PROGRAMME

09:30 – 10:00	**REGISTRATION AND COFFEE / TEA**
10:00 – 10:15	**WELCOME AND INTRODUCTION BY CHAIRS** (Mariet Hefting, Utrecht University /Albert Tietema, University of Amsterdam)
10:15 – 10:30	**25 EDITIONS OF CURRENT THEMES IN ECOLOGY** (Hans de Kroon, Radboud University/NERN)
10:30 – 11:00	**RESEARCH ON THE IMPACTS OF NITROGEN DEPOSITION IN HISTORICAL PERSPECTIVE** (Frank Berendse, Professor emeritus, Wageningen University)
11:00 – 11:30	**COFFEE / TEA**
11:30 – 12:00	**NOXIOUS NITROGEN: IMPACTS OF NITROGEN ENRICHMENT ON WATER QUALITY** (Dedmer van de Waal, NIOO-KNAW)
12:00 – 12:30	**NITROGEN IN THE DUTCH DUNES: SENSITIVITY DEPENDS ON PH, P AVAILABILITY AND PLANT STRATEGIES** (Annemieke Kooijman, University of Amsterdam)
12:30 – 13:00	**WINTER: PEAK SEASON FOR NITROGEN LOSSES IN AGROECOSYSTEMS AND HOW TO MITIGATE THEM** (Nicolas Brüggeman, Forschungszentrum Jülich, Institute of Bio- and Geosciences – Agrosphere (IBG-3), Jülich, Germany)
13:00 – 14:00	**LUNCH**
14:00 – 14:30	**BUTTERFLUXES: LONG-TERM EFFECTS OF AMMONIA ON BUTTERFLY OCCUPANCY AND NEW METHODS OF STUDYING FLUXES** (Henrik Barmentlo, University of Amsterdam)
14:30 – 15:00	**LOCAL AND GLOBAL IMPACTS OF NUTRIENT ENRICHMENT ON GRASSLAND PLANT DIVERSITY AND FUNCTIONING** (Yann Hautier, Utrecht University)
15:00 – 15:30	**COFFEE / TEA**
15:30 – 16:00	**NITROGEN POLICY IN A CRISIS** (Jan Willem Erisman, Leiden University)
16:00 – 17:30	**PLENARY DISCUSSION FOLLOWED BY WRAP-UP OF THE DAY AND DRINKS IN THE BAR**

CURRENT THEMES IN ECOLOGY (25)

Nitrogen:
Past, Present and Future

Thursday 28 October 2021

Amsterdam Science Park Congress Center (Turingzaal)
Science Park 123, 1098 XG Amsterdam, The Netherlands

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SUPPORTED BY:

Netherlands Ecological Research Network (NERN)
Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO)

ABSTRACTS

10:15 RESEARCH ON THE IMPACTS OF NITROGEN DEPOSITION IN HISTORICAL PERSPECTIVE

Frank Berendse, Professor emeritus, Wageningen University

Between 1950 and 1980 the atmospheric deposition of nitrogen increased rapidly as a result of the increases in livestock, traffic and industry after World War II. In the 1970s and 1980s the impacts on natural ecosystems became clearly visible. In the 1980s Dutch ecologists published the first papers on the far-reaching consequences of the high nitrogen inputs. These impacts included two phases: (1) an increase in vegetation productivity and the loss of slow-growing species; (2) soil acidification, increased solubility of toxic metal ions and leaching of essential minerals. Agronomic studies on the nitrogen balance of dairy farms revealed that more than 80% of the nitrogen imported to feed cattle was lost to the environment by ammonia volatilization, nitrate leaching and denitrification. From 1990 onwards, nitrogen deposition slowly declined, amongst others due to policy measures that aimed to reduce the discrepancy between nitrogen inputs and outputs at the farm level. However, in 2006 this policy was abandoned and thereafter nitrogen deposition did not decline any further. Field experiments set up to answer the question whether reduced nitrogen deposition resulted in recovery of the former biodiversity revealed that soil chemical parameters recover rapidly, but that restoration of biodiversity can take several decades. More than three decades ago, Dutch ecology and agronomy had provided a solid scientific basis for drastic policy measures that would have protected Dutch biodiversity.

11:30 NOXIOUS NITROGEN: IMPACTS OF NITROGEN ENRICHMENT ON WATER QUALITY

Dedmer van de Waal, NIOO-KNAW

Nitrogen is among the major elements in life: it is required for a range of key cellular compounds including proteins and enzymes. Moreover, it is assimilated by primary producers into a wide range of secondary metabolites, including toxic compounds. Excessive supply of nitrogen in aquatic ecosystems has led to the proliferation of harmful algal blooms. These toxic blooms form a major threat to ecosystem and human health. Besides nitrogen supply alone, consequences of eutrophication also depend on the availability of other resources, such as phosphorus, light and inorganic carbon. Changes in the relative availabilities of these resources in the environment determine the elemental composition of primary producers, and thereby the synthesis of cellular compounds such as toxins. In this talk, I will explore the impacts of nitrogen enrichment on aquatic ecosystems, emphasizing the consequences of stoichiometric shifts for harmful algal blooms and thereby water quality.

