

## Analysis of restorative outdoor characteristics on a university campus

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It has been hypothesized that work requiring intense direct attention is more efficient if the workplace is surrounded by certain restorative qualities of nature. If this is the case, then universities and high tech business parks – typical environments for intense creativity, concentration and innovative productivity – should benefit from such green restorative qualities.

I believe this aspect must be considered much more carefully in professional environmental work. This paper presents a relevant research background and a method for evaluating important outdoor environmental characteristics. The method developed here is applied to the highest ranked Swedish research university: Karolinska Institute, Stockholm.

University life can be pleasant and joyful, but is at times characterized by pressure and stress. In Sweden, 50% of high school students continue to higher education. In South Korea, the corresponding figure is 80%, which is much higher than the marketplace demands. Competition at the university level can be very tough, and competition can lead to stress.

### *The nervous system*

Naturally, competition and stress are not modern phenomena. They have been important driving forces throughout human history. Through evolutionary processes, humans have adapted to physical struggles, hunting and flight from danger. In our modern society, human struggles are more subtly adapted to cultural norms, but our physical reactions remain the same: increased pulse rate and blood pressure, increased blood circulation to the skeletal muscles and decreased blood circulation to the skin and internal organs. During taxing situations, the stress hormones cortisol and adrenalin are produced, activating the sympathetic nervous system. The parasympathetic nervous system works to counteract this – to calm us down, lower our pulse rate and blood pressure and activate our internal organ functions, e.g., the digestive process. We live in a constant state of alternation between action and rest.

When we engage in physical activity, e.g., walking, biking, doing sports or garden work, our muscles XX stress hormones. If our level of physical activity is not proportional to our level of stress, long-term tension can set in and perhaps lead to burnout. We know that the parasympathetic nervous system, which promotes relaxation, is activated by physical work, as well as by alcohol. Moreover, Annerstedt (2012) showed that even exposure to greenery (e.g., experiencing a green area and hearing bird song) can have significant effects on the parasympathetic system by decreasing our blood pressure and pulse rate.

### *Two theories of recovery*

Roger Ulrich's theory is that stress is a reactive process triggered by taxing stimuli and that stress reduction occurs in innate and involuntary patterns that humans have acquired and maintain during evolution, that is, that we have an innate capacity to respond in a restorative manner to nature, but not to built environments and more modern material (Ulrich 1993). Ulrich referred to Wilson (1984),

who suggested in his Biophilia Hypothesis that this restorative response originated from prototypes for survival and security found during human evolution.

Ulrich explained psychological and affective reactions using his Affective Aesthetic Theory (AAT). According to him, recovery occurs in environments that are calm and pleasant, preferably with vegetation and water elements. It is often held that savanna-like environments are favorable in this regard with reference to their importance during the early phases of human evolution. This notion is also used to explain why large expanses of grass with occasional solitary trees is one of the ideals for park design today.



A calm, “savanna-like” and relaxing environment (Harvard Univ.).



Chairs in an open park offer free forms for meeting others or relaxing, or both (student housing area at Harvard Univ.)



The worn-out patches of grass show that students choose closeness to greenery (Princeton necessary for concentration? (Princeton Univ.) Univ.)



Do views of greenery outside provide the calm students necessary for concentration? (Princeton Univ.)

Another theory that explains why greenery is relaxing is Attention Restoration Theory (ART; Kaplan & Talbot 1983; Kaplan et al. 1998). According to ART, our brains require a great deal of energy to sort out necessary from unnecessary information. Long-term and intensive use of this brain function can lead to exhaustion. Such exhaustion can, in turn, lead to increased mistakes, reduced self-control, increased stress and irritation, weakened mental capacity regarding both thought and experience, as well as a diminished ability to focus.

Kaplan suggested that people in such a state can achieve recovery if they feel secure in a given environment. We have become used to natural environments during millions of years of evolution, which is why information from nature does not require a great deal of energy. When we are out in



nature, there is less need for the energy-demanding direct attention that we use to sort and react to information in our everyday lives.

Kaplan pointed out several ways of recovering from stress:

1. To “get away from” our everyday environment.
2. To experience fascination with something that is interesting but does not require energy.
3. To feel scope and a space and context that allow engagement.
4. To experience compatibility in places where people can spend time together.



