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Environmental workshop: indicators and missing areas
Fondazione Eni Enrico Mattei & Siena University

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Deliverable 4.1

Environmental workshop: indicators and missing areas

Summary

The E-FRAME "Environmental workshop: indicators and missing areas", held in Venice the 5th-6th December 2013, analyzed and discussed the more recent developments in the environmental indicator literature and shed some lights on the challenges for future research. Indicators are indeed powerful tools to synthesize a multidimensional phenomenon and convey information. At the same time however, their use and reliability is often limited by problems of data quality and consistency, lack of agreement on common definitions and methodological approaches, of transparency and intrinsic subjectivity in construction. This workshop analysed three important issues in the assessment of environmental performances: the role of ecological indicators, the practice of integrated economic-environmental accounts and the correlation between indicators and environmental policy.

Index

1 Introduction

The 21th century has seen an unprecedented economic and social development but, at the same time, increasing threats for Earth system and its functioning. Human activity is triggering the planetary boundaries reducing biodiversity, exerting pressure on natural resource assets and altering the climate equilibrium (Rockström et al., 2009; OECD, 2013). The complexity of the problem advocates the use of transparent and synthetic measures providing clear insights on the current situation and to identify some boundaries guaranteeing the integrity of the system. Against this background, indicators of environmental performance constantly improved, covering more and more aspects, becoming more reliable and refining the measurement approaches. Moreover, since the first World Earth summit (1992), it has become evident that the environmental dimension cannot be conceived separately from the economic and social ones, causes and effects of environmental performance. All the three concur to determine the future evolution towards a sustainable development path. The recent Inclusive Green Growth initiative offers some suggestion in this direction discussing a paradigm of balanced economic, social and environmental development (GGKP, 2013; Hallegatte et al. 2013).

The E-FRAME "Environmental workshop: indicators and missing areas", held in Venice the 5th-6th December 2013, presented and debated on the more recent developments in the environmental indicator literature and practice and shed some lights on the challenges for future research.

This chapter aims to give an overview of the outcomes of the workshop, analysing three key topics in measuring environmental performance: the role of ecological indicators, the practice of integrated economic-environmental accounts and the indicators' correlation with environmental policy.

2 State of the art of environmental indicators

Monitoring environmental state is fundamental in understanding the effects of economic growth and social development on the Earth system whose equilibrium and correct operation guarantees future generations' well-being and wealth. Indicators are long-established and widely used tools to synthetizing highly specific information into trends that are robust, easily understandable and communicable to a non-expert audience (Stiglitz et al, 2009). The frameworks used to select, measure and rank indicators are many e.g. the Pressure-State-Response approach, the issue - or theme - based approach, the ecosystem, well-being and capital-accounting approach. Indicators are indeed powerful tools to synthesize a multidimensional phenomenon and to easily convey information. Nonetheless any aggregated/holistic measure unavoidably induces a loss of detail in the information produced as the "big picture" may hide specificities and special cases. Moreover, the criteria governing the aggregation process itself (e.g. what to aggregate, how, with which weights) can be prone to subjectivity. This fostered two tendencies in the use and development of environmental indicators: one to produce "summarizing" indexes, the other to use large set of indicators.

Many aggregation methodologies, aggregated and composite indicators flourished in a natural attempt to resolve complexity and convey clear and holistic messages to practitioners, policy makers, stakeholders, but also to be more transparent and reach the general public. In this vein: the ecological footprint (Rees and Wackernagel, 1994; Wackernagel and Rees, 1996, 1997), which is probably the best example of a successful communication device for its widespread use outside the academia, the Yale Environmental Performance Index (EPI)[1], Environmental Sustainability Index-ESI (World Economic Forum, 2002) and Living Planet Index-LPI (Loh, 2002)

A milder form of aggregation took also place, addressing specific aspects of environmental sustainability rather than environmental sustainability as a whole. This is witnessed since the early '90s not only by a real booming of "footprint indicators" like e.g. the water footprint[2] (Hoekstra *et al.*, 2011), the carbon footprint[3], the material footprint (Wiedmann *et al.*, 2013), but also by more complex indicators proposed by ecological economics, like work-energy[4], eco-exergy[5] (Jorgensen, 2010), emergy[6] (Odum, 1996). These last recognize that a simple evaluation of environmental performance, neither gives a complete account of ecosystem role nor capture adequately the support supplied to the economic and social systems by ecosystem services (provision of materials and physical space; absorptive capacity; life support; recreation). Moreover, they try to go beyond the monetary evaluation that can be a first step to identify the contribution of natural capital to growth and progress, but lacks in reproducing the forces determining natural capital formation and operation.

