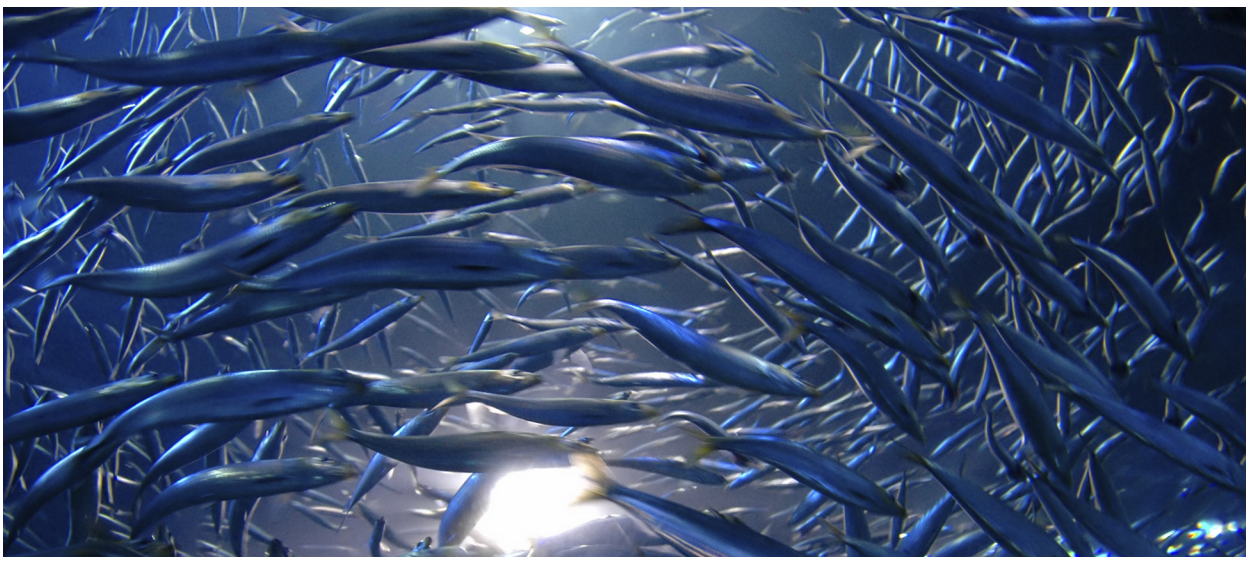
Vetenskapsrådet

EVALUATION OF SWEDISH BIODIVERSITY RESEARCH



– funded by the Swedish Research Council and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning 2002–2009

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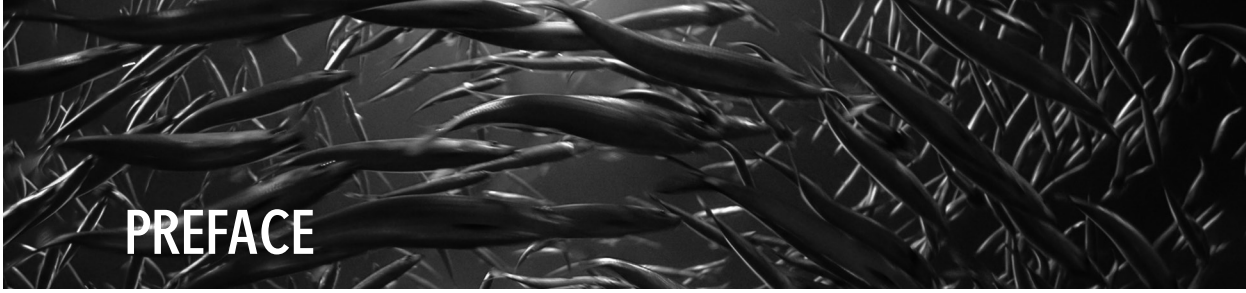


PREFACE

In 2001 the Swedish government allocated 400 million SEK for research on biodiversity and ecological sustainable development for the years 2002–2004 to the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning Formas (250 million SEK) and the Swedish Research Council (150 million SEK). Most of the fundning were distributed to individual research projects through open calls. The management of the funding has varied over time and between the councils, but initially a joint call was carried out.

The increased funding became a permanent supplement to the Research Councils, however after 2007 the biodiversity earmark was removed. Since then, both funding agencies have had no special management of the funding to biodiversity research. Recently, more strategic initiatives, such as impact on natural resources, ecosystem services and biodiversity were introduced (Government Bill 2008/09:50; A boost for research and innovation). Against this background, the two Councils decided to jointly evaluate the previous efforts on biodiversity research, to assess the research quality and relevance, to analyze the development of the area, and to take advantage of lessons learned from management of a major research effort.

For this purpose, the Councils appointed two separate committees of distinguished experts given the task of carrying out the evaluation; one science committee with international scientists and one relevance committee with experts working in national and international stakeholder organisations. Prof. David Penman was appointed Chairman of the Science Committee and Prof. Peter Bridgewater was appointed Chairman of the Relevance Committee. This report contains the findings and recommendations of the committees.

The evaluation comprised projects that had funding during 2002–2009, i.e. projects starting from 2002 to 2007. In total, over 400 individual projects with some 220 project leaders, spending more than 630 Million SEK, were included.

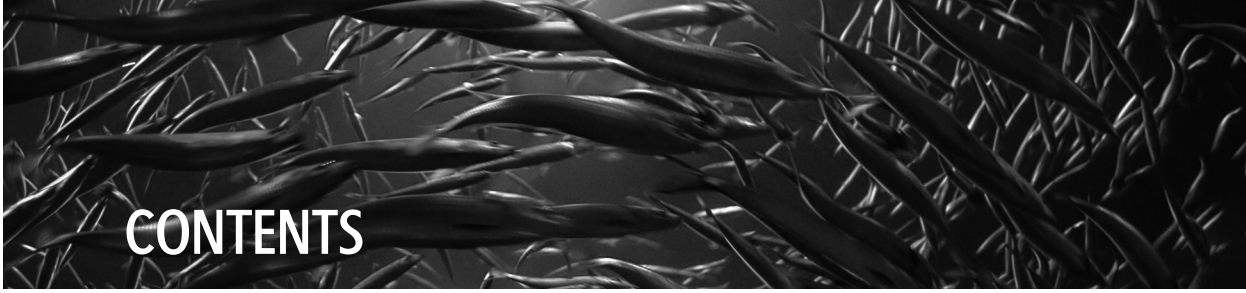
The evaluation was planned and supported by a secretariat of staff comprised of Andreas Augustsson (Swedish Research Council), Marie Emanuelsson (Formas), and Sven Larsson-Östergren (Swedish Research Council). A reference group was appointed comprised of Arne Johansson, Dan Holtstam and Maud Quist from Swedish Research Council and Hans-Örjan Nohrstedt and Sofie Björling from Formas.

The Research Councils would like to express their deepest gratitude to the participating researchers and to the Science and Relevance Committees for devoting their time and expertise to this important task. The recommendations of the committees are highly appreciated by the Councils. The findings and recommendations will provide important guidance for future initiatives in the area of biodiversity research.

Stockholm June, 2010

Pär Omling
Swedish Research Council

Rolf Annerberg
Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning



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EVALUATION REPORT

To
The Swedish Research Council
The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning

At the request of the above-mentioned organisations, we have evaluated the Swedish research in Biodiversity, funded by the Swedish Research Council and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning during 2002–2009. We take full responsibility for the judgements and the recommendations given in the report.

Stockholm, April 2010

The Science committee

Prof. Ellen van Donk

Prof. Emmett Duffy

Prof. Rob. Freckleton

Prof. Douglas MacMillan

Prof. L. Scott Mills

Prof. Ole Seberg

Prof. Ian Swingland

Prof. Tom Veldkamp

Prof. Katherine Willis

Prof. David Penman
Chairman

The Relevance committee

Dr. Anna-Helena Lindahl

Dr. Mark Marissink

Assoc. Prof. Lennart Nyman

Dr. Tania Runge

Prof. Peter Bridgewater
Chairman

The committee members, back row left: Peter Bridgewater, David Penman, Rob Freckleton, Lennart Nyman, Emmett Duffy, Ole Seberg, Tom Veldkamp, Mark Marissink, front row left: Katherine Willis, L. Scott Mills, Douglas MacMillan, Ian Swingland, Tania Runge, Ellen van Donk, Anna-Helena Lindahl.

EXECUTIVE SUMMARY AND RECOMMENDATIONS

Sweden has a long and proud history in biological and ecological research and has shown a strong commitment to being part of global environmental initiatives such as the Convention on Biological Diversity (CBD), taking a key role in both the Conference of the Parties' (CoP) and subsidiary body's (SBSTTA) meetings in the formative years. Swedish research has been particularly strong in areas such as taxonomy, population ecology and genetics and in ecosystems such as boreal forests, lakes, running water, and agricultural systems. In 2001 the Swedish Government made a special allocation of funding for biodiversity research to be administered by the Swedish Research Council (VR) and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas). The research councils appointed 2010 two committees to evaluate their investment in biodiversity research from the perspectives of the quality and strategic direction of the science (Science Committee) and the relevance of the research (Relevance Committee). The Science Committee consisted of ten international experts representing a wide range of science relevant to biodiversity. The Relevance Committee consisted of five national and international experts representing stakeholder organisations relevant to biodiversity issues.

This report outlines the analyses and findings of the two committees. The committees evaluated the quality of the research entities that were recipients of project funding from 2002. The Committees noted a wide range of performance with some particularly strong research groups in forest, lake and agricultural ecology and strong disciplinary capability in areas such as taxonomy, evolutionary biology, population biology, conservation genetics, microbial ecology, climate/ecosystem modelling, economics and landscape ecology. The Committees also noted that much of the investment served to deepen existing areas of research whereas truly integrative interdisciplinary research was in the minority. In particular there was little evidence that the human dimensions of biodiversity research were well incorporated into projects. The Committees concluded that the investment since 2002 had developed some strong, mainly disciplinary-based groups and a number of PhD students who were finding positions outside of the academic research community. More work on integrating stakeholders into the development and mangement of projects, to enhance rapid and appropriate uptake of results should be encouraged where practicable. Deepening novel areas

of biodiversity research, by encouraging the linkage between natural and social sciences should also be part of the research programme.

The Committees provided a number of general findings and the following recommendations for consideration by the research councils. The recommendations are not listed in priority order.

Recommendations of the Science Committee

1 That the research councils continue with earmarked investment for biodiversity research but with future project investments being predicated on:
- Development of a clear strategy reflecting the needs of the wider Swedish biodiversity community;
- Agreement on a definition for biodiversity science;
- A greater emphasis on larger long-term projects with strong emphasis on integrative and interdisciplinary endeavors.

2 That the research councils reconsider the balance of investment to encourage the provision of more ongoing biodiversity positions in research institutions instead of the current dominance on producing PhD's.

3 That the research councils develop means to incentivize greater collaboration with international partners and to encourage research proposals that are more collaborative across disciplines and institutions.

4 That coordination of investments by the Swedish Research Council and Formas be improved and a joint Biodiversity Research Committee be established of scientists representing a range of relevant disciplines and key stakeholders/end users.

5 That communication and awareness of biodiversity research be enhanced through mechanisms such as:
- A conference on Swedish biodiversity science to encourage cross-disciplinary and institutional collaboration;
- Specific workshops to build interdisciplinary links especially with the social scientists;
- A prize for a person making an internationally significant contribution to biodiversity research.

6 That Swedish researchers be encouraged to synthesize their past research in more internationally-significant review papers and that the research councils specifically promote synthesizing activities in ways similar to those used by the National Center for Ecological Analysis and Synthesis in the US.

7 That the research councils note the need to continue to support the development of infrastructure and capability in genomics, bio- and biodiversity informatics, and modelling but provide the appropriate incentives and mechanisms to apply them to solving biodiversity problems.

8 That the research councils review the text of their calls for proposals to enhance collaboration, cross-disciplinary interactions and communication, and ensure that the appropriate performance measures are part of project contracts.

Recommendations of the Relevance Committee

9 At the level of call and application the definition of biodiversity projects should be clarified – We recommend the following, based on using the CBD definition:
- Biodiversity projects should be developed from a human perspective, and be integrative, including diversity questions at genetic, species, ecosystem, landscape and seascape levels and responding to research needs for the conservation, sustainable use and benefit-sharing of life on earth.

10 Biodiversity research is a cross-cutting discipline between natural and social sciences, and successful projects should be funded with that in mind, but especially:
- Preference should be given to project proposals with a broader perspective than nature conservation;
- Biodiversity research should be seen to comprehend research on human and wildlife/ plant health issues linked to viruses and parasites;
- Traditional and indigenous knowledge is relevant for the success of some projects and should be incorporated where appropriate.

11 An increased awareness that specific Swedish research might be of relevance for other countries and globally and should be encouraged. When identifying relevance the transferability of outcomes internationally should be considered,

12 Assistance should be provided for applicants to develop projects including societal relevance:
- Some time should be allocated in the project for interaction with stakeholders, for example by workshops;
- Participation of stakeholders should have funding provision within the application;
- Stakeholder involvement is often a bottle neck regarding agencies and county boards.

