

Innovation for conservation: pushing technological frontiers

Prof. dr Arthur P.J. Mol, rector magnificus

Dies lecture 2019

Welcome

Highly esteemed colleagues, Ambassadors and formal representatives of 28 countries, Commissioner of the King in Gelderland, Mayors, partners of all kinds, ladies and gentlemen.

Today, at the 101st Dies Natalis, we officially close our centennial year, a memorable year full of scientific conferences and workshops, engagements and interactions with stakeholders, cultural events, coins and books, etc. One would almost add: “and now back to business as usual”. But remarkably, during our centennial we continued business as usual, with excellent science and education, growing student numbers, a Spinoza laureate, many international delegations visiting us, and many prestigious grants. A major achievement of our staff!

If anything, the start of a new century of WUR is marked by a new Strategic Plan. This Strategic Plan focuses on key global challenges and identifies a number of transitions that are needed to meet these challenges and to which we aim to contribute: mitigating climate change below 1.5 °C increase, a circular and biobased economy, safeguarding biodiversity, liveable metropolitan areas, a protein transition. New technologies, digitalization and big data are key building blocks in these transitions. In one way or the other, these challenges and transitions all have to do with nature, nature conservation and environmental sustainability, a domain that is and continues to remain at the core of our organization.

Wizard & Prophet

In 1989 the American environmental scientist Samuel Hays¹ wrote a magnificent book, of which the title summarized the three main reasons

¹ Hays, Samuel P. (1989), *Beauty, Health and Permanence. Environmental Politics in the United States 1955-1985*, Cambridge: CUP

why we have to safeguard nature and our environment: *Beauty, Health and Permanence*. *Beauty* refers to our sensory experiences and valuation of natural beauty and nature's integrity. *Health* refers to the interdependency of nature and environmental quality with public health, but also with animal, plant and ecosystem health. *Permanence* refers to overall sustainability of our human activities, to stay within the planetary boundaries.

There is wide global agreement on the importance of maintaining – or further developing - Beauty, Health and Permanence. But there exist major differences in the perspectives, worldviews and normative systems on how we are going to safeguard (and develop) nature and at what and whose costs. What are desirable levels of biodiversity conservation? What are acceptable trade-offs between nature and other societal goals and interests? Who are or should be in the lead in coping with global challenges affecting nature? How should the burden be distributed, and who gains? And what kind of technological regime is or should be key in strategies coping with the global challenges that interfere with nature?

In 2018 Charles Mann² - who will visit our university on March 29 this year – published a new book, *The Wizard and the Prophet*. In this book he contrasts two perspectives on how to meet global challenges while safeguarding nature and our living environment. While Wizards (Norman Borlaug being taken as a typical example) believe in centralized, standardized, high-technological, and market-driven approaches focused on maximizing supply, Prophets (the US nature conservationist William Vogt being the example) aim for an emphasis on context-dependent technological means, bottom-up developments, public endeavours and demand management. Of course, there is not too much new under the sun in distinguishing these contrasting perspectives. Since at least the last quarter of the previous century, soft-energy path were distinguished from hard paths, small intermediate scale technology from large scale technologies, mainstream agriculture from organic agriculture, liberal market approaches from state-organized endeavours, etc. And these distinct paths and world views came with major societal debates.

Academics and academic institutions have no legitimate authority to judge on rights and wrongs of these contrasting world views. What we as a research organization can do is investigating and illuminating the coherence

² Mann, Charles (2018), *The Wizard and the Prophet. Two Remarkable Scientists and Their Dueling Visions to Shape Tomorrow's World*, New York: Alfred A. Knopf

and consequences of these 'solutions' for global challenges. Impact-driven academic institutions, such as ours, have shown that strongly juxtaposing such perspectives often simplifies reality, is too static and can be counterproductive. Here you see how Wageningen research has identified all kind of combined Wizard/Prophet perspectives (which are called modernized mixtures) in concrete approaches to solve SDG challenges in Africa and Europe.³ In addition, initial 'alternative' low-tech and decentral energy production (wind and solar) is becoming mainstream, partly centralized and high-tech. Our experimental test location Agro-ecology and Technology in Lelystad also gives constant evidence of such combinations of Wizard/Prophet perspectives in addressing nature-inclusive food production. And not the least, these combinations/integrations of perspectives are also very helpful in building bridges in a polarized world!

