planning process and challenges and drivers related to the use of ecological information. The research questions are presented in more detail in the methods section. Based on the findings of this study, recommendations for promoting the use of ecological information in the Finnish planning process will be presented.

Methods

Figure 1 illustrates the guidelines for linking ecological information from biodiversity surveys and assessments to the planning process in Finland (modified from Söderman, 2003; Helsingin kaupunkisuunnittelu, 2004). For instance, in the City of Helsinki, ecological information should be linked to a detailed planning process as follows. When the plan preparation begins in the Helsinki City Planning Department, the needs and magnitude for biodiversity impact assessment in the plan's area of influence are considered. During the plan programming (often linked to a participation and assessment plan) the scale and methods of a biodiversity survey and an impact assessment are targeted in detail, and earlier surveys and assessments are collected. In the biodiversity survey, essential ecological information for the biodiversity impact assessment is produced. This is done alongside other surveys (such as surveys of the physical-chemical environment and social impacts), usually by consultants. Plan options and sketches are composed and subjected to public participation, which can offer important local

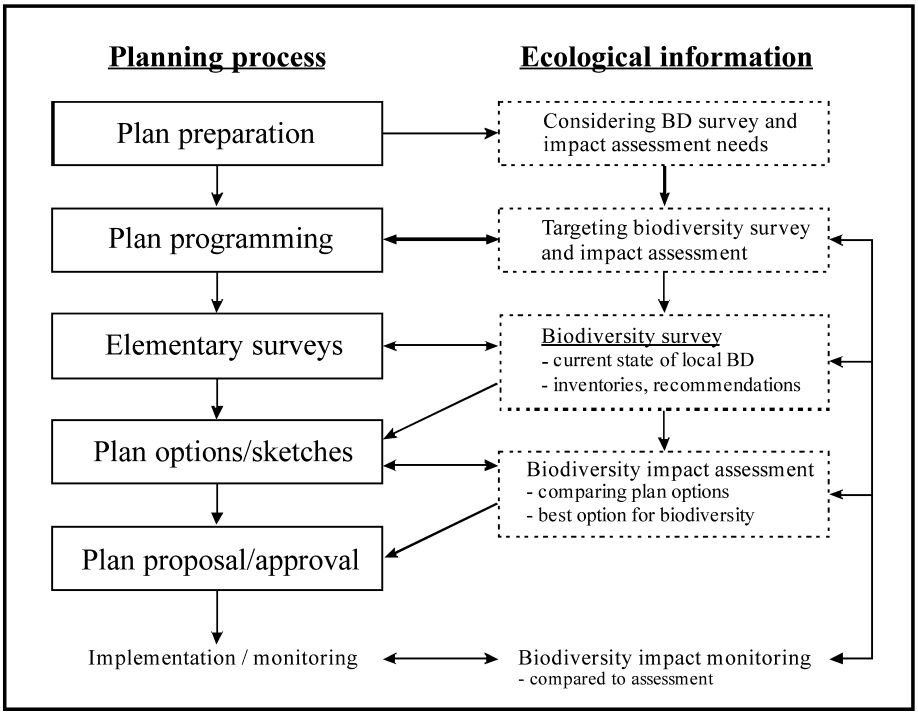

Fig. 1 Ecological information from biodiversity (BD) surveys and assessments in the Finnish land-use planning process (modified from Söderman, 2003 and Helsingin kaupunkisuunnittelu, 2004)

ecological knowledge. In the biodiversity impact assessment the significance of the impacts of the various options are compared. Finally, a plan proposal including a plan map and a plan report covering the results of the impact assessment is presented to the political decision-makers in the City Planning Board and the City Council. Before the final approval, statements and complaints are considered, and changes to the plan proposal are done, if required. Biodiversity impacts should be monitored alongside the plan implementation monitoring.

Three representative development approval processes

In order to answer the research questions, data were collected by expert interviews (Flick, 1998) from actors working in three representative development approval processes in the Helsinki Metropolitan Area in Finland.

