Nature valuation in landscape planning and its application to urban areas

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I had my academic training in landscape ecology, and did my PhD on the economic value of nature, but I must confess, I am not a specialist in urban areas. So I looked in the literature to find the definition of what an urban area actually is. One says that: "It is a spatially limited area characterised by humans living in high density and supported by biophysical processes mostly occurring somewhere else." This definition was inspired by the background of the person who wrote it, Bill Rees. He is the inventor of the ecological footprint concept, and he rightly emphasised the relation between the area were you live and the wider surroundings. As far as I could see in the literature, there isn't a scientifically accepted definition. *The Millennium Ecosystem Assessment* stated that the mostly used definition is the amount of people living per square kilometres which should be between 400 and a thousand, to be an urban area. The final decision on the definition makes very different kinds of landscapes. At a global scale, the Millennium Ecosystem Assessment calculated that almost 3 billion people are living in urban areas; it was about 50 % of the total population at that time. And I could understand from the previous presentation that Sweden actually is an urban society, 85 % of you are living in urban areas, which for me, living in the Netherlands with a much higher population density than Sweden, was quite surprising. I thought you were a rural kind of society. You can debate later today on the consequences of what is better in terms of sustainability, and what is better in terms of quality of life. Those are two important issues that not always go hand in hand.

I also looked up the definition of *landscape*, and that also proved difficult. On the IALE homepage, there is a definition that emphasises the link between the social and biophysical aspects of the discipline, and I could not find a definition of landscape itself. One by Felix Kienast is "a portion of land or territory that has been shaped by natural and human driving forces yielding specific qualities for the life of its inhabitants". It emphasises the link between natural and human driving forces. Wikipedia tells that the word "landscape" comes from the Dutch history, from the field of painting, the word *landschap* that earlier meant simply "region, tract of land'" but had acquired the artistic sense, which it brought over into English, of "a picture depicting scenery on land". As an example I use a painting of a river landscape.

So can we actually speak of urban landscapes or even urban ecosystems? If we accept

the definition that it should have a combination of natural and human dominated processes, I think there is very little "nature" left in the very densely populated urban areas and the term "ecosystem" seems problematic. Ecosystem means that there is a combination of life communities and their abiotic environments, being able to self-organise, i.e. self-sustaining, which obviously is not the case.

As I mentioned earlier, the concept of ecological footprints has been used by Carl Folke from Stockholm University, who calculated that an urban area needs an area as big as 500 to 1000 times as big as itself to support its community, with food, with recourses, with energy, all kinds of things that you need to maintain your quality of life.

To make urban areas more sustainable, we may need to work towards true "urban ecosystems". Some examples are developing in Asian areas, where you can see a balance between the natural and the human-dominated processes. But in the long run, will this be the future we want for the planet? A global urban village where everything looks the same? The idea behind the image was that we will all be living happily and sustainable together, but, this will take up a bit of space, and its very different from what we call "nature". I'm not quite sure if this is the best way to go – something to discuss today!

We are increasingly trying to get nature back into these urban areas. Stockholm is one of the greenest or 'bluest' (with much water) urban areas in the world, and the reasons for doing this are very mixed, aesthetic reasons, also ecological reasons (even red-list species are found in the Stockholm wider area), and also for economic importance, which is what I will focus on in the rest of my presentation.

A green area takes up space. If you have a green area, you cannot build an office or some other economically important buildings, so it's quite expensive and often seen as a cost to society. What are the economic benefits of having nature and protecting nature? Often we only realise the full value of nature after it's gone. For me as an ecologist the motivation to calculate economic (monetary) values of nature is to communicate the "true" value of nature to human society since economics is often the driving force for converting nature into something else.

I mentioned the Millennium Ecosystem Assessment. It was a global assessment on the dependency of human well-being on biodiversity, and on ecosystems. It was published in 2005 and over 1360 scientists were involved in that study. It was a very widely published study which I think helped much to put the notion of ecosystem services on the map and in the consciousness on the policy arena. I will focus on the economic aspects of it. One message that came out, which was not the purpose of the assessment, was that we are at the brink of disaster. It was mainly to emphasise what we can do to live in harmony with the ecosystem and it's services. They claimed that it was unique that they looked at the ecosystem services, which was maybe not true, because research has been going on for 30 or 40 years now. But it was the first global assessment that looked at it in a comprehensive and systematic way.

There are three main types of services: The *provisioning* services, the things that we get out of nature, the food and the recourses and

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so on, the *regulating* services at the process side, the things nature do in terms of maintaining air quality and water quality and so on, climate regulation and so on. And the third service was *cultural* services, the non-material benefits from ecosystems. This was my main contribution to the study. I was leading the part that was looking at the cultural services together with Prof. Ramakrishnan from India. It was a very interesting experience to look at it from a western and a more eastern perspective. A lot of reports came out of the MA (see www.maweb.org). The balance sheet showed quite predictably that over 60 % of the ecosystem services were degraded, mainly in terms of the regulating services, which we destroy on expense of the provisioning services, taking the resources out of the environment. The millennium assessment purposely did not look at the economics of the assessment, not to get into all kinds of difficult political discussions, but now that has been picked up recently, in a study called TEEB, *Economics of Ecosystems and Biodiversity* (www.teebweb.org). It is lead by Pavan Sukhdev – a banker on the Indian board of Deutsche Bank. I think it is very good that he is leading this study, because it is important that someone that is trained in the economic field is leading a study like this. This is the statement he made when the study was launched: "Society must urgently replace its defective economic compass so that it does not jeopardize human well-being and planetary health through the undervaluation and consequent loss of ecosystems

and biodiversity". The study was initiated after the G8-meetings in Potsdam in 2007. Germany at that time chaired the European commission and initiated this study.