13 Encourage research focusing on:
- Projects that include elements of economics and cost-benefit analysis of the provision of ecosystem services;
- Novel research areas, for example modelling, especially the interface between data and model development; and Cross-cutting research, that is comprising basic, applied or problem-based research;
- Changes in biodiversity and long-term evolution, with land use change and climate change as drivers, and with a particular focus on managing for change;
- Biodiversity issues around fish and fisheries in marine and freshwater systems.

14 User-driven research should be increased in order to guarantee practical application of results.

15 Provide information in the call detailing how the post-project evaluation will be carried out. Giving priority to a thematic basis would probably contribute to stronger exchange and collaboration between scientists.

16 Formas in particular, but The Swedish Research Council where appropriate, should seek to make engagement with society more rewarding for scientists by:
- Promoting engagement with society as an indicator of success in the university system;
- Interaction with stakeholders should be considered as part of research project activities;
- Publication of problem-based and applied research in peer-reviewed journals should be encouraged.

17 A stronger focus is needed on possibilities available to bridge the gap between science community and stakeholders, end-users, politicians, and governmental bodies – some possibilities are:

- Thematic meetings/workshops between stakeholders and scientists, for example, regarding land- and seascape research, mycorrhiza, ecosystem approach;
- Arrange a search function in the Formas webpage to facilitate identification of scientists working on user-relevant projects;
- Help scientists to define the right timing for contact to stakeholders, packaging of information;
- Keeping the political context in mind.

1 INTRODUCTION

Biodiversity emerged as a concept in 1986; by 1987 the US Office of Technology Assessment had issued a report *Technologies to Maintain Biodiversity*, containing most of the concepts since (often less clearly) elaborated.

At the Rio (1992) conference on Sustainable Development the threats to life on earth were recognised and embodied in the Convention on Biological Diversity (CBD). Parties to the Convention were expected to commit to reducing the rate of species loss and address three key issues:

- Conservation
- Sustainable use
- Equitable sharing of benefits.

Biodiversity is defined by the CBD as *"the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."* 'Biodiversity science' is, therefore, a relatively new concept that builds on a wide range of disciplines to deliver benefits to humans and other organisms that occupy the spectrum of interactions among ecosystems, species and genes. Science relevant to biodiversity has been going on for centuries and Sweden, through Linnaeus, has been at the founding edge of key disciplines such as taxonomy. As issues of societal importance have gradually emerged core science disciplines within the natural sciences have focused on providing understanding of these issues and providing possible solutions and benefits. New disciplines have emerged in areas such as ecology (in the 1920s), and more recently molecular biology and informatics.

Such relatively new disciplines are now combining with more traditional disciplines such as botany, zoology, microbiology and geology into a focus on biodiversity science. However with the strong international emphasis on involving humans in seeking solutions to biodiversity loss and enabling sustainable development, biodiversity science cannot be merely a subset of the natural sciences. Instead it must embrace the integration of human dimensions through greater involvement of the social sciences. The DIVERSITAS programme, supported by International Council for Science (ICSU) and UNESCO[1] in its formative years and now part of the ICSU Earth Systems Science group, has made attempts at promoting biodiversity science. Its attempts almost always lack the fully integrative nature across the natural and

[1] United Nations Educational, Scientific and Cultural Organization

social sciences that biodiversity science must encapsulate. The search, then, for this 'Holy Grail' is still on.

In 2001, the Swedish Government took a bold step in promoting more targeted research into gaining a better understanding of biodiversity across its many diverse elements (see Appendix 1) . Most of the funds went to the Swedish Research Council and Swedish Research Council for Environment, Agricultural Sciences and Special Planning (Formas), where most would be allocated to individual research projects through open calls.

The investment in biodiversity science projects was over 630 Million Swedish kronor (SEK) over the past 8 years (the Swedish Research Council – SEK270 Million and Formas – SEK360 Million) and has been in addition to more disciplinary (mainly the Swedish Research Council) or wider investments in environmental science and sustainability (mainly Formas). The initial calls for proposals sought excellent science largely from within the then existing more traditional disciplinary funding panels but with some emphasis to foster more interdisciplinary research.

The key emphasis for these first rounds of proposals for the Swedish Research Council in 2002–2004 was to support basic research on biodiversity and ecology with a focus on species adaptation and interactions, their natural characteristics and living conditions. There was also the opportunity for the submission of wider interdisciplinary projects. In 2004 the Swedish Research Council established a committee for research on Biodiversity, with the specific purpose of handling applications and other matters related to biodiversity.

In the subsequent (2005) the Swedish Research Council call for proposals the intentions of this funding round were to support research that:

- Studies processes that explain how biodiversity arises and is maintained, and its importance in ecosystems subject to varying degrees of human influence;
- Explores biodiversity as a concept and topic of discourse;
- Tackles issues relating to management and sustainable use of biodiversity;
- Studies the importance of biodiversity to humankind and society;
- Describes or surveys variation at genetic, species and ecosystem level (including taxonomy);
- From a biodiversity perspective, investigates the adaptations, interaction and functions of species in ecosystems.

Within the Swedish Research Council several funding panels supported research relevant to biodiversity (relative share of the funds in parantheses):

- Ecology and systematics (77%)
- Organism biology (10%)
- Other natural science panels (5%)

- Processes in land air and water (4%)
- Humanities and Social Sciences (3%)
- Medicine (1%)

The factor of 'additionality' is crucial in understanding the role and impact of the focus on biodiversity science.

The majority of the additional biodiversity funds of SEK270 Million where allocated to the *Ecology and Systematics* panel where funding for research more than doubled on an annual basis. By contrast, funding for O*rganism biology* increased by about 13%, and *Processes in land, air and water* by about 7%.

For the first rounds of proposals for Formas 2002–2004, the investment focused on four priority areas:

- The state and development of biodiversity;
- Factors affecting biodiversity;
- Measures to preserve or restore biodiversity and its functions;
- The importance and use of biodiversity in sustainable development of the society.

In 2004 two more areas were included:

- The occurrence and properties (taxonomy, systematics, ecology) of species for which more knowledge is of special importance in assessing diversity;
- The significance of diversity for the function of ecosystems.

In these Formas calls, it was stated that the research could cover both natural environments and managed or built environments, and both wild and domestic species. Research within natural and social sciences was welcomed, as well as applications for interdisciplinary projects.

For the 2002 call Formas funding panels were (relative share of the funds in parentheses):

- Ecology, population genetics and taxonomy (26%)
- Microbiology, environmental chemistry and toxicology (17%)
- Aquatic systems (14%)
- Agriculture and the cultural landscape (12%)
- Forest and forest production (12%)
- Organization, instruments of control (governance) and actors (11%)
- Biodiversity in the built environment (8%)

The bulk of the Formas funds in the period 2002–2005 were managed within the standing panels *Terrestrial ecology and biodiversity*, and *Aquatic ecology and biodiversity, and fishing*. A few projects related to biodiversity were reviewed by the panels for *Climate and biogeochemistry*, *Forestry*, *Agriculture and horticulture*, *Urban development*, and *Man, lifestyles and environment*. In 2006, the terrestrial panel was split into two panels due to a high number of applications. The new panels were *Ecology and biodiversity in terrestrial systems* and *Nature conservation and biodiversity in terrestrial systems*. Formas panels evaluated project proposals not only on scientific excellence, but also on relevance. To do so, the panels usually included one or a few persons from stakeholder organisations.

Formas called for applications, targeted to the two areas highly relevant to biodiversity research in 2003–2005 and 2006 respectively:
- Marine environmental research
- Sustainable management of biodiversity

This means that in this review the Swedish Research Council projects should have a greater impact on the quantum and quality of biodiversity-related papers and presentations within the general disciplines of Ecology and Systematics than in other less central disciplines and have a greater focus on more basic science.

However, achieving real benefits from biodiversity-related science requires more focus on interdisciplinary research and a clear recognition that achieving sometimes necessary policy and behavioural change requires an increased understanding of human factors, hence the need for social scientists to become more integrated into biodiversity projects. Within the Formas-funded projects we should see increased interdisciplinary research and benefits from social science involvement.

2 EVALUATION PROCESS

As biodiversity science has become more recognised as an emerging area of research and with the growing recognition that biodiversity underpins human wellbeing and environmental sustainability, the research councils have commissioned a review of the past investments into biodiversity science projects as a means of assessing performance and guiding future investments to maximise the strategic position of Sweden in this area. The research councils wished to assess the scientific quality of the research within the area, as seen in an international context, and the relevance and value for biodiversity and sustainable development of society. Given the diversity of the projects the councils decided to appoint two separate committees of distinguished experts to carry out the evaluation; one Science Committee (SC) with international scientists and one Relevance Committee (RC) with experts working in national and international stakeholder organisations.

Specific evaluation objectives and committee responsibilities were:

1. Assess the scientific quality of the research area within an international perspective (SC);
2. Assess the relevance and user value for society of the research results (RC);
3. Identify strong research areas and successful Swedish research groups and the councils' support to those areas (SC);
4. Identify unique research areas for Sweden (SC and RC);
5. Identify important but weak and neglected areas of research in Sweden (SC and RC);
6. Identify new interesting areas and future investments (SC and RC);
7. Elucidate the bills importance for the research teams overall operation, direction and results in short and long term. (SC);
8. Evaluate how the outcomes relate to the objectives as set out by the government (SC and RC).

Given the number and diversity of the projects (over 400 individual projects with 220 project leaders), individual assessments were not possible. Instead the research councils grouped the project leaders into 24 different reporting entities, largely based on affiliation (see Appendix 3 for list of included projects). A rapporteur then developed a summary report for the entity as a whole. The committees were then invited to assess the reports by the individual project leaders as well as the summary reports from their respective perspectives. The Science Committee focused particularly on assessing scientific achievements and the quality of publications, while the Relevance

Committee focused particulary on assessing the relevance of biodiversity research for society, and cooperation with stakeholders.

The indivudual and summary reports were distributed to committee members prior to the meeting in Stockholm, 12–16 April 2010 and initial assessments of science quality and relevance for each reporting entity were made before the meeting. The two committees met jointly to establish a mode of operation and then undertook separate work programmes involving interviews with rapporteurs and other key personnel for each reporting entity followed by an analysis by members of the two committees of each entity. These entity reports focused on their scope, areas of strength relating to biodiversity, future opportunities and a ranking of the quality of their scientific publications and other contributions, inluding the relevance of the research to society at large, or other parts of the scientific community. The quality ranking was based on the following criteria:

Outstanding

Outstanding research in an international perspective; of great international interest with broad impact and with publications in internationally leading journals; the entity/grant holder is among the leaders in the evaluated field of research in an international perspective.

Research with outstanding relevance for biodiversity and for society; widespread impact on society; cooperation with stakeholders is integrated in the project, well designed and executable.

Excellent

Research at a very high international level; of international interest with impact within its field and with publications in internationally leading journals; the entity/grant holder is competitive in the evaluated field of research in an international perspective.

Research with excellent relevance for biodiversity and for society; with positive impact on society; cooperation with stakeholders is well designed.

Very good

Research at a very good international level with publications in internationally well-known journals; the entity/grant holder has a good international reputation within the field.

Research with high relevance for biodiversity and for society; with some impact on society; cooperation with stakeholders is thought through.

Good

Research that is of good international standard and partially published in well-known international journals.

Research with moderate relevance for biodiversity and for society; with fair impact on society; cooperation with stakeholders is minimal.

Insufficient

Research of low international standard. Research with no or limited relevance for biodiversity or society; with no or limited impact on society; cooperation with stakeholders is insufficient.

The Science Committee also considered bibliometric data on citation and impact factors. However, the Committee treated the analysis with due caution as the data did not directly align with the targeted research areas and entities.

Once the entity reviews were complete and the conclusions agreed by the Science Committee, Research Areas were analysed to give an overview of the quality of broad areas of science. Each area was reviewed against:

- *Science quality:* Overall ranking of the area;
- *Strengths:* The best contribution to biodiversity science;
- *Weaknesses:* A more limited contribution to advancing biodiversity knowledge;
- *Opportunities:* Emerging opportunities that the area should build on or establish.

The Science Committee then reached conclusions on the respective contributions of the research areas to advancing biodiversity science in contrast to more disciplinary advances. We expected some areas to have extremely high quality of science but with a lesser relevance to biodiversity. To assist our deliberations we discussed and agreed on a working definition of 'biodiversity science' as:

> "The research subject of 'biodiversity' describes an interdisciplinary field that embraces aspects of both the natural and social sciences that are relevant to describing, managing and conserving biological diversity. Using this description of the research subject, social science topics including economics and law should be included. In addition, there should be far greater focus on interdisciplinary research and on the aspects of natural sciences that can display a tangible contribution to biodiversity management. Results should have societal relevance."