The *Rekola* 6 detailed plan area (**R** in Figure 2), situated in the Rekola district in Vantaa (20 km north-east from the Helsinki city centre) offers an example where challenges related to a railway line extension and conserving local green areas (including Rekolanoja stream flowing through the plan area) met. The purpose of the detailed plan was to guide the land use of the non-zoned railway track surroundings, and slightly change the land use of nearby residential blocks and green areas. The aims included the improvement of the ecological condition of the stream for the local recreational use, conserving the Rekolanoja stream as well as possible and restoring the damaged streambed and surrounding landscape (Vantaan kaupunki, 2002). The planning process started in September 2001 and the final plan came into

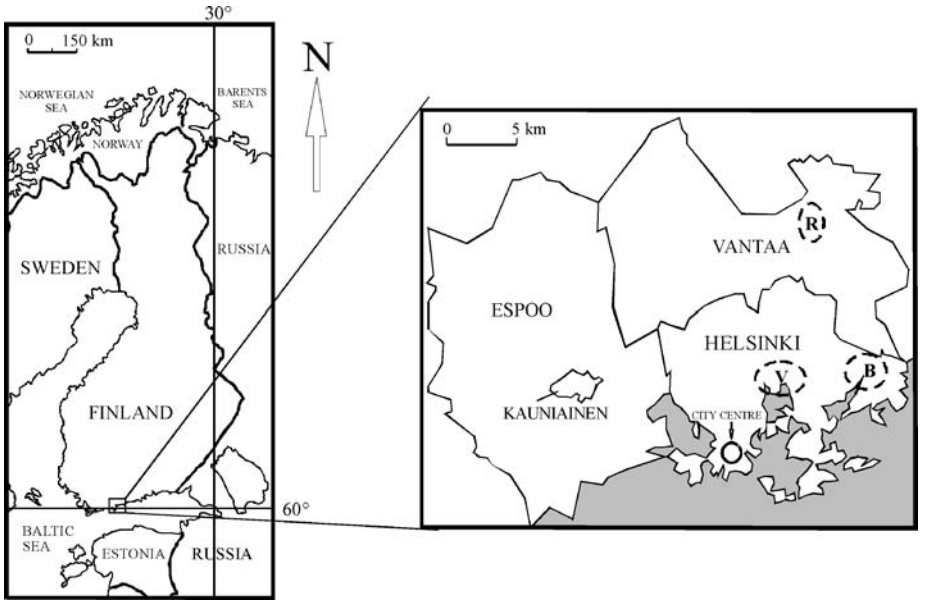

Fig. 2 A schematic map of the core of the Helsinki Metropolitan Area. Studied planning processes are marked: (R) Rekola 6, (F) Fallpakka, (V) Viikki

effect in June 2003 after consideration of remarks and complaints. Four planning professionals (a land-use planner, a landscape planner, a district architect in-charge and a water engineer) and an ecologist working in the local environmental centre were interviewed.

The *Fallpakka* detailed plan area (**F** in Figure 2) is located 12 km east from the Helsinki city centre. The plan includes new housing for 1000 dwellers partly on a field situated very close to a Natura 2000 conservation area. The field is an important habitat for rare bird species and functions as an important recreational area. The area forms a part of one of the large greenways of Helsinki. For these reasons, a comprehensive landscape and biodiversity assessment of the area was done during the planning process (Helsingin kaupunki et al., 2001). The final plan proposal was approved by the City Planning Board in April 2004. Four planning professionals (a land-use planner, a landscape planner, an environmental planning official and a water engineer) and two ecologists (a consultant and a researcher) were interviewed.

The *Viikki* district, located 8 km north-east from the Helsinki city centre, represents a large urban planning project with an emphasis on the ecological planning (**V** in Figure 2). Before the development of Viikki started in the early 1990s, the landscape consisted mainly of extensive recreational areas, fields and nature reserves, and formed a part of one of the greenways of Helsinki. The Viikki-Vanhankaupunginlahti nature reserve, which is a part of the international Ramsar Convention on wetland bird habitats and Finland's Natura 2000 network, and a culturally important agricultural landscape of open fields, were located in the planning area. Therefore, environmental issues had to be seriously taken into account (Pekkarinen-Kanerva, et al. 2000).

