

Radboud University



Radboud Institute for  
Biological and Environmental  
Sciences (RIBES)

Research Review 2014–2020



Research Review according to the  
Strategy Evaluation Protocol 2015–2021

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## Preface

Every six years, the research quality of the various institutes of Radboud University is assessed by external committees. This report summarizes the findings of the international review committee regarding the Radboud Institute for Biological and Environmental Sciences (RIBES).

The review committee consisted of seven members all active in the field of biological and environmental sciences. The committee was happy that – even during the Covid-19 pandemic – it was possible to visit RIBES in November 2021. We would like to thank Radboud University and more specifically the people of RIBES for their cooperation in the various stages of the review process. During the site visit, we were very pleased with the great openness by the management, academic staff, postdocs, PhD candidates and research assistants of RIBES. The interviews were highly constructive, informative and stimulating.

I take this opportunity to thank all committee members for their contributions to the review. Special thanks go to Floor Meijer, the independent secretary of the committee. She guided us smoothly through all stages of the review.

**Prof. Geert R. de Snoo**  
Chair of the committee

29 January 2022

# I. Introduction

The executive board of Radboud University (RU) commissioned a review of the Radboud Institute for Biological and Environmental Sciences (RIBES) as part of the university's regular six-year quality assurance cycle. This review had the dual purpose of improving the quality and relevance of research, and providing accountability to the executive board, funding bodies, the government and society as a whole.

Because of the Covid-19 pandemic, the assessment was postponed from 2020 to 2021. Consequently, the review covers a seven instead of a six-year period: 2014-2020. The site visit at RIBES took place from 1 to 3 November 2021.

## Composition of the committee

The executive board appointed a review committee (hereafter: 'committee') of seven external peers, including a PhD candidate. The committee consisted of:

- Prof. Geert R. de Snoo (Chair), director of the Netherlands Institute of Ecology (NIOO-KNAW), The Netherlands;
- Prof. Nicholas J. Bernier, professor at the Department of Integrative Biology, University of Guelph, Ontario, Canada;
- Prof. Brenda B. Casper, professor at the University of Pennsylvania, USA;
- Prof. Nancy Dise, professor at the UK Centre for Ecology & Hydrology, Edinburgh, UK;
- Prof. Michael Zwicky Hauschild, professor at the Department of Technology, Management and Economics at the Technical University of Denmark (DTU), Lyngby, Denmark;
- Melanie Münch MSc, PhD candidate at the Faculty of Geosciences, Utrecht University, The Netherlands;
- Prof. Michael Wagner, vice director of the Centre for Microbiology and Environmental Systems Science at the University of Vienna, Austria.

Dr Floor Meijer was appointed independent secretary to the committee. Appendix 1 includes a short curriculum vitae of each committee member.

To ensure a transparent and unbiased assessment process, all members of the committee signed a statement of impartiality and confidentiality. Prior to the site visit, existing professional relationships between committee members and research units under assessment were discussed. The committee concluded there was no risk in terms of bias or undue influence.

## Assessment criteria

As the assessment was originally due to take place in 2020, the committee was given instructions to conduct the assessment according to the then applicable Standard Evaluation Protocol 2015-2021 ('SEP'). This protocol describes the aims and methods used to assess publicly funded research in the Netherlands. It was drawn up and adopted by the Association of Universities in the Netherlands (VSNU), the Dutch Research Council (NWO), and the Royal Netherlands Academy of Arts and Sciences (KNAW).

Under the Terms of Reference issued by RU, the committee was required to evaluate both the level of the institute and the level of the three underlying research clusters: (1) Ecology & Physiology, (2) Environmental Science, and (3) Microbiology. The institute and clusters were assessed on the three SEP criteria: (1) Quality, (2) Societal Relevance, and (3) Viability, with the cluster level being scored only qualitatively, and the institute level also receiving quantitative scores. The four-point assessment scale (1=excellent to 4=unsatisfactory) is detailed in appendix 3. In its assessment, the committee was asked to

take current international trends and developments in science and society into account, and provide recommendations for improvement at both levels.

Acknowledging that a new protocol (Strategy Evaluation Protocol 2021-2027) was introduced in 2021, the committee was asked to retroactively include qualitative assessments on four aspects introduced in this new SEP. These aspects, which had to be assessed in relation to the three main assessment criteria, are: (1) Open Science, (2) PhD Policy and Training, (3) Academic Culture and (4) Human Resources Policy.



In addition to the guidelines and criteria suggested by the SEP, the committee considered additional requests made in the Terms of Reference. In this document, the committee was specifically invited to provide a qualitative assessment of RIBES as a whole in relation to its strategic targets and to the governance and leadership skills of its management, including recommendations concerning these two subjects. Finally, the committee was asked to advise on:

- (1) optimization of the collaboration between and within the research clusters and

- (2) on the organization of the BioScience education and research within the Faculty of Science, with one educational institute and three research institutes.

## Documentation

Prior to the site visit, the committee received the self-evaluation report of the institute, including the information and appendices required by the SEP. The following additional documents were provided:

- Standard Evaluation Protocol 2015-2021;
- Terms of Reference for the research review;
- Previous Assessment Report (2015);
- Midterm review IWWR (2017);
- Template Training and Supervision Plan (TSP) for PhD candidates;
- Faculty Guidelines and Procedures for Appointing Academic Staff (2021);
- Key publications for institute and cluster levels;
- Sample of recent PhD theses.

## Working method

Leading up to the site visit, the committee members were asked to study the documentation and formulate preliminary findings and questions. The committee divided the workload by allocating each cluster to two committee members who would take the lead for this particular cluster during the site visit and assessment process.

The three-day site visit started with a committee meeting, during which the committee discussed its preliminary assessments. Additionally, it considered procedural matters and agreed upon a working method. During the site visit days, the committee met with representatives of the faculty board, institute and clusters, including the institute management, well-established and more junior researchers and PhD candidates. The committee also spoke with societal stakeholders and the directors of

adjacent BioScience institutes within the Faculty of Science. The site visit was concluded with a meeting in which the committee discussed its findings and conclusions, followed by a presentation of initial findings and recommendations by the committee. The schedule for the site visit is included in appendix 2.

After the site visit, the secretary drafted a first version of the committee report, based on the assessments drawn up by the committee members. This draft report was circulated to all committee members for comments. Subsequently, the draft report was presented to RIBES for factual corrections and comments. After considering this feedback in close consultation with the chair and other committee members, the secretary finalized the report. The report was presented to the executive boards of RU.

### **A note on the report**

In this report, the review committee presents its findings, conclusions and recommendations. The first chapter of the report discusses the RIBES at the institute level, while the second chapter contains the assessments at cluster level. In line with the SEP and the Terms of Reference, the committee did not attempt to quantitatively compare or rank the three clusters. Each cluster was assessed in light of its own aims and strategy, while taking the international context of its research field into consideration. Scores are limited to the overarching RIBES level.

The committee noticed that RIBES only recently started implementing the organizational changes proposed at the time of the previous evaluation (2015). Much of the restructuring came into effect over the course of 2021, i.e. after the end of the current evaluation period. This means that the committee was unable to assess the direct impact of the changes made. This will be the responsibility of the next committee. The

current committee limits itself to evaluating whether the implemented changes constitute a viable strategy for the future.

The committee was challenged by the fact that the self-evaluation report mainly presents the organizational structure and strategy of RIBES as it stands in 2021. It provides little information about the institute's strategic objectives during the 2014-2021 evaluation period. This meant that retrospectively assessing the institute's accomplishments in the way intended by SEP was complicated: the vision, strategies and targets underlying the results were difficult to reconstruct. In response, the committee has chosen a forward-looking approach that emphasizes new opportunities for the institute.

The interviews showed that RIBES and its underlying clusters would like suggestions on how best to carry out their plans. This request partially guided the committee's work. Throughout the report, the committee lists potential areas for improvement, and provides suggestions it believes will help RIBES stay on track in implementing the organizational changes devised in the recent past.

# I. Institute level

# Radboud Institute for Biological and Environmental Sciences

## Organization

Formerly known as the Institute for Water and Wetland Research (IWWR), the Radboud Institute for Biological and Environmental Sciences (RIBES) is one of eight research institutes within the Faculty of Science of RU. The committee learned that the name change, effected in September 2021, sealed a long-running process of organizational change that was already proposed at the time of the previous review in 2015. As part of this process, the institute's structure was reorganized and its aims sharpened. The new name reflects a research agenda much broader than implied by the institute's previous name, i.e., not solely focused on water and wetland research.

In line with the previous committee's recommendation, the institute has recently replaced its seven departments with three main research clusters, each led by a cluster head. These clusters are: (1) Ecology & Physiology (EcoPhys), (2) Environmental Science (ES) and (3) Microbiology (MB). While the Environmental Science and Microbiology clusters are effectively a continuation of the previous departments of the same name, the EcoPhys cluster is a – currently incomplete – merger of five departments in plant and animal sciences. Compared to the previous department structure, the new clusters have more autonomy over their own budgets and staff. Thus, the clusters are expected to increase transparency and fairness in decision-making processes, particularly in the allocation of resources within the institute.

The committee supports the ideas that have guided the new organizational structure. It appreciates that the choice of clusters was

informed by the content already present, as well as by strategic motives. At the same time, the committee stresses that it is still too early to assess the effectiveness of the new structure. The new clusters were only established in the spring of 2021, and departments continue to exist within the EcoPhys cluster. Since the restructuring was essentially a top-down process, ensuring that changes are accepted by all those involved, and properly implemented, will be critical. This need is particularly relevant for the success of the newly merged EcoPhys cluster, which is understandably the most diverse group. The committee appreciates that the management is open to making further changes along the way. There is clearly an attitude of seeing what works, taking feedback seriously, and adjusting where necessary.

Along with the name and organizational/financial structure, the institute management also changed. As of 1 April 2021, RIBES is led by a four-person management team (MT) that meets biweekly. The MT is responsible for the scientific quality, profile, and financial planning of RIBES, as well as for strategic investments in personnel, facilities, and instrumentation. It consists of the institute's managing director and representatives of the three clusters. One representative is scientific director and chair of the MT.