The Science Committee then assessed the relationship and relevance of each research area to the above definition of biodiversity sceince and ranked them as:

- Very high
- High
- Medium
- Low

The Relevance Committee also undertook interview sessions with two stakeholder organisations, Federation of Swedish Farmers (LRF) and the Swedish Board of Agriculture.

Both Committees then established some more general findings and conclusions with recommendations for the consideration by the Swedish Research Council and Formas.

3 RESEARCH AREAS

Research areas reviews by the Science Committee.

Following a review of designated research entities whereby some similar projects and institutions were linked (see Appendix 2 for commentary and assessment of each entity), the Science Committee reached some overall conclusions of the Research Areas on the quality of their contribution to science within an international context. The rankings were as per the Evaluation process (Chapter 2). The Committee also reached some conclusions on the relevance of the research to biodiversity science (see Chapter 2) as there were some examples of outstanding science but with more limited contribution towards deepening or broadening our understanding of biodiversity and its management.

The reporting entities, as they were grouped by the Secreteriat, mainly corresponded to general Research Areas. However, some entities were very broad and were making significant contributions to several areas. Accordingly, our following analyses reach some broader conclusions of quality and scientific relevance than from a compilation of entity reports (see Appendix 2).

3.1 Zoology

The overall quality of Zoology science in Sweden is **Excellent** to **Outstanding**, with overall contributions to biodiversity science as a result of this funding being **High** to **Very High**. General subject areas with clear research strengths include evolutionary ecology, population ecology (from population dynamics to migration and dispersal ecology), conservation biology (especially related to managed landscapes in forests and agricultural lands), systematics, and conservation genetics and genomics. Primary taxa being addressed in these studies include butterflies and other insects, birds, fish, and some mammals (especially endangered Arctic foxes and recolonizing wolves).

Of the dozens of projects conducted on numerous species, some have made particularly strong contributions to biodiversity science. First, systematics and phylogenetics – traditional strengths in Sweden – continue to be strong; biodiversity funding has helped leverage cutting-edge molecular genetics into these fields. Second, conservation genetics has strong application

to biodiversity science in Sweden, from objectively defining appropriate units for conservation (for example subspecies, evolutionarily significant units, management units) to assessing effects of small populations (inbreeding) on genetic diversity, fitness, and population dynamics. Third, some of the research in ecology evolutionary biology is contributing to biodiversity science by evaluating phenotypic and adaptive changes to stressors ranging from climate change to land-use practices. Fourth, a growing expertise in quantifying ecosystem services of biodiversity is emerging. Fifth, a small number of high-impact projects are tackling complex issues in community ecology, quantifying trophic cascades, interactions among species, and dynamics within species across large spatial and temporal scales.

Sixth, and cutting across many of the previous, Zoology research in Sweden is establishing particular strengths at the interface of ecological, evolutionary, and human dimensions aspects of agriculture and forestry practices. Forest ecology is particularly well developed across disciplinary lines, with responses of animals linked to plant responses, silvicultural practices, and constraints of timber managers and landowners. As a result, Sweden is indeed a world leader in incorporating science – and measured potential impact on animals – directly into forest management before the gridlock of conflict arises.

Publications in journals of high international impact are both numerous and strong. Given the multiple contributions of Swedish Zoology research to issues of global importance for biodiversity science, however, we find a surprising deficit, overall, in Review and Synthesis papers. We would like to see more of such reflective, synthetic review papers, so that the global community can benefit from the pioneering work being done by Swedish scientists, learning both the lessons and the mistakes. Along similar lines, such perspective papers could help initiate the development of much needed, higher-level theories of biodiversity.

One primary barrier to continued future proliferation of Swedish biodiversity research is clearly the absence of long-term, stable funding. The incentive for young researchers to stake their careers on biodiversity science, or for senior researchers to make substantial transformative detours into this area, are undercut by the lack of a stable, predictable, long-term assurance of research funds. Likewise, the cross-disciplinary nature of biodiversity research means that funds are needed to not only nurture collaborations, but also to maintain sophisticated research equipment. One possibility for necessary infrastructure such as high-throughput DNA sequencing facilities – used by many researchers in multiple fields across Sweden – would be to focus on centres of excellence in these areas.

3.2 Botany

Research relating to taxonomy and systematics is treated in the section **Research area – 3.9 Taxonomy**. This also applies to part of the research dealing with speciation and alloploidy, which clearly has it outset in systematic research. However, even following removal of taxonomic and systematic research, botanical research in Sweden covers a large and very heterogeneous set of research areas.

The overall scientific quality of Swedish research in botany covers the whole spectrum from **outstanding** to **insufficient**, though most of the research must be characterised as **excellent** to **very good**. The relevance of the research in a biodiversity perspective is equally varied and ranges from **very high** to **low**, most being **very high** to **high**.

In most research groups, the biodiversity programme has primarily added funding to existing research, though it has in some instances facilitated changes to new research topics for instance, habitat fragmentation, soil acidification, and conservation biology.

The research that combines genetic diversity, population genetics, and ecology stands out as fairly unique. Within this field a number of projects are studying the effects of habitat fragmentation on genetic variation and differentiation, and attempting to link genetic variation, adaptive or functional traits to landscape ecology. Another related, significant research area is the study of alloploidy, speciation, hybridization, and gene flow between populations on a local to regional scale.

Genetic variation in cultivated and ornamental plants is being studied using the same techniques. The issues of genetic variation and chemical defenses are critically important to gaining a better understanding of how ecosystems function and their resilience in the face of climate change, but there are profound risks that a strong focus on cultivated plants alone may limit the ability of the research group to contribute to wider biodiversity research.

At the landscape scale research is performed on plant population and community dynamics in a spatially heterogeneous landscape context, and on the relationship between land use, landscape history and diversity. The landscape ecological research yielded relevant information for grassland conservation and for population viability analyses.

Another noteworthy part of the research has obvious ties to the very strong research on boreal forests described in the **Research area – 3.5 Ecology section**, for example, descriptions of complex effects of nitrogen fertilization on host-pathogen dynamics in forests, description of a new type of N_2-fixing symbiosis between a moss and cyanobacteria in forests, and progress in identifying the molecular genetic basis of cold hardiness in trees.

Future research will to some extent maintain clear biodiversity aspects, as biodiversity related research plays a role for some but not all involved researchers.

Botanical research in Sweden seems with a few notable exceptions to be rather fragmented, which is a threat to its continued development. Critical mass can be reached and considerable synergy maybe be harvested in collaborations between traditional ecological and botanical entities, which will also open up new avenues towards truly multi-disciplinary research.

3.3 Cellular, Molecular and Microbial Biology

The research carried out within this area is covering a very broad spectrum of activities in cellular, molecular and microbial biology. The majority of the projects in this area, however, relate to evolutionary mechanisms behind biodiversity.

Genome sequencing technology makes it possible that scientists with a molecular training can move away from detailed study of a single system and are beginning to embrace comparative approaches to biology. The research climate in Sweden is favorable for this type of research, since there is an established track record in areas such as bioinformatics and systematics, and genomics infrastructure is developing and increasingly accessible. This strong capacity in molecular and cellular biology may give the opportunity for cross-disciplinary research and training. The university departments, however, are relatively small and focused on very specific areas of study. This fact may form a problem for any cross-disciplinary areas of research.

The research at the Stockholm University straddles across biodiversity and medicine. Excellent are the studies on malaria, phages and the origin of the domestic dog. Phages are the most abundant and diverse biological entities on earth, and they play an important role by controlling the distribution and abundance of bacteria as well as their evolution.

The biodiversity research at the Uppsala University has an excellent reputation concerning the understanding of the relation between antibiotic resistance and fitness, and of the impact of the environment on mutation rates. This has importance for how antibiotics will be used in the future and will help reduce the increasing problem of antibiotic resistance. Further knowledge about the genetic and non-genetic nature of human variation is important to understand our own biological origin, as well as the causes of behavior and development of diseases.

The work at the Swedish University of Agricultural Sciences is in the field of forest mycology and pathology. Forest ecology is a strength of Swedish

biodiversity research and this group is playing a leading role in elevating the significance of microbial processes to the functioning of ecosystems.

The overall scientific quality of the area by the international standard is **excellent**. Relevance of the research to biodiversity science is generally **medium**, and in several areas **high**.

3.4 Aquatic and Marine Research

Freshwater and marine environments have been important elements of Swedish culture and commerce for centuries. Biodiversity of these environments notably provides the foundation of historically and currently important fisheries industries, as well as sentinels for monitoring the health of ecosystems and resources. Thus, scientific understanding of aquatic ecosystems is central to Sweden's future.

The overall scientific quality of Swedish research on marine and aquatic biodiversity-related themes is **excellent** to **outstanding**. Relevance of the research to biodiversity science is generally **high**, and in several areas **very high**. Research in this area spans a broad spectrum of questions, issues, approaches, and types of organisms. Much effort is focused on basic research in ecology and evolutionary biology, while a smaller but still substantial part is more explicitly related to practical conservation, management, and environmental impacts. Research output has been very strong, on average, with numerous publications in top international journals, and international leadership in several areas.

Aquatic ecology – mostly focusing on lakes – is an area of outstanding strength in Sweden, with a large group of investigators dispersed throughout the country, and many active collaborations both within Sweden and internationally. Swedish researchers are international leaders in the areas of aquatic community and ecosystem ecology, as also developed in the **Research area – 3.1 Zoology and 3.5 Ecology** sections. Research focuses on trophic interactions, ecosystem processes, biodiversity effects on ecosystem functioning, general systematics and ecology of plankton, impacts of invasive species, and global change effects. Taxa studied range from bacteria through all levels of the plankton and benthos to fishes.

The marine research community in Sweden is not as large as that of freshwater researchers, but the marine scientists also have been, on average, highly productive of quality research products and several are internationally recognized leaders. Particular strengths of Swedish marine biodiversity-related research include work on evolutionary origins of biodiversity through studies of speciation in invertebrates and seaweeds, chemical ecology

of interactions between algae and herbivores, and studies of links between marine biodiversity, food web structure, and ecosystem functioning. Several of these research programmes are internationally recognized for innovation.

Marine and freshwater researchers have made important contributions to Sweden's marked academic strength in evolutionary ecology, which spans theoretical ecology, behavioral ecology, speciation research, phenotypic plasticity, and predator-prey interactions. Finally, there is substantial strength among both freshwater and marine (Baltic) researchers in aquatic pollutant effects, which includes work on risk assessment, endocrine disruption and other pollutant impacts, and development of indicators.

Much of the research has clear and important relevance to conservation and management, including management of Baltic Sea and lake eutrophication and pollutant effects, responses to climate change, and impacts of invasive species.

A key impediment to sustained scientific progress, identified repeatedly by researchers in this and other groups, was the generally low level and instability of funding for ecology and biodiversity research in Sweden. Thus, the targeted biodiversity funding was seen by researchers as having been key to maintaining the country's scientific capacity against this backdrop, and in particular was instrumental in training and establishing a new generation of researchers with expertise in biodiversity-related expertise ("It saved a generation of ecologists", according to one project leader). More specifically, the support was also important in developing projects and collaborations that established a new Centre for Marine Evolutionary Biology.

Several opportunities exist to advance aquatic and marine biodiversity research in Sweden. These include more explicit integration of Sweden's very strong research tradition in behavioral and evolutionary ecology, particularly involving fishes and other aquatic animals, into applied conservation and management of biodiversity. Another promising direction would be expanded integration of the strong research in community ecology with research aimed at ecosystem processes, and interaction with social scientists toward a goal of understanding mechanistic control of ecosystem services.

3.5 Ecology

Ecology encompasses a wide range of research groups, not just the research performed by the ecology research entities. The particular strengths in this area lie in population biology, as well as in applied topics in forestry and lake management. The applied topics are very relevant to management problems

within Sweden, and there have been clear outcomes in terms of benefits for the country.

An area of particular strength is plant ecology, especially moving from population dynamics and distributions to population genetics. This is internationally significant research. Similarly long-term research is another area of great strength, with the availability of resources unique in both their spatial and temporal scales. There is a desire in many of the research groups to develop and continue long-term projects. The biodiversity funding has permitted mid- to -long-term continuity for a number of projects.

Overall the relevance to biodiversity science was assessed to range from **high** to **very high**. This generally reflected that individual projects concerned subjects that are relevant to biodiversity and could feed into further research on this subject. However few projects were focused primarily on biodiversity or approached biodiversity from a multi-disciplinary perspective.

There are several areas relevant to biodiversity science that are not well represented. First community ecology is not a prime focus of many groups. The bulk of research tends to be on focal species, variation within species and evolutionary adaptation.

Second, apart from the research in Lund Zoology, there has been relatively little work on ecosystem processes and ecosystem services. Internationally this is a growth area in applied ecology.

Third, there is little pure theory developed within the ecology groups in Sweden. No project leaders specialize in either theory or in ecological statistics, although many project utilize models. The key developments in this literature are being made in other countries, notably within groups in other parts of Scandinavia. This would help enormously with the interpretation of long-term data resources which, although a great strength, are currently perhaps under-exploited. Related to this are concerns about bioinformatics and biodiversity informatics. This is especially an issue as several groups are planning to use next-generation high throughput sequencing that will generate enormous amounts of data.