The new planning included a Viikki Science Park specializing in biological sciences, and housing with ecological principles. The plan area of Viikki was 1 132 hectares (including 840 hectares recreational areas and nature reserves). The main residential districts will be constructed by 2012 (City of Helsinki, 2002). When completed, Viikki will provide at least

6000 jobs, a study location for 6000 students, and homes for 18000 people, which will make it one of the three largest new housing districts in Helsinki (Viikki-Kivikko—projekti, 1995). Three planning professionals (a project manager, a landscape planner and a plan researcher) and one ecologist (researcher) were interviewed. Furthermore, two interviewees (the environmental planning official and the water engineer) related to the Fallpakka process had also been working with the Viikki planning, and their interviews were used also for the Viikki case.

Interviews

Semistructured interviews were used to reveal matters that are unlikely to be discovered using alternative methods (Flick, 1998) such as questionnaires. The direct verbal and nonverbal interaction between an interviewer and an interviewee provides a possibility to target data collection in the interview situation, and provides an opportunity to find the motives behind the answers (Hirsjärvi and Hurme, 2000). The interviewees received the questions prior to the interviews to prepare themselves. The concept *ecological information* was presented to the interviewees to make sure they understood the emphasis of the study. The interviews were carried out during August 2002–December 2002, lasted between 60 and 90 minutes and were recorded on Minidiscs. After the word-by-word transcription the interview data were analyzed using qualitative content analysis (Flick, 1998; Patton, 2002). The transcribed data were classified to separate thematic files according to the three main research questions and answers to the related interview questions, which are thematically presented later on in this section. The most relevant parts of the thematic files were then condensed to text parts which were further analyzed in order to answer the each research question (Kvale, 1996). The most relevant parts of the thematic files included the issues that were frequently mentioned in the answers of several interviewees, or specific issues, examples or justifications that were mentioned only by individual interviewees, but which we considered to be crucial and deep information for the study. No formal scoring system was used due to relatively small number of interviewees. The language of the interviews was Finnish, and the excerpts presented in the results section are translations (as direct as possible) into English.

The described three representative development approval processes are situated in the core of the Helsinki Metropolitan Area, which is the largest conurbation in Finland, and consists of four cities: Helsinki, Espoo, Kauniainen and Vantaa, with a total about 1,000,000 inhabitants. Fifteen people were interviewed based on their professional expert roles (Silverman, 2000) related to the use of ecological information in the three planning processes and related to urban planning in general. The 15 interviewees consisted of 11 planning professionals working in the planning departments of the two cities, and of four ecologists working as consultants, environmental officials and researchers. This approach was used in order to better link the research questions to the planning processes, and thus more clearly understand similarities and differences in the views of actors in the same process. The three planning processes were chosen after negotiations with the head officials in the City Planning Departments of Helsinki and Vantaa, and represent good examples of considering the role of green areas in or close to detailed plan areas.

Representativeness and validity

The interviewed participants were selected with snowball sampling and saturation methods (Hirsjärvi and Hurme, 2000; Berg, 2001). A couple of relevant and known key informants (Silverman, 2000) related to each planning process were first interviewed. These key

informants were then asked to suggest persons who they have worked with in the planning process and who would be good information sources. This sampling strategy was used to interview people who were familiar with the plan areas, compared to random sampling of interviewees (Berg, 2001). Considering the research resources and since little new information on the subject matter emerged from the last interviews in each planning process (saturation), the 15 interviews conducted were considered to be adequate for the study.

The relatively small number of interviews in this study could have resulted in bias. An interview situation is always unique; in another situation the person could have answered in a bit different manner (Flick, 1998). However, the conducted interviews were thorough and produced extensive information. Moreover, the interview method used here can result in biased interpretations if not treated critically. And, the conclusions of this study are not to be generalized broadly (Berg, 2001), but are suggestions on how ecological information is used in urban planning.