The committee notes that RIBES has made a conscious decision to not necessarily include cluster heads in the MT. The institute preferred to empower a younger generation by giving mid-career staff a role in the MT. Within the MT, cluster representatives are not so much seen as spokespersons for their clusters but as team members, each with their own portfolio. Requests from the clusters are submitted in writing and discussed by the MT. The director has the mandate to make decisions in consensus with the other MT members or, if required, by simple majority vote. The committee approves of the involvement of mid-career staff members in the MT. Nevertheless, it is not entirely

convinced that including unmandated cluster representatives will work well in practice. In the opinion of the committee, it is important to clarify the position of cluster representatives vis-à-vis the cluster heads. In the long run, the efficacy of the MT will need to be monitored and adjusted if necessary. Overall, the committee notes that the management made a decisive and energetic impression during interviews.

RIBES's scientific director is accountable to the faculty board and has monthly progress meetings with the dean of the faculty. The interaction between RIBES and the faculty board was an important topic during the interviews. From the interviews, the committee gathers that the communication on strategy and its implementation between faculty and institute will need to be intensified. Still, the vice-dean stressed that the faculty board is pleased with the direction taken by RIBES and is supportive of the new management structure. This should contribute towards developing an increasingly productive working relation.

### **Mission and strategy**

RIBES describes its research aim as 'to perform world-class research in order to understand the response of the natural environment to human impacts', with a collective focus on stress and adaptation processes in severely affected ecosystems. Responding to the previous committee's recommendation to work with research themes in a more multidisciplinary, 'big-question'-oriented, and unifying manner, the institute established the new overarching research theme, 'Towards Healthy Ecosystems'. This research theme was designed to (1) quantify and understand the responses of organisms, populations and ecosystems to human-induced environmental change, and (2) apply this knowledge to designing and evaluating measures and strategies for mitigating or repairing ecosystem damage. The common research

theme was further elaborated in four focus areas:

1. Macronutrients and chemicals of emerging concern;
2. Physical conditions: understanding responses and adaptation mechanism to stressors;
3. Biodiversity decline and recovery of ecological communities;
4. Mitigation of greenhouse gasses.

These focus areas were said to represent the three clusters' existing research strengths. The management indicated that they will be taken as a starting point for cross-fertilization within and between clusters, thus creating more synergy across RIBES.

The committee was pleased to find efforts into defining a shared purpose and identifying commonality within RIBES. Further steps can, however, be taken in designing an institute-wide unifying framework. The vision that inspired the mission and common research theme is still quite implicit. Instigating an institute-wide discussion on what is meant by a 'healthy ecosystem' could help to gain more clarity, including how to measure progress towards a 'healthy' type ecosystem (are there indicators of health? what are the metrics for describing progress to this state?).

After studying the documentation and speaking to staff, the committee also wonders whether the mission, focus and overall research theme fully reflect the sum of both fundamental and applied research activity in the institute. There seems to be a unidirectional emphasis on human impact, whilst a glance through the publications featured in the self-evaluation report shows a significant number of these are concerned with developing a fundamental understanding of the natural world. The committee, therefore, suggests a re-think toward a more basic scientific aim, linked with its applications in industry and society – something along the lines of 'understanding how ecosystems

function, and applying this understanding to resolving pressing environmental issues.’ This would include human impacts, but not be restricted to them.

With respect to the four focus areas, the committee concludes that they function as the broad, guiding research themes proposed by the previous committee. They are topical and add to the profile and strategy of the Faculty of Science. As yet, the focus areas are in their early days. For them to be fully embedded in RIBES and the clusters will require some attention – as was evidenced by the different titles (‘focus areas’, ‘research themes’, ‘central research areas’, ‘foci’) used across the institute. The institute-wide focus areas to some extent run parallel to cluster-specific research lines, and it is not entirely clear how the two relate or what will be done to avoid competition between them. To ensure that focus areas receive the proper attention and contribute towards the goal of cross-institute synergy, RIBES could appoint a focus area coordinator or devise some other monitoring mechanism.

The committee notes that a necessary follow-up will be to construct a concrete strategic plan, which details how RIBES will go about realizing its research aims and the actions needed. A strategic plan should include the institute’s strategies and policies with respect to funding, research, HR, infrastructure, diversity, etc. The committee believes that developing a strategic plan will prove instrumental in ensuring that RIBES’s needs are heard at the faculty level.

## **Quality**

### *Scientific output*

The committee established that one of the main reasons for establishing the overarching research theme ‘Towards Healthy Ecosystems’ was to bring the international competitiveness of RIBES to the highest level, by leveraging the complementary expertise of the clusters. Overall, the committee is

impressed with the scientific quality of the research. Publication records reveal a high proportion (up to 70%) of RIBES articles were published in Q1 peer-reviewed journals, including Nature, Science and PNAS. Moreover, research excellence seems rather evenly spread across the focus areas and clusters. The self-evaluation report gives examples of top-notch research, which collectively represent each of the four focus areas and all three clusters. Citation metrics in the self-evaluation report indicate the work is well-used and referenced by the academic community. The committee was informed that scientific papers published during the evaluation period were, on average, cited 2.1 times more often than the world-average for papers published over the same period in the same research fields. This is 55% higher than the field-normalized impact score of 1.36 for Natural Science research in the Netherlands for the period 2015-2018. Articles are increasingly published open access (from 40% in 2014 to 80% in 2020).

The volume of peer-reviewed articles and dissertations grew compared to the previous evaluation report (by 13% and 11% respectively), but so did the number of research FTEs. In the absence of data on the publication rate per research-active staff member, the committee cannot make firm statements about whether the institute’s productivity has increased. In any case, the committee’s interview with the management made clear that the focus is not so much on growing the number of publications, but on aiming for higher-impact publications. The committee fully supports this strategy.

The committee notes that RIBES receives worldwide recognition for its research quality. Besides citations, indicators that testify to the institute’s academic esteem include keynotes, invited lectures, and memberships of editorial and scientific advisory boards. Success in highly competitive (inter)national funding schemes such as NWO Veni-Vidi-Vici and ERC consolidator/advanced grants also

underlines the institute's academic reputation. The share of research grants in the overall research budget increased over the evaluation period. In acquiring competitive funding, the committee found that the MB and ES clusters have been very successful, with external funding representing an average of 64-69% of their budget. The MB cluster has been particularly successful in obtaining individual grants (11 in total) over the evaluation period. The large EcoPhys cluster has the lowest proportion of external research funding (annual average of 35%), which may in part be attributed to a higher teaching load.

#### *Collaboration within RIBES*

Research collaboration within RIBES is as yet limited. Over the evaluation period, the institute produced an annual average of around ten papers co-authored by researchers from multiple clusters and one shared PhD graduation. In future years, RIBES aims to increase cross-cluster collaborations. Creating synergy is an important objective for the new institute. The focus areas and overarching research theme 'Towards Healthy Ecosystems' were explicitly designed to stimulate internal collaboration among and within the clusters. The management plans to facilitate interaction between the clusters by organizing research meetings around biological questions rather than by discipline, and by providing strategic funds for institute level initiatives. Such strategic initiatives will include exploratory PhD projects supervised by staff from different clusters. For 2021 and subsequent years, seven PhD positions have been made available which in part have been used to enhance this multidisciplinary research. In the committee's opinion, the allocation of institute budget to strategic initiatives is a positive way of addressing new research opportunities and challenges. Other RIBES-wide mechanisms to further strategic projects could also be useful, for example, seed money for proof-of-concept small research projects.

The first RIBES-wide research meeting took place just before the site visit. This meeting was reported to have been a success, with staff (especially junior- and mid-career researchers) desiring more occasions for socializing and knowledge exchange. The committee advocates establishing an ambitious, cross-cluster seminar series, which includes research presentations by internal staff (including professors) and by external guest speakers representing, in particular, relevant cross-disciplinary research. The committee suggests putting a committee of postdocs in charge of organizing the series, giving them a budget for organizational expenses. Delegating this responsibility to upcoming researchers would enable them to hone their organizational and networking skills, simultaneously providing them with useful contacts within their fields and an overview of research conducted within the institute and by the faculty as a whole.

As information does not seem to trickle down to all organizational levels, the committee also recommends improving communication across the institute. RIBES should update their website and consider launching an internal newsletter. Showcasing the research conducted within RIBES will contribute towards the institute's visibility and the exchange of good practices.

Finally, the committee suggests implementing initiatives to encourage day-to-day informal interactions among staff. Examples include providing a shared experience for first year PhD candidates, facilitating the work of the PhD Council in connecting PhDs across the clusters, and creating a mechanism (e.g. a monthly Science Café) for post-docs across the institute to get together and 'talk research'. Facilitating bottom-up interaction is important for all clusters, but particularly for the EcoPhys cluster that still seems divided along former department lines.

### *Collaboration outside of RIBES*

The committee is pleased with the level of national and international collaboration. It notes that RIBES researchers participate in a large network of research institutes and have established partnerships via special professorships, shared personnel, co-supervised PhD projects and gravitation centers of excellence financed by NWO. During the evaluation period, the institute obtained several prestigious grants in scientific consortia, including one ERC Synergy, two Dutch Gravitation, one Marie Curie European Industrial Doctorate (as coordinator), and several NWO-TTW and Horizon Europe collaborative projects. The proportion of papers published with international partners increased from 55% in 2014 to 77% in 2020.

The committee also considered collaborations within the Faculty of Science. In this respect it notes that BioScience research at RU is rather fragmented: the faculty is not just home to RIBES, but to two additional institutes with an important BioScience component, i.e., the Radboud Institute for Molecular Life Sciences (RIMLS) and the Donders Center for Neuroscience (DCN). Connections between the three institutes have been limited. The interviews underlined that collaboration takes place on an ad-hoc/individual rather than a structural basis, with RIMLS and DCN leaning towards Radboud University Medical School (Radboudumc) rather than to BioScience researchers within their own faculty. The lack of intrafaculty collaboration is perceived as somewhat of a missed opportunity and the committee agrees that there is much to be gained from strengthening ties. Discussions with the research directors of these two other institutes indicated that some of their facilities and technological capabilities could be beneficial to RIBES.

In a broader sense, the committee understood that a merger of the three institutes was discussed during the reorganization of RIBES, but ultimately decided against as it was felt

that RIBES should first improve its own strategic position. While RIBES includes some proponents of more formalized collaboration, and even of a fusion of the three institutes, the committee feels that all three institutes have their own particular research foci and strengths. Further gains are more likely to come from investing in mutual visibility, joint outreach efforts and infrastructure exchange than from a merger. The committee was pleased that contacts at the management level have recently increased through bimonthly meetings of institute directors.