A place for fellowship that brings us together.  
Where do we prefer to sit? (MIT)



Next to the greenery!



Green areas provide unpretentious arenas for fellowship and fascination (Princeton Univ.).



Water is calming and fascinating (Amherst College, Boston).

Searls (1960) suggested that the elements found in our surroundings are varyingly “demanding.” He categorized the following natural elements as “non-demanding” (in ascending order of “demandingness”): water, stones, soil, sticks, branches, greenery and animals.

Another pair of concepts in this context is “refuge” and “prospect.” We prefer sitting in a protected and secure place (refuge), but also to have a view of the surroundings (prospect) to monitor what is happening there.



Concentration in a protected environment (refuge) with a view of the surroundings (prospect) (Princeton Univ.).



The greenery sends in soft information that requires little energy (Princeton Univ.).

### *Noise as a stress factor*

Excessive noise levels at night that disrupt deep sleep also impair the brain's recovery from the stress experienced during the day. Such impairment has even been shown in people who did not wake up completely, but only shifted from deep to more superficial sleep, and who were thus not aware of any disruption. The brain also needs periods of deep rest now and then during the day. Excessive noise decreases people's inclination to help others. Noise is a stress factor, and in situations of increased stress our capacity to concern ourselves with others diminishes. This is an important factor in knowledge-based environments, in that creativity and innovativeness require an exchange of ideas and thoughts between individuals. Here we need sufficient mental capacity to share our ideas, i.e., to help one another find new trains of thought through mutual interaction.

### *Empathy, well-being, willingness to cooperate*

The finding that our empathic capacity can be impaired under situations of excessive stress has been revealed, e.g., in comparative studies of preschool playgrounds. Children who played on playgrounds rich in nature elements have been found to develop better motor abilities, including strength, balance and speed (Grahn et al. 1997). Moreover, these children also scored better on various mental/social traits, including concentration ability (greater), impulsivity (lower), lack of consideration (lower) and dangerous behavior (lower), i.e., they showed a higher degree of empathy (Grahn 2007; Mårtensson et al. 2009).

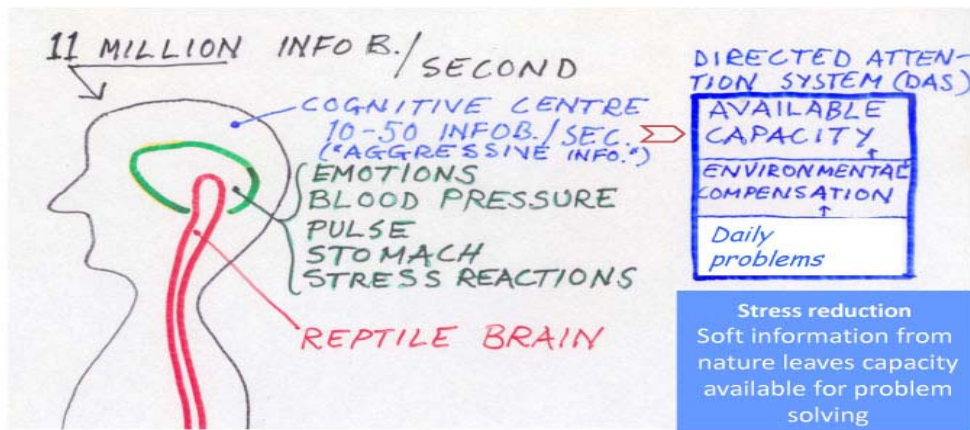
Also of interest in these studies were the differences between the staff. Staff working at the preschool with a playground rich in nature "assigned meaning to the outdoor environment. They were clearly proud of their work and their playground." In contrast, the staff at the preschool with a playground lacking in nature elements "gave no impression that the outdoor environment was of any emotional significance" (Grahn et al. 1997, p. 70 and p. 41, respectively). Furthermore, the staff at the latter preschool were more likely to report "burdensome working conditions," "unruly days filled with conflict" and "feeling relief when leaving the work environment after work" (ibid.).