Finally, the majority of study systems and problems are within Sweden. There is relatively little work done overseas funded by the biodiversity funding. Arguably, many of the key issues in biodiversity, biodiversity loss and conflict are elsewhere and to contribute internationally to biodiversity research the lessons learned in Sweden could be generalized more widely.

Although interdisciplinarity is an important feature of biodiversity research, this was generally thought by the Science Committee to be a weakness. For example there were a number of projects in social sciences funded by the biodiversity funding, but there was essentially no linkage with the ecological projects (see also **Research area – 3.8 Human Dimensions**).

The consensus from the hearings was that the funding had resulted in a deepening of the research in ecology within Sweden. In most cases this has allowed researchers to consolidate existing research. The funding has resulted in a large number of PhD students being trained and finding jobs in local agencies. The funding has however, not fundamentally altered the direction of research in ecology in Sweden.

Overall the research in this area is **Excellent**. In terms of relevance to biodiversity science the research in this area is assessed to be **high** to **very high**.

3.6 Landscape

The research area has two central reporting entities Landscape and ecosystems at Stockholm University and Linköping University and Landscape Architecture, Planning and Management at and Swedish University of Agricultural Sciences but many other entities contain relevant landscape research. The higher quality landscape scale research is usually done by the more ecological groups who have been working on long term development of managed forest and agricultural landscapes. Unfortunately the applicability of their research for conservation is limited. A more interdisciplinary and integrated modelling approach could enhance this research to outstanding levels. Overall the research in this research area is considered **Very Good**. Within the more ecological entities the research quality is considered **Excellent** (genetic diversity in landscapes) while more applied entities are rated as **Insufficient**. The funding has provided opportunities for groups to establish themselves in the realm of biodiversity science and some projects can be described as transformational. In terms of relevance to biodiversity science the research in this area overall is **Very High** to **High**.

The natural science disciplines and human sciences in Sweden had only limited collaboration within the reviewed projects. It sometimes appears that Swedish ecologists collaborate more with human scientists from outside Sweden on non-Swedish landscapes. Several groups use the concepts and approaches of Resilience Alliance as advocated by the Stockholm Resilience Centre. This raises the question if the Social Ecological System approach is indeed a suitable scientific framework for developing interdisciplinary biodiversity research. It is recommended to invest efforts in further developing the theoretical frameworks to advance the development of biodiversity science.

The long term landscape data and sites provide an unique opportunity with modelling approaches to further develop the human ecosystem interactions and co-evolution in managed landscapes (multifunctional ecosystems). This would lead to concrete insights in how long term management

and land use affects biodiversity in cultural landscapes. Sweden is very well positioned to lead research on biodiversity dynamics in cultural landscapes (both forest and agricultural landscapes). Apart from continuing research in these landscapes more explorative interdisciplinary research should continue to develop new frameworks and models to support biodiversity management of landscapes.

3.7 Biodiversity Dynamics

The dynamic processes of species and their interactions with biotic/abiotic changes over time forms an important area of biodiversity research in Sweden. A vastly rich data resource of palaeo-ecological records including fossil pollen, plant macrofossil, micro and macrofossil charcoal and fossil insect remains has been collated by researchers, in many cases with continuous records spanning back to >10,000 years. These have been used with great effect to examine the impact of climate change, fires, herbivore grazing and prehistorical and historical human activities on the present day structure and biodiversity of Swedish landscapes. To compliment this work, some excellent quantitative models have been developed to reconstruct the mosaic structure of the landscape over thousands of years. Results from this work have direct relevance to conservation of the current cultural Swedish landscapes.

Another important area of research is in the development of dynamic models to determine the interactions between biodiversity and ecosystem function under climate change. The work on these models is outstanding and highly relevant to understanding ecosystem responses and species diversity to current and future climate change. This work has attracted a high level of international collaboration and additional research income, in particular from the EU.

Reconstructing biodiversity dynamics at a genetic level using molecular phylogenies also represents a strong research area in Sweden. Important datasets have been developed to explain the current patterns of genetic diversity of a number of groups of European plants and animals. These results are important for both understanding the processes responsible for current patterns of genetic diversity in Europe, and also to identify important regions/species for the conservation of genetic diversity.

The overall quality of research into biodiversity dynamics through time is **excellent** to **outstanding** and the relevance to biodiversity science being **high** to **very high**. Future research strategies also look extremely promising and it is encouraging to see that many of the researchers in this field are early career academics who are already taking an international lead. A common

recurrent theme to emerge from the researchers involved in this work, however, is that although they clearly appreciated the relevance to their results to management of current and future biodiversity, they were less clear about the mechanisms available to disseminate their results into relevant policy. Several times it was mentioned that greater effort was needed to develop this aspect of the work and in particular more interdisciplinary collaboration with social scientists and training was required.

3.8 Human Dimensions

Research in this Research area involves a broad spectrum of disciplines drawn from the social sciences including law, economics, political science, history and sociology. As a consequence the questions, issues, and methodologies were diverse and covered topics ranging from attitudes and perceptions to large carnivores, to economic valuation of ecosystem services, to an analysis of institutional capacity to support biodiversity policies. The projects were largely focused on Sweden and typically involved some case studies where data could be collected. A few were broader and/or more philosophical in nature.

Several of the projects were of international quality, producing some publications in highly respected international journals (for example Ecological Economics, Global Environmental Change) but the majority of published outputs were in journals or books with more limited impact internationally. Some research was presented at major international conferences, and some, for example the research on wolves, had achieved significant media interest. Highlights include the development of novel approaches to researching fear of large carnivores among humans and new understandings and appreciation of the role of stakeholder networks in the governance of ecosystems.

Much of the research is of considerable policy interest and relevance to managing biodiversity but the extent and significance of the research in this context is difficult to measure from the available information. New directions of future research were identified and many of these would appear to be potentially fruitful avenues and worthy of funding. Several PhD students benefited from training and it is hoped that opportunities will be available for them to develop their careers as biodiversity researchers.

Given the diversity of disciplines and research topics covered it is difficult to assess the subject area as a whole but some broad points are worth making. 1) There was little evidence of interdisciplinary activity across the disciplines covered or with scientists; 2) Most projects were quite small and involved only single individuals or small teams. As a consequence of 1) and 2), the

overall research programme has limited impact and lacked ambition; 3) There was insufficient emphasis placed on quantitative research and this may be problematic with respect to future collaboration with natural scientists; 4) Social scientists on the whole normally produce fewer outputs than natural scientists per year as they work in much smaller teams, but having said this the overall productivity of this programme was disappointing with relatively few outputs with only a small proportion in good international journals.

On the positive side, the funding has provided an important opportunity for new individuals and groups to establish themselves in the realm of biodiversity science and some projects can be described as transformational, at least in some respects. Indeed, it can be anticipated that several researchers may go on to establish strong international reputations in the field, especially in relation to institutional economics and the sociology of human-wildlife conflict. Overall the research in this research area is considered **Very Good**. One entity was considered **Excellent** although several were **Insufficient**. In terms of relevance to biodiversity science the research in this area overall is **high**.

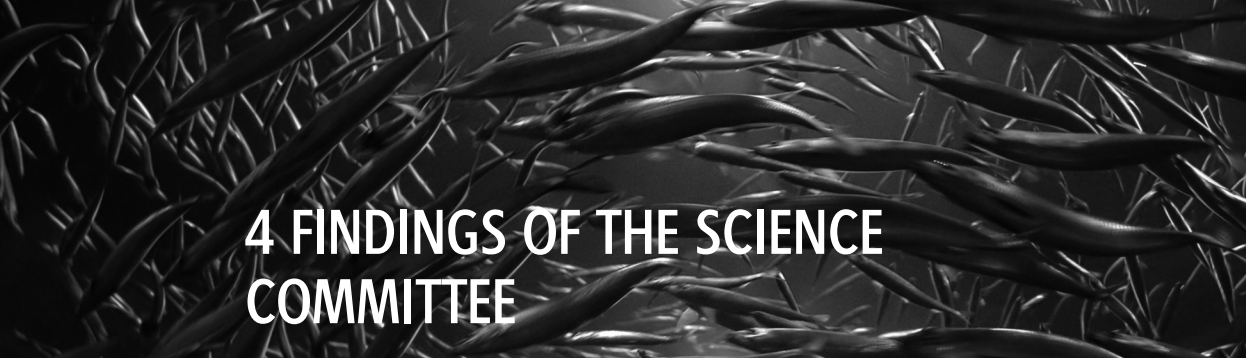
3.9 Taxonomy

The biodiversity crisis threatens to eradicate much of the earth's evolutionary history even before it is known, and our generation is the first fully to understand the threats facing countless species and many ecosystems. Systematics and taxonomy underpins nearly all areas of biology and deals with documenting life and its relationships at all scales; 1) hierarchically, from genes to phyla; 2) in time, from the earliest life to the present, and 3) spatially, from the tinniest inhabited spot to the whole globe. Acknowledging its Linnaean legacy Sweden has a 250 years old tradition for strength in systematic and taxonomic research.

Overall the current quality of taxonomic research in Sweden is **outstanding** to **excellent**, with a **very high** relevance for biodiversity science. By nature taxonomic research have a very large diversity in the types of organisms studied. This is also reflected in Swedish research, which, relative to many other countries is rather unique in having strength both in research on extant and extinct biodiversity. Research covers all aspects of the area, from classical taxonomy and flora-writing to studies of, for example, character evolution, speciation, hybridization, phylogeny, and biogeography. Research is being done using state-of-the-art methodologies and equipment, and some groups have been instrumental in adding new dimensions to the subject in both areas.

The taxonomic expertise is based at the Swedish Museum of Natural History and scattered at various universities, which none the less all have a primary role in developing future taxonomists. This may potentially be a weakness as the critical mass of researchers at some universities may be too small to attract students and funding and potentially may make it difficult to stay at the forefront of research in a given area. However, a few universities by tradition do have larger groups of taxonomists attached. It is, however, unfortunate that research groups at the same institution in some instances are administratively separated, thereby impeding interactions and developments of the field.

The major challenges to taxonomic research are rejuvenate the field by moving many of its activities onto the web, to secure access to state-of-the-art equipment, and to change the science from a one man enterprises to 'big science'. Fortunately, Swedish taxonomy seems eminently suited to cope with the first and last challenge, as researchers are already involved in international activities like Global Biodiversity Information Facility (GBIF) and FishBase or in several "Assembling the Tree of Life"-projects or other larger projects. Access to the relevant infrastructure is a political and strategic decision that needs to be met if Sweden is to maintain its international reputation.



4 FINDINGS OF THE SCIENCE COMMITTEE

Strategic direction: Swedish biodiversity research had what could be regarded as a 'windfall' in additional funding from 2001 as a result of a political process. An effective doubling of funding for biodiversity-related research is unprecedented in an international context. While some funding was allocated to support some long-term initiatives, most was advanced to the Swedish Research Council and Formas to allocate to researchers, mainly in universities, through an open and competitive process. There appeared to be little strategic guidance at either political or research council levels for where or how the funds should be invested. Consequently the approach of the Swedish Research Council and Formas was pragmatic in seeking projects across a broad spectrum of disciplines that might contribute to biodiversity research and outcomes and to get funding out quickly to research groups. A large number (140) of projects were subsequently funded for periods of 2–3 years. In the following period both the Swedish Research Council and Formas attempted to be more specific in expectations with funding panels given some more specific guidance.

Finding: The sudden provision of significant but targeted extra funding meant that calls for proposals lacked a clear strategy and intent for biodiversity research. The pragmatic approach may have led to some suboptimal investment decisions.

Biodiversity Science: We have agreed that the research subject of 'biodiversity' describes an interdisciplinary field that embraces aspects of both the natural and social sciences that are relevant to describing, managing and conserving biological diversity. Using this description of the research subject, social science topics including economics and law should be included. In addition, there should be far greater focus on interdisciplinary research and on the aspects of natural sciences that can display a tangible contribution to biodiversity management. Results should have societal relevance. The bibliometric analysis gave the Science Committee an overall awareness of the quality and impact of research relating to biodiversity and it is clear that in many areas Swedish research has citation rates and impact above the international norm (Appendix 4). However the analysis was insufficiently fine-grained to assess the impact of the additional funding for biodiversity science through the Swedish Research Council and Formas.

Findings: We have developed a working definition of the research subject of 'biodiversity' that we used for this evaluation.

Transformational science: The lack of a strategic framework and a clear definition of the scope and intent of the investment in biodiversity science did result in many researchers realigning proposals in other, but related areas, of science to the intent of the targeted biodiversity research funding. With the effective doubling of funding in, for example, the Ecology and Systematics portfolio of the Swedish Research Council, the Science Committee concluded that many funded projects merely deepened an existing area of research rather than moving research teams into new endeavours, especially to embrace other disciplines and approaches and connect to biodiversity policy and management. The Committee concluded that about 70–80 percent of project funds served to enhance existing research areas with only about 20–30 percent being more transformational. The Committee concedes that to expedite change, and broaden intellectual capacity, funding for multidisciplinary projects drawing on all the sciences should be part of the strategic funding package. This should enable the brightest to be fast tracked into true interdisciplinary science with competencies in both the natural and social sciences.