Research questions and interview questions

The following research questions were addressed:

1. *Is ecological information regarded important in the urban planning process and what determines the importance?* According to Grimm et al. (2000) and Yli-Pelkonen and Niemelä (2005) three main human-oriented drivers affect the incorporation of ecological information into urban planning process; (a) flow of information and knowledge, (b) incorporation of culturally based values and perceptions, and (c) creation and maintenance of institutions and organizations. It is expected that elements of driver (b) determine the importance level through the values and perceptions of the actors in the planning process. The interview questions related to this research question were: Is it important to consider ecological information a) generally in urban planning, b) in detailed plan level.
2. *In what ways do the users of ecological information seek, find and incorporate the information into the planning process?* This research question is directly linked to the driver (a) in question 1, but it is also expected that the elements of drivers (b) and (c) are visible. A basic determinant is the contemporary legislation in Finland that obliges planners and decision-makers to base land-use decisions on adequate ecological information (Land Use and Building Act, 1999). In a regular planning project, a biodiversity impact assessment can be done as presented in Figure 1, but if the planned activity requires a comprehensive Environmental Impact Assessment, the biodiversity impact assessment is done as a part of it (Environmental Impact Assessment Act, 1994; Söderman, 2003). The interview questions related to this research question were: (a) Where and how do you search for ecological information for planning purposes? (b) How was ecological information collected and incorporated into the planning process in question? (c) What are the best methods to incorporate ecological information into your work?
3. *What kind of challenges are associated with the use of ecological information in the planning process?* Elements of all the drivers (a), (b) and (c) in the question 1 are expected to affect these issues. Some challenges have been addressed in previous studies. Niemelä (2000) noted that in order to facilitate the use of ecological information in urban planning it is essential to know how to synthesize and communicate the results of ecological studies to planners and decision-makers (see also Norton, 1998; Ehrlich, 2002). Flores et al. (1998) argued that inappropriate or outdated concepts are being used in the context of

land-use decision-making. Urban biodiversity information is a good example of these conceptual challenges (Gyllin, 1999; Niemelä, 2000). Furthermore, challenges associated with developing tools for land-use planning to better consider biodiversity information have been addressed by Lindholm (1999), Löfvenhaft et al. (2002) and Maijala (2002). The interview questions related to this research question were: (a) What kind of ecological information is appreciated in your work, and why? (b) In what form ecological information should be presented in order to use it in urban planning? (c) What challenges were related to the use ecological information during the planning process in question? (d) What is the role and value of ecological information compared to other information used in urban planning?

Results

Concept of ecological information

All the interviewees stated that *ecological information* means at least the biological information as defined earlier in this paper. However, the architects and landscape architects added that in their education *ecology* was mainly landscape ecology, and in their work they often integrate physical-chemical information from (abiotic) 'natural processes' (e.g. soil and water conditions, climate, flow of matter) and ecological or environmentally friendly construction in the broader concept of ecological information. Overall, the interviewees were familiar with the terminology used in this study, which made it easier for them to concentrate on the use of the narrower meaning of ecological information (biological; related to species, populations and habitats) during the rest of the interview. The detailed results related to the research questions are addressed next and summarised in Table 1.

Question (1): Importance of ecological information in urban planning

All the interviewees felt that it is important to consider ecological information in urban planning due to legislation and general importance of preserving biodiversity in urban areas. At the master plan level, decisions on urban green structures, such as the green space network, protected areas, wide urban greenways, and ecological corridors, guide detailed planning. In each of the planning area, the exact reasons given for the importance of ecological information were related to the local nature values. In the *Rekola 6* area, ecological information was seen important for guiding the conservation of the valuable Rekolanoja stream corridor that forms a long, rich and vulnerable streamside ecosystem severely disturbed by urbanization. The planners recognized its importance both for local residents and for the city image of Vantaa. In *Fallpakka* the nearby Natura 2000 conservation area made ecological information very important. In *Viikki* the closeness of valuable green areas (both with conservational and recreational status), and overall ecological principles in planning determined the importance.