### *Research support*

The committee deems that the support structure offered at university, faculty and institute level is appropriate. Interviewed staff confirmed receiving help to set up their research, apply for funding and conduct experimental work. Research facilities are staffed by well-qualified (even over-qualified) technicians. In the near future, the institute plans to hire a statistician to facilitate and support statistical analyses. He/she will be supported by a working group with representatives from each research cluster. The committee suggests that a RIBES-wide coordinator for highlighting and facilitating large international (e.g. EU) grants may also be a beneficial addition.

### *Open Science and integrity*

With respect to Open Science, one of the particular aspects mentioned in the Terms of Reference, the committee does not have much evidence to go on. The information in the self-evaluation report is limited to remarks on open access publishing and data management, which is consistent with the requirements of the previous edition of the SEP. Other aspects commonly linked to Open Science, such as pre-registration of research, reuse of data, replication research, open peer review and sharing of data and research tools, are not mentioned. Thus, the committee was not able to reconstruct review RIBES's policy on Open Science. It believes further

strategizing is required, in line with the new SEP.

With respect to data management and safeguarding research integrity, the committee found that proper university and faculty policies and procedures are in place. In line with national and international requirements, RU has installed integrity protocols, an integrity committee and counsellors. Furthermore, there is a Research Ethics Committee (REC) at the faculty level and a university-wide Animal Ethics Committee (RUDEC). RU's Research Data Management support team offers general support on research data.

At the institute level, supervisors are tasked with educating early-stage researchers on topics such as scientific conduct and intellectual property rights. Lab and field journals are checked during progress interviews. In 2017, RIBES appointed a data steward to support researchers with data management. Information sessions were held to acquaint researchers with the research data management policy and ways of obtaining support. As part of RIBES's data management policy, all projects are required to have a data management plan (DMP), the construction of which is facilitated by an online DMP tool. Raw and processed research data are stored and backed up on university servers during a study and archived/made public once it ends. Increasingly, data are accessible through digital repositories. As of mid-2020, a research data management appendix is mandatory for all PhD theses.

Concerning important topics such as integrity, data management and biosafety, the committee is satisfied with achievements thus far, but also sees room for improvement in instilling procedures in the hearts and minds of staff. The committee strongly argues for initiating a RIBES-wide discussion on sensitive topics such as research integrity, data management, biosafety, Nagoya, IPR and paper authorship criteria. Agreed protocols

should be covered in mandatory PhD training on research integrity and in the onboarding of new staff. The committee also advocates easily accessible information regarding whom to contact in case of dilemmas or suspected violations.

### **Societal relevance**

The committee is strongly convinced of the inherent societal relevance of RIBES's research. As part of its overall research ambition, the institute aims to cross-link curiosity-driven, fundamental research with innovative applications in both industry and society, with a focus on mitigating ecosystem degradation and finding solutions for ecosystem restoration. This focus also resonates in the overarching research theme 'Towards Healthy Ecosystems', with which RIBES hopes to contribute towards the UN's sustainable development goals (SDGs), particularly those on Life on land/Life below water, Climate action, Zero hunger, and Clean water and sanitation.

The committee notes that the self-evaluation report and interviews highlighted excellent examples of societally relevant research, including studies on anammox, tomato heat tolerance, insect decline, and limiting global warming to 1.5°C. These examples were drawn from all focus areas and clusters. The latter two projects especially generated considerable public attention. Results of RIBES's ground-breaking work on insect decline (2017) were picked up by international media, resulting in broad coverage. This accelerated the development of the 'Deltaplan for Biodiversity Recovery' in which nature organizations, farmers, citizens, scientists, banks, agrobusinesses, and local government authorities collaborate to restore biodiversity in the Netherlands. Researchers from the EcoPhys and ES clusters took leading roles in the 2018 IPCC report on limiting global warming and the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. This led to many

public engagements, including a briefing to the Dutch Parliament.

From the above, and from an interview with societal stakeholders, the committee concludes that RIBES researchers interact frequently and effectively with government bodies, such as the Netherlands Environmental Assessment Agency (*Planbureau voor de Leefomgeving*, PBL), NGOs (including species-oriented NGOs grouped in 'Natuurplaza', which is located on the RU campus), companies (including vegetable breeders and drinking and waste water companies) and the general public. These interactions take place at individual, department or cluster level and are often long-standing. Models and computer programming code are openly available and widely used in the international community.

As far as the committee is aware, RIBES does not yet have a common strategy with respect to societal relevance. Specific economic, social, and cultural target areas for RIBES have not been explicitly defined. An appropriate next step would be to instigate a RIBES-wide discussion on existing and emerging target areas. The institute is also advised to systematically map its contribution to policy change at the local, national, and international level and to compile indices of public awareness (e.g. media coverage). The committee supports the institute's decision to hire a support officer to improve its internal and external communication strategy. This strategy should include improving the institute website.

### **Viability**

Considering RIBES's strong performance in producing scientifically robust and societally relevant research, the committee does not question the institute's long-term viability. It also applauds the organizational changes made at the institute level. While it is obviously too early to assess the results of this restructuring process, the committee was

impressed with the energy and momentum it created. The new organizational structure seems broadly welcomed within RIBES. Nevertheless, the institute's SWOT analysis and the interviews with management and staff underscored that the transition is not yet complete. As the management is aware, the full practical implementation of the new organizational structure requires a number of additional steps. Importantly, the leadership will need to engage actively in unifying the EcoPhys cluster, which has no history of making collective decisions, and in facilitating RIBES-wide discussion and collaboration. Furthermore, it will be essential to develop institute wide strategies on funding, infrastructure, HR and diversity.

### *Funding*

Over the reporting period, RIBES increased the absolute level of total research funding by 15.8%, resulting in a more balanced ratio between direct and other funding sources (on average 53:47 in 2020, vs 64:36 in the previous evaluation period). Despite this increase, RIBES expenditures have exceeded revenue for several years, and a recovery plan was needed to improve the balance of income and expenses both at the cluster and at institute level.

During the site visit, the committee learned that the financial position of the clusters (previously departments) varies quite a bit. The largest cluster, EcoPhys, has high running costs and decidedly less grant income than the other two clusters, resulting in shortages. The budgeting system in use during the evaluation period required that the deficit be covered by the surplus of the other two clusters. MB and ES were not able to access their own reserves and, as a result, have felt limited in the investments they could make, putting solidarity within RIBES to the test.

A new budgeting system, giving clusters access to their own overhead, is broadly seen as a positive change. RIBES representatives also described the institute's current financial

position as better than before, since EcoPhys is considered more viable as a cluster than as five separate (small and therefore financially vulnerable) departments. Arrivals of new scientific staff to the cluster (a professor and associate professor in Plant Science appointed in 2019-2020 and a new professor in animal physiology to be appointed in 2022) are expected to increase external revenue.

In the committee's opinion, the plan to give clusters more autonomy over their finances is fair and likely to stimulate research in those clusters. The committee would, however, have liked a long-term financial strategy, detailing which types of funding the institute will be aiming for and how the clusters will be supported in their financial management. As the new budget plan only takes effect when all clusters are financially healthy, RIBES as a whole is advised to think about how to organize financial solidarity between the clusters in the long run and to promote institute-wide cohesion.

Another factor that has contributed to financial insecurities at the institute level relates to the long-term illness of some key staff members. The management described the cost of their replacement as a considerable burden on the institute finances and a matter of difficulty between RIBES and the faculty. In current practice no direct funds are available to properly deal with replacement in case of long-term illness, resulting in very high workloads for the remaining staff. The committee noted that long-term illness is an issue for RIBES. It believes that in the long run an institute of RIBES's size should be able to cover these costs, whether or not from reserves or in collaboration with the faculty.

#### *Facilities*

RIBES offers its staff a high-quality working environment, with excellent research facilities, including a state of the art, purpose-built greenhouse, modern phytotron, outdoor facilities for root research, experimental gardens, bioreactors for cultivation of non-

model microorganisms, well-equipped aquaria, and a series of analytical labs for research from the molecular to the organismal level.

Securing the long-term financial stability of physical facilities was highlighted as an issue during the interviews. Recently, the Faculty of Science has taken over the financial upkeep of the greenhouse as the institute's most costly experimental facility. There is, however, some uncertainty over what will happen once the current five-year contract ends in 2025. The position of the Faculty Board, as expressed during the site visit, seems to be that expensive facilities need to be embedded in the institute's research and infrastructure strategy, to underline that they are indeed indispensable. In the committee's opinion, this is a reasonable request. A tour taken during the site visit gave the impression that some facilities were underused at that particular moment (in case of the greenhouse) or largely at the service of outside-users in the faculty such as RIMLS and DCN (i.e., zebrafish facility). In the committee's opinion, a facilities management strategy should consider near and longer-term expected use within RIBES, raise awareness of facilities across the BioSciences, and potentially explore commercial opportunities for facility use by external fee-paying users.

A related issue is that technicians in the EcoPhys cluster expressed concern over a loss of staff. Retiring staff are not being replaced, resulting in an increasing workload for remaining technicians. The committee feels that a RIBES-wide overview of technical support responsibilities, time allocation, and job flexibility is warranted.

#### *HR policies*

RIBES aims to facilitate and stimulate personal and professional growth and academic leadership among its staff. Since the previous assessment, the institute has rejuvenated the clusters by appointing

postdocs and new tenure-track staff. The total number of scientific staff increased slightly. Following up on the previous committee's recommendations, the institute set out to standardize and clarify career pathways for tenure track- and tenured staff. In cooperation with the faculty, the tenure track procedures have been streamlined and a post tenure-track career path from assistant to associate professor has been defined, including tailor-made criteria. Furthermore, a mentoring system was introduced for tenure-track staff.

The committee welcomes the steps already taken. It has reviewed the criteria for tenure and promotion and feels that these are clear and fair. However, from speaking to staff, the committee concludes that there are still issues to overcome in order to arrive at a level playing field for recruiting and promoting early career talent. The tenure track programme seems inconsistent across (and even within) clusters. The committee understood that tenure track contracts are set up individually, and vary in terms of duration (depending on when the maximum term for temporary employment is reached) and the start-up package (e.g. PhD candidate, financial support) offered. The same apparent lack of consistency and transparency holds for progression time to associate professor. Mentoring seems to be organized differently in each cluster, and either done by the cluster head (e.g. ES) or according to the faculty-wide mentoring system (e.g. EcoPhys). Training could be further developed and made more widely accessible. For example, courses in academic leadership are currently only available to full professors, but would clearly be beneficial to other staff.