One study of staff at various workplaces (Iottrup et al. 2012) showed that good access to greenery at the workplace was important: Staff were happier at work and their stress levels were lower. The study also showed that having a view of greenery through a window was important, but that being able to go out into the green area during breaks was even more important.

## Brain research

We all feel instinctively that nature environments have a calming effect, but why is this? The human brain takes in 11 million pieces of information a second through all our senses, e.g, vision, hearing, smell, taste, touch and proprioception. However, our conscious mind can only attend to 10-50 pieces of information a second. This kind of direct attention requires a relatively great amount of energy. The information we are conscious of is called “aggressive information,” not because it is negative but because it demands to be brought up to the level of consciousness. Our society is becoming increasingly information dense, causing the sympathetic nervous system to shift into high gear (see the figure below).

### DAS has limited capacity



In contrast to built environments, information from nature has come to largely be processed unconsciously after millions of years of adaptation. Such information requires little energy and is therefore called “soft information,” but it nevertheless affects our limbic system, blood pressure, pulse rate, metabolism, etc. When we are surrounded by a great amount of greenery, we are exposed to less aggressive information, which allows the brain to rest from new sensory impressions and reflect on old ones.

### How, then, should we design knowledge-based environments?

Modern society is becoming less and less dependent on permanent workplaces made up of fixed offices and conference rooms. Instead, a great deal of the innovative thinking, creativity and production are taking place in looser constellations within and between companies, universities, individual entrepreneurs and researchers. Such constellations require freer forms in which to have meetings, exchange ideas and be creative, e.g., cafés, bars and restaurants, and meeting rooms. But in addition to these places meant for intensive interaction, where our sympathetic nervous system is stimulated, our parasympathetic nervous system also needs places where we can relax.





Students need meeting places that are free in design.



Places for indoor meetings allowing contact with greenery (North West Science Building, Harvard Univ.)



Sometimes we just need to relax (Harvard Univ.)



A place to meet, relax or both. (Princeton Univ.)

Thus far, architectural concepts for knowledge-based environments have been highly focused on the need to create environments, primarily indoors, for meetings and exchanges between people, and less focused on the need to sort information, relax, recovery and reflect on one's own. The present paper looks more closely at the second set of needs because they are served particularly well by outdoor environments.

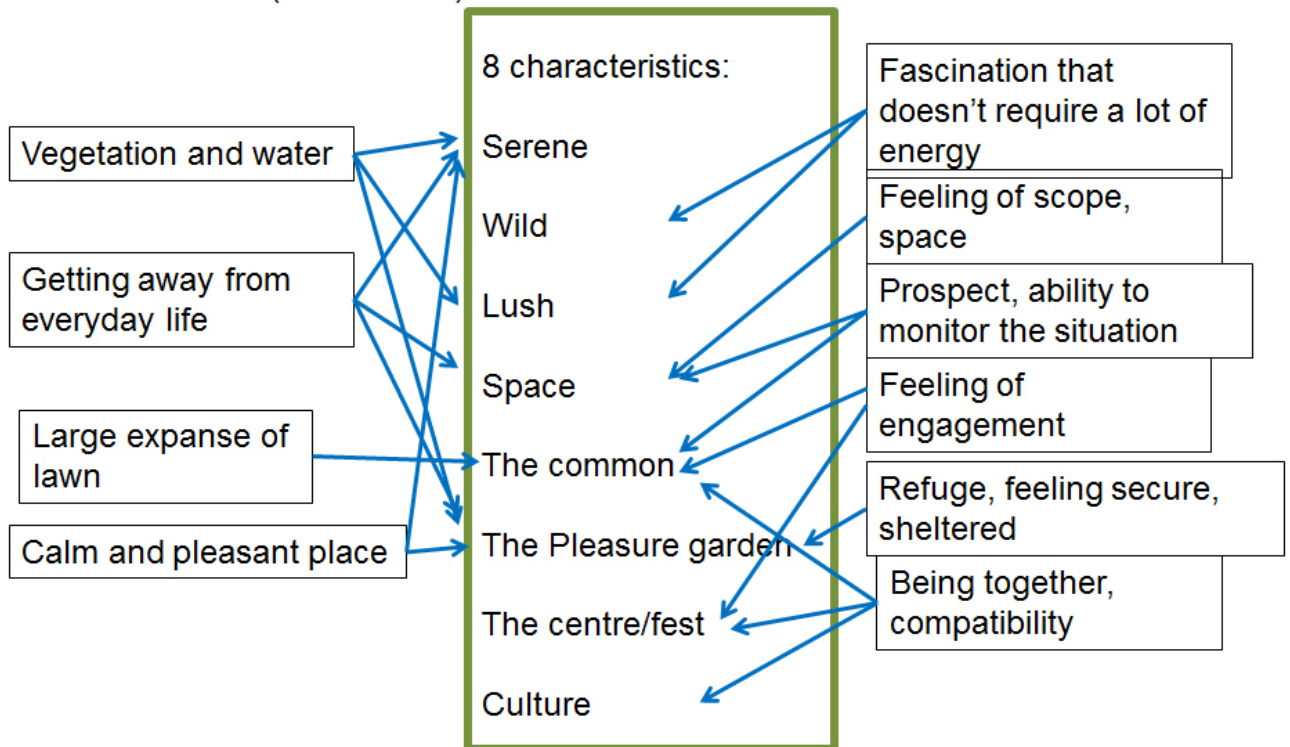
### ***Eight characteristics of the outdoor environment that meet people's needs***

