PROGRAMME	
09:00 – 09:30	**REGISTRATION AND COFFEE**
09:30 – 09:40	**WELCOME AND INTRODUCTION BY CHAIR** (Frank Berendse, Wageningen University)
09:40 – 10:20	**DIVERSITY AND STABILITY OF ECOLOGICAL SYSTEMS AT MULTIPLE SCALES** (Michel Loreau, Centre for Biodiversity Theory and Modelling, CNRS)
10:20 – 11:00	**THE NEW GENERATION OF BIODIVERSITY EXPERIMENTS** (Andy Hector, University of Oxford)
11:00 – 11:30	**COFFEE / TEA**
11:30 – 12:10	**THE MECHANISMS RESPONSIBLE FOR THE MAINTENANCE OF PLANT SPECIES DIVERSITY** (Jasper van Ruijven and Frank Berendse, Wageningen University)
12:10 – 12:50	**THE ROLE OF BELOWGROUND BIOTA IN PLANT BIODIVERSITY-PRODUCTIVITY RELATIONSHIPS** (Alex Dumbrell, University of Essex)
12:50 – 13:50	**LUNCH**
13:50 – 14:30	**THE INFLUENCE OF STOCHASTICITY, SPECIATION, IMMIGRATION AND EXTINCTION ON BIODIVERSITY AND COMMUNITY ASSEMBLY** (Rampal Etienne, University of Groningen)
14:30 – 15:10	**COEXISTENCE OF TREE SPECIES IN TROPICAL FORESTS** (Lourens Poorter, Wageningen University)
15:10 – 15:40	**COFFEE / TEA**
15:40 – 16:20	**PLANTS AND POLLINATORS: PATTERNS AND MECHANISMS** (Koos Biesmeijer, Naturalis Biodiversity Center)
16:20 – 16:40	**THE NEW STEPS TO BE MADE** (Hans de Kroon, Radboud University Nijmegen)
16:40 – 17:00	**PLENARY DEBATE**
17:00 – 18:00	**DRINKS**

CURRENT THEMES IN ECOLOGY (20)

Biodiversity research at the crossroads:

Understanding the long-term dynamics of ecosystems

Thursday 20 November 2014

Conference Centre “Hof van Wageningen”
Wageningen, the Netherlands

ORGANISERS:

Prof. Frank Berendse (Wageningen University)
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Dr. Claudius van de Vijver (NERN)
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SUPPORTED BY:

Netherlands Ecological Research Network (NERN)
NWO Aard- en Levenswetenschappen (NWO-ALW)
Graduate Schools PE&RC, RSEE, and SENSE

ABSTRACTS

09:40 DIVERSITY AND STABILITY OF ECOLOGICAL SYSTEMS AT MULTIPLE SCALES

Michel Loreau, Centre for Biodiversity Theory and Modelling, CNRS

The relationship between the diversity and stability of ecosystems has been highly contentious over the past century. Recent theoretical and experimental work provides a completely new perspective on the diversity–stability relationship. Both experiments and theory show different diversity–stability relationships at different hierarchical levels, thereby offering a potential resolution of the old diversity–stability debate. Theory based on stochastic community dynamics also allows the mechanisms that underlie diversity–stability relationships to be identified. In particular, it shows that asynchronous species responses to environmental changes play an important role in the stabilizing effects of biodiversity on aggregate ecosystem properties, although other mechanisms also come into play. In contrast to previous qualitative theories, this theory has the additional advantage of being predictive and testable; its predictions match data from long-term biodiversity experiments reasonably well. This theory can further be extended to multiple spatial scales and provides a consistent hierarchical framework for ecosystem stability. Analogously to the spatial partitioning of biodiversity, we have proposed the concepts of alpha, beta, and gamma variability. Our hierarchical framework predicts that ecosystem variability decreases from local to regional scales, which creates a positive ecosystem stability–area relationship. It also predicts that biodiversity provides insurance for ecosystems, thus generating positive alpha, beta, and gamma diversity–stability relationships, at all spatial scales. Overall, theory now clearly shows that biodiversity plays an important stabilising role in ecosystems at multiple scales, thereby ensuring the steady provision of ecosystem services to human societies.

10:20 THE NEW GENERATION OF BIODIVERSITY EXPERIMENTS

Andy Hector, University of Oxford

My talk will contrast the more recent generation of biodiversity experiment to the initial cohort, focusing on forests as the main new study system under consideration. I will also re-examine how our specific experimental designs map onto our broader scientific questions in this area and what it means from what we can infer about results. I will also contrast biodiversity manipulation experiments with studies of functioning across natural gradients of diversity.