The committee established that the career path becomes even less formalized and transparent for staff at associate professor level. Internal promotion from associate to full professor, after the criteria for full professor are met, currently takes place on an irregular basis. This problem seems to lie in the interaction between faculty and institute and

has to do with the rather opaque five-year strategic planning regarding professorships. Moreover, full professor positions are advertised, inviting applicants from outside of the institute. The committee encountered some quite understandable frustration about this untransparent process that blocks young (especially female) talents from climbing the career ladder. A solution of formulating a clear career track from associate to full professorship, combined with an embedded system of individual mentorship to achieve timely career progression, needs to be implemented at the faculty/university level. The committee also notes that having a clear institute strategy with respect to promotions will likely be helpful when interacting with the faculty.

In summary, the committee concludes that standardising and formalizing the hiring and promotion programmes and the mentoring and training support available are urgently needed to ensure a smooth career progression from assistant to associate to full professor. This will also likely help with RIBES's retention and diversity issues, as the current system seems to negatively affect the gender balance (especially at associate and full professor level) and contributes to the loss of promising young researchers who receive better offers elsewhere.

The committee also notes a (perceived) high teaching load, especially in the EcoPhys cluster, contributing to an overall high working load. In particular, female tenure trackers told the committee they sometimes have difficulty maintaining a healthy work-life balance. To spread the workload and to plan ahead, they would appreciate less short-term assignments from the institute/faculty. The committee encourages easily accessible coaching. Also it commends annual central monitoring of the time spent on teaching and service work.

#### *Diversity and inclusivity*

Institute and faculty diversity policies focus on gender and nationality. To arrive at a better

representation of women and minorities, the faculty's 'Gender and Diversity' (GenDi) committee (established in 2014) has made a number of recommendations. All members of hiring and selection committees receive mandatory training on avoiding implicit bias during the hiring process. To raise awareness, activities such as Gender and Diversity Days are organized at the faculty and university level.

RIBES is doing well on gender balance in the lower academic ranks. The proportion of female PhD candidates, postdocs, and assistant professors at RIBES is around 50%. However, there is a drop-off at the associate and (especially) the professor level. Currently, there is only one female professor. RIBES is aware this situation requires urgent attention. At the faculty level, so-called Mohrmann Fellowships have been extended to attract talented women at the assistant, associate, and full professor level. Mentoring programmes for female staff have also been set up. Additionally, a €50,000 support grant for continued research during maternity leave is offered to female tenure trackers and assistant/associate professors to safeguard productivity around pregnancy. While these measures are certainly appreciated, they need to be applied for and are not made available as a matter of course. Further, they have not sufficiently addressed the issue that it is very difficult for women to be promoted from associate to full professor. As indicated above, RIBES is in favour of introducing a standardized career track from associate to full professor. The committee agrees that this is essential in preventing a further loss of female talent. Moreover, the committee proposes to discuss whether only female candidates should be considered for soon-to-be vacant full professorships, as this is a proven method to rectify a skewed gender balance at professorial level.

To promote internationalization, RU offers special support for international staff members and their dependents through HR and the

International Office. In the evaluation period, the number of international PhD candidates and postdocs remained steady at about 30%. As the institute is (under Dutch law) not allowed to record data on ethnicity, the committee has not been able to assess this aspect of diversity. The impression from the interviews is, however, that the staff is predominantly Dutch/European and fairly homogeneous in ethnicity and cultural background. The committee encourages a wider representation of minorities across RIBES.

Notwithstanding the points for improvement outlined above, the committee established that, overall, there is a welcoming and inclusive working environment within RIBES. Staff members interviewed praised the safe and collegial atmosphere.

### **PhD programme**

The committee is pleased with the overall quality of RIBES's PhD programme. Representatives of the RIBES PhD community spoke enthusiastically of the training and supervision they receive. A general trend, however, seems to be that there are quite substantial differences across clusters and even across individual supervisors. Some of these disparities are addressed below, along with potential scenarios for achieving more consistency and structure.

Selection and admission of PhD candidates seem to follow the usual pathways. A trend of gradual internationalisation was interrupted by the Covid-19 pandemic. Currently, the ratio of Dutch-to-Non-Dutch PhDs stands at 70:30, with EcoPhys having the lowest number of international PhDs. Contracts usually run for four years. While 80% of the PhDs that graduated in the evaluation period were financed by grants and scholarships, the remaining 20% were external PhD candidates who combined their research with a job elsewhere.

Incoming PhDs are paired with at least two supervisors: a professor or associate professor who acts as promotor, and a daily supervisor, often an assistant or associate professor or postdoc (the co-promotor). The occasional involvement of supervisors from different clusters (or even from other faculties or universities) is to be applauded as co-supervision of PhDs contributes towards further integration of the institute and towards building its (inter)national network. Supervision seems most structured in the MB cluster, which consciously aims for a good match between supervisor and candidate, in terms of content and personality. Here, supervisors also turn to each other for help or mediation in case of problems or conflicts; a best practice which other clusters could follow. In all clusters there are regular supervision meetings at different levels (i.e. daily supervisor, promotor, entire supervision team), but the frequency seems to vary.

The start of the PhD project involves drawing up a Training and Supervision Plan (TSP), which lists agreements on the research project, supervision, training and teaching commitments and is intended as a living document. The TSP is evaluated and adjusted annually. At the end of the first year, an appraisal interview occurs, and a go/no go decision is made for the remainder of the PhD project. PhDs do not seem concerned about this evaluative decision, as regular communication with their supervisors gives them a clear idea where they stand. The final decision is left to the supervisors. In the committee's opinion, it may be useful to consult one or more additional staff members who are not directly involved in the supervision.

Consistent with agreements made in the TSP, candidates spend 10-15% of their time on training. This includes transferable skills courses and content-related courses in the PhD candidate's field of research. Training is tailored to individual candidates and primarily takes place at the level of various national

graduate and research schools, with different clusters sending their PhDs to different schools. There does not appear to be a standard PhD programme of required courses or training modules, either at RIBES or at the cluster level. While the committee understands the merits of a tailor-made approach, it was surprised to learn that there is little central communication on, and monitoring of, PhD training. This leads to a situation of unclarity about requirements and responsibilities. Not all PhD candidates with whom the committee spoke are part of a graduate/research school, and there was some confusion about which courses are mandatory (e.g. scientific integrity, didactics, academic writing) and whether there is a minimum course credit requirement. In the committee's opinion, a more structured approach to PhD training is highly advisable. Information on requirements should also be easily accessible to PhD candidates and their supervisors, with supervisors taking a proactive role in informing candidates on their options and formalizing the training programme in the TSP.

PhD candidates are expected to spend 10% of their time on teaching, such as lecturing and supervising BSc and MSc students. The interviews, however, gave the impression of a higher teaching load. PhDs mentioned that teaching can be somewhat of a burden; there is a high demand, and PhDs sometimes feel they cannot decline to supervise MSc students. In the view of the committee, RIBES would do well to monitor that teaching does not exceed the 10% limit. An interesting development mentioned during the site visit is that the MB cluster started a five-year 'educational' PhD track, which involves obtaining a university teaching qualification (UTQ) and additional teaching duties. After a pilot phase, this option is now adopted by the whole institute and offered to PhD applicants on a regular basis. According to the interviewed PhD candidates, this route is quite popular.

Central PhD project monitoring is still in its early days. At the time of the site visit, RU had just implemented a new system ('Hora Finita'), which the committee sees as a welcome first step towards establishing a coherent quality management system. To ensure a level playing field for all PhDs, the committee further recommends unifying the use of the TSP over the institute, with clear instructions given on the frequency of progress meetings and what should be included in the planning (courses and their timing, conferences, publication planning etc.). It is also advisable to appoint a RIBES PhD coordinator who checks that procedures and formal requirements are being observed.

The committee saw good evidence of attention to the personal wellbeing of PhD candidates and an adequate support structure, which includes confidential counsellors at the university and faculty level, an HR adviser, coaching and career counselling and the International Office buddy programme. Interviewed PhD candidates said that they were given a list with contacts when they started their job, and the committee noticed signs in the toilets that inform about whom to contact in case of personal issues, conflict, or harassment. During the evaluation period, mentoring and coaching took place at the personal PhD-supervisor level, with some variations in the level of personal support observed across clusters. The committee was pleased to learn about a dedicated mentoring programme currently under development. In this system, each student who wishes to participate will be assigned a mentor from another RIBES cluster.

Overall, the committee found that RIBES could do more in terms of promoting cohesion and cohort building by facilitating structural exchange between PhD candidates from different clusters. A central 'onboarding' programme could help incoming PhD candidates to get to know one another and familiarise themselves with requirements and procedures. This programme could also

include one or more mandatory courses. PhD candidates across clusters currently seemed unaware of each other's work, which argues for RIBES research days (potentially organised along the lines of focus areas), further collaboration across clusters and more social events and opportunities for networking. All PhD candidates expressed the wish for more seminars and opportunities to present and see each other's work and the work of more senior staff members. Here, there is also a clear opportunity for the recently revived RIBES PhD Council to take a more prominent role. The committee noticed that there is quite a bit of interest and enthusiasm amongst PhD candidates across clusters for taking part in this council. It feels that – given the proper resources – the council could be a useful binding agent across clusters, representing PhD candidates, promoting their interests at management level and contributing to scientific exchanges within and between clusters.

Good career progression of PhD candidates was evidenced in the self-evaluation report. Career orientation is part of appraisal interviews and PhDs have access to university-wide career counselling services. According to the interviews, they know this offer exists. Interestingly, there seems to be little interaction with long-term societal partners where it comes to joint supervision and placement of PhDs. Completion times vary between clusters, with MB achieving the best results (74% of PhDs graduating within their contract period). The institute wide percentage of 12% graduating in their fourth year, 50% in their fifth year and 24% in their sixth year shows that there is room for improvement across the institute. A uniform and transparent supervision structure, with clear requirements and strategic planning, coordinated by a non-scientific staff member at institute level ('PhD coordinator'), would be a powerful tool to achieve this aim. The committee learned that PhD candidates with an end-of-contract date set in 2020-2022

were offered a three-month COVID-19 extension, which it applauds.

To conclude, the committee's general impression is that the overall atmosphere in the institute is good and that PhDs feel cared for. However, information pathways seem winding and untransparent and there is a need for a more structured approach to training and supervision. To ensure all PhD candidates have a similar experience, requirements for PhD candidates and their supervision should be uniform throughout RIBES. Also, the committee believes a mechanism for sharing and monitoring good practice across RIBES should be initiated.