The environmental psychology research being done at, among other places, SLU Alnarp in Sweden (Grahn, Stigsdotter, Berggren-Bårring 2005; Grahn & Stigsdotter 2010) has caused scholars there to conclude that there are eight characteristics of the outdoor environment that meet the basic needs we all have. These characteristics are: 1) "serene" – places where we can hear the sounds of nature; 2) "wild" – places where we can be fascinated by untouched nature; 3) "rich in species" – places where we can experience the variation in vegetation and animal life across the seasons; 4) "space" – places that allow us to enter into another world without sharp contours, disturbances or signals that demand attention; 5) "the common" – places where we can engage in common activities; 6) "the pleasure garden" – enclosed and secure places where we can let children play and enjoy ourselves;

7) “the center/fest” – squares, meeting places and cafeterias/restaurants where we can visit with other people; 8) “culture” – places where we can experience traces of previous generations’ lives.

Characteristics 5 thru 8 largely correspond to social needs (e.g., meeting places), while characteristics 1 thru 4 are preferably experienced while one is alone. The figure below shows how Kaplan’s and Ulrich’s theories of recovery from stress can be related to the eight characteristics of outdoor environments defined above.

Figure 1. Qualities for restoration (Ulrich, left; Kaplan, right) in relation to the 8 characteristics (Grahn et al.)



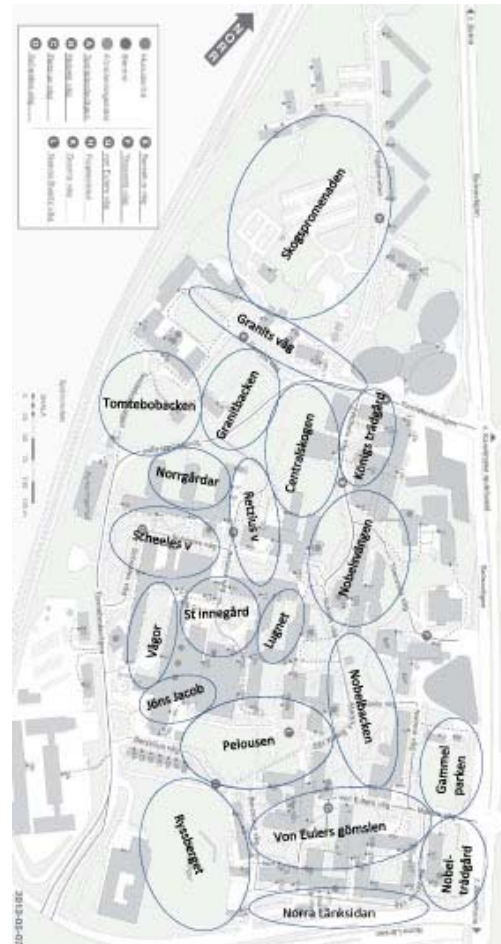


## Development of a method at Karolinska Institute, Stockholm

In an attempt to apply the above theories in practice, I have analyzed the campus of the Karolinska Institute (KI) in Stockholm. KI is Sweden's highest ranking university, as well as home to the prestigious Nobel Foundation. The method includes taking an inventory of the eight characteristics for health and well-being, analyzing the various outdoor environments' qualities and shortcomings, and suggesting possible improvements and priorities.

