Contribution to Beyond GDP „Virtual Indicator Expo“

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Name of the indicator/method: **The Natural Capital Index framework (NCI)**

Summary prepared by: Ben ten Brink, Netherlands Environmental Assessment Agency (MNP)

Date: October 25, 2007

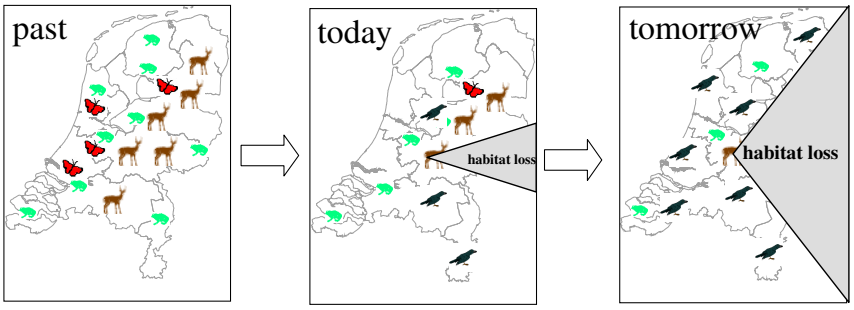
As any successful business that keeps track of revenues and expenditures, society needs robust accounts of its ecological assets. That is what the Natural Capital Index framework accounts for next to complementary indicators such as change in the extent of ecosystems, the Red list and the ecological footprint.

The Natural Capital Index framework (NCI), developed as a contribution to the implementation of the Convention on Biological Diversity (CBD), was designed to answer the questions “How much biodiversity remains?", “What are the causes of loss?" and "What can we do about it?” for policy-makers and public. NCI measures human impact on biodiversity and has been implemented in national, regional and global assessments. It is not so much one single –fixed- indicator but merely a flexible indicator framework which can be tailored to the specific scale, available data, and demand.

Which process to indicate?

The rate of biodiversity loss has been accelerating rapidly throughout the industrial era. According to the Global Biodiversity Assessment, species are now becoming extinct at 1,000-10,000 times the natural rate. However, extinction is just the final step in a long process of ecosystem degradation, in which a decline in the abundance of many original species is accompanied by the increase in the abundance of a few other, often human-favoured, species. This we call the homogenisation process.

This trend has two main components: i) loss of habitats, or “ecosystem quantity”, resulting from the conversion of natural areas into agriculture and built up land and ii) loss of ecosystem quality due to factors such as climate change, pollution, habitat fragmentation and over-exploitation. In the figure below, the grey cutouts illustrates the habitat loss, while, in the remaining natural areas, the decline in ecosystem quality is shown by the decreasing abundance of many original species. Notice the initial increase in the species richness. ‘Species abundance ‘ (number of individuals of a species) has turned out to be a far more sensitive, more measurable and a more accurate indicator of biodiversity loss than the more traditional species-richness indicator. The CBD has selected ‘species abundance’ as a key indicator to evaluate the progress towards the 2010-target.



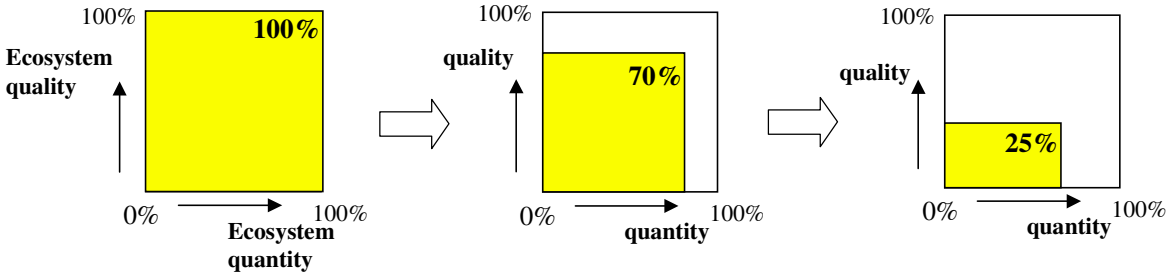
The Natural Capital Index framework (NCI)

The challenge is to create a tangible, powerful composite indicator that accurately describes the above process for meeting policy requirements. Furthermore, this indicator must be relevant and appealing for policy development, quantitative, sensitive, affordable, measurable and universally applicable. Finally, it should represent the entire ecosystem and must be linkable with socio-economic scenarios to make projections. *For these reasons NCI considers biodiversity as "natural capital", containing all original species with their corresponding abundance*.

Given its two main components, as mentioned above, NCI is defined as the product of the size of the remaining ecosystem (quantity) and its quality.