Finding: The majority of project funds deepened existing research themes in areas of ecology and systematics in particular with limited effectiveness in addressing more interdisciplinary biodiversity science.

Revitalizing science: Without a doubt, this increase in funding had a dramatic effect on morale and excitement in many research groups. We heard comments such as "it saved a whole generation of ecologists" and that it enabled more pathways for PhD and Post-doctoral researchers to be developed and retained within the Swedish science system. Sweden also has had an enviable record in taxonomic and biosystematics research but a slow decline in funding and non-replacement of retiring staff was threatening this position. The targeted funding had a dramatic effect and enabled many areas of taxonomy to retain existing staff and train the next generation especially in the use of new technologies.

Finding: The targeted funds revitalized many areas of biological sciences relating to biodiversity issues and brought the potential use of emerging technologies such as molecular biology, phylogenetic analysis, and bioinformatics to the forefront of new biodiversity-related research.

Staffing profile: The Science Committee was struck by the lack of provision of career prospects for new PhD graduates and the near absence of tenure-track or long-term recurrent research-supported positions. It is strongly suggested by the Committee, and supported by the interviewees and project leaders, that some of the biodiversity research funds should be used for this purpose. This would not only secure a future for the most able young Swedes

in biodiversity but enable the available intellectual capacity to become more multidisciplinary over time and ultimately ensure that a new breed of interdisciplinary biodiversity scientists will evolve with the capacity to address questions in conservation and other complex strategic problems. It would also address the rapidly ageing population of increasingly senior ecologists with few younger permanent academics to follow on and take the best of what has been achieved in Sweden in the last 200 years on to new heights and pertinence to global challenges.

Finding: This phase of the biodiversity-related funding focused on building PhD student support for established researchers but there are limited posts for more permanent science careers in biodiversity science.

Balance of funding: The Science Committee considered that part of any new funding strategy should be to retain part of the funding for 'blue sky', basic, or investigator-led research (within the Swedish Research Council) but the funding profile retains a significant proportion of the funding available for strategic work (within Formas). Such strategic research would focus on multidisciplinary problems and novel areas such as ecosystem services as collaborative projects between individuals or groups within institutions, or between institutions nationally or internationally, bringing together the best natural and social sciences. Such an approach would further reinforce the evolution of ecological research into biodiversity science and conservation and would align with the recruitment needs stressed above. The Committee noted the tensions especially within the the Swedish Research Council funding when faced with making decisions with some reference to their relevance to biodiversity issues. The the Swedish Research Council evaluation system is heavily attuned to science excellence. In contrast, the Formas evaluation approach does require some consideration of uptake pathways and contribution to biodiversity outcomes. There needs to be greater clarity of the respective roles of the two funding agencies.

Finding: Investment in biodiversity research from the current bill should cover the spectrum of basic to more applied and strategic research with the Swedish Research Council predominating in the more basic science are and Formas having primary responsibility for applied and strategic research.

Coordination: The Science Committee noted that several projects funded by either the Swedish Research Council or Formas appeared to have similar aims and some submitters noted that it was possible to submit proposals to both organisations that were almost identical apart from meeting the greater relevance requirements for Formas. Within the Swedish Research Council the formation of a Biodiversity Committee was a laudable attempt

to develop some strategies and coordination mechanisms across funding panels. This approach did, however, conflict with the more traditional disciplinary-based evaluation process and led to the disestablishment of the committee. The panel considers this to have been an important initiative and regrets the loss of the means to focus research on biodiversity issues. Formas appears to have had a more settled approach but there has been little evidence of coordination with the Swedish Research Council.

Finding: Coordination of funding decisions in the Swedish Research Council has been weakened by the loss of the Biodiversity Committee and coordination between the Swedish Research Council and Formas is weak

Collaboration: More than fifty percent of all work recorded in this Science Committee's work was done exclusively in or between Swedish institutions. Biodiversity, and the problems associated with its conservation, are transboundary. The Committee believes many of its recommendations should stimulate much greater collaboration internationally not least because Sweden does not yet have the breadth of expertise in the full range of biodiversity skills in both natural and social sciences. Through such interaction researchers will gain enormously and help rapidly evolve their own interdisciplinary skill set. The Committee also notes there are some real areas of strength in Swedish biodiversity research where a significant contribution can be made to international understanding of the drivers of biodiversity loss and its sustainable management. The Committee also noted that collaboration between Swedish universities was also weak in some areas. Bibliometric analyses showed a high level of international collaboration on publications, which is commendable; but there was less evidence of such partners being fully engaged in the research programmes from their inception.

Finding: Collaborative research with international partners is not as strong as it should be given the depth and quality of Swedish biodiversity research and collaboration and communication within the Swedish research community could be improved.

Profile of biodiversity: The Science Committee concluded that biodiversity research did not have a significant profile beyond the immediate group of researchers who received funding through the Swedish Research Council and Formas. However, there is some very exciting and high quality science that deserves a higher profile. It was very clear from a considerable number of interviewees that they themselves had little awareness of the possibly relevant research by others. As a follow-up to this review, the Committee considers it very timely for the Swedish Research Council and Formas to host a conference with targeted workshop sessions and with stakeholder

involvement to stocktake the current state of biodiversity research, encourage disciplinary and interdisciplinary communication and establish a forward-looking strategy for biodiversity science. Once this is done, a strategy should be developed for greater international connectedness for science and biodiversity policy. A Nobel Prize, or equivalent, for international contributions to biodiversity could be hosted by Sweden.

Finding: The profile of biodiversity research is low in Sweden and needs to be enhanced through greater awareness across the research community, stakeholders and internationally.

Review and Synthesis: Despite strong individual achievements in fields relevant to biodiversity research, few of these efforts have been synthesized into reflective, integrative outputs such as review papers and workshops centred on meta-analyses and syntheses. These review workshops and publications would allow the global community to benefit from the pioneering work being done by Swedish scientists, learning both the lessons and the mistakes. Such synthetic outputs would also help initiate the development of much needed, higher-level theories of biodiversity. Researchers should be encouraged to compile their insights as review papers. In addition, some funding should be dedicated to supporting workshops whose goal is integration, review, and synthesis of aspects of biodiversity research.

Finding: The strong individual achievements in biodiversity research are not being synthesized into integrative review papers and workshops. Reviews of relevant biodiversity research would both increase the profile of Swedish biodiversity research to an international audience, and would help initiate higher-level theories of biodiversity science.

Interdisciplinarity and integration: It is widely recognised within research and policy communities across the world that biodiversity research is an interdisciplinary and integrative endeavour. Although there was considerable diversity of disciplines and topics funded under the Bill, there was little evidence of interdisciplinary activity across and within the natural and social sciences, nor were research objectives sufficiently integrative to address the more challenging areas of biodiversity research. Research outputs were also largely confined to traditional disciplinary journals. It was also noted that the Biodiversity Committee at the Swedish Research Council comprised a large number of ecologists, with only one out of ten members with knowledge and awareness of the social sciences.

Finding: There is a lack of interdisciplinarity and integration in the research programme and it would appear that Sweden significantly lags behind other countries in terms of research capacity to tackle complex biodiversity issues.

Long-term research: The panel heard two important messages from researchers regarding long-term research and monitoring. First, there is a perceived need for better recognition of, and support for, long-term experimental and monitoring research. This is because climate change and many other extrinsic processes affect biodiversity gradually over long time periods, and also because long generation times of key organisms such as trees can result in slow responses to change. The second message was an emphasis that dedicated support for long-term research must not compromise funding opportunities for researchers to conduct the more typical short-term research projects that are also critical to innovations in biodiversity science.

Finding: A formal framework should be established for support of long-term research necessary for understanding biodiversity trends and processes. Support for long-term research must be balanced with that for shorter-range projects and must be evaluated with the same rigor and attention to relevance for biodiversity research.

Data management, analysis and stewardship: There are several internationally important long-term projects in which long time-series of data have been generated. There is also a desire to collect more long-term data. There was a feeling in both the Science Committee and from individual investigators that lack of expertise in fundamental modelling, statistical analysis and biodiversity informatics could hinder the development of the field. In the areas of population and conservation genetics it is very likely that increasing amounts of data will arise from new technologies such as high throughput sequencing. In this area increased expertise in bioinformatics will be needed to make best use of new technology.

Finding: There is a greater need, identified by both the Committee and individual scientists, for more capability and research leadership in modelling and data analysis, including bioinformatics, statistics and theoretical modelling.

5 COMMENTS FROM THE RELEVANCE COMMITTEE

A key (but not universal) observation was that the additional funding *had* made a difference *and* had changed the behaviour in applying for grants, and in seeing how the results could be both made relevant to societal needs (decision makers) and communicated appropriately (better use of media). These effects on the performance of research groups were not uniformly obvious however, and there was still a very strong affirmation of the view that "basic science is the only science worth doing".

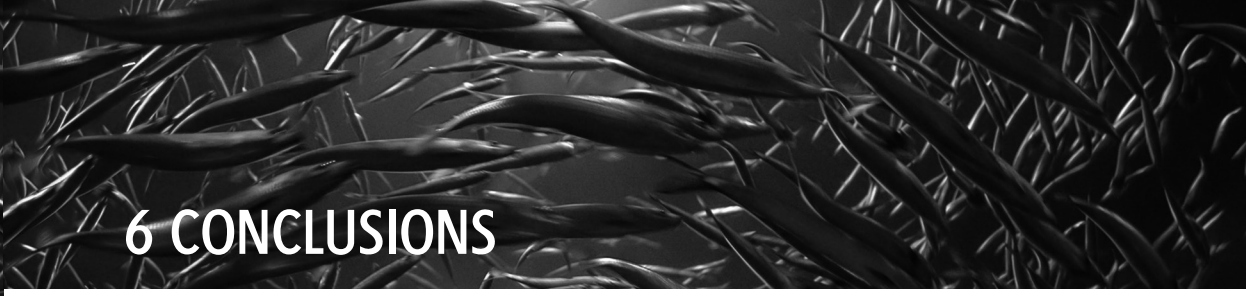
Trying to change behaviours from seeing science as the main consumer of science will be a key need for the future. One issue raised was that the need for reapplication within a year and a half (having already published) leading to people reverting to their old programme. Other negative views were that cooperation with the policy process does not apt off in science. These views somehow need to change, and perhaps short workshops or training courses could do this.

Trying to identify novel research areas for the future, as well as continuing to grow the existing corpus of knowledge is vital.

Long-term field experiments through permanent stations are a strength of Swedish biodiversity research, but universities are increasingly under funding pressure and these field resources are seen as a luxury. Commitments to help maintain existing stations and even develop new ones would be welcome.

For future calls, the following points are worth bearing in mind:

- Prioritize projects within thematic groups putting emphasis on novel approaches/novel research questions/interdisciplinary approaches, but always maintain the criterion of excellence;
- Favour projects that identify cooperation between basic and applied research;
- For a future evaluation if possible have thematic-based entities, rather than specific groups focused on research establishments with highly diverse research areas, taking acre always to maintain, interviews process.



6 CONCLUSIONS

The Science and Relevance Committees established by Formas and the Swedish Research Council reviewed the outcomes of the investment since 2002 of SEK 630 Million in biodiversity science through a process of analysis of documents from the funding agencies, reports by project holders, summaries of research entity performance, and interviews with representatives of the entities. The Committees met in Stockholm from 11–16 April, 2010.

The Committees reached the following conclusions on the specific objectives and criteria provided by the Swedish Research Council and Formas (see page 9):

1. *Scientific quality of the research area within an international perspective:* Our overall assessment was that Sweden has a wide range of quality in biodiversity science publications as measured by the placement of papers in key international journals with some areas assessed as being **Outstanding** with most areas meeting **Excellent** to **Very Good** criteria. A few areas had some entities/projects that were **Insufficient** in performance (see Appendix 2 for the specifications for each ranking).
2. *Relevance and user value for society of the research results:* Our overall assessment was that Sweden has a mixed record in achieving societal relevance for its biodiversity research. In general our rankings were from **Good** to **Very Good** criteria. One entity had projects that were **Insufficient** in performance, and a few were ranked as being **Excellent** with one **Outstanding** (see Appendix 2 for the specifications for each ranking). In general there seemed an increasing awareness of the value to researchers to engage with stakeholders, and we think this trend is encouraging, and should be further encouraged.
3. *Identify strong research areas and successful Swedish research groups and the councils' support to those areas:* The Science Committee identified boreal forests, lakes, and agricultural systems as ecosystems where Swedish research has particularly strong knowledge bases and where there has been substantial investment. We considered that particular areas and subdisciplines of strength supported by the councils included:

   Taxonomy
   Evolutionary ecology
   Population biology
   Conservation genetics
   Microbial ecology
   Climate/ecosystem modelling
   Landscape ecology

We also noted that Sweden has considerable strength in Ecological Economics but the area had received little support from the councils. (see Chapter 3 for an analysis of research areas and Appendix 2 for an analysis of the reporting entities).