At the same time, international organizations and institutions such as the United Nations, the OECD, the World Bank, the European Union, the European Environmental Agency, as well as single countries and research institutions constantly developed a widespread set of indicators to measure environmental performances and the status of natural ecosystems and resources.

The current environmental indicators' dashboards branch into several themes: emission accounts (GHGs, CO_2, SO_x, NO_x, and particulates), worth to mention here the GhG inventory framework according to the IPCC guidelines (IPCC 2006), environmental assets exploitation (water use, land use, use of forest resources, use of fish resources, use of material resources, waste disposal) and quality (water and land pollution, biodiversity), and efficient use of resources in the consumption and productive processes (energy intensity, energy efficiency).

Composing the dichotomy between top-down or aggregated measures of environmental sustainability, and bottom-up, specific indicators, remains thus the first and partially unresolved challenge for environmental indicators. Indeed the closer an indicator is to raw data - differently said, the highest is its degree of specificity - the closer it is to what it measures and the higher it is

[1] Yale Environmental Performance Index: http://epi.yale.edu/

[2] For further information on water footprint: http://www.waterfootprint.org/?page=files/home and http://www.waterfootprint.org/?page=files/WaterFootprintAssessmentManual

[3] Carbon footprint: http://www.carbonfootprint.com/

[4] In physics, work energy is that part of the total energy that can "do work" in contrast to the heat released at the temperature of the environment that cannot be utilized to do work. All activities require work-energy – therefore it seems reasonable to apply work-energy to express sustainability.

[5] Exergy is a measure of the thermodynamic distance of a system from the equilibrium with the surrounding environment, and therefore, it is both a quantitative and qualitative measure of the energy (mostly free energy in the context of ecological systems) incorporated into a system.

[6] Emergy evaluates the work previously done to make a product or service. It is thus a measure of energy used in the past and embedded in the product and service. In that it differs from a measure of energy now.

its degree of interpretability. This higher exactness, so important for scientifically sound analyses, is however inversely proportional to its ability to offer a comprehensive measure of environmental sustainability. This last is what is mostly sought by policy-maker, in other words one of the most important requisites to make the indicator policy relevant.

Indeed, the contribution of environmental indicators to inform the policy-decision process assessing countries' progresses in reaching given targets is an aspect often disregarded. And when the analysis concerns effectiveness, efficiency, political feasibility and social acceptability of environmental policies the use and reliability of environmental indicators is often limited by problems of data quality and consistency, lack of agreement on common definitions and methodological approaches.

3 The debate and the main results

3.1 Ecosystem performance

The first session of the workshop proposes alternative approaches in measuring environmental performances based upon concepts derived from the ecology and ecological economics and centred on ecosystems. An ecosystem is a community of organisms interacting with each other and with the surrounding environment. Ecosystem integrity is defined by Kay (1993), "An ecosystem has integrity if it retains its complexity and capacity for self-organization (arguably its health) and sufficient diversity, within its structures and functions, to maintain the ecosystem's self-organizing complexity through time".