Question (2): Incorporating ecological information into the planning process

Best sources of ecological information for the interviewed planners were local environmental centres and other city agencies, GIS based biodiversity information systems and personal expert contacts (with universities, environmental centres, local residents and nature enthusiasts). If planners have expert acquaintances it is easy to make a phone call and ask for advice or to 'cross-check' the received information by asking for a second opinion from

Table 1 A summary of the main results

Research question	Issues mentioned in majority of interviews	Issues repeated in several interviews
1 "Importance of ecological information (E.I.) in urban planning"	E.I. is important due to: – legislation – preserving urban nature & thus local recreational values – preserving biodiversity in the city	E.I. is important due to: – diminishing negative environmental impacts of construction – preserving ecological corridors and networks in the city
2 "Incorporation of E.I. into the planning process"	Sources of E.I. for planners: – local environmental centres and other city agencies – GIS based biodiversity information systems – personal expert contacts – consultant ecologists conducting surveys and impact assessments	Sources of general knowledge of urban ecology: – excursions – courses – seminars – library databases
3 "Challenges of the use of E.I. in urban planning"	- insufficiency and fragmented nature of E.I. – interpretation and presentation of E.I. – requirements for tools for using E.I. – value of E.I. compared to other information	- finding adequate and up-to-date E.I. – shortcomings in the planning process

another expert. If there is not enough ecological information available, there can be a need for a biodiversity survey and an impact assessment, which are usually conducted by consultants. However, conducting surveys and assessments must be well justified since they are usually labour-intensive, time-consuming and thus expensive. Furthermore, excursions, courses, seminars and library databases are good sources of general ecological information for planners. There is also a demand for more seminars and other such events where representatives of natural sciences and practical planning would meet, discussing issues related to urban planning and ecology.

In Rekola 6, the planning officials used existing biodiversity surveys (such as vegetation, bird and fish inventories), and an existing environmental impact assessment related to the extension of the railway line for planning purposes, and thus learned to appreciate the valuable biodiversity in the area. More specifically, biodiversity surveys were useful for recreational area stipulations, preserving the rich vegetation on the streamside, and for ecological restoration of the damaged streambed. In Fallpakka, the extensive landscape and biodiversity impact assessment (Helsingin kaupunki et al., 2001) offered most of the needed ecological information. The interviewees noted that in 'regular' planning such a comprehensive assessment would not have been done due to high costs. In Viikki, a comprehensive environmental impact assessment (Insinööritoimisto Paavo Ristola Oy, 1990) offered valuable ecological information already in the beginning of the planning process and more was obtained from the biodiversity impact assessment later on (Ympäristötutkimus Oy Metsätähti, 1997). The nature conservation area, flora and avifauna of the Viikki area are already well

known. All this information had a considerable significance in the planning of the housing areas.

Question (3): Challenges of the use of ecological information

The challenges and requirements of ecological information listed here are based both on the interviewees' general experiences from their career and on their experiences from the focused planning processes.

Insufficiency and fragmentation of ecological information. Planning officials noted that ecologists may not know enough about all the species or taxa in the area to make reliable estimations of their abundance, distribution and responses to environmental changes. They also emphasized that many ecologists are experts on a particular taxon, which they have studied intensively for a long time, and this is creating an image of quite an inconsistent professional ecological expertise. Thus, if information is fragmented, it is even more difficult to predict indirect effects on other species or taxa, or on the function of the whole ecosystem in the area. Although such masters of 'holistic' ecological information would be useful for planners and decision-makers, the planning officials also understand that it is difficult and time-consuming to gain such knowledge, since ecology is a broad field of still unknown patterns, processes and interactions.

Finding adequate and up-to-date ecological information. In Finland, the Land Use and Building Act (1999) obliges planners to "*. . . foster the preservation of biological diversity and other nature values based on adequate surveys*". This means that a planner is required to contact the local environmental centre during the plan preparation, although an ecologist working as an environmental official noted that not all planners always follow the spirit of the Act. Furthermore, the planner may assume that if biodiversity surveys from a particular area have not been done, there is nothing valuable there, and no further biodiversity surveys are initiated.