### **Conclusion, scores and recommendations**

After reviewing the documentation and speaking to RIBES representatives, the committee is fully convinced of the quality and societal relevance of the institute's research – and thus of its viability. The institute presented many excellent examples that underscore the value of its approach and societal impact. Considering the newness of the current organizational structure, the institute's governance was more difficult for the committee to assess, as were its strategy and policies. In terms of strategic planning, a clear conclusion is that RIBES still has some way to go. The committee is of the opinion that cementing the institute should be given priority in the coming period. This particularly includes the necessary amalgamation of the EcoPhys cluster.

The above results in the following scores:

- Quality: Very good
- Relevance: Excellent
- Viability: Very good

The committee offers the following recommendations:

- Translate the overall mission and vision into a comprehensive, six-year

strategic plan (on funding, HR, research infrastructure etc.), which can be implemented step-by-step.

The strategy should provide the institute with its own unique identity, and facilitate interaction with the faculty and the university.

- Establish and support cross-institutional initiatives to unify the clusters in the institute, thereby cementing RIBES as a whole. This includes setting up a new and appealing website and establishing a scientific communication culture. Encourage postdocs and PhDs to take a leading role in organizing regular seminars at the institute and cluster level, providing them with the necessary funding.
- Make the distribution of teaching obligations transparent, both within the institute and at faculty level (within the BioSciences). Address the issue of unequal funding between the clusters in collaboration with the clusters themselves to ensure solidarity and cluster cohesion.
- Initiate a discussion with the faculty and the university board on transparent and accessible career paths from associate to full professor. Set up an institute-wide mentoring programme for assistant and associate professor-level staff, covering wellbeing and career progression. Mentoring should include an individually tailored programme to ensure timely progress towards promotion to avoid a loss of talent.
- Harmonize PhD supervision and training practices, with clear, consistent, requirements for PhD candidates and their supervisors. Make all processes transparent and ensure an efficient flow of information.

## II. Cluster level

# Environmental Science

## Strategy and targets

The mission of the Environmental Science (ES) cluster is to provide high-quality scientific knowledge that can help the world move towards a higher level of sustainability. To achieve this, ES aims to understand, project and address the impact of anthropogenic pressures on ecosystems and humans from the landscape to the global scale. The cluster develops predictive models to investigate the entire environmental cause-effect chain from drivers to responses and from responses to drivers. This is carried out within four interconnected research lines, which are linked to the UN's sustainable development goals (SDGs):

1. Human and Ecological Risk Assessment (HERA);
2. Life Cycle Assessment (LCA);
3. Biodiversity Assessment (BA);
4. Sustainability Transition Assessment (STA)

The committee welcomes the clearly defined mission and aims of the cluster, which encompass its main work of environmental impact modelling. The research lines also reflect the mission and aims, and are centred on timely and important topics capable of ensuring high visibility and attracting funding. The committee finds it somewhat surprising, however, that the cluster does not synthesise the coherent mission, aims, focus, and research lines with a name that expresses this clear profile. 'Environmental Science' is such a broad term that it could be applied to essentially all of RIBES's research. A more specific name expressing the cluster's core focus on modelling and assessment of environmental impacts and sustainability would give the cluster a more recognisable profile and enable the outside world to easily comprehend the type of work it does.

The committee applauds the cluster's explicit linking of its four research lines to the SDGs. This embeds its research in topics of societal relevance, and provides a clear pathway to impact. However, it is difficult to map research lines to individual researchers or publications. As the research lines are not clearly delineated in the self-evaluation report, the committee wonders to what extent they still mainly exist on paper. This is an opportunity for improvement.

## Quality

In the recent past, the ES cluster has undergone an impressive transformation from a previously teaching-oriented group into a highly esteemed modelling-based research group. There is a dedicated focus on high quality and quantity of outputs, with a clear shift towards the former. Over the review period, the cluster provided significant contributions to the scientific body of knowledge. The committee especially notes the strong transferability of knowledge into impact.

The cluster has had a high research output of excellent quality, with a substantial number of papers in Q1 journals including some of the most prestigious journals in the field (e.g. Science, Nature, Global Change Biology, Nature Climate Change, Nature Sustainability, PNAS). The teams within some of the research lines – especially LCA and BA – are among the leading in the world. By the nature of its work, the cluster has strong collaborations from the local to the international scales, covering multiple disciplines from the natural sciences (hydrology, chemistry, toxicology, ecology, technology) as well as the social sciences, (historical ecology, policy and innovation studies). It could strengthen these partnerships and potentially develop new research themes by expanding initiatives such as jointly supervising PhD candidates with collaborator institutes.

The committee applauds the practice of making models, code and databases freely available in accessible platforms ('open door policy'). Citation metrics indicate that these cluster outputs are well regarded and used in the scientific community, in clear recognition of their scientific strength and validity. Considering the strong focus on modelling, the committee is surprised there is not more interest in working with possibilities in machine learning and big data within the field.

The cluster is quite successful in attracting external funding and expresses a wish to keep the current balance between external and internal funding. However, since external funding appears primarily contract-based, the committee sees opportunities to increase the level of external research grant funding.

### **Societal Relevance**

With its focus on the real-world impacts of products and technologies, and its outputs ranging from decision support tools for individual users to global models, the ES cluster evidently has a high societal relevance. Of the three clusters, ES has the highest proportion of contract research, a clear indicator of the societal demand and transferability of their work.

LCA and BA are, for example, world-leaders in life cycle assessment of products/human activities and modelling of global biodiversity under different socio-economic pathways, respectively. The work of STA on the benefits of limiting global warming to 1.5C is another excellent example of research addressing a pressing societal need. Further work, including research on industrial best practice for carbon emission mitigation in the Netherlands, sits strongly at the interface of science, policy, and business. HERA's current work appears primarily focused on Europe, but there is clear potential for applying their approaches worldwide. This line also has a strong potential for generating new scientific insights through collaboration, for example by linking their work

on toxicity assessment with biodiversity impacts or with multi-pollutant effects.

ES has many collaborations with stakeholders from local government, governmental research institutes (such as TNO, RIVM, PBL), NGOs and industry (e.g. ExxonMobil, Unilever, Statoil/Equinor, Concawe, ArcelorMittal, Chemelot). The cluster has delivered important contributions to decision support in the environmental field including the aforementioned product life cycle assessments and modelling of biodiversity loss; other examples include prioritization of pharmaceuticals for reduced freshwater ecotoxicity, and modelling of climate change mitigation potentials. Stakeholders confirmed that models, databases, and guidelines produced by the cluster are widely used outside of academia, highlighting their applicability to real-world issues. Furthermore, the committee notes the cluster staff's involvement in many advisory boards at the regional, national and EU level.

### **Viability**

The committee has a favorable impression of the cluster's viability. The mission to provide high-quality scientific knowledge for helping move the world towards greater sustainability is obviously relevant to today's climate- and biodiversity crises. The world is eager for strong science to support decision making towards sustainability, both in government and industry. Over the coming decade(s), society will increasingly require results that the cluster is able to deliver.

The committee does feel, however, that the cluster's strategy for the future is rather 'un-strategic'. It would have welcomed a clearer expression of what the cluster sees as the grand societal challenges of the coming decade(s), and how it can contribute to finding solutions to these challenges. The committee encourages the cluster to aim for more truly innovative, ground-breaking research contributions.

Exploring new connections across the cluster research lines, across RIBES, and beyond, may bring new scientific insights and provide the opportunity for more funding from external research organisations. Within RIBES, there is also clear potential for wider application of the models and approaches developed in the cluster, for example, regional/global scale modelling of denitrification potential, or of insect decline.

Nationally and internationally, the cluster's approaches could be widely used in fields from epidemiology to the social sciences (as recognised). With respect to the latter, the committee believes that collaborations with social scientists would almost certainly open up interesting new research foci and pathways. This makes it especially regrettable that a talented female researcher from the social sciences was offered a full professorship elsewhere, and is now only part-time at the ES cluster.

The cluster seems to be on good financial footing, with a reliable level of contract research across all four research lines. It looks forward to accessing a larger share of its overhead under the new cluster organisation, allowing it to reinvest surplus. In terms of staffing, the cluster has been successful in expanding its PhD candidate pool, recruiting many international students. Retiring staff are set to be replaced by newly employed senior staff in their forties and fifties, thus ensuring continuity.

## **Recommendations**

The committee offers the following recommendations:

- Consider expanding the research to innovative topics such as machine learning and big data, which offer good opportunities for future development.
- Explore new and innovative collaborations as springboards for more external grant funding. Examples

include cross-cutting projects with other clusters, expanding collaborations with existing partners, and developing new transdisciplinary proposals with social scientists.

- Consider a name change to better capture the unique focus of the cluster.
- Strengthen the cohesion and visibility of the research lines.
- Formulate an ambitious strategy for the future, addressing grand societal challenges.

# Microbiology

## Strategy and targets

The mission of the Microbiology (MB) cluster is to conduct world-leading research at the forefront of microbial ecology and ecophysiology, aimed at understanding the diversity of microorganisms responsible for the biogeochemical cycling of nitrogen and carbon. Within these goals, using its twenty years of expertise in state-of-the-art methods, the MB cluster aims to discover and understand new anaerobic microorganisms, and, with the help of collaborators across RIBES and external partners, identify the role and interactions of these microbial symbionts in wetland plants and animals. Currently, there are five research lines:

1. Microbiology of extreme ecosystems;
2. Microbial Cell Biology and Biochemistry;
3. Anaerobic oxidation of methane;
4. Nitrogen cycle microbiology;
5. Host-microbe interactions.

The committee concludes that the cluster's aims are in line with the RIBES research strategy, while the five complementary research lines are well integrated with (but not identical to) the four RIBES research focus areas. The research lines have inherent and increasing societal relevance, i.e. the cluster is well poised to make a significant impact on environmental issues of concern.

## Quality

The MB cluster is a global leader in the field of environmental microbiology, contributing high quality publications with a significant impact at national and international levels over the evaluation period. Most papers are published open access, in leading journals (69% in Q1 microbiology and interdisciplinary journals), and with either national or international collaborators. The work is highly cited (with a 2.2 category-normalized impact score) and

has added many novel findings of fundamental importance to our basic understanding of microorganisms. Team members received invitations for lectures and keynotes, were awarded scientific prizes and held positions on editorial boards of leading journals in the field of microbiology (e.g. *Antonie van Leeuwenhoek Journal*).