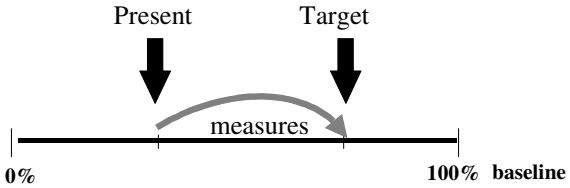
NCI = ecosystem quantity (%) x ecosystem quality (%).

The NCI can be established for natural areas such as forests, inland waters and grasslands, as well as for man-made areas such as agricultural land and urban areas. *Ecosystem quantity* is calculated as a percentage of the total area (% area of the country or region). *Ecosystem quality* is calculated by counting the average abundance of a core set of characteristic animal and plant species. Quality is defined as the ratio between the current situation and baseline state (percentage of the baseline). The three diagrams "ecosystem quantity and ecosystem quality" below show how the process of ecosystem degradation can be visualised using the Natural Capital Index. If for example 50% of the natural area remains, with a quality of 50%, than the NCI is 25%. This means that the average abundance of the original species is 50% of the natural or low-impacted state, and so on. To avoid masking, significant increased populations of original species are truncated at 100%, although they should actually have a negative score. Exotic or invasive species are not part of the indicator, but their impact is represented by the decrease in the abundance of the original species they replace. The NCI ranges from 0 to 100% representing an entire deteriorated and intact ecosystem, respectively. The dimension is 'mean species abundance of the original species' or briefly 'mean species abundance' (MSA).



Baselines needed

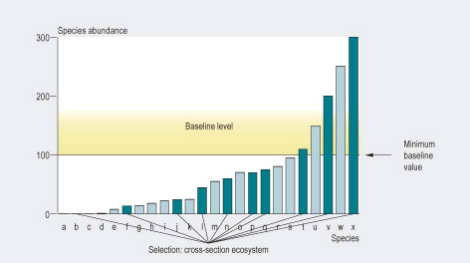
Ecosystem quality cannot be determined without defining a baseline. Baselines are starting points for measuring change from a certain state or date. They are common practice for such items as medical care, economic development and climate change. Since there is no unambiguous natural baseline point in history, and all ecosystems are also transitory by nature, a baseline must be established at an arbitrary but practical point in time. Because it makes the most sense to show the biodiversity change when human influence was accelerating rapidly, the first CBD Liaison Group on Biodiversity Indicators recommends "a postulated baseline, set in pre-industrial times" or a "low-impact



baseline" as being the most appropriate. The baseline i) allows aggregation to a high level, ii) makes figures within and between countries comparable, iii) is a fair and common denominator for all countries, being in different stages of economic development, and iv) is relevant for all habitat types. Similarly, agricultural ecosystems are compared with the traditional agricultural state as the baseline, actually before industrialisation of agricultural practices started.

It has to be stressed that the baseline is not the targeted state. Policy-makers choose their ecological targets somewhere on the axis between 0 and 100%, depending on the political balance between social, economic and ecological interests.

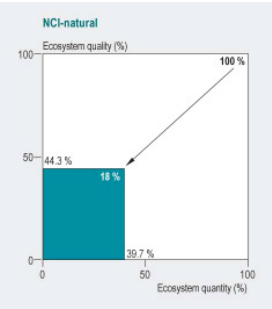
Smart sampling

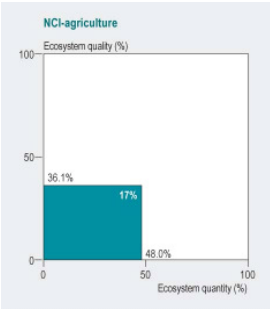


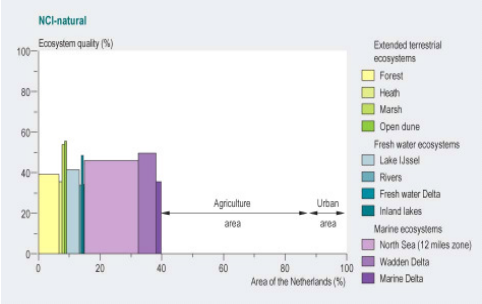
How can ecosystem quality be determined in a practical and affordable way? It is neither necessary nor possible to monitor all species. A representative cross-section of characteristic species suffices to describe –the above mentioned- the uniformity process of the entire ecosystem. For each species, quality is calculated as the ratio between the current state and the minimum baseline value. Ecosystem quality is a function of the abundance of species relative to the baseline. Ecosystem structure variables such as 'area coral reef and canopy cover' can be used as substitute in case of lack of data on species abundance. This selection and averaging method is similar to that for economic indicators, such as the retail price index, a representative selection of products monitored in a subset of stores, the so called "shopping bag". Subsequently, the changes in prices are also averaged and weighted; this is because a price increase in bread cannot simply be averaged with a price increase in cars.