Technology for nature conservation

Something similar is happening with respect to nature conservation research and practices. Until not so long ago, nature and biodiversity conservation was often associated with a Prophet perspective, where technology was not seen as of major importance. Or to put it more precisely: technology, especially in its modern high tech form, was seen as endangering rather than offering opportunities for conserving nature and biodiversity. Oil drilling, airplanes, mining, car mobility infrastructures, high tech agriculture and large metropolitan areas were jeopardizing global biodiversity. Good ecological research required just cameras, binoculars, microscopes and other relative simple tools to determine species and to understand ecological interdependencies. And nature conservation practices included simple technologies like fences, monitoring and managing species, and reforestation. But this simple association of nature conservation with low tech has changed dramatically over the past decades. Or in the words of the German sociologist Joseph Huber, current times are marked by "*Die verlorene Unschuld der Ökologie*".⁴

³ E.g. Spaargaren, Gert, Peter Oosterveer, Joost van Buren et al., (2006). *Mixed modernities: Towards viable urban environmental infrastructure development in East Africa*. Wageningen: Wageningen University (Environmental Policy group)

⁴ Huber, Joseph (1982), *Die verlorene Unschuld der Ökologie*, Frankfurt/M.: S. Fischer Verlag

The frontiers of ecological research and nature conservation practices are marked by new advanced technologies. Hence, we see all kind of new technologies entering the domain of nature conservation: eDNA sequencing, GIS, tags, sensors, big data, new materials, high speed cameras, drones, camera traps, Artificial intelligence, facial recognition technology, bioacoustics, synthetic biology, Internet of plants, etc. What role do these new, advanced technologies play in nature conservation? Let me mention 5 roles.

1. These technologies open up *new avenues for ecological research* for better understanding and monitoring nature. E-DNA is such a tool which enable us to use a surface or salt water sample, assess traces of DNA in it and by that provide information on the prevalence and quantity of species. Camera traps, tagging systems, new sensors, facial recognition and bioacoustics all help us to better monitor nature and the prevalence and movement of species. And we can do that increasingly in real time and from behind our desk.
2. Such technologies, the real time data collected through them and the advanced computer based analytical tools, also enable the *surveillance of nature-endangering practices and processes*. Satellites keep track of global deforestation, advanced camera and sensor systems can trace illegal entrance or activities in nature parks.
3. We might also start to use new technologies for *replacing current nature-endangering activities*. Building with nature concepts are employed in infrastructure development, e.g. artificial core reef construction. Think also about virtual reality technologies that can replace tourism, real time camera's that reduce disturbances by bird watchers, or synthetic biology technologies that produce nature or nature-based chemicals in the lab rather than by harvesting from nature-out-there.
4. New technologies also enable a wide spectrum of possibilities for *engaging citizens* in nature conservation and thus increasing support for nature conservation. Mobile phones, facial recognition tools and interactive websites and apps have strongly enhanced citizen science in nature conservation and we have some fantastic examples here at Wageningen University & Research.
5. And finally new technologies have enhanced our research into nature for *applying 'natural' processes and techniques outside nature*. High speed cameras have enabled Wageningen University to learn much more about flying behaviour of birds and insects, which for instance helps us

(together with Delft University of Technology) to construct better drones. And Wageningen Marine research has shown how mussel banks can be used as flood protection technology, as alternative for hard, concrete structures.

Technology in context

In developing and employing these new technologies in real-world nature, so outside our laboratory, we have to realize that technologies never come in isolation. They always function in concrete social settings, where people use them and systems support them. Here in monitoring illegal fishing. To function these technologies need social and material preconditions, such as skills, money, energy, maintenance, institutions, societal support. And they can cause new social relations and societal effects, desired and undesired ones, such as surveillance, dependencies, privacy intrusions, and power shifts. Hence, these high-tech technologies in nature conservation come with social and economic conditions and effects. Here is how Indonesia deals with illegal fishing vessels.

This 'technology in context' has two consequences. First, the new technological frontiers in nature conservation raise new – non-technological - questions: Who wins and who loses? Are these advanced technologies applicable in every context? Do these technologies come with new access regimes: access to nature, access to ecological research, and access to ecological information and data? How to prevent that these technologies are used for nature destruction? To be short: the new technological frontiers in nature conservation do not just come with state-of-the-art ecological and technological research and knowledge; by the same token advanced social and economic expertise is needed to investigate, assess and design equity, ethical considerations and societal support and engagement in nature conservation. This poses requirements on the teams investigating, designing and implementing these new technological frontiers for future nature conservation practices and research. Wageningen University & Research has a proven record in such interdisciplinary work.

A second consequence of the non-technological dimensions of nature conservation innovation is the need for collaboration. To have impact – on conservation and on conservation research – we need to collaborate with others: with societal parties and stakeholders in and around nature conservation practices as well as with other research institutions on for

instance data sciences, sensing, artificial intelligence, ecological justice and other technological and non-technological disciplines. While our institution has a strong track record in ecology and nature conservation, the new frontiers in this domain urges us to cooperate: with other disciplines and transdisciplinary. And that brings us back to the essence of our Strategic Plan for the coming four years: further collaboration to find answers together and to have impact. Certainly in the areas of nature conservation and sustainability that are so central to our mission!

Prof. David Coomes

The need for collaboration is also the reason why we have asked one of the most eminent scientists in this field to speak at this Dies Natalis.

Professor David Coomes is professor of Plant Ecology and head of the Forest Ecology and Conservation group at the University of Cambridge, UK. He is an world renowned expert on using modern technological devices such as lidar and high resolution remote sensing in nature conservation research and practice.