The status of processes and structures essential for the system's operation can be measured with a pool of specific indicators that capture the systemic-holistic dimension of the topic. One important aspect is the energy balance of the system that can be measured for example using an indicator of useful energy supplied by the ecosystem: exergy. Also the work energy concept can be a valuable measure. The work energy capacity of an ecosystem is computed as the sum of useful energy that can do work; in its count, it is excluded the heat released at the same temperature of the environment that cannot be used to do work. Undertaking any activity, including the system structure regulation, requires energy that can be therefore considered a unifying unit measure for evaluating natural capital and its services. The work energy decreases when the renewable and non-renewable resources are used and when natural ecosystems are damaged or destroyed by pollution; this is due to the reduced ecological services supplied by the destroyed or damaged ecosystems. Instead, when the work energy capacity remains constant or increases, the ecosystem remains preserved and proceeds on a sustainable path. In assessing environmental sustainability, it is also important to distinguish between renewable and non-renewable energy that can be recovered and materials that are exhaustible and not-restorable.

Using work energy capacity, it is possible to assess whether a country or a region exploits its natural capital to favour growth or to stem natural and economic disturbances, highlighting the unavoidable link between the economic activity and the state of natural capital.

The sustainability of an ecosystem depends also on other aspects. For instance the carbon and nitrogen balance can be captured through indicators of nutrient loss (nitrate leaks) and storage capacity (intrabiotic nitrogen) (Muller, 2005). In addition, the functioning of the water cycle has a pivotal role to guarantee the equilibrium and the correct operation of the system and the organisms constituting it. Furthermore, biodiversity indicators, such as biotop heterogeneity and species abundance that evaluate the abiotic and biotic structure of ecosystem, can be useful in evaluating environmental resilience to external disturbances because maintaining the heterogeneity of species of an ecosystem preserves the width of possible solutions to future uncertainty.

All these dimensions should be evaluated in order to assess the integrity of ecosystems. This set of indicators of ecosystem performances can be used at national and local level to shed some light on the state and the perspectives of ecosystem and to assess the effects of different management options on its correct operations.

3.2 Integrating economic and environmental account frameworks

In recent years an increasing number of Multi-Regional Input-Output (MRIO) databases have been made available: their peculiarity is to combine economic and productive information (National Input-Output tables) with environmental accounts. These are global databases used in multi country multi sector General Equilibrium Models, like the GTAP database (Narayanan and Walmsley, 2008; Narayanan *et al.*, 2012), the OECD-WTO TiVA database (2013), or research projects developed within Sixth or Seventh Framework Programmes (FP6, FP7) like the FP6 EXIOPOL[7], or the FP7 CREEA[8] and WIOD[9]. The great advantages of these data bases are to provide internally consistent records of inter and intra country exchanges of inputs, goods and services, with a high sectoral detail, and to report additional statistics on emissions, material use, land use, water use, energy use, etc.

This offers a great potential for the computation of country-level indicators of environmental performance like the carbon or the material footprint, but also for the assessment of environment/economics linkages, e.g. energy efficiency and intensity. Paradoxically however, this abundance of data can be a problem when non negligible differences across databases are observed. The sources of inconsistencies are many: different raw data across databases due to different data access, different methodologies applied to recording some data types, different approaches used to resolve data asymmetries. In particular, major inconsistencies are observed in the treatment of international trade, import-export flows and when the methodologies applied to MRIO databases are replicated at the national level using national accounts. It is obvious that if (footprint) indicators are highly sensitive to the statistical methodologies used, then the comparability of different national measures is very weak. One potential solution is offered by Single-country National Accounts Consistent (SNAC) footprint indicators. This methodology consists in adjusting MRIO database, especially international trade data, to conform to the national and environmental accounts. It has been successfully applied to the Netherlands to calculate the adjusted carbon footprint. The method is generic in the sense that other countries can re-use the procedure to adapt MRIO to their own official statistics. In general an effort is required to uniform statistical methodologies through co-operation between statistical offices, between MRIO developers and statistical offices, between

[7] http://www.exiobase.eu/
[8] http://creea.eu/
[9] http://www.wiod.org/new_site/home.htm

statistical offices, MRIO developers and ecological and environmental economists which develop new indicators.

3.3 Environmental indicators and policy

The third session of the workshop analysed the interaction between the environmental indicators and policy-making. On one side, there is wide recognition that environmental policy-making should rely more on available data and be more rigorous on science foundations; effective environmental indicators can shape the public debate, guiding and legitimising the policy-making (conceptual and political roles). On the other side, indicators directly incorporating the policy targets, such as the ones measuring distance to target (Yale Environmental Performance Index[10]), can be important tools for institutional and private actors, helping them to tune policy measures and their effects (instrumental role).