4. *Identify unique research areas for Sweden:* It is difficult to identify uniqueness but there are interesting opportunities to capitalize on the new capability produced through the project funding. Particularly strong in Swedish biodiversity research was the connection to forest ecology, with scientific strength ranging from decomposition and silvicultural practice to insect and bird responses to applied management responses; a complete package from science to forest management. Also, and apart from the forest and lake ecosystems, the Relevance Committee noted that fisheries research especially with respect to Baltic ecosystems had the potential to contribute significantly to more research and management of brackish aquatic systems. Achieving a greater number of high-quality research proposals which encompass both social and natural science elements, and integrate stakeholders from planning to completion should be an aim of future biodiversity calls.
5. *Identify important but weak and neglected areas of research in Sweden:* The Science Committee was not privy to the full range of biodiversity science expertise in Sweden so was unable to reach clear conclusions of this topic. The Science Committee did note the need to invest more in both equipment and human capital in the areas of genomics, bioinformatics, and biodiversity informatics to take advantage of the strength in Swedish research in conservation genetics and systematics. There are also opportunities to increase investments in:

   Community ecology (especially in terrestrial systems)
   Theory development using biodiversity informatics and modelling
   Ecosystem processes
   Human dimensions especially within wider long-term projects
6. *Identify new interesting areas and future investments:* We have identified some promising areas above. We did note a particular opportunity for Sweden to capitalize on some emerging capabilities that integrate genomics, taxonomy and systematics within an ecosystem context. A further opportunity exists in the development of landscape research (across natural, forest and agricultural landscapes) which continues the developments of resilience thinking, has a strong link to social sciences, and underpins the research needs of the CBD's Ecosystem Approach.
7. *Elucidate the bills importance for the research teams overall operation, direction and results in the short and long-term:* The injection of funds clearly did revitalize and deepen several areas of science relating to biodiversity,

for example, ecology, conservation genetics, taxonomy, and produced a significant number of PhD students with a more limited number of permanent positions. The bills had more limited success in developing what the Committees viewed as more integrative and interdisciplinary research that provides benefits to biodiversity management. This will require more long-term projects with incentives to build interdisciplinary teams.

8. *Evaluate how the outcomes relate to the objectives as set out by the Government:* The Government's desire was to enhance the funding for biodiversity research with the intent to support ecologically sustainable development through a broadening and deepening of knowledge. The Committees considered that the investment did indeed deepen existing research areas of relevance to biodiversity science by producing significant new knowledge and capabilities. The Committees felt that the broadening of Swedish biodiversity science through more interdisciplinary research was less successful, although there are promising developments in some universities to include societal relevance as part of project development, and to involve stakeholders throughout the project. These developments should be fostered by the Swedish Research Council and especially Formas in the coming years.

From the findings and conclusions a number of recommendations have been developed (see Executive Summary and Recommendations).

Acknowledgements

The Science and Relevance Committees thank the support of the Swedish Research Council and Formas to enable this review to take place and for their work in providing initial analyses. In particular the Committees wish to thank Andreas Augustsson (the Swedish Research Council) and Marie Emanuelsson (Formas) for their efforts in coordinating and managing the process and to thank Andreas and Marie for their efforts in supporting committee members through the travel disruptions caused by the Icelandic volcanic eruption.

APPENDIX 1: EXCERPT FROM THE BUDGET BILL FOR 2002

Expenditure Area 16: Education and University Research (page 238)

"The increased funding announced in the Spring Fiscal Policy Bill of 2001 regarding research on biological diversity and research supporting ecologically sustainable development represents a permanent supplement to the Swedish Research Council, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), and the Swedish Species Information Centre at the Swedish University of Agricultural Sciences.

This supplement should be directed towards research aimed to expand knowledge about species distribution, natural characteristics, and living conditions. The investment can contribute substantially towards broadening and deepening our knowledge about the fundamental conditions for a long-term, ecologically sustainable society. Several different research fields are affected, and the supplement is distributed within different agencies' areas of responsibility, as described below.

Funds are allocated to the Swedish Research Council for basic research addressing biological diversity and ecology, focusing on the adaptation and interaction of species, their natural characteristics, and their living conditions. The funds apply to research in different specialty areas and studies in a broader perspective, including, e.g. research in evolutionary biology, population genetics, biodiversity, and related topics in botany-zoology.

Funds are allocated to the Swedish Research Council for Environment, Agricultural Sciences, and Spatial Planning for basic and applied research in ecology and related areas, e.g. research on the composition and change of biotopes and studies of biological and chemical processes in ecosystems. Concurrently, a programme is proposed for the recruitment of researchers in the environmental field at the Swedish Research Council for Environment, Agricultural Sciences, and Spatial Planning.

Funds are allocated to the Swedish Species Information Centre to continue the work on a total inventory and taxonomic identification of all living species of animals, plants, and fungi in Sweden.

To understand biological diversity it is essential to develop and preserve the national collections needed for research in biological diversity. For that purpose, the Swedish Research Council for Environment, Agricultural Sciences, and Spatial Planning receives funding that shall be allocated to museums and botanical gardens based on the Council's analysis of the scientific value of the collections.

These different research components are mutually dependent, and it is essential that the agencies responsible utilize opportunities to benefit from collaborating in this effort."

APPENDIX 2: ASSESSMENTS OF REPORTING ENTITIES

Reporting entities

Scientific and relevance reviews of the reporting entities by the Science and Relevance Committees; see section **2. Evaluation Process** for criteria and ranking.

The following notes have been used in this appendix:

[R] Rapporteur for a reporting entity, that is, writing a summary report of the entity

[H] Project leader that attended the hearing with the Science and Relevance Committee

[+] Project leader that did not submit an individual background report

No note: Project leader that submitted an individual background report

Botany and Mycology at University of Gothenburg

Ellen Larsson, Ulf Molau, Bengt Oxelman[R,H]*, Claes Persson, Plant and Environmental Sciences, University of Gothenburg*

Science Committee review:

This is a small entity within the Plant and Environmental Sciences department and initial appraisals show considerable diversity of research interests. Research in this reporting entity covers four different areas: Contributions to the fungal tree of life, mychorrhizal research, alpine landscape ecology and potential threats to it, Flora of Ecuador, and allopolyploid speciation – gene trees versus species trees, primarily in Sileneae.

In contrast to research based in natural history museums, universities generally have limited biosystematics capacity but nonetheless have a primary role in developing future taxonomists. To do this they must have some diversity in the types of organisms studied and have access to modern

technologies such as molecular and bioinformatics tools. Additional advantages also arise by developing links to functional biodiversity research within the university and to other groups in Sweden and internationally. This entity demonstrates these capabilities.

The target biodiversity funding has been instrumental for establishing and anchoring some of the research in this reporting entity. It has had special importance for reinvigorating mycological research at the department, as also seen in the Zoology department at the same institution.

Future challenges to this entity are to enlarge its research to include more truly interdisciplinary research in systematics and taxonomy by involving for example, population geneticists and mathematicians, and to take advantage of international initiatives aimed at moving taxonomic research onto the web.

The entity has had relatively modest funding and has the lowest percentage of time committed to research (additional time is presumably committed to collection management and curation). Despite this, the entity has performed well in publication rates and is developing the new cohort of researchers. Science quality is assessed as being **excellent** to **very good**, with a **high** relevance for biodiversity science.

Relevance Committee review:
Relevance assessment: **Very Good**

Impact of taxonomy on society is important for helping to make correct decisions. How will society understand biodiversity? Understanding the underlying mechanisms for diversity can help improve the conceptual framework.

This entity contributes to the Intergovernmental Panel on Climate Change (IPCC) and the Convention on Biological Diversity (CBD). Also climate change in Arctic communities.

Only 20% of time of key researcher is spent on research. Publications – show good scientific competence. How can plant taxonomy help understand climate change?

Flora of Ecuador started many years ago by former professor. Now there is cooperation worldwide on this major project. This has benefitted from the extra biodiversity money.

Botany at Stockholm University and Bergius Botanic Garden

Birgitta Bergman, Katariina Kiviniemi Birgersson[*], *Johan Ehrlén*[H], *Ove Eriksson*[R,H], *Peter Hambäck, Lenn Jerling, Jürg Schönenberger, Department of Botany, Stockholm University*

Birgitta Bremer[H], *Torsten Eriksson, Bergius Botanic Garden, Royal Swedish Academy of Sciences and Stockholm University*

[*]Uppsala university

Science Committee review:

This entity contains a diverse group of studies. Projects include systematics, phylogeny, ecophysiology, population-community ecology, and landscape ecology. The phylogeny and diversification in plants groups of the Asterids and the Ericales have been investigated. Furthermore, studies have been performed on the diversity and functioning of cyanobacteria in marine systems, relating to nitrogen cycling and algal blooms. At the landscape scale research has been performed on plant population and community dynamics in a spatially heterogeneous landscape context, and on the relationship between land use, landscape history and diversity.

Most of the research has been curiosity driven. The landscape scale research has direct applicable links with biodiversity conservation. Most research yielded important and significant results, for example, in understanding patterns of genetic diversity in space and time for a number of flowering plant groups, and an improved understanding of evolution of plant-animal interactions relevant for plant dispersal and recruitment and ecology. Whilst the study of cyanobacteria is fundamental, many potential applications relevant to biodiversity conservation are possible with respect to understanding mechanisms responsible for algal blooms in the Baltic Sea. The landscape ecological research yielded relevant information for grassland conservation and for population viability analyses.

The entity had a large number of high quality international publications which were on average cited well above the world average. Overall, biodiversity research in this report entity is **excellent** to **outstanding** with well-established strong international collaborative networks. Overall, the relevance for biodiversity science is **high**.

Relevance Committee review:

Relevance assessment: **Very Good**

Much research on basic science – ecological studies, plant dispersal and seed traits; applied research on landscape ecology, collaboration with geographers, economists, and historians. Grasslands that are the product of human culture and human history are included.

General systematics research on many different levels, currently focussed on one plant family, Rubiaceae, especially its occurrence in Madagascar. Key questions are: Why is biodiversity so large on Madagascar? Where do groups come from and how have they radiated? Is this a general pattern? Lots of collaboration exists with other Stockholm institutions, Uppsala, and globally. Sweden must take responsibility for areas outside Sweden, particularly in a place like Madagascar. Attempts to collaborate with Malagasy people and train them, giving them options, but allocating time is a problem.

Systematics situation is critical in Sweden and many other countries of the world. 20 years ago biology in Sweden was analysed, too many systematics professors' chairs (9). Now Gothenburg has only systematics chair in botany. This is a critical situation. It does not attract students (applies to biology as a whole, chemistry even worse).

The additional funding has broadened the views considerably. Early 1990s basic research questions, had no stakeholders at all. Work on semi-natural grasslands has broadened this. Working in cultural landscapes you need to be involved with other scientists (social) and actual people, the farmers who maintain the grasslands. Now it is of interest what people actually value in the landscape. Species richness and rare species are not as high on the list as for biologists. A publication was produced free-of-charge, distributed to county administration level. There seemed much positive response, but unknown direct impact. Working in the political arena was not a priority, even a weakness.

Cell and Molecular Biology and Microbiology at Uppsala University

Lars Hellman[H], *Diarmaid Hughes, Leif A. Kirsebom*[R,H], *Department of Cell and Molecular Biology, Uppsala University*

Dan Andersson, Department of Medical Biochemistry and Microbiology, Uppsala University

Ulf Gyllensten, Department of Genetics and Pathology, Uppsala University

Dan Larhammar, Department of Neuroscience, Uppsala University

Rolf Ohlsson, Department of Microbiology, Tumor and Cell Biology, Karolinska Institutet

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Science Committee review:

Research at this reporting entity covers a variety of topics spanning from studies of evolutionary mechanisms behind biodiversity, over the importance of biodiversity for human beings and society, to project that are best described as human genetics – studies which have resulted in an increased understanding of human diversity and have an impact on treatment, prevention and detection of various diseases and disorders. Other research areas are: Selective and mechanistic processes that influence the evolution of antibiotic resistance in bacteria, gene duplication and evolution of gene families in vertebrates, immunoglobulins, Zinc fingers, and serine proteases and mammalian evolution, and tRNA gene organization and structure in E. coli. The available biodiversity funding seems to have had no significant influence on the choice of research area, but has added volume to ongoing research.

The biodiversity related projects has generated a large number of papers published in very high-impact scientific journals (for example Proceedings of the National Academy of Sciences (PNAS), Science Genome Research), but the output of PhD students is disappointing. The impact of the programme on the scientific output is difficult to judge since the lists in several cases contain publications not relevant for this programme.

The scientific this reporting entity is **excellent** to **outstanding**. The relevance to biodiversity science is **medium**.