The cluster's internationally leading position in the field of environmental microbiology is also reflected in the number of prestigious (personal) grants awarded to team members, including ERC Advanced, ERC Synergy and several NWO Veni/Vidi's. The committee established that the MB cluster increased its portfolio of grants substantially over the evaluation period: 69% of the funding between 2014 and 2020 came from external sources. Success in securing external funding enabled the cluster to support five research lines and train many PhDs. In the 2014-2020 period, the scientific staff graduated 31 PhDs, two of whom were awarded a cum laude distinction, while three won the *Koninklijke Nederlandse Vereniging voor Microbiologie* (KNVM) Westerdijk award for best microbiology PhD thesis of the year. Further, most of the MB PhDs graduate on time due to the well-organized and team-based supervision structure in place. In this respect, the cluster can serve as an example to the other RIBES clusters. Although the quality of the work is impressive, high numbers of PhD candidates challenge the current resources. It is clear that the current level of PhD supervision cannot be maintained without additional staff, especially in light of upcoming retirements.

The MB cluster actively collaborates (inter)nationally with several advanced research institutes with complementary expertise (e.g. Max Planck Institute for Medical Research, Heidelberg, Germany). Such collaborations have led to many high-impact articles. MB also collaborates with various research groups within the ES and EcoPhys clusters, through joint publications

and joint PhD supervision (currently four joint PhD projects). Some collaborations within RIBES are long-standing and have recently intensified with new hires in the Aquatic Ecology group. Overall, ~76% of the publications (229/302) from the MB cluster in the 2004-2020 period were the result of collaboration with external national and international complementary experts, including 29 joint RIBES publications.

The committee was pleased with the cluster's collaborative spirit and the strong complementarity of staff's expertise. There is a strong shared belief in the merits of team science, with frequent staff meetings and interaction. To promote the professional development of its researchers, the cluster provides ongoing mentoring. In this respect, Microbiology could be a source of inspiration for the other RIBES clusters. Sharing good practices with the other two clusters is strongly recommended.

Finally, the committee commends the research facilities. Over the past twenty years the cluster has built two fully equipped and internationally unique bioreactor labs with more than forty reactor systems in operation. This infrastructure is complemented by an extensive analytical suite to assess the chemistry of metabolites and for metagenomics research.

### **Societal Relevance**

The five research lines are highly relevant to current societal challenges. For example, the goal of the MB cluster to extend its own research and collaborations to understand and counteract greenhouse gas emissions speaks to climate change. Similarly, ongoing research on the biology of anammox, comammox and other non-model bacteria will contribute to advances in wastewater and drinking water treatment. Finally, current and planned research on methane oxidizers, ammonia oxidizers, and toxin degraders is

relevant to the fields of agriculture and conservation biology.

Apart from contributing to the scientific body of knowledge on these topics, Microbiology has identified potential for future applications, such as employing microorganisms in greenhouse gas mitigation strategies, for recycling of rare earth elements, for new measures to restore ecosystem health, and to control or eliminate harmful insects. Specifically, the cluster has identified applications for microorganisms in the removal of nitrogen, methane, and micropollutants for sustainable water production and wastewater treatment systems. The latter occurs in close collaboration with societal stakeholders in the water and wastewater industries and water boards. The committee notes broad acceptance of the technical advances from the MB cluster in society. More than a hundred operational installations worldwide are now, for example, using anammox to remove nitrogen from concentrated side stream wastewater. In recognition of its translational contributions, the MB cluster was recently awarded (together with Utrecht University) an ERC Synergy grant for work on the removal of nitrogen and methane in coastal sediments.

The committee learned that the whole team tries to stimulate microbial literacy wherever possible. MB cluster staff have been interviewed by the national and international press on several occasions, have prepared several outreach videos in collaboration with national organizations, and participate in other outreach activities.

### **Viability**

In the committee's opinion, the MB cluster could rightfully be called a powerhouse. MB forms a cohesive and dynamic research group, which is carefully maintaining its focus by jointly prioritizing research topics. Moreover, the cluster is very well-funded, with

most of its scientific staff able to finance themselves through fellowships and research grants. Given the recent success of the cluster in obtaining major grants, adequate external funding has already been secured for the next five years. From the interviews, the committee established that the formation of RIBES has not (yet) much impacted the day-to-day operations of this cluster. However, Microbiology clearly sees the benefits of RIBES in providing financial rewards and incentives to increase connections and interactions among clusters.

The cluster will soon see significant turnover, with two senior professors retiring in the next five years. A proactive strategy was developed to meet this upcoming replacement challenge. The cluster has, for example, hired a coach to work with senior staff on developing a position vision/profile for one of the new professors. Most of all, the cluster seems to be looking for someone who fits the team – which is a good approach. Like the cluster management, the committee sees potential for in-house promotion of research staff. Towards this, the cluster would like to see more clarity from the faculty on the career track requirements to retain and promote current associate and assistant professors.

The productivity of the cluster relies heavily on external research grants and on a substantial contribution from its technical and analytical support staff. The recent purchase of high-throughput sequencers and the hiring of two bioinformaticians provide the necessary resources for future advances in genome

analysis and to support work on the microbiology of extreme ecosystems and plant-microbe interactions. Genomics data will provide new areas of investigation and broaden the research scope of the cluster. The cluster plans to continue submitting personal and general research proposals to granting agencies to support basic research, in parallel with its more applied work.

Provided timely replacement of retiring staff, the MB cluster appears to be well positioned to meet its targets and to continue contributing excellent research of societal relevance. To enable future growth, the cluster would like more flexibility from the faculty to use funds from grants to support technical staff, and the allocation of additional space. The committee supports these wishes.

### **Recommendations**

The committee offers the following recommendations:

- Formulate an explicit, continuous strategy to prioritize quality over quantity, thus maintaining the high level of achievement in the face of retirements and a high supervision load.
- Balance capacity for PhD training with staff availability.
- Actively search for additional collaborations and funding opportunities with the other clusters, especially the EcoPhys cluster.

# Ecology and Physiology

## Strategy and targets

The cluster Ecology and Physiology (EcoPhys) is a recent grouping (Spring 2021) of the following departments: Plant Systems Physiology, Animal Ecology and Physiology, Plant Ecology, and Aquatic Ecology and Environmental Biology. After the clustering, new possibilities for research were identified, building on existing collaboration between the departments. These involve research on fundamental processes at different organizational levels within plant or animal systems, as well as common work on physiological stress responses and biodiversity mechanisms in plants and animals alike. The cluster's mission is to perform world-class research toward understanding and counteracting ecosystem degradation and discovering innovative new restoration solutions.

The cluster's four research themes are identical to the RIBES focus areas. These aim at developing the scientific knowledge to lead in reducing the impact of macronutrient pollution, developing breeding programmes of climate-resistant crops, designing effective biodiversity recovery measures, and achieving a reduction in the global carbon footprint. Much of the research along these themes seems to come from the Plant Systems Physiology, Plant Ecology, and Aquatic Ecology and Environmental Biology departments, although research in the Animal Ecology and Physiology department also fits in because of the work on developing climate-resistant fisheries and aquaculture.

Despite the merger into a cluster, the departmental structure currently remains, indicating reorganisation is incomplete. The departments are led by department heads, who serve as representatives on the cluster board that considers matters such as

personnel, finances, and organization. This implies that decisions are made at both the cluster and department levels. At least to some extent, there is also physical separation between the departments, which are housed on different floors of the building. The interviews suggested there is a silo-effect: staff are not necessarily aware of the work done in other departments, let alone other clusters.

## Quality

The committee positively assesses the cluster's research quality. The number of publications in the evaluation period (on average 92 per year) is consistent with the number of research staff (24.5 FTE in 2020) and comparable to that of the two smaller RIBES clusters. The percentage of Q1 and Q2 publications is also comparable to that of the other clusters. Papers have a high citation rate. The percentage of open-access papers has increased from 44% in 2014 to 72% in 2020, while the percentage of papers resulting from international collaboration grew from 51% in 2014 to 73% in 2020.

The cluster has produced high-profile papers and has, from all indications, a strong international reputation. Highlights include the studies linking pesticides to the decline in insects and birds, which drew international attention, and research that identified a gene for thermal tolerance in tomato pollen, which should likely be foundational for other research and is already being used in tomato breeding programmes. The committee further notes that a decision-support tool was developed for communicating invasive species risks. The committee found it difficult to assess whether research quality is evenly spread across the departments.

As for leadership, several researchers are members of international management teams or scientific consortia, sit on scientific advisory boards or are a part of other organizations dealing with policy or decision making.

Several members serve on editorial boards for major journals in their fields.

Collaborations take place with other RIBES clusters and with other research entities at Radboud, such as the zebra fish research with Radboudumc. Further opportunities await in this respect. The committee, for example, notes that the Plant Ecology department has begun to work with soil microbial communities in the context of plant/soil feedback, but it seems that more directed work with soil microbiomes and with microbiomes in animal guts could involve fruitful collaborations with the MB cluster. More concerted collaboration with modelers in the ES cluster could also be worthwhile. In general, there is potential for working with a data scientist, thus embracing the management and exploration of large data sets.

Grant income in this cluster is limited compared to the others. As a result, the number of PhD positions declined during the evaluation period. The cluster participates in six (inter)national research consortia and takes the lead in several of them (including the new Healthy Landscape consortium).

### **Societal Relevance**

In addition to scientific output, the cluster has delivered output to professionals and to the general public. The committee established that much of the research has societal relevance, especially (but not exclusively) the projects applicable to ecological management. Application of research results is actively explored in collaboration with industrial, governmental, and non-governmental partners. The cluster communicates with, and their work informs, land managers, policy makers, and at least one commercial enterprises (seed companies). Clear examples of research with a commercial application are the work on thermal tolerance in tomato pollen, which is of value to seed companies, and the findings on temperature and oxygen effects on fish, which can be of benefit to

animal welfare in aquaculture and to fisheries. Other findings are usefully applied to mitigation of macronutrient pollution, biodiversity loss, and greenhouse gas escape from peatlands. In addition, the collaboration with the ES cluster on the globally important IPCC report has generated social recognition and publicity, while the media coverage of the pesticide-insect-bird studies has led to major policy discussions.