11:30 THE MECHANISMS RESPONSIBLE FOR THE MAINTENANCE OF PLANT SPECIES DIVERSITY

Jasper van Ruijven and Frank Berendse, Wageningen University

To date all biodiversity experiments showed positive diversity-productivity relationships that could be attributed to complementarity effects. These relationships help to understand the possible consequences of diversity loss for important ecosystem services. But even more important is that such complementarity effects might have significant stabilizing impacts on plant species abundances in stochastically fluctuating environments. Unravelling the mechanisms behind these complementarity effects may provide an important step forward in our understanding of the processes that stabilize or destabilize the dynamics of plant communities. Two hypothesized mechanisms responsible for complementarity effects in diversity experiments are: (1) vertical root stratification and (2) plant-species-specific impacts of root pathogens. Vertical root stratification does probably not contribute to the observed complementarity effects since monocultures of most species can exploit the whole soil column as well as mixtures do, while the specific impacts of root pathogens might explain an important part of the patterns observed in biodiversity experiments. However, both root stratification and the specific impacts of root pathogens lead to frequency-dependent competition and can have strongly stabilizing impacts on the dynamics of plant communities. These insights enable us to predict what environmental change will distort such stabilizing mechanisms and will subsequently lead to the loss of biodiversity.

12:10 THE ROLE OF BELOWGROUND BIOTA IN PLANT BIODIVERSITY-PRODUCTIVITY RELATIONSHIPS

Alex Dumbrell, University of Essex

In general, ecosystem productivity increases as a function of diversity and this relationship has now been documented in numerous plant-biodiversity experiments. A number of ecological mechanisms have been proposed to explain this ‘overyielding’ effect. Earlier work suggested this may be due to resource use and niche complementarity. However, researchers have now begun to look belowground for explanations, and two potential drivers emerge. Plant productivity may be suppressed in monocultures due to high abundances of species-specific soil microbial pathogens. Alternatively, increased plant diversity may increase the diversity of host-specific beneficial microbes (e.g. mycorrhizal fungi), which in turn increase productivity across all plant species. Here I present results from recent studies examining belowground fungal diversity in plant-biodiversity experiments, and explicitly test predictions from these competing hypotheses. Using the latest molecular-ecology techniques, we examine the diversity of these fungal communities and begin to draw some broad conclusions. Notably, we find beneficial interactions have very little influence on plant-productivity relationships. In contrast, strong species-specific associations of fungal pathogens are observed in monocultures and it is this that likely suppresses productivity in monocultures, rather than other mechanisms increasing productivity in diverse plant communities.

13:50 THE INFLUENCE OF STOCHASTICITY, SPECIATION, IMMIGRATION AND EXTINCTION ON BIODIVERSITY AND COMMUNITY ASSEMBLY

Rampal Etienne, University of Groningen

The theory of Island biogeography, the neutral theory of biodiversity and phylogenetic community assembly theory have emphasized the importance of stochasticity, immigration, speciation and dispersal for the assembly of ecological communities. However, approaches to draw inferences from community composition data have remained underdeveloped. In this talk I will present new directions to infer forces of community assembly from data that can critically alter our view of how species assemblages originate and are maintained.

14:30 COEXISTENCE OF TREE SPECIES IN TROPICAL FORESTS

Lourens Poorter, Wageningen University

Tropical forests are hotspots of biodiversity; they harbour 96% of global tree diversity, and as many as 300 tree species can coexist in a single hectare. The question is how this biodiversity can be maintained, and what it means for ecosystem processes and the services these forests provide. In this presentation I first briefly review what mechanisms of species coexistence have been found to be important for tropical forests. Then I use my own work in Bolivia as an example, how niche differentiation for light and water affect species distribution patterns, community composition, and species coexistence. Finally I show to what extent biodiversity in these hyper-diverse tropical forests is important for ecosystem functioning, such as carbon storage and sequestration.

15:40 PLANTS AND POLLINATORS: PATTERNS AND MECHANISMS

Koos Biesmeijer, Naturalis Biodiversity Center

Pollinators play a key role in ecosystem functioning as almost 80% of plant species need animal pollinators. In addition, a large part of our crops show increased production with animal pollinators present. Pollinators, particularly bees, are under pressure and may be declining in several regions. The lack of standardized monitoring schemes precludes, however, a good assessment of the status and trends of pollinating insects and the impacts on plant reproduction and plant-pollinator networks. Here I will show how we can use non-standardized collection and observation records to obtain insights in the long-term trends of bees, butterflies, hoverflies and plants. A next step would be to understand the mechanisms underlying these trends. For that we must upscale from individual species and species richness to community-level. To do that we need to understand the linkage between the pollinators and plants. I will try to do this using data from plant-pollinator networks and data from crop pollination studies. The former can tell us how plants are linked to each other by sharing pollinators, while the latter can show how important different species are in providing the pollination service. Together, these data allow us, in the absence of well-controlled experiments, to get a better idea of the functioning of plant-pollinator systems.

16:20 THE NEW STEPS TO BE MADE

Hans de Kroon, Radboud University Nijmegen

The gap between theory and empirical evidence will be central in this concluding presentation. I will start with a brief outline of the overarching theory of species coexistence as formulated by Peter Chesson in 2000. I will discuss the key elements of this theory and examine to what extent they have been tested in empirical work. What do we know, and what methodological and conceptual hurdles are yet to be taken? I will use the example of belowground Janzen-Connell effects to illustrate how new empirical results may remain disconnected from theory and lack critical tests in the field. The long-term dynamics of ecosystems will only be understood by concerted efforts from theoretical, modelling, experimental and field monitoring approaches.