Relevance Committee review:

Relevance assessment: **Excellent**

Key question in the area of cell and molecular biology is "how much it is really part of biodiversity." Genetics generate biodiversity, and immunoglobulins reflect the biggest genetic variety, with much more potential variety than number of b-cells in body. There is a large database of genomes allowing us to trace the origin of bacteria – the main part of earth's biomass.

Understanding interaction between bacteria can help increase mouth hygiene. Bacteria and microorganisms are good for us, we should use them to our benefit and for that we have to understand them.

Genetics for the wolf populations – again the question arose as to why so many groups look at this issue? How large is the population genetically? Answers related in part to the 'cheetah bottleneck' – cheetahs are almost identical, meaning you could transplant organs between any two individuals, but this also makes them very vulnerable as a species. Tools are needed to cope with genetic information. Bioinformatics is one, yet there must be a marriage between experiments and bioinformatics.

The extra biodiversity funding supported researches which lead to new questions. Example: The discovery that mycobacteria form spores. This can help answer how a mycobacterial human disease in Africa (Mycobacterium ulcerans) spreads. But the cost to develop this into benefit for society is a challenge.

Work on wildlife diseases can help understand how they spread; and therefore can be managed. Several years of cooperative work with scientists in Australia on platypus and other monotreme immune systems; yielding unique techniques for immunoglobin production, as well as the ability to manage diseases in the wild.

Earth and Ecosystem Sciences at Lund University

Anna Broström, Benjamin Smith, Lena Ström, Martin Sykes[R,H] *, Department of Earth and Ecosystem Sciences, Lund University*

Science Committee review:

Biodiversity research at this entity is strongly focused on the development of models to predict responses of biodiversity (mainly terrestrial vegetation/community composition) to climate change and changing land-use patterns in time and space. As a entity they are highly productive with many different model developments and applications spanning from Arctic through to African ecosystems. Although most of work is model-based, they also have some excellent field-based studies emerging that demonstrate the relationship between CO_2 and CH_4 flux measurements and plant composition in wetland ecosystems in the Arctic.

All elements of the work emerging from this entity have important implications for biodiversity conservation. Particularly notable are landscape-based results that demonstrate the importance of discontinuous land-use at different temporal and spatial scales for maintaining biodiversity in cultural landscapes, and development of tools to provide a quantitative assessment of potential vegetation and ecosystem changes under global climate change. Many aspects of the biodiversity work emerging from this entity are leading the international field – in particular their focus on interactions between biodiversity and ecosystem functional change under climate change.

For this entity, the increased funding in biodiversity has led to a number of new opportunities and research directions. Judging by the number of publications in top journals including Nature and Science plus the large network of international collaborators for all members of this entity, the

research undertaken is **excellent** to **outstanding** and represents a very good investment of biodiversity funding with **high** relevance to a biodiversity science perspective.

Relevance Committee review:
Relevance assessment: **Outstanding**

This entity is the ecosystem modelling group in Lund with interests in ecosystem and global change, including climate, land use, and invasive species. Much research focuses on developing a model, adding new things to it, and becoming more integrated with socio-economics.

Many stakeholders are involved, depending on what part of the model is going to be used. For forest part, forest managers/owners, for agriculture, farmers etc. The practical user value of the research is it helps to guide thinking on where to go regarding ecosystems and ecosystem services (trendy word, "ecosystem processes" in the past). Outputs are often at a larger scale than what is directly relevant for policy. Data are needed to be able to work on a finer scale. They hope to be able to do more than just value biodiversity economically.

Carbon sequestration work can use the model to for instance plant forests, to calculate how much carbon will be stored in future. Or assessing what will happen with vegetation in north when permafrost disappears. It is important to say that the scenarios will not necessarily happen as presented. They present ranges or probabilities for future outcomes.

Funding changes in last eight years have resulted in combination of many things. Large inputs from EU, BiodivERsA et al. in addition to Swedish. It has influenced at least some of the people in Lund, apart from some hard core ecologists. The entity is more integrated. Data acquisition depends on the scale of the field study. It is very important to receive data. They need more field and environmental data on individual species. But it is also a scale issue; much research is at a very fine scale that they cannot yet handle in the models.

The modelling uses species as set of traits as opposed to species per se, as it is easier to model traits, probably also easier for others to understand. Gene level is important, but difficult. You also run into range issues, species having adapted to the situation at the edge of the range. It is possible to explore what might happen with certain ecosystem services in relation to biodiversity and possible processes.

Often at the beginning a range of stakeholders is involved; formerly they were involved only at the end to receive results. In a number of new projects in which stakeholders are involved almost from the beginning, for example

the new project LUsTT: Land Use Today and Tomorrow. A little group has been involved, drawing a stakeholder meeting in autumn. Overall stakeholder board at an elevated level, but they are also seeking to have broader range of people involved.

Local knowledge in farmers and landowners/managers is also useful.

The permafrost work is sharing the results globally across the boreal zone, with a specific project focussing on Northern Russia. There is also a permafrost module in the global model, still under development.

Ecology and Evolution at Uppsala University

Stefan Bertilsson, Mats Björklund, Peter Eklöv, Jan B Ekman, Urban Gunnarsson, Lars Gustafsson, Jacob Höglund[H]*, Anssi Laurila, Eva Lindström, Anna Qvarnström, Håkan Rydin, Hans Kristen Stenøien*[*]*, Lars Tranvik*[H]*, Jon Ågren*[R,H]*, Anders Ödeen, Department of Ecology and Evolution, Uppsala University*

[*] *Section of Natural History and Archaeology, Norwegian University of Science and Technology*

Science Committee review:

This entity has expertise in ecology and evolution of species in changing environments and links population biology, genetics, genomics and conservation. The study systems encompass a range of taxa, including microbes, plants and animals in terrestrial, marine and freshwater environments. Quality of science across projects ranges from outstanding to very good, and applicability of research to biodiversity study ranges from excellent to good (or perhaps insufficient in one case). One strength of this entity is in wetland and peatland restoration and nutrient cycling. Another particularly strong area is in microbial biology, an area with particular relevance to applied biodiversity research. The rest of the research in this entity would be considered to be evolutionary ecology and genetics, targeting taxa from fish to birds to mammals to frogs to plants. Most of this work is outstanding in its quality and application to biodiversity research.

The biodiversity funding boosted research in this entity. It also promoted more applied work and allowed a critical mass of researchers in ecology and evolutionary biology to develop.

Overall the research conducted in this entity is **excellent**, with **very high** relevance for biodiversity science.

Relevance Committee review:
Relevance assessment: **Excellent**

A big range of activities is undertaken in this entity, including population biology, conservation biology, genetic diversity of vertebrates, plant ecology, limnology, and microbial ecology.

Stakeholders are not that relevant as primary role is basic research, in concordance with the university profile. Much of work is focused on processes behind maintenance of biodiversity.

Species and genetic diversity in grazing pressure on Öland, together with county administration, including the field station.

Genetic and lab research is costly and developing very fast into new techniques. Needs are the same funding as medical geneticists, who have 10 times the budget. Last year merged together in the same building, which has meant a lot, both for teaching and research. Geneticists have tended to become less lab-dependent by sending away samples to central analytical labs. Methods have changed; this has driven change in working methods, rather than a shift of interest. In the old days, you had to cull part of the population when studying rare species, but non-invasive sampling has become much more feasible now. Microbial ecology dealing with diversity did not exist before molecular techniques.

The additional funding was very helpful, boosted the field at the time the programme was launched. It was difficult the years before this to get a post doc or a junior research position.

Ecology at Lund University

Anders Brodin, Lars-Anders Hansson[H]*, Tomas Johansson, Almut Kelber, Per Lundberg, Anders Persson, Karin Elisabeth Rengefors*[R]*, Pia Romare, Anders Tunlid, Kajsa Åbjörnsson, Department of Ecology, Lund University*
Dan-E. Nilsson, Eric Warrant, Department of Cell and Organism Biology, Lund University
Stefan Weisner, Wetland Research Centre, University of Halmstad

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Science Committee review:
The research topics within the reporting entity range from studies of genomes to physiology, community and ecosystem ecology. Most of the research within the entity is basic science oriented, with evolutionary or ecological (or both) questions regarding variations in behaviour, function, genetic diversity,

species richness, and ecosystem functioning. Only two of the project readers reported on more applied projects, related to lake restoration and wetland management. The majority of the projects cover ecological aspects of biodiversity and study organisms ranging from eukaryotic microorganisms to fish. Some groups are oriented towards more functional and evolutionary biology, also covering a wide range of organisms, from box jellyfish to insects.

The biodiversity funding has positively affected the work in this entity through increasing the focus on diversity questions. One outcome of this is planned future work, for instance the link between climate and biodiversity. Other planned projects with biodiversity relevance may include work on pelagic benthic systems and nutrient cycling/retention. Barriers to research that were identified included a need for more theoretical work, as well as a need to increase international collaboration.

The projects have generated a large number of papers published in very high-impact scientific journals (for example Ecology, Nature, Biological Reviews), and several PhD students have been involved in the projects. The scientific quality of the work is **excellent** to **outstanding**. The relevance to biodiversity science is **very high** to **high**.

Relevance Committee review:
Relevance assessment: **Good – Very good**

This research entity has few connections between the component members. It represents pure biology without large biodiversity focus, and also includes sensory biology, microbiology and aquatic issues. Microbiologists tend to be more applied, and the aquatic issues are both basic and applied.

There is a connection between climate change, genetic and other levels of biodiversity and decomposition systems in forests.

There is good stakeholder involvement in the sensory biology work, leading to good interaction with industry – for example Toyota, and airports. The aquatic work has long tradition of working closely with the Swedish Environmental Protection Agency (EPA), and more widely in Europe on restoration topics; and the microbial projects have cooperation with forestry.

The view was expressed that without basic research there will be no applied research within 10 years time, only consultancy companies without new thinking. But funding has increased the willingness to work on applied research and implementation as well. There are areas where more research is not needed (acidification, possibly eutrophication), but only implementation of research results through policy decision and application. The role of media is important and it is easier to communicate with media than five years ago.

Ecology at Swedish University of Agricultural Sciences (SLU)

Jan Bengtsson[H], *Lena Gustafsson, Mats Jonsell, Anna Lundhagen, Bo Långström, Tryggve Persson, Tomas Pärt*[R,H], *Thomas Ranius, Håkan Sand, Tord Snäll, Bo Söderström, Lars-Åke Wikars, Department of Ecology, Swedish University of Agricultural Sciences*

Tommy Lennartsson, Swedish Biodiversity Centre, Swedish University of Agricultural Sciences and Uppsala University

Per Angelstam[+], *School for Forest Engineers, Swedish University of Agricultural Sciences*

Gesa Weyhenmeyer, Department of Ecology and Evolution, Uppsala University

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Science Committee review:

Organisms studied range widely, from lichens to wolves. One distinguishing characteristic of this research is the success in connecting high quality biological science to on-the-ground natural resource management concerns. For example, several project leaders focused on how logging or agriculture might be conducted in such a way as to maintain, or even subsidize, particular lichen, plant, insect and bird species. At the same time, the projects are revealing basic biological insights into processes including food web dynamics, dispersal mechanisms, extinction drivers, habitat selection, and adaptation to climate change and range periphery. Often, the projects involve close collaborations across fields that lead to cross-cutting insight. For example one research group has combined genetics, demography, and landscape, community, and behavioural ecology to gain novel insights into population dynamics and ecosystem effects of recolonizing wolves.

The biodiversity funding positively affected the work of this entity. The work became more process driven and there was an increased focus on applied problems. This led to more publications in applied and conservation journals.

In the future the challenges that this entity wishes to work on include climate change, changing land use and ecosystem services. Constraints on future research include the need for more long-term data and the need for more predictable funding to permit collection of the type of information required for this type of work. There was also highlighted a need for closer links to theory in order to underpin the empirical work. They have aspirations for more interdisciplinary projects and there are links to national policy.

Overall this entity has research expertise that is unique within Sweden, and the quality of research is **very good** and the relevance to biodiversity science is **very high** to **high**.

Relevance Committee review:

Relevance assessment: **Very Good**, with some areas **Excellent**

Much of this research is management driven, although perhaps unsurprisingly not all research topics are novel. There is an interesting link between outcomes and policy implications. The 'science-policy interface' concept is used and understood by this entity. The new department of ecology at SLU is good for the future, and the biodiversity funding increase had contributed to the establishment and functioning of this department.

Much of the work focuses on ecosystems in farmland and forests – and has clear links with land use, farming and forestry practices. The results change present views on biodiversity conservation, or particular farming practices. Regular discussions are held with policy makers and decision makers.

The results from work on organic farming are not the ones that policy makers want to hear – as they showed that effects of management on biodiversity are context dependent. Outside Sweden – the AgriPOPES project involving EU partners especially, Wageningen, Göttingen and Cambridge. Domestically cooperation extends to Stockholm and Lund universities. For forestry there is cooperation with universities in Finland and Canada.