It mainly looks at three aspects: The benefit side of biological diversity, the cost of loosing biological diversity and the last point was looking into the consequences of not taking this into account: *the cost of doing nothing*. Similar to the Stern-report a few years ago, that calculated that if we don't do anything now, to combat the climate change, the cost will be much higher later on. Similar reasoning you can apply to loosing biodiversity.

The fourth group is the *habitat* services, that the MEA has called supporting services. I think this is a very important category to explicitly include in the assessment. Often the criticism on this kind of utilitarian approach to nature, translating ecological processes and services into values, is that we forget the ethical side to it. I have been working on this now for 25 years, and in the beginning I was one of the few natural scientists looking at this, and got a lot of emotional reactions. There are a lot of discussions about price and value, and I will not go into any detail now, but still I think the concept has more positive than negative aspects.

By including the habitat service in the basic assessment, you can avoid this kind of criticism. Within the TEEB study, I am working on developing a database, with all the ecosystem services and values, and for that we have identified more than 78 different sub-services. I will provide a few examples in relation to urban areas. One report I would like to mention here is a report by Bolund & Hunhammar 1999, who made an assessment of Stockholm: Green space and the services provided by the green spaces in the city and around it, when you're looking at food, air quality, climate regulation, regulation of water flows, water purification and the habitat and cultural aspects. Just a few examples on the provisional side: Urban agriculture is a term that is coming up more and more. UNDP released a report last year on the link between urban agriculture and the food provisioning, providing jobs and leading to a more sustainable city. A study that is ongoing at the moment looks at Almere, a satellite city to Amsterdam, where they want to produce 10 % of the food needs in the area in the future with "stadlandbouw" which means city agriculture, and they calculate that it would save 5 000 000 car kilometres. That is saving the same amount of energy that 4000 households would be using, and equals the carbon fixation of 500 hectares of forest, so it can have a big environmental impact.

Another example of these regulating services provided by green spaces would be air quality regulation. A study in the Netherlands, calculated that an average hectare captures around 30 to 70 tons of particles per ha/year, thus the air in a forest is on average ten times as clean as an industrial area. On the economic side, a park in a city has an economic value in terms of avoided damage costs. 125 people die too early in big cities like Paris because of air pollution. That is mainly elderly and sick people, who could have lived longer without this air pollution. You could also calculate other health effects.

Another way is looking at the replacement costs. Instead of a tree, you could replace it by a filter, which they did in Paris. In the

1960ies, they had these artificial air filters, which were thought to clean the air. It didn't work very well: It was quite expensive and the filters got clogged. Today we develop more modern alternatives and you can go to so called oxygen bars in Tokyo city and other big cities, where you can get fresh air for two dollars a minute, representing (part of) the replacement cost of a tree. The same principle you could apply to water purification in Amsterdam. Some years ago they had an experimental load in the canals, the floating islands, which would absorb the organic matter and nutrients. It costs 2000 dollars per hectare per year.

In most places we are not using nature anymore but we replace it without realising how much we lose. The cultural services, or the so called information functions or non-material benefits of nature, of green space and nature, are the aesthetic values of nature, we like to walk in a park, take pictures of sunsets … Also the spiritual and historical aspects are really important. In some big cities we have big parks and lakes that are protected for this reason, which represent a very high opportunity cost, and inspiration for art, design and learning as a cognitive aspect. The economic value, in this case, you could calculate through the influence of physical health, like fitness and obesity. It has been calculated that children that have access to open green space are less obese than children that don't have that opportunity. Finally the habitat service, the fourth category: A lot of species have been accustomed to living in the city, and actually there are studies showing that some evolution (speciation) is going on. Some bird species and insect species are becoming so adapted to this urban environment that they are forming new sub-species. Finally, though we know a lot about these ecosystem services and economic values, one should always realise, that there is a lot of things we don't know yet. "Optional values" as they call it such as the many unknown uses of frogs; little tree frogs have a lot of functional services, one of them is the structure of their feet, which can be used making post-its stick without glue, or improve car tires.

What can you do with this information to improve planning? Work with nature instead of against! Money spent on nature conservation is still seen as a cost. This is money that we cannot use for something else, but scientific evidence is more and more showing that the benefits of investing in nature conservation is much higher than the costs, and we now loose between 3-5 % of GDP on damage and repair cost due to loss of ecosystem services. We have thus built up an enormous "natural debt". Studies are showing that nature-restoration (something that will be discussed later this afternoon) has a positive benefit-cost ratio between 3 and 75 times for every € invested. Money spent on nature conservation and restoration should therefore not be seen as a "cost" to society but as an investment in enhancing and maintaining the many services provided by these ecosystems.