Furthermore, indicators can also be developed for assessing environmental policy in itself. Policy effects materialize at different levels: in the perception of actors, in changing agents' behaviour, in producing the desired environmental outcome. Accordingly, even quantifying apparently simple attributes, like policy stringency or effectiveness, may require a multiplicity of methods and measures depending on the context: perception surveys, shadow cost estimates, environmental performance based measures etc. The same can be said when policy costs need to be assessed. In principle there are clear indicators of costs: direct and indirect effects on productivity growth, effects on competitiveness and in terms of additional administrative burden. The use of composite indicators seems thus particularly appropriate. In practice, each of the aspects mentioned poses very difficult problems of data availability to substantiate the indicators and of their interpretability.

4 The open issues

The three thematic sessions of "Environmental workshop: indicators and missing areas" highlighted gaps and challenges in current research on environmental indicators.

The natural capital and the services it produces have a key role in drawing sustainable development perspectives; however, the standard practice in assessing the state and trends of many environmental/ecological aspects remains anchored to monetary metrics (revealed preferences or stated preference techniques). This approach which disregards the underlying forces that determine the equilibrium and the operation of an ecosystem gives poor or still unsatisfactory outcomes. A valid alternative can be represented by ecosystem integrity indicators stemming directly from the ecological literature. The challenge ahead is therefore to integrate ecological perspective and instruments in the ecosystem evaluation, complementing the monetary-based approach; this will require an intensification of dialog between the statistical and ecological research communities, but

[10] Yale Environmental Performance Index: http://epi.yale.edu/

also a huge effort by national and international institution in collecting information on ecosystem characteristics.

Another relevant issue in measuring environmental performance, as part of the wider paradigm of sustainability, is the consistency of statistical information supplied by different institutions or collected for different purposes. The creation of MRIO databases is an important step toward the construction of more reliable and consistent environmental and economic indicators; however, the more recent SNAC footprint indicators that complement and correct multi-regional statistics with more local information are a promising research direction.

Furthermore, improving the dialog between researchers and policymakers is an unavoidable requirement to obtain better targeted policies and to customise indicator construction to the stakeholder's needs. Environmental indicator research could improve its policy relevance providing ex-ante and long-term assessment of environmental sustainability. The problem here is not that existing indicators are not fit to the purpose. In fact, there are many examples where environmental indicators have been used to assess potential future effects of given policies. The criticality relies on the uncertainty of the characteristics of the future reference scenarios and on the availability of projections for the variables of interest: the former component increases and the latter decreases depending on the time span of the investigation. This area is thus one in which mutual benefit can derive from the cooperation between indicators developers and economic-ecological modellers that have a long expertise in the analysis of long-term scenarios.

In the background, the debate on the complementarity between indicators and indices, and the correctness of aggregating heterogeneous indicators continues and some way forward are proposed. Aggregate environmental indicators are seldom used in isolation, but are usually supported by the information provided by larger indicator set and richer analyses. Composite indicators are increasingly transparent in the description of their single components, their weighting, aggregation processes and sources. Interestingly, the opportunity offered by recent development in communication technology, and in capability and flexibility of computer software, allowed also a higher interaction between indicators' developers and users, extremely useful to increase the transparency and acceptability of complex environmental sustainability assessments. This lead for instance to the development of decision support systems or deliberation support tools increasingly sophisticate. These go beyond the concept of an end user "at the end of the pipe", to involve actively relevant stakeholders in each phase of the environmental indicators based decision process: from the pertinence of the indicator proposed to the weights associated to each of these, to the targets to be pursued or the scenarios to be considered.

5 Conclusions

A still unsolved issue pertains to the dichotomy between scientific exactness, informative content and precision that are higher the closer environmental indicators are to raw data, and ability to convey easily interpretable messages on overall environmental sustainability, that is negatively correlated to the complexity and specificity of raw data and requires elaboration and aggregation of indicators. A viable strategy is to use aggregation methodologies together with specific indicators and to increase their transparency also involving actively stakeholders in each step of the decision/evaluation process.