The concept 'adequate surveys' in the law is open to interpretation. For example, if a biodiversity survey was made 15 years ago, many aspects of the area's nature may have changed. Thus, it can be justifiable to conduct a new survey to get updated and 'adequate' information. Furthermore, if existing reports are on the master plan scale, more specific surveys, particularly in the detailed plan area, may be needed to reveal local nature values. However, as one ecologist working as a consultant noted (excerpt A, Table 2), new surveys can reveal something unpleasant from a developer's perspective.

Interpretation and presentation of ecological information. The excerpt B (Table 2) illustrates how the planning officials emphasized that ecological information is useful for them when they are made aware of what the information means for planning and decision-making. For example, what does it mean for planning that there is a population of a particular species in the area at a certain time of the year or in certain years? From a planner's point of view, ecologists should master the credible presentation and popularization of their research results for land-use planning purposes, and should interpret the results of biodiversity surveys and assessments, and present recommendations for them (excerpt C, Table 2). If ecologists cannot provide interpretation, then planners have to try to do it themselves with insufficient ecological expertise.

Table 2 Interview excerpts depicting the challenges of using ecological information

A	"If new construction has already been planned for a certain new area, but (ecological) studies done after that show that it is not a good idea to go there after all, the conflict situation begins. In a way, the use of ecological information is connected to a certain purposefulness; either the information fits to advance plans or then it doesn't." (a biologist working as a consultant)
B	"If I get a map with bird territories in front of me, it doesn't help a whole lot instantly. Someone has to interpret that information; that is to say, what affects what—and what can be taken away from the system without the whole system collapsing." (an architect working as a land-use planner)
C	"One of the largest questions in using ecological information still seems to be: who interprets ecological information? Who actually has such holistic comprehension of the meanings of urban ecological information, that he can interpret it better than others?" (a planning official specialised in environmental issues)
D	"In our work, plans have to be made and implemented, preferably based on some specific theory than randomly—even if generally accepted theories were not available. For example, the theory of ecological corridors is tempting because it is spatially easy to understand and linkable to recreational area networks." (a landscape architect working as a land-use planner)

Requirements for tools for using ecological information. The interviews revealed that proper indicators of changes in ecological conditions, criteria for comparing different land-use options in urban areas, and knowledge of the usefulness of components of ecological attributes, such as ecological corridors, are missing in Finland. Planners and decision-makers need a simple index, which is indicative of biodiversity or ecological quality. This would be a useful tool for planners to estimate the consequences of the plan to the nature of the area. However, developing such instruments for biodiversity estimation has proved to be difficult, which was noted by ecologists as well.

The interviewed urban planners seem to consider ecological principles derived from general ecological theories, such as the theory of island biogeography and metapopulation theory, at least to some extent. The ideas of urban greenways functioning as movement corridors for species, and the superiority of larger and contiguous green patches compared to smaller and more fragmented ones are seen useful for planning. Nevertheless, the theoretical background and usefulness of these ideas are not clear for planners (excerpt D, Table 2).

Value of ecological information compared to other information. Although interviewees emphasized the importance of ecological information in urban planning, urban nature has difficulties in finding its own place in the value scale of planners, decision-makers, and urban dwellers. Other factors challenge the idea of preserving valuable urban nature and biodiversity within the plan area. The excerpts A-D in Table 3 illustrate the economic and political drivers affecting land use (see also discussion).