How much Natural Capital is left in The Netherlands?

The quantity of natural aquatic and terrestrial ecosystems in the Netherlands has declined to 40% of its total territory, while the average quality of these ecosystems is estimated at a modest 44%. The resulting NCI is thus 18%, the product of quantity and quality. So roughly speaking, 18% of the average abundance of the original species remains in comparison with the baseline state. The NCI for agricultural land is 17%.



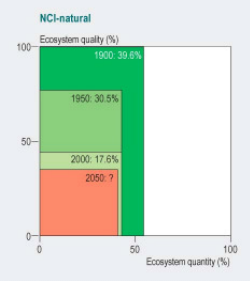


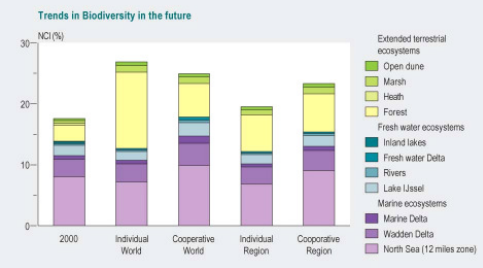


The contribution of the various natural ecosystem types to the Dutch Natural Capital is presented in the figure above right. Quantity and quality are given for each ecosystem type. Marine and large fresh-water ecosystems are very important in the Netherlands, together covering more than 75% of the area of natural ecosystems and displaying medium quality. Forests, heath and inland lakes are examples of smaller areas with a lower quality. In the diagram alongside the x-axis has been enlarged in order to see the contribution of the smaller ecosystem types.

A snapshot of NCI values taken in the year 2000 does not provide sufficient information for policy-makers. What happened in the past, what were the main causes, what can be done to restore biodiversity in an efficient manner? The NCI for Dutch natural ecosystems has declined rapidly in the last hundred years. Much of the area was lost in the first half of the century, while ecosystem quality decreased, especially in the second half of the century. A scenario analysis shows that the Natural Capital Index may improve from 18% up to even 27% over a 30-year period, which represents a significant increase in natural capital.

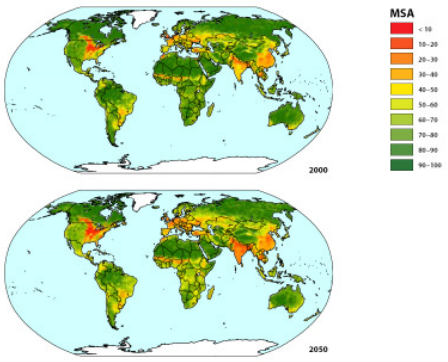
History of Natural Capital & Future trends in The Netherlands

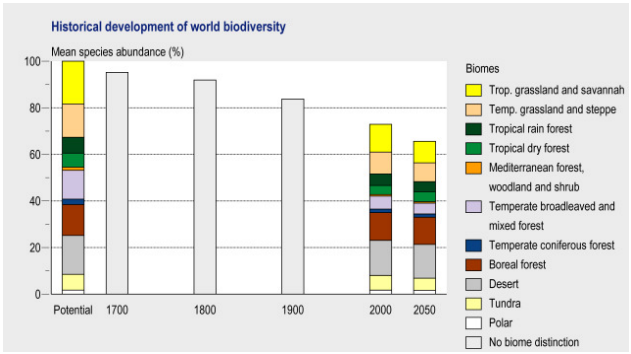




How much Natural Capital is left in the World?

If there are no data on species abundance available a pressure-based NCI may be used as substitute. The underlying assumption is that the higher the pressure on biodiversity the lower the probability of a high mean species abundance of the original species (MSA). The GLOBIO model contains global cause-effect relationships between agriculture, forestry, climate change, N-deposition, fragmentation and infrastructure and MSA, based on more than 700 publications (Alkemade et al. 2007). For each grid cell the considered pressure values are added and calculated into a MSA value. The NCI at global and regional levels is the sum of the MSA of the underlying grid cells, in which each square kilometre of every biome is equally weighted (ten Brink, 2000). The GLOBIO model is a joint cooperation between the Netherlands Environmental Assessment Agency (MNP), UNEP-WCMC and UNEP-GRID Arendal in conjunction with many partner institutes. GLOBIO has been implemented for example to UNEP's Global Environment Outlooks, the CBD Global Biodiversity Outlooks (GBO), and OECD's Environment Outlook and Strategy. The maps below show the calculated MSA in 2000 and 2050 and the global NCI over the period 1700-2050 (95% -> 63%) (CBD technical series no. 31, 2007).





Contact:
Netherlands Environmental Assessment Agency (MNP)
ben.ten.brink@mnp.nl
0031-30-2742210