A very similar problem is related to monetization. Money metric can be a useful unit of measure, but cannot capture many aspects of environmental sustainability. Ecological indicators in this case can provide a useful support. Ecological concepts could/should be thus fruitfully included in the beyond GDP debate.

Environmental policy assessment remains a complex exercise as aspects like policy stringency and policy costs are difficult to capture. Different methodologies have to be applied and the challenge is to derive a coherent picture from all the different information.

Using environmental indicators for long-term assessment is an underdeveloped research area with unexpressed potential. This would require more interaction between indicators developers and ecological/environmental economics modellers, used to scenario analyses.

Finally, great benefits in terms of, informative capacity, robustness of result, and ultimately credibility and policy influence of environmental indicators would be gained by fostering communication across different disciplines especially environmental economics, ecological economics and statistics. There is indeed a basic need to uniform terminologies, concepts and statistical methodologies. This last aspect calls also for stricter linkages across different statistical offices, databases' and indicators developers.

References

EEA (2012), Environmental indicator report 2012. Ecosystem resilience and resource efficiency in a green economy in Europe, European Environmental Agency

Hoekstra A.Y., Chapagain A.K., Aldaya M.M. and Mekonnen M.M. (2012), The water footprint assessment manual: setting the global standard, Earthscan, ISBN: 978-1-84971-279-8.

IPCC, (2006). IPCC Guideline for National Greenhouse Gas Inventories. Eggleston, H.S., Buendia, L., Miwa, K., Ngara, T., Tanabe, K., (Eds.), IGES, Japan.

Jørgensen S.E. (2010). Eco-exergy as ecological indicator. In: Jørgensen, S.E., Xu, F., Costanza, R. (Eds.), Handbook of Ecological Indicators for Assessment of Ecosystem Health. 2nd ed. CRC, Baton Rouge, Florida, pp. 77–89.

Kay, J.J. (1993). On the nature of ecological integrity: some closing comments. In: Woodley, S., Kay, J. & G. Francis (eds.): Ecological integrity and the management of ecosystems. University of Waterloo and Canadian Park service, Ottawa, 201-214.

Loh, J. (ed.) (2002): Living Planet Report 2002. World Wildlife Fund. 39 pp.

Müller, F. (2005). Indicating ecosystem and landscape organization, Ecological Indicators, Volume 5, Issue 4, November 2005, Pages 280-294

Narayanan G.B., Aguiar A. and McDougall R. (2012), Global Trade, Assistance, and Production: The GTAP 8 Data Base, Center for Global Trade Analysis, Purdue University.

Narayanan G.B. and Walmsley T.L. (2008), Global Trade, Assistance, and Production: The GTAP 7 Data Base, Center for Global Trade Analysis, Purdue University.

Odum E.P.(1977) The Emergence of Ecology as a New Integrative Discipline. Science, 195 (4284), pp. 1289-1293.

Odum H.T. (1996). Environmental Accounting. Emergy and Environmental Decision Making. New York: John Wiley and Sons.

Rees W. and Wackernagel M. (1994), Ecological footprints and appropriated carrying capacity: Measuring the natural capital requirements of the human economy, in Jansson A. et al.. Investing in Natural Capital: The Ecological Economics Approach to Sustainability. Washington D.C.:Island Press. ISBN 1-55963-316-6

Stiglitz,J.E., Sen, A. and J. Fitoussi (2009), Report of the commission on the economic and social progress, Commission on the Measurement of Economic Performance and Social Progress http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf

Wackernagel M. and Rees W. (1996), Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island, BC: New Society Publishers. ISBN 0-86571-312-X.

Wackernagel M. and Rees W. (1997), Perceptual and structural barriers to investing in natural capital: Economics from an ecological footprint perspective, Ecological Economics, 20: 3-24.