Shortcomings in the planning process emerged from the interviews as a challenge. For instance, master and detailed planning on the one hand, and landscape planning and design of green areas on the other hand, may not be well connected. Master plans or detailed plans do not usually provide guidelines for how public green areas should be developed. Usually, the green area departments of cities govern the planning of green areas, from the level of ideas and strategic planning to implementation. After approval of a detailed plan, green area planners and managers may come up with solutions, which will never come to the attention of detailed planners due to shortcomings in communications. Furthermore, long-term monitoring of biodiversity impacts is not well planned or is

Table 3 Interview excerpts depicting relationships between ecological information and social drivers

A	"Land use today is all about the market world; different residential districts and local centres compete with each other. And if the land-use actions help in increasing the value of the area, the city will get better tax-payers in the long run." (an architect working as a land-use planner)
B	"Technical solutions of construction may become too expensive or too time consuming if planning is conducted thoroughly in terms of ecology. Final plans and decisions are compromises based on what is important and valuable in the eyes of planners and decision-makers." (an architect working as a land-use planner)
C	"In my opinion, it would be interesting to find those examples, where planned construction has been cancelled solely because of biological diversity (if there were no Natura 2000 sites or normal conservation areas in or around the plan area already); that is to say: what is really the value of biodiversity." (a biologist working as a consultant)
D	"The ultimate value of ecological information depends on the persons sitting in city planning boards. In practice, members of the boards *(Author's comment: for instance, 10 members in the Helsinki city planning board)* often have different opinions about the plan and the final decision is usually the result of voting. But votes may not be individuals even in city planning boards, because of political reality in the form of party discipline." (a biologist and city-planning activist, working as a researcher)

inadequate. There seems to be a lack of coordination of who should finance and perform the monitoring.

Discussion

Social drivers determining the importance and incorporation of ecological information

Urban land-use planning is a social process in which the importance of ecological information is determined by culturally based values and perceptions (Yli-Pelkonen and Niemelä, 2005). All the interviewees considered preserving urban biodiversity as a valuable goal for the society. As Maijala (2002) also noted, this reflects the attitudes of planning professionals themselves, and of urban residents and decision-makers whose ecological appreciation is transmitted to planners. Furthermore, as was seen in this study, green patches can be of high value without a conservational status (see also Merrill, 2004), mainly due to recreational values (Korpela et al., 2001; Sievänen, 2001; Grahn and Stigsdotter, 2003). The value of the green space formally increases with a conservational status. However, when the city needs more housing and tries to compact the city structure, planners may have to try to plan the construction very close to protected areas in order to achieve economic goals of the plan, as was the case in the Fallpakka and Viikki. Due to the effective production and use of ecological information, rather wide buffer zones were left around protected areas, and ecologically these planning projects thus provide positive examples.

The Finnish legislation determines the requirements for ecological information in planning, but the effort put into biodiversity surveys and assessments in the first place seem to depend on the interest and attitude of the planner in charge and on the strategic importance of the plan area. If the area is considered important due to its size, popularity, nature and image value for the city, then social drivers affecting the planner in the form of pressure from colleagues, superiors and the public, may result in better consideration of ecological information than would have been otherwise.

Alberti et al. (2003) and Alberti and Marzluff (2004) explained how human drivers such as population growth, economic growth, land-use policy and infrastructure investments cause changes in biophysical and human patterns and processes of urban development, and Yli-Pelkonen and Niemelä (2005) illustrated how plan decisions affect ecological patterns and processes and human behavior which again affect environmental context and human drivers. Similarly, in the representative development approval processes in this paper, human drivers initiate the planning needs in the first place (Table 3, excerpts A-B), and finally, in the political decision-making process, the values and perceptions of the decision-makers determine how much emphasis is put on the ecological aspects in the plan (Table 3, excerpts C-D).

The interviewed actors in this study were conscious of the importance of ecological information, which was not unexpected, since general environmental and ecological awareness have influenced the whole society, including planners in the urban ecosystems (Johnson and Hill, 2002; Berkowitz et al., 2003). The studied planning processes represent examples where ecological values and biodiversity issues were considered thoroughly and were transmitted to final plan decisions rather successfully. However, some planners pointed out that not all their colleagues consider ecological values and information as important as they themselves do, but feel that additional ecological information just adds to the workload or 'restricts creative planning', and thus do not want to convey it into the plan. In such cases the guidelines and goals for comprehensive biodiversity surveys and assessments are not fulfilled. This observation underlines the importance of the personal set of values of the planner, which in turn may depend on educational and professional background, world-view, age-class, or attitudes of colleagues. The interviews indicated that the younger generation of planners is more willing to reconcile or integrate ecological values into planning, as they may have been more influenced by ecological ideas through their education and career (see also Hill et al., 2002).