### **Viability**

The quality and relevance of the research suggest that the cluster, as a sum of the constituent departments, is viable. Nonetheless, there is work to be done in forging a focused cluster identity, thus carving out a strong position within RIBES. Interviews suggested the cluster feels overloaded with teaching and not quite able to keep up with the other two in funding and staffing. This might become a RIBES wide problem if not addressed quickly.

As mentioned, the EcoPhys cluster relies more on institutional funds and less on extramural grants and contracts than the other two clusters. This is ascribed to a perceived higher teaching load (>40%) hindering funding applications. The committee also learned that junior staff who obtain external grant funding do not always stay because of the limited number of tenure track positions, contributing to a brain and money drain. A more equal, better enforced distribution of the teaching load, in combination with some deliberate teaching relief for writing multi-investigator or other major grant applications, seems prudent. Cluster representatives are also concerned about continued institutional support for research facilities, coupled with the fact that there is currently insufficient funding to replace retiring support staff. In the committee's opinion, the way to address these issues with facilities is to make a plan that clearly shows the needs for the facilities and sets out strategies for enhancing their further

use, including ways they might generate additional income.

The highest priority for this cluster, however, is to meld the departments into a single unit by building a common intellectual community. This will not only benefit the cluster, but will improve cohesion and collegiality within RIBES as a whole. Thus, the committee recommends that the institute provide the required support for formulating a clear and openly communicated cluster strategy. The services of a professional consultant to help with creating an efficient organization, as is already planned, should prove beneficial. Measures to move toward unifying the departments would, in the committee's opinion, involve (1) overcoming the separation of departments in space by encouraging frequent informal interactions, (2) organizing cross-departmental and cross-cluster seminars or short talks where staff learn about each other's research, including research still in an initial phase, (3) facilitating contacts between PhD candidates and postdocs across departments, to include a common first year PhD experience.

### **Recommendations**

The committee offers the following recommendations:

- Finish the transition to a cluster structure by abandoning the departments. Even if the change in governance structure needs to

happen gradually, department names – such as on the RIBES website – should be removed to encourage a common identity.

- Build a strong mutual academic culture by stimulating informal and formal contacts and interaction between staff of different departments. Culture-building can occur at all levels, through interactions among PhD candidates, postdocs and faculty. A shared first-year PhD experience would work toward this goal.
- Quantify and, if appropriate, rectify the perceived high teaching load. Compensation for teaching above the expected 40% time commitment should substantially facilitate research.
- Grant some teaching relief to put together major, multi-investigator funding applications. Applications involving investigators from different departments should be especially encouraged.
- Quantify the extent to which experimental plant and animal facilities are utilized and construct a plan to attract more users from within and outside the university.
- Revisit the management of technical support staff.

## Response to the review report of the RIBES assessment committee

We thank the RIBES assessment committee for the time and effort dedicated to evaluating the RIBES and providing us with a well-balanced review report. We appreciate the positive assessment of the scientific quality, societal relevance and viability of our research, including the specific recommendation to adjust our mission statement such that it better reflects that our research contributes to a fundamental understanding of the natural world. The review report also provides a number of concrete suggestions for improvement for both the institute and the individual clusters, which we address below.

### A. Institute level

1. *Translate the overall mission and vision into a comprehensive, six-year strategic plan.*

We agree and we will use our newly developed research strategy as a basis to develop a coherent strategic plan for practical implementation of our research ambitions. The strategic plan is meant to directly facilitate research in the four central research areas of RIBES, i.e. (I) Macronutrients and chemicals of emerging concern; (II) Physical conditions: understanding responses and adaptation mechanism to stressors; (III) Biodiversity decline and recovery of ecological communities; and (IV) Mitigation of greenhouse gases. It will include details on career development, PhD supervision, research facilities and funding strategy. The permanent academic staff of RIBES will together annually define and evaluate concrete actions to implement the strategic plan. Scientific coordinators (one from each cluster) for each research area will be appointed with the opportunity and means to

develop meetings and collaborative research projects.

2. *Establish and support cross-institutional initiatives to unify the clusters in the institute.*

We are developing a cross-cluster meeting structure with regular seminars. We will use the results of a recent survey among the members of the RIBES to ensure these meetings match the needs and preferences within the institute. We will also (financially) support other cross-institutional initiatives, such as PhD activities organized by the recently installed RIBES PhD council.

3. *Make the distribution of teaching obligations transparent.*

We will transparently discuss the redistribution of the teaching tasks with the clusters. The aim is to transfer part of the tasks from the Ecology & Physiology cluster to the Environmental Science and/or Microbiology clusters.

4. *Initiate a discussion with the faculty and the university board on transparent and accessible career paths from associate to full professor. Set up an institute-wide mentoring programme for assistant and associate professor-level staff.*

In consultation with the university and the faculty board, we are currently initiating career tracks from associate to full professor. We will also connect to the university-wide mentoring programme for assistant professor-level staff and encourage our academic staff to follow academic leadership programmes.

5. *Harmonize PhD supervision and training practices.*

The recently implemented Hora Finita PhD monitoring system will greatly aid in the harmonization of supervision and training practices of PhD candidates in our institute. Currently, PhD candidates are part of 4

different (national) graduate schools. We will start a RIBES graduate school where PhD mentoring and training are centralized, including the implementation of an integrity course for all PhD candidates and an introduction day for all new PhD candidates.

## **B. Cluster level**

### **B1. Environmental Science**

1. *Consider expanding the research to innovative topics such as machine learning and big data.*

The Environmental Science cluster has been exploring machine learning and big data techniques over the past few years and is looking to expand this further, since we recognize that these are powerful approaches for discovering patterns and relationships and establishing predictive models.

2. *Explore new and innovative collaborations as springboards for more external grant funding.*

The cluster is strengthening its participation in the Radboud Centre for Sustainability Challenges, with members of the cluster acting as co-director and coordinator, and is actively looking for new research collaborations on sustainability themes within and outside the university. We are also developing a new MSc programme 'Science for Sustainability' together with the Faculty of Management. We expect this to lead to more innovative, interdisciplinary research collaboration.

3. *Consider a name change to better capture the unique focus of the cluster.*

The cluster is happy with the name "Environmental Science", which is in line with the broad names of the other two clusters within RIBES.

4. *Strengthen the cohesion and visibility of the research lines.*

The cluster acknowledges the need to strengthen the cohesion and visibility of the research lines and will explicitly address this in its upcoming research strategy (see next point).

5. *Formulate an ambitious strategy for the future, addressing grand societal challenges.*

The cluster will formulate a new and ambitious research strategy as part of the 6-year strategic RIBES plan that will be formulated in 2022. The strategy will include research, education and impact in an integrated way, aiming at the grand societal challenges revolving around chemical pollution, climate change, the circular economy, and biodiversity decline.

### **B2. Cluster Microbiology**

1. *Formulate an explicit, continuous strategy.*

The Microbiology cluster will formulate a research strategy as part of 6-year strategic RIBES plan that will be formulated in 2022. One of the goals of the strategy will be to secure long-term funding for the bioreactor research facility and its technical support.

2. *Balance capacity for PhD training with staff availability.*

The cluster is in the process of opening a vacancy for a full professor in microbial (eco)physiology, a tenure-track assistant professor, and will likely welcome a female Mohrmann professor in 2022 that was recently awarded by the Faculty of Science.

3. *Actively search for additional collaborations and funding opportunities with the other clusters.*

The cluster will continue to seek collaboration and grant applications with the other two RIBES clusters.

### **B3. Cluster Ecology & Physiology**

1. *Finish the transition to a cluster structure by abandoning the departments.*

As a recently emerged unit, the Ecology & Physiology cluster acknowledges the need to take serious and urgent steps towards integration regarding scientific strategy and organization to be able to capitalize on new opportunities. The cluster will, in direct consultation with the RIBES management team, carefully consider which internal structure is preferred. This structure will be described in the new 6-year strategic RIBES plan that will be formulated in 2022.

2. *Build a strong mutual academic culture by stimulating informal and formal contacts and interaction between staff of different departments.*

The cluster agrees that a common culture and language are prerequisites for effective integration and will work on a comprehensive interaction strategy, directly aligned to activities at the level of the institute and the four research themes.

3. *Quantify and, if appropriate, rectify the perceived high teaching load.*

We will discuss the redistribution of the teaching tasks with the clusters. The aim is to transfer part of the tasks from the Ecology & Physiology cluster to the Environmental Science and/or Microbiology clusters.

4. *Applications involving investigators from different departments should be especially encouraged.*

The cluster agrees to encourage innovative multidisciplinary research within and between

the clusters of RIBES and to support shared research applications.

5. *Quantify the extent to which experimental plant and animal facilities are utilized and construct a plan to attract more users from within and outside the university.*

The cluster agrees that insight into the utilization of and the value created by its experimental facilities is instrumental to their optimal operation and sustainability and will devise a plan as recommended.

6. *Revisit the management of technical support staff.*

The cluster will create plans for seamless sharing of facilities, equipment and expertise, including that of the support staff.

# Appendices

## 1. CVs of committee members

**Geert de Snoo** (chair) is currently the director of the Netherlands Institute of Ecology of the Royal Netherlands Society of Arts & Sciences (NIOO-KNAW) and professor of Conservation Biology at Leiden University. His research is about the conservation and restoration of biodiversity in human-dominated landscapes. His focus is on nature conservation on farmland and the transition towards sustainable land use. Linked to this, he is interested in the impact of pesticides on biodiversity and the environment. De Snoo supervised approximately 35 PhD students in the field of conservation biology and environmental sciences. In addition to his research activities, he held various managerial positions in academia. From 2012-2019 he was the dean of the Faculty of Science at Leiden University. He was also the director of the Institute of Environmental Sciences.

**Nicholas J. Bernier** is professor in the Department of Integrative Biology at the University of Guelph, Canada. He earned his BSc from McGill (1986), MSc at the University of British Columbia (1994), and PhD from the University of Ottawa (1998). He was appointed at the University of Guelph in 2001. Bernier has expertise in the fields of fish endocrinology and physiology. His research is focused on identifying the neuroendocrine pathways that regulate the stress response, understanding the developmental and long-term effects of environmental stressors, and developing novel endocrine and molecular biomarkers of physiological performance and health in fish. He has supervised 28 graduate students and published more than 90 peer-reviewed papers and book chapters. Bernier served on and chaired a Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant panel, co-edited *Fish Neuroendocrinology*, and is currently the

Endocrine Systems section editor of the *Encyclopedia of Fish Physiology*.