World Economic Forum (2002): 2002 Environmental Sustainability Index. An Initiative of the Global Leaders of Tomorrow Environment Task Force, World Economic Forum

Wiedmann T.O., Schandl H., Lenzen M., Moran D., Suh S., West J. and Kanemoto K. (2013), The Material Footprint of Nations, PNAS, doi:10.1073/pnas.1220362110

Annex I

PROGRAMME

Thursday, December 5th, 2013

08:30 – 09:00 Welcome breakfast

09:00 – 09:30 Registration
09:30 – 09:40 **Welcome address and Workshop introduction**
Francesco Bosello, FEEM, CMCC and University Statale of Milan, Italy
09:40 – 10:00 **Introduction to the e-Frame project**
Marina Signore and **Donatella Fazio**, Italian National Institute of Statistics, Italy
"e-Frame project and its contribution on the Beyond GDP debate"

10:00 – 12:30 **Thematic Session I - New trends and methodologies to measure environmental performances**

10:00 – 11:00 **Sven Erik Jørgensen**, Copenhagen University, Denmark
"Selection of Sustainability Indicators"

11:00 – 11:30 Coffee break

11:30 – 12:30 **Felix Müller**, Kiel University, Germany
"Recent development in ecological indicators to represent environmental performance"

12:30 – 14:00 Lunch

14:00 – 18:30 **Thematic Session II - Challenges, procedures and experiences in including environmental indicators in national accounting**

14:00 – 15:00 **Rutger Hoekstra**, Statistics Netherlands (CBS), The Netherlands
"Sensitivity of carbon footprint calculations: bridging the gap between academia and statistics"
15:00 – 16:00 **Martin O'Connor**, International Centre for Research in Ecological Economics, Eco-Innovation and Tool Development for Sustainability (REEDS), France
"Descriptive and normative uses of ecosystem services indicators developed within the framework of integrated economic-environment accounting"

16:00 – 16:30 Coffee break

16:30 – 18:30 **Poster session – Theory and practice of Environmental Indicators: selection, construction, measurement and use issues**

Chair: **Francesco Bosello**, FEEM, CMCC and University Statale of Milan, Italy
Simone Borghesi, Dario Caro, Simone Bastianoni, Federico M. Pulselli, University of Siena, Italy, *"Toward a different emission allocation method in national GHG"*
Francesco Bosello, Lorenza Campagnolo, Carlo Carraro, Marinella Davide, Fabio Eboli, Elisa Lanzi, Ramiro Parrado, FEEM, Italy, *"Can Climate Policy Enhance Sustainability?"*

Leonardo Casini, <u>Fabio Boncinelli</u>, Gabriele Scozzafava, University of Florence, Italy, *"The determinants of well-being in rural areas: Tuscany case study"*
Luigi Costanzo, Alessandra Ferrara, <u>Angela Ferruzza</u>, Italian National Institute of Statistics, Italy, *"Landscape indicators: an overview of the first set proposed under the BES project*"
<u>Donatella Fazio</u>, Italian National Institute of Statistics, Italy, *"The European Network on Measuring Progress: an opportunity to foster the debate on environmental indicators for a sustainable societal progress"*
<u>Angela Ferruzza</u>, Stefano Tersigni, Paola Ungaro, Italian National Institute of Statistics, Italy, *"Environmental Indicators to measure Sustainable Human Wellbeing in Italy"*
Jean Louis Pasquier (presented by <u>Claire Plateau</u>), INSEE, France, *"The Hidden Face of Material Consumption. Illustration from the French Economy"*
<u>Federico M. Pulselli</u>, Luca Coscieme, Simone Bastianoni, Nadia Marchettini, University of Siena, Italy, *"From ecosystems to human systems: an input-state-output approach to categorize National Economies"*
<u>Lucia Rigamonti</u>, Irene Sterpi, Francesca Lovato, Mario Grosso, Politecnico di Milano, Italy, *"An indicator for the assessment of environmental and economic sustainability of integrated MSW management systems"*
<u>Katharina Stepping</u>, German Development Institute, Germany, *"Challenges for measuring the state of the environment in developing countries"*
17:30 – 18:30 Discussion