Recommendations for the use of ecological information in the Finnish urban planning system

In order to produce more comprehensive ecological information from urbanizing areas in Finland, there should be increasing collaboration between ecologists and land-use planners to define and agree upon priorities as to what kind of ecological information is needed for planning and, as Dale et al. (2000) suggested, to revise the validity of these priorities on a regular basis. For instance, the fragmented nature of ecological information is partly a consequence of research traditions, where vegetation and some faunal groups such as birds are generally well studied in Finnish urban areas (Ranta et al., 1997; Kurtto and Helynranta, 1998; Jokimäki et al., 2002). To meet the challenge, more research should be targeted at less well-known taxa, such as insects.

Broberg (2003) suggested that ecologists should play an active role in the planning process to make sure that land-use decisions meet the goals of preservation and enhancement of urban biodiversity and functional ecosystems. By making their expertise more visible, Finnish ecologists could educate other actors in the planning process, help join the parts of fragmented ecological information, seek more specialized 'second opinions', and function as communicational links between the actors in the process (also noted by Christensen et al., 1996). Planning officials in Finland, on their part, should be trained to demand adequate ecological information and initiate the process of collecting it.

The interviewed planners requested practical indices of biodiversity. Attempts have been made to test biodiversity indices in Finland (Teeriaho 1998), but they can usually only be

used for comparing similar habitats and have not been used in urban areas. In North America, Mahon and Miller (2003) presented a method for identifying and ranking high-value green areas prior to land development in order to provide information for conservation efforts, and Reed et al. (2004) suggested a method for linking ecological, social and legal rapid assessment to determine conservation priorities in urban areas. To build a proper biodiversity valuation method in Finland, such methods should be scrutinised and considered for test use in urbanizing areas in Finland.

The interviewees noted that new information on the function and usefulness of ecological corridors would be important in Finnish urban planning. The idea of ecological corridors has been popular both in rural and urban land-use (Zipperer et al., 2000; Jongman and Pungetti, 2004), although the possible benefits of corridors at the population level are not unambiguous (Simberloff et al., 1992; Niemelä, 2001). Furthermore, applying the corridor idea in urban conditions based on theory of island biogeography has limitations (Kendle and Forbes, 1997; Niemelä, 1999). Part of the problem is that people with different disciplinary backgrounds may understand the concept of 'corridor' differently, which may lead to confusion about the goals or implied functions of corridors (Hess and Fischer, 2001). To tackle the challenge, there should be more research on the function of ecological corridors and networks in Finland, especially in urbanizing areas.

The results of long-term biodiversity monitoring could be useful for the particular plan area, but such results would be useful also in other areas to be planned. In the Viikki case there is a long-term bird monitoring program, because of the important nature reserve in the area. The results could provide experiences on how certain implementation procedures have affected local nature, and could provide opportunities for adaptive learning and process management (Christensen et al., 1996; Mitchell, 2003). Because the ecological effects of construction may become visible long after the impact, monitoring should be long-term. While the responsibility of monitoring should perhaps be with the developer, environmental centres of cities could be suitable parties to coordinate the monitoring. Recent green area programmes in some major cities in Finland, such as Vantaa (Leino et al., 2001), Helsinki and Espoo, offer some tools for this since they have been aimed at guiding the development of green areas on the whole city level.

Acknowledgements The research (ECOLINK project) was funded by the Helsinki University Environmental Research Centre (HERC). We would like to thank the ECOLINK steering group: Pekka Kansanen, Harry Schulman, Peter Clark and Johanna Kohl. We also thank Stephen Venn, Mark McDonnell, Laura Muukka and two anonymous reviewers for constructive comments and suggestions for the manuscript.

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