12:00 NITROGEN IN THE DUTCH DUNES: SENSITIVITY DEPENDS ON PH, P AVAILABILITY AND PLANT STRATEGIES

Annemieke Kooijman, University of Amsterdam

High N deposition leads to grass-encroachment, especially in lime-poor dunes. Lime-rich and lime-poor dunes differ in P availability and plant strategies for P uptake, which affect many ecosystem properties and sensitivity to high N deposition. In lime-rich dune soils, mineral P may be abundant, but unavailable to the vegetation at high pH. Lime-rich dunes are dominated by arbuscular mycorrhizal (AM) plants, which improve P uptake with help of AM-fungi. These plants profit especially when P is a limiting factor, but photosynthesis costs to the fungi may lead to low relative growth rates, low plant biomass and high diversity even under conditions of high N deposition. In lime-poor dunes, availability of P to the vegetation is higher due to dissolution of calcium phosphates and weaker P sorption at low pH, which is more suitable for nonmycorrhizal (NM) plants, which especially take up weakly sorbed P. In combination with high P availability, high N deposition leads to high plant biomass and grass-encroachment. Dominance of AM- or NM-plants may also affect food quality of aboveground vegetation and root biomass, which in turn affect rabbit density and blowout activity, and reinforce patterns in pH, P availability to the vegetation, plant strategies and plant diversity.

12:30 WINTER: PEAK SEASON FOR NITROGEN LOSSES IN AGROECOSYSTEMS AND HOW TO MITIGATE THEM

Nicolas Brüggeman, Institute of Bio- and Geosciences Forschungszentrum Jülich, Germany

After harvest, large amounts of mineral nitrogen often remain in the soil or are formed by mineralization of plant residues that remain in the field after harvest. If there is not an adequate plant sink for these significant amounts of nitrogen, such as in fallow fields or winter cereals that take up only small amounts of nitrogen in the fall and winter, much of the mineral nitrogen is lost to groundwater in the form of nitrate. High-carbon soil amendments could help sequester excess nitrogen very effectively in the post-harvest period if applied in the fall, preventing its loss in the winter and releasing it in the next growing season. This presentation will review the various mechanisms of nitrogen immobilization by high-carbon soil amendments and present data from lab and field experiment on how they can be used to effectively retain nitrogen in the soil for the next growing season.

14:00 BUTTERFLUXES: LONG-TERM EFFECTS OF AMMONIA ON BUTTERFLY OCCUPANCY AND NEW METHODS OF STUDYING FLUXES

Henrik Barmentlo, University of Amsterdam

Excessive nitrogen (N) deposition in ecosystems is a cause for concern as it has been found to alter the flora and fauna composition of natural areas. However, long-term impacts are rarely addressed for insects, usually to a lack of data. Using 13 years of butterfly counts provided by the Dutch Butterfly Association and long-term monitoring of gaseous ammonia concentrations performed by the RIVM, we studied the impacts of ammonia on butterfly occupancy of 53 species across Dutch nature reserves. We found both increases and decreases in butterfly species with increased ammonia concentration. While the overall occupancy of all butterflies was negatively affected, this pattern was strongly species-specific and depended on their respective 'Ellenberg Nitrogen Values' or habitat investigated. While this study reflects clear patterns, the use of ammonia gas concentrations does not necessarily reflect actual nitrogen deposition as this is strongly regulated by several atmosphere-biosphere interactions. Therefore we present here our new technique on measuring ammonia fluxes using the newly developed ECO2Flux version 3.0 automatic and manual flux chambers. We aim to study both the ammonia fluxes in agricultural as well as natural sites to close the knowledge gap on local nitrogen deposition.

14:30 LOCAL AND GLOBAL IMPACTS OF NUTRIENT ENRICHMENT ON GRASSLAND PLANT DIVERSITY AND FUNCTIONING

Yann Hautier, Utrecht University

Human-induced nutrient input to terrestrial ecosystems is a major threat to plant diversity and to the provision of essential ecosystem services such as primary productivity and carbon sequestration. Yet, the precise mode of action by which nutrient inputs drive plant diversity loss is still controversial, precluding the development of effective conservation strategies designed to minimize nutrient impact on biodiversity and ecosystem services. Moreover, Earth's ecosystems are almost certain to experience substantial climate change, including increased frequency, magnitude and duration of climate extremes such as drought. We urgently need to understand the potential interaction between these major global change drivers. I present recent evidence shedding light on the drivers of local and global herbaceous plant diversity decline thereby providing the mechanistic underpinnings for future conservation and management practices. I also present novel experiments manipulating multiple global change drivers simultaneously to unravel their combined and interactive effects on biodiversity and ecosystem functioning. This integrated approach will provide the necessary knowledge base for future management strategies.

15:30 NITROGEN POLICY IN A CRISIS

Jan Willem Erisman, Leiden University

In addition to the corona crisis, the nitrogen crisis is also a major threat to the economy and ecology. Since the ruling of the Council of State in May 2019, hard work has been done to find solutions to the crisis that then arose. Many studies have been done and reports written, but there is still no real solution. It is also not a new problem and the difficulty is to find the right balance between economy and ecology. The quality of Natura 2000 areas and biodiversity has deteriorated sharply, partly due to the high nitrogen loads. Many stakeholders are involved, each with their own priorities and perspectives. Agriculture is the largest contributor to nitrogen deposition and although policies to reduce nitrogen losses have been successful in the past, the current challenge is enormous, especially in a market where margins are small. This presentation will look at some of the lessons from the past, current policies to tackle nitrogen and future prospects for possible solutions.