20:00 – 23:00 Social dinner at Bacarando in Corte dell'Orso, San Marco 5495, Venice

Friday, December 6th, 2013

08:30 – 09:00 Welcome breakfast

09:00 – 13:00 **Thematic Session III - Environmental indicators in the broader policy context and/or in relation with other sustainability dimensions**

09:00 – 10:00 **Tomasz Koźluk**, OECD, France
"Indicators of environmental policy stringency and burdens"
10:00 – 11:00 **Angel Hsu**, Yale Center for Environmental Law and Policy, USA
"Indicators in the Policy Process: Over a Decades' Lessons Learned from The Environmental Performance Index"

11:00 – 11:30 Coffee-break

11:30 – 12:30 Open discussion: keynote speakers and e-Frame partners
12:30 – 13:00 Wrap-up and conclusions

13:00 – 14:00 Farewell lunch

Annex II

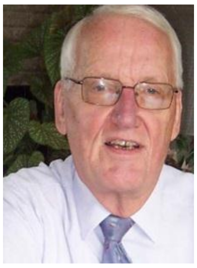
Speaker's Profiles

Rutger Hoekstra
Statistic Netherlands (CBS), The Netherlands

Dr. Rutger Hoekstra is a senior statistical researcher in the Department of National Accounts of Statistics Netherlands. He graduated from Wageningen University and did his Ph.D. in environmental economics at the Free University of Amsterdam. He has worked at Statistics Netherlands since 2003. Rutger was chairman of the joint UNECE/OECD/Eurostat Task Force for Measuring Sustainable Development (TFSD). He shared the chair with colleague Jan Pieter Smits. The final report of the TFSD, which provides a framework and indicators for measuring sustainable development, was endorsed by the Conference of European Statisticians in June 2013. Rutger Hoekstra is also co-chair of the e-Frame Consortium Management Board and organizer of the e-Frame Final Conference in February 2014. Various other (environmental) positions include: Dutch Sustainability Monitor (project leader); Carbon Footprint (project leader); FP7-prject World Input-Output Database (member of the advisory board).

Angel Hsu
Yale Center for Environmental Law and Policy, USA

Angel Hsu is Director of the Environmental Performance Measurement Program at the Yale Center for Environmental Law and Policy at Yale University in New Haven, USA. Her research focuses on environmental performance measurement and policy evaluation, aiming to understand how quantitative data and scientific approaches can be better geared toward environmental solutions and policymaking. Prior to Yale, Angel was a Research Analyst at the World Resources Institute (WRI), a non-profit environmental Think tank in Washington D.C., where she developed corporate greenhouse gas accounting and reporting initiatives in developing countries, including Mexico, Brazil, India, Philippines, and China, where she managed and led WRI's efforts. She has written in and been cited by major media outlets, including The Economist, The Atlantic, and The Guardian. She has provided expert testimony for the U.S.-China Economic and Security Review Commission. She holds a Ph.D. in Forestry and Environmental Studies from Yale University, an MPhil in Environmental Policy from the University of Cambridge, and a BS in Biology and BA in Political Science from Wake Forest University in Winston-Salem.



Sven Eric Jorgensen
University of Copenhagen, Denmark

Sven Erik Jørgensen is professor in environmental chemistry at the University of Copenhagen. He has received a Master of Science in Chemical Engineering from the Danish Technical University (1958), a Doctor of Environmental Engineering (Karlsruhe University) and a doctor of science in ecological modelling