**Brenda Casper** conducts primarily experimental and often field-based research in plant ecology, which has included a five-year climate change study in the steppe of northern Mongolia. Work in her lab has spanned pollination biology and plant breeding systems, belowground plant competition, plant-soil feedback, demographic and community responses to climate change, and plants' roles in shaping coastal sand dunes. She joined the faculty of the University of Pennsylvania in 1982, where she now chairs the Department of Earth and Environmental and has previously chaired the Department of Biology. She is a Fellow of the Ecological Society of America and has served on the editorial boards of *Oecologia*, *Ecology*, and *Ecology Letters*. She earned her B.S. at Yale University (1976) and her PhD at the University of Utah (1982).

**Nancy Dise**'s research concerns the biogeochemistry and biodiversity of terrestrial ecosystems, particularly the cycling of carbon, nitrogen, and sulfur in peatland, grassland, forest, and riparian zones, controls on trace gas emission from these ecosystems, and regional-scale modelling of air pollution impacts. She was formerly Section Head and Science Area Lead at the Centre for Ecology & Hydrology (now UKCEH) in the UK, and is currently a UKCEH Fellow. She has served on the editorial boards of the journals *Ecosystems* and *Biogeochemistry*, and was a member of the UK National Environmental Research Council College. She obtained her BSc at the University of Notre Dame, MSc at the University of Virginia, and PhD at the University of Minnesota, all in the USA.

**Michael Zwicky Hauschild** is professor in quantitative assessment of sustainability at the Department of Technology, Management and Economics in the Technical University of Denmark (DTU) and he has worked on the development of methods for sustainability

assessment of products and technologies for more than 25 years. He has an extensive experience in the development of metrics and indicators for sustainability, and served as chair on consecutive working groups under UNEP-SETAC Life Cycle Initiative developing the recommended scientific consensus model USEtox ([www.usetox.org](http://www.usetox.org)) for assessment of chemical impacts on health and environment. He has acted as a consultant to the European Commission, creating the groundwork for the ILCD Methodology, which is the Commission's standard methodology for life cycle assessment of products and systems and in 2018 he received the SETAC Europe Edana Award for lifetime achievement in Life Cycle Assessment. He has authored or co-authored more than 230 peer reviewed scientific publications and a leading textbook on Life Cycle Assessment.

**Melanie Münch** started off with a BSc in Chemistry at the University of Basel in Switzerland, followed by a MSc in Biogeochemistry at Utrecht University in the Netherlands. 'How does this work exactly?' is the question that makes her get up in the morning. To explore the world outside of academia, Melanie first went to work in the private sector as an environmental engineer for the investigation and removal of soil and water pollution and in fundraising/communication for Greenpeace Switzerland. During this time, she further broadened her scope by trainings in facilitation/non-violent communication and permaculture design. However, following the need to get more thorough answers to her fundamental question, she decided to return to science and

obtained a PhD position at Utrecht University with the European H2020 Marie Skłodowska-Curie Innovative Training Network P-Trap (Preventing Phosphorus Input to Surface Waters – New Concepts in Trapping, Recycling and Management). In her project she investigates the phosphorus and iron dynamics in lake sediments with the objective to design sustainable restoration solutions for eutrophic freshwater systems.

**Michael Wagner** is full professor of Microbial Ecology and vice director of the Centre for Microbiology and Environmental Systems Science at the University of Vienna. Since 2019, he is also visiting professor in Engineering Science at the University of Oxford in the UK, and distinguished professor at Aalborg University, Denmark. Wagner's research team has two major research foci. It is interested in all aspects of nitrification with a particular focus on the biology of ammonia-oxidizing archaea and bacteria as well as on complete nitrifiers of the genus *Nitrospira* (Comammox). Furthermore, it continuously develops innovative single cell tools for investigating the identity and function of individual microbial cells within their natural habitats. Wagner has been the president of the International Society for Microbial Ecology and a senior editor of the journals *Environmental Microbiology* and the *ISME Journal*. He has authored or co-authored more than 275 peer reviewed scientific publications and has been recognized as a highly cited researcher in the last seven years.

## 2. Schedule of the site visit

### Concept Programme RIBES assessment

#### Day 1: MON 1 November 2021 – Hotel Van der Valk (Nijmegen)

15.00	Closed committee meeting: site visit preparation	Committee members
17.00	Kick-off meeting	Chair Secretary University board representative
17.30	Welcome reception and introduction	Committee members Rector Magnificus Dean Vice-dean MT RIBES Heads of cluster
18.30	Closed committee meeting: site visit preparation	Committee members
19.00	Dinner	Committee members
20.30	Further preparation of the site visit	Committee members

#### Day 2: TUE 2 November 2021 (Campus, Huygensbuilding, 01.060)

08.30	Taxi from hotel to Faculty of Science	
09.00	Start & short presentation on RIBES by director 15' presentation – 30' interview	Prof. dr. Lutgarde Buydens (Dean) Prof. dr. Richard van Wezel (Vice-dean) Prof. dr. Mark Huijbregts (Director) Prof. dr. Laura van Niftrik (MT member) Dr. Ivo Rieu (MT member) Dhr. Martijn Frieling (Managing director)
09.45	Recording findings	
10.00	Interview Cluster Ecology & Physiology 15' presentation – 30' interview	Prof. dr. Hans de Kroon Prof. dr. Henk Siepel Prof. dr. Jian Xu Dr. Sarian Kosten (Associate professor) Dr. Marnix Gorissen (Assistant professor)
10.45	Recording findings	
11.00	Break	
11.15	Tour along facilities and laboratories RIBES	
12.15	Lunch	
13.00	Interview Cluster Environmental Sciences 15' presentation – 30' interview	Prof. dr. Ir. Jan Hendriks Prof. dr. Ad Ragas Prof. dr. Mark Huijbregts Dr. Aafke Schipper (Assistant professor) Dr. Rosalie van Zelm (Assistant professor)
13.45	Recording findings	
14.00	Interview Cluster Microbiology 15' presentation – 30' interview	Prof. dr. ir. Mike Jetten Prof. dr. Laura van Niftrik Dr. Cornelia Welte (Associate professor) Dr. Robert Jansen (Assistant professor) Dr. Sebastian Lücker (Assistant professor)

14.45	Recording findings	
15.00	Break	
15.30	Interview PhD candidates	Wouter Mes (Cluster Ecology & Physiology / Microbiology, 3 <sup>rd</sup> year) Robin Lexmond (Cluster Ecology & Physiology) Martijn Jansen (Cluster Ecology & Physiology, 3 <sup>rd</sup> year) Ana Rios Miquel (Cluster Microbiology / Environmental Science, 4 <sup>th</sup> year) Floris Neijns (Cluster Environmental Science, 2 <sup>nd</sup> year) Caterina Zillien (Cluster Environmental Science, 4 <sup>th</sup> year)
16.00	Recording findings	
	Writing and discussion experience and impressions first day	
17.30	Walk to 'Huize Heyendael'	
18.00	Dinner	Committee Vice-dean MT Heads of cluster
20.30	Taxi to Hotel	

**Day 3: WED 3 November 2021 (Campus, Huygensbuilding, 01.060)**

08.30	Taxi from hotel to Faculty of Science	
09.00	Interview with research directors of Bioscience Institutes DCN & RIMLS	Prof. dr. John van Opstal (Research Director DCN) Prof. dr. Michiel Vermeulen (Research Director RIMLS)
09.30	Recording findings	
09.45	Interview Stakeholders	Dr. Wim Vriezen, Principal Scientist Trait Development (BASF) Dr. René Rozendal Managing Director (Paques) Dr. ir. Rob Alkemade Ecologist / Special Professor (PBL / WUR) Drs. Teo Wams Director Natuurbeheer (Natuurmonumenten)
10.15	Recording findings	
10.30	Break	
11.00	Interview analysts	Dr. Jeroen Boerrigter (Cluster Ecology & Physiology) Ing. Niels Wagemaker (Cluster Ecology & Physiology) Dr. Jelle Hilbers (Cluster Environmental Science) Ir. Katinka van de Pas (Cluster Microbiology)
11.30	Recording findings	

11.45	Interview postdoc researchers	Dr. Wouter Versantvoort (Cluster Microbiology) Dr. Silvia Coolen (Cluster Microbiology) Dr. Koen Kuipers (Cluster Environmental Science) Dr. Peter Vermeiren (Cluster Environmental Science) Dr. Coline Boonman (Cluster Ecology & Physiology) Dr. Andrew Allen (Cluster Ecology & Physiology)
12.15	Recording findings	
12.30	Lunch	
13.00	Interview Tenure Track researchers	Dr. Steef Hanssen (Assistant professor, Cluster Environmental Science) Dr. Marlee Tucker (Assistant professor, Cluster Environmental Science) Dr. Annelies Veraart (Assistant professor, Cluster Ecology & Physiology) Dr. Bjorn Robroek (Assistant professor, Cluster Ecology & Physiology) Dr. Robert Jansen (Assistant professor, Cluster Microbiology)
13.30	Recording findings	
13.45	Interview with MT RIBES (if necessary, faculty board will join the interview)	
14.15	Discuss results, writing and preparing presentation of first conclusions	
15.15	Presentation of preliminary findings	In lecture hall HG.00.304
16.00	Informal gathering and drinks	In central corridor next to lecture halls
18.00	Taxi to hotel/train station	
19.00	Dinner (optional)	Committee

### 3. Assessment scale

	<b>Meaning</b>	<b>Research quality</b>	<b>Relevance to society</b>	<b>Viability</b>
<b>1</b>	World leading/ excellent	The relevant research unit has been shown to be one of the few most influential research groups in the world in its particular field.	The relevant research unit is recognised for making an outstanding contribution to society.	The relevant research unit is excellently equipped for the future.
<b>2</b>	Very good	The relevant research unit conducts very good, internationally recognised research.	The relevant research unit is recognised for making a very good contribution to society.	The relevant research unit is very well equipped for the future.
<b>3</b>	Good	The relevant research unit conducts good research.	The relevant research unit is recognised for making a good contribution to society.	The relevant research unit makes responsible strategic decisions and is therefore well equipped for the future.
<b>4</b>	Unsatisfactory	The relevant research unit does not achieve satisfactory results in its field.	The relevant research unit does not make a satisfactory contribution to society.	The relevant research unit is not adequately equipped for the future.