To get an overview of the various outdoor environments and a feeling for the context, I have divided the campus into different areas. Then I have classified the development of the eight characteristics for each area separately and suggested measures for improvement, prioritizing them in terms of importance.

The photos on the next page (©Skärbäck) are just some examples of each characteristic. Notice that you can find several characteristics in some of the photos. Not all of the characteristics meet the requirements for a proper distribution of good qualities close to each separate building. The last map shows a prioritization of areas that need to be redesigned.



Serene



Wild





Lush



Space



The Common



The Pleasure garden



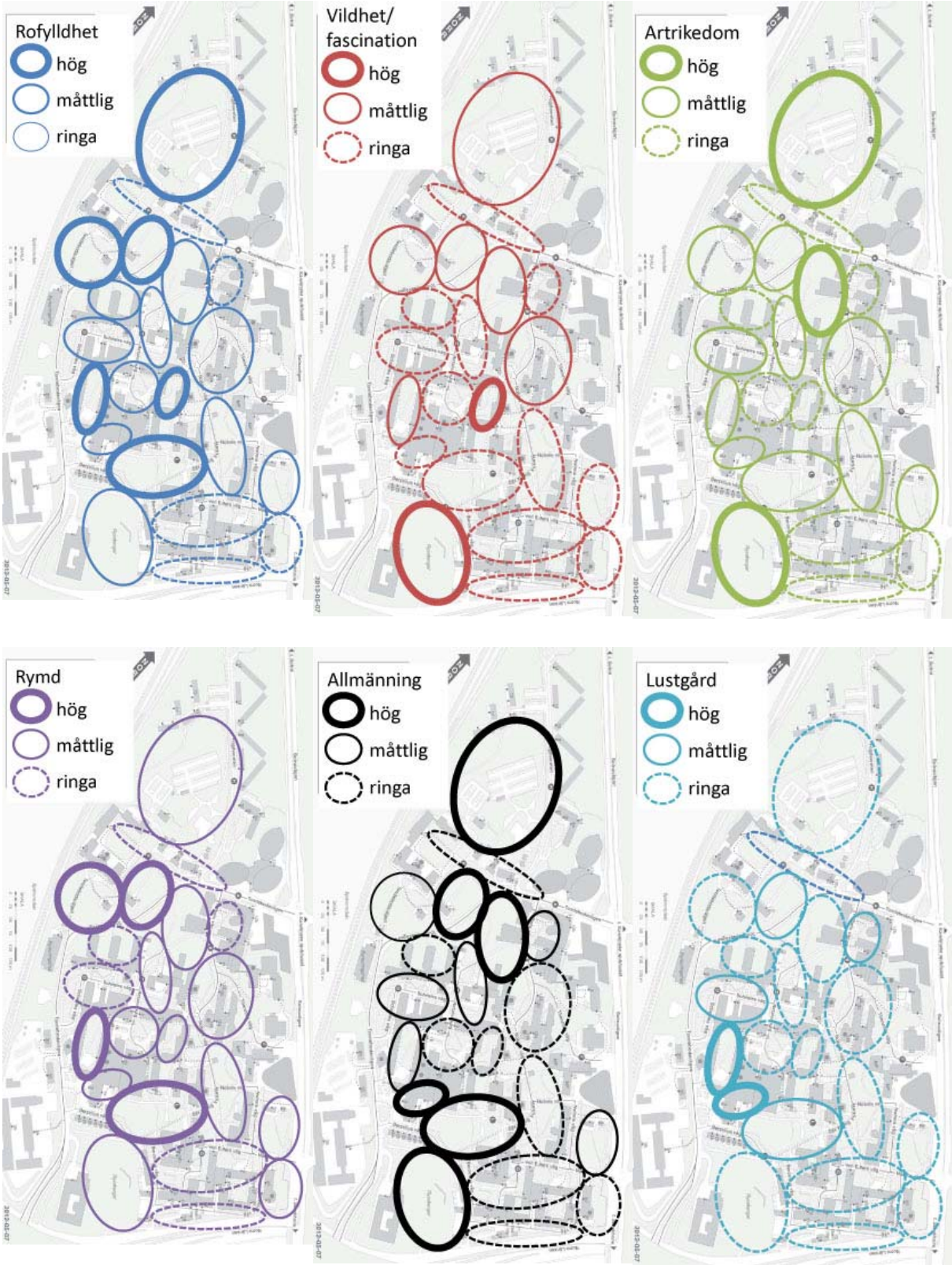
Center/fest



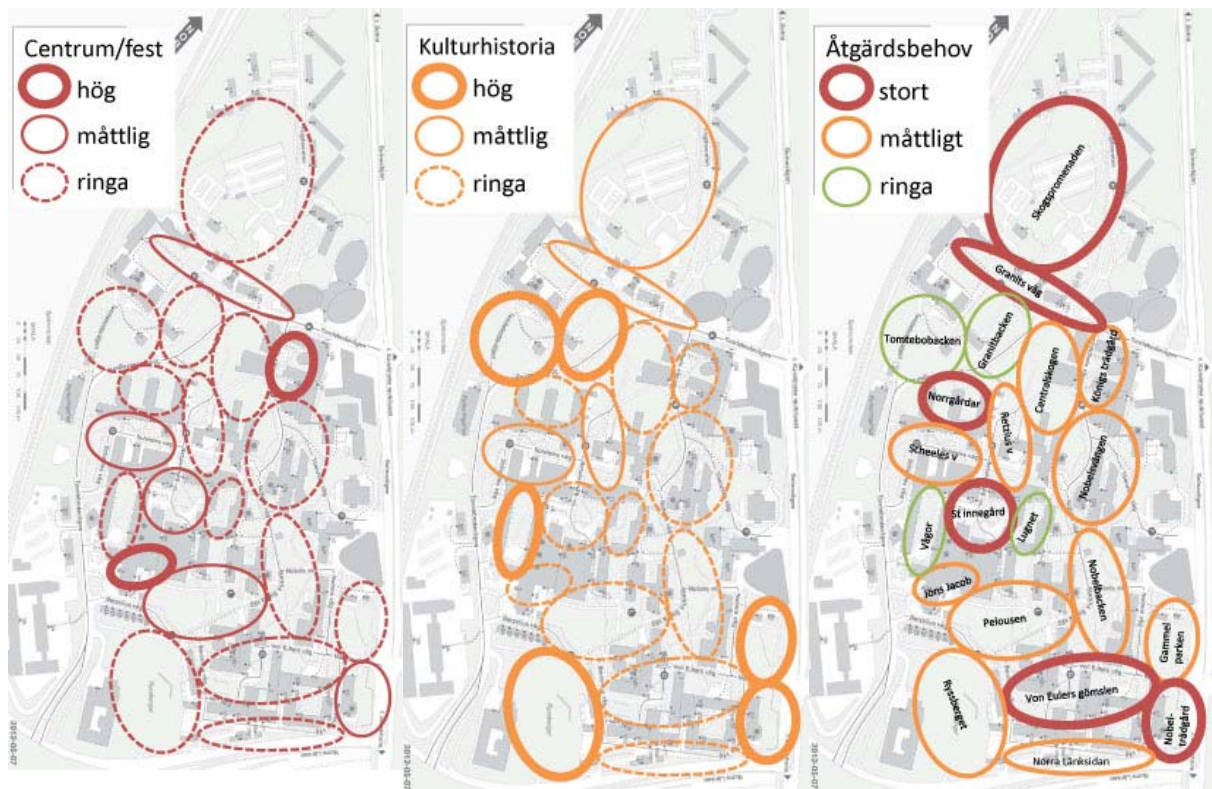
Culture



**Overall comparison of the development of the characteristics in the separate areas and a prioritization of need for improvement**







### Further use of the method

The above analysis of the KI campus is now being used by KI as the basis for a new master plan and detail plan. The analysis is one of the basic documents being used by the property owner for procurement of consultants/architects suitable to work with the continuing detailed planning.

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