(Copenhagen University). He is honourable Doctor at Coimbra University, Portugal and at Dar es Salaam University, Tanzania. He has received the Einstein Professorship of the Chinese Academy of Science. In 1975 he has founded the journal Ecological Modelling and in 1978 International Society of Ecological Modelling, ISEM. He has received several awards: The Ruder Boskovic Medal, The Prigogine Prize, The Pascal Medal, The Einstein professorship at the Chinese Academy of Sciences, The Santa Chiara Prize for multidisciplinary teaching and the very prestigious Stockholm Water Prize. He has published 366 papers of which 275 were published in peer-reviewed international journals and he has edited or authored 76 books, of which several have been translated to other languages (Chinese, Russian, Spanish and Portuguese). He has authored a successful textbook in ecological modelling “Fundamentals of Ecological Modelling”, which was published as a fourth edition together with Brian Fath in 2011. It has been translated to Chinese and Russian (third edition). Recently he authored a well-received textbook in system ecology entitled “Introduction to Systems Ecology”. It was published as English edition in 2012 and as Chinese edition in 2013. He was editor in chief of the Encyclopedia of Ecology that was published in 2008 and of the Encyclopedia of Environmental Management that was published in December 2012. He has taught courses in ecological modelling in 32 different countries. He is the editorial board member of 18 international journals in the fields of ecology and environmental management. He is currently the president of ISEM and he has been elected member of the European Academy of Science’s, for which he is the chairman of the Section for Environmental Sciences.

Tomasz Koźluk
Organisation for Economic Co-operation and Development (OECD), France

Tomasz Koźluk is a Senior Economist on Green Growth at the OECD in Paris. He joined the OECD Economics Department in 2007, and worked on issues related to competition, market regulation, fiscal policies, environmental policies, as well as transport, infrastructure investment and public private partnerships. He has co-authored a number of papers, reports and survey chapters related to green growth. Tomasz is currently working mainly on economic effects of environmental policies and on measurement and indicators in the area of green growth. He holds a Ph.D. in Economics from the European University Institute in Florence.

Felix Müller
Kiel University, Germany

Felix Müller has studied Biology and Geography at the Universities of Kiel and Regensburg. His Ph.D. thesis about soil-geographical investigations on the fate of pesticides and nutrients in ecosystems was published in 1987. Since that time he has been working at the Ecology Centre of the University of Kiel. He was the scientific coordinator of the long-term R&D project “Ecosystem Research in the Bornhöved Lakes District” and has since that time participated in 15 national and international research projects. Since 2010 Felix Müller is affiliated as leader of the Department Ecosystem Management at the Institute of Resource and Nature Conservation of Kiel University. The main recent research interests are ecosystem analysis, ecosystem modelling, ecosystem services and ecosystem theories, applications of ecosystem approaches at the landscape scale and the derivation of holistic indicator sets for the management of human-environmental systems. Müller has been editor or co-editor of 21 books and special issues and has published more than 130 scientific papers.

He is editor-in chief of the journal “Ecological Indicators” and board member of 5 journals, e.g. “Ecological Complexity” and “Ecological Modelling”. In 2010 he received the Prigogine Medal of the Wessex Insitute of Technology and the University of Siena. Felix Müller was the president of the German Chapter of the International Association of Landscape Ecology, Secretary of the German Chapter of the International Long-Term-Ecological Research Program and member of the executive committee of the Ecosystem Service Partnership.

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Martin O’CONNOR is Professor in Economic Science since 1995 at the University of Versailles St-Quentin-en-Yvelines (UVSQ) in France and Director since 2010 of the International centre for Research in Ecological economics, Eco-innovation and Tool Development for Sustainability (REEDS) based at the UVSQ. University-trained in physics and in social sciences, he has specialised since the 1980s in inter-disciplinary research on the interface between society and environment. After 10 years of teaching and applied social science research in New Zealand, he joined the C3ED at the UVSQ in 1995, where he led research in integrated energy-economy-environment modelling and scenario studies, social science methodology for environmental valuation, indicators for sustainable development, risk assessment, water resources and other domains. He has been a participant in the United Nations 'London Group' on integrated environmental and economic accounts since 1996. He founded the International Journal of Water (an inter-disciplinary scientific journal published by Inderscience since 2000) and has been a leader in the experimental development of Internet-based multimedia tools for knowledge mediation, multi-criteria evaluation and deliberation support in the fields of integrated environmental assessment, territorial development and eco-innovation. He is a prime mover in several inter-university cooperation programmes for post-graduate education in ecological economics and sustainable studies, including collaborative learning platforms and "open university" type distance delivery options of Masters-level curriculum.

Annex III

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