Wolf genetic work can help with possibilities of re-wilding, but there seems not enough cooperation between different groups dealing with this question across Sweden.

It is possible to develop strategies involving stakeholders in adaptive implementation schemes. One example of research resulting in policy change: The Board of Agriculture intends to give extra funding for biodiversity set-asides, varying the amounts according to landscape context, with more to open intensive agricultural landscapes, less to those with already established ecological buffering.

The users are not only agencies but also farmers, to have them understand biodiversity (and vice-versa – biologists to know about farming). Farmers always decide about use. The broad research focus is on developing coherent land use with a common institutional land use approach.

Ecology at Umeå University and Mid Sweden University

Göran Englund[R,H]*, Lars Ericson, Per-Anders Essen, Barbara Giles, Mats Jansson, Roland Jansson, Frank Johansson, Björn Malmqvist, Jon Moen, Christer Nilsson, Lauri Oksanen, Tarja Oksanen, Johan Olofsson, Ecology and Environmental Sciences, Umeå University*

Bengt Gunnar Jonsson, Natural Sciences, Engineering and Mathematics, Mid Sweden University

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Science Committee review:
The researchers within this entity are very actively engaged in science of fundamental importance to understanding and managing biodiversity, ranging from theoretical ecology ad population genetics to long-term field experiments on species interactions. Plant-herbivore interactions are a strong focus of several investigators. The research output of this entity is outstanding in terms of both quantity and quality of publications, with most leaders publishing regularly in top international journals, and is characterized by creativity, 'big picture' thinking, and in many cases by significant links to applied conservation issues. Most of the project leaders collaborate extensively with researchers in several countries, and many are engaged with managers and practitioners in putting the results of research to work in applications.

The funding for biodiversity research has positively affected the work in this entity through increasing the number of people working in the field and increasing the possibility to collect longer-term data with continuity beyond what is offered by a normal three-year research project.

In the future problems to be addressed will include climate change, although the longer-term direction of the entity was not well articulated. Although the current funding has led to important scientific outcomes, it is not clear how this will influence future research. The PhD students trained in this entity have, however, had success in finding employment with local stakeholders.

Overall, the research by this reporting entity is **excellent** to **outstanding**, with most of the project leaders being highly productive with high-quality, influential research outputs. The relevance to biodiversity science is **very high**.

Relevance Committee review:
Relevance assessment: **Good**, with some projects being **Excellent**

This was a large diverse entity, and the rapporteur did not know details of the full suite of projects. The entity felt there was mostly a focus on basic research; with some recognition there could be long-term positive effects on society. There was recognition that 10 years is too short a time for relevance, as an example the 20 year old study on Phosphorous in lakes, the discoveries ensuring major changes to textbooks. Our view is that much is old knowledge – this is not a big problem if there is building on old previously published knowledge in good journals. In that way it is made transparent that research builds on the existing corpus of knowledge.

There seems little overall empathy with projects needing to be societally relevant, and indeed, seemed to be reluctantly driven when requested by a primary sector for using basic science to help solve a problem. One exception was the analysis of the degree of fragmentation of rivers on a global scale, the result of which can and is being used at a national, regional and global level and, as such, is of high relevance to society. In another case heterogeneity incorporated into non-linear models – now this may be used for calculation of a cod-population recovery for creation of better models to predict future changes. The scientist concerned was invited by fisheries authorities to a workshop – not as his own initiative. His view was that although there may be better predictions, politicians will not listen and take advice.

While some projects were formulated in cooperation with stakeholders (for example deadwood, forest edges' projects – here stakeholders were the Swedish Forest Agency, forest companies) many projects were not at all involved with stakeholders. Stakeholders were variably involved in design, duration or after the projects activity.

There was recognition that the funding contributed to finalising existing projects.

Evolution, Genomics and Systematics at Uppsala University

Siv Andersson[R], *Katarina Andreasen*, *Rolf Bernander*, *Peter Engström*, *Anders Götherström*[H], *Elena Jazin*, *Martin Lascoux*, *Mats Thulin*, *Department of Evolution, Genomics and Systematics, Uppsala University*

Science Committee review:

The overall research focus of the Evolution, Genomics and Systematics entity is broad ranging from the genetic diversity of European cattle, biodiversity of gene expression in the brain, to gene expression in flowering plants. There is also some taxonomic and systematic work on plant diversity in the Horn of Africa. Many elements of the work have important applications to biodiversity conservation, and a few have been realised. Particularly notable in this respect is the use of data detailing phylogenetic distinctiveness to determine conservation prioritization for rare and endangered taxa. The systematic work on the flora of Somalia has also led to some excellent initiatives in biodiversity conservation including to the classification of this region as one of 34 biological hotspots on earth. For a number of the other projects within this entity, however, the potential of the results obtained for biodiversity conservation have yet to be fully-realised. This is particularly

apparent in the choice of journals in which work from this entity is published which are on the whole, subject specific molecular and genetic journals. Indeed one of the project leaders from this entity comments that the "integration of evolutionary biology and population genetics into conservation could be better".

Despite the lack of linkages to biodiversity science, the standard of publications and collaborations from this entity suggest that much of the research produced is of an **excellent** standard and that the entity as a whole has produced a lot of research of **medium** to **high** relevance to a biodiversity science perspective.

Relevance Committee review:
Relevance assessment: **Very Good**

Varied entity, including an archaeology focus. Work on highly degraded DNA, focusing on traditional hunting-gathering to farming, and domestication. The audience for this work is outside the science community but includes geneticists, archaeologists, chemists etc. Stakeholders include other researchers, but also cooperation with milk producers. The methodology is being used in forensic work and popular science.

Cattle genetics – based on Rendel's work current work is about domestication. Student working on thesis studying genes in various areas back in time, that we think have been under selection. Try to link them with specific traits, breeds. Interest for pigmentation all through history is shown.

Increased stakeholder interest has arisen from new methodologies, easiest to see for milk producers. They are interested because of new methods that enable to draw new conclusions about people being able to drink milk.

We can follow what species went extinct versus expanding due to climate change. Bears and Arctic foxes (including outside Scandinavia) went extinct or suffered severe range contractions. Ancient European Arctic foxes are not like Scandinavian – they went extinct in Europe, did not move to Scandinavia. If climate change leads to changing landscape, corridors may not solve the problem – did not save European Arctic foxes. Tracking habitats is not good – we have to promote survival of the genetic unit in this area.

Additional funding has allowed much of this work to be carried out.

Humanities and Social Science

Ing-Marie Gren[H]*, Department of Economics, Swedish University of Agricultural Sciences*
Thomas Hahn[H]*, Stockholm Resilience Centre, Stockholm University*
Gabriel Michanek, Faculty of Law, Uppsala University
Berit Balfors[H]*, Land and Water Resources Engineering, Royal Institute of Technology*
Anna Tunlid, Research policy institute, Lund University
Andreas Duit, Department of Political Sciences, Stockholm University
Mats Widgren, Department of Human Geography, Stockholm University
Marie Stenseke[H]*, Department of Human and Economic Geography, University of Gothenburg*
Maria Johansson, Architecture and the Built Environment, Lund University
Anders Melin[H]*, Centre for Theology and Religious Studies, Lund University*

Science Committee review:
Only project leader reports; see section about **Research areas – 3.8 Human Dimensions.**

Relevance Committee review:
See review of entity **Landscape Architecture, Planning and Management at Swedish University of Agricultural Sciences**

Landscape and Ecosystems at Stockholm University and Linköping University

Thomas Elmqvist[R]*, Jon Norberg, Department of Systems Ecology, Stockholm University*
Sara Cousins, Helle Skånes, Department of Physical geography and quaternary geology, Stockholm University
Bo Ebenman, IFM, Biology, Linköping University

Science Committee review:
This entity did not provide a summary background report not did they have an interview with the evaluation panel. The different projects are quite diverse but have in common that they use theoretical concepts of the resilience alliance.

One aim is to develop insight in biodiversity and robustness of ecological communities in fragmented landscapes. To accomplish this goal a community viability analysis and performed in silico experiments on model communities in deterministic and stochastic settings as well as on communities in a spatial setting (metacommunities). Another project investigates landscape memory as means to deal with human impact on biotype resilience and potential biodiversity using remote sensing. A third project is aiming at developing a general trait-based approach for ecology to understand ecosystem dynamics for climate change impact predictions. Another project looked at land use change and effects of functional and spatial connectivity on historical and present biodiversity patterns.

The theoretical studies suggest that species-rich ecosystems might be more vulnerable to an increasingly variable environment than species-poor ones. The human impact studies are all linked to EU projects and have direct conservation relevance. The impact studies also looked at the role of institutional diversity for resilient governance of natural resources as well as the role of diversity in mental models for social community performance. The land use change research yielded as result that landscapes with many remnant grassland habitats have the possibility to buffer and also increase grassland biodiversity when grazing is increased. Although project money was given for urban ecosystems no results were presented in this field. Overall the relevance for biodiversity science is **high**.

The entity has only a limited number of high quality international publications linked to the funding, which were on average cited above the world average. Overall, biodiversity research in this report entity is **excellent** to **very good** with well-established strong international collaborative networks. One project can be considered insufficient while others have some excellent outputs. The reported project activities and outputs are strongly linked to the Stockholm Resilience Centre and list excellent output related to this centre but not to the biodiversity funding.

Relevance Committee review:

Relevance assessment: **Excellent** to **Outstanding**. Lack of interview hampers giving a rating fully comparative with other entities.

For this reporting entity no summary was provided and no project leader attended the committee meeting. The chair of the Relevance Committee met informally with the rapporteur outside the frame of the formal interviews.

Based on the information provided in reports provided by all project leaders it is clear that the project outcomes are of high relevance for the society. All of them look at the interaction between human activities and ecosystems.

The projects are using different approaches to analyse human induced impacts on ecosystems, one using community viability analysis, another with the landscape change trajectory analysis, and one using historical land use data. Another approach targets the resilience of ecosystems. No indication is given regarding stakeholder involvement; besides a statement that there is an increasing demand for hard figures regarding state and trends of biodiversity. Several project leaders are heavily involved in political discussions, for example by contributing to The Economics of Ecosystems and Biodiversity (TEEB), and the global discussions on ecosystem resilience.

Landscape Architecture, Planning and Management at Swedish University of Agricultural Sciences

Per G. Berg[+], *Clas Florgård*, *Roland Gustavsson*[H], *Mats Lieberg*[R,+], *Magnus Ljung*[+], *Erik Skärbäck*, *Faculty of Landscape Planning, Horticulture and Agricultural Sciences, Swedish University of Agricultural Sciences*

Science Committee review:

This entity did not provide a summary background report. The projects are quite diverse but have in common that they use theoretical concepts of the resilience alliance.

One of the projects dealt with preservation of indigenous vegetation in urban areas in Sweden. Another project tried to develop instruments of control biological diversity in agricultural landscapes. Landscape architect developed an ecological-spatial approach to understand how architecture can be identified and categorized as prototypes for city plantations.

The planning, design and management of natural vegetation has lead to preserved green areas in cities. The main aim of the project for the landscape architects was not to write scientific articles but rather to establish a platform of knowledge, cooperation, and demonstration plantations. They state to have used this knowledge several times in winning themes in competitions in Scandinavia about city landscapes. Overall the relevance for biodiversity science is **low** to **medium**.

The entity has almost no quality international publications linked to the funding. Overall, biodiversity research in this report entity is **insufficient** some of it maybe **good** with very limited international collaborative networks.

Relevance Committee review:

Relevance assessment: **Excellent**

The project leaders of this entity and in Humanities and Social Sciences were interviewed at the same time, and as the areas covered by these groups are very similar in focus – and equally different for the most part from all other entities – a consolidated entity report is presented. The relevance assessment for all is the same: excellent.

Human aspects of enhancing and conserving biodiversity are necessary. There is a clear interface between social society and natural. Work on ethics can help understand human aspects of biodiversity. Different types of knowledge are needed, but no need to cooperate in every project.

Biodiversity is a social construct. Most social science is more qualitative, not waiting for natural science data. Social sciences more applied research, and difficult to get funding for. Biologists do not see that there is a large social science issue here as well. TEEB not really understood! But then some areas are aware. Ecosystem approach is dominating now in the area on human-nature, but maybe this is not enough. Goals towards future generations and nature for its own sake are seldom discussed, taken for granted. There is a distinction between anthropocentric and non-anthropocentric positions.

The stakeholders are politicians and agencies, and the direction of the research is still the same contact with stakeholders, but applications are written in a different way. The new money has helped these areas of research. Ecosystem services contribute to human well-being. Economics has made new frontiers. The Millennium Assessment was very anthropocentric, but there are always species behind the services. Now we have functional groups.

This group working a lot with Environmental Impact Assessment (EIA) standards, also on a strategic level to integrate this kind of questions, find forms and processes for this. Also outside Sweden, there is the International Association for Impact Assessment.

The stakeholders are landowners, fishing associations. Sometimes strong commercial interests make communication difficult, but often there are also social interests which make for social learning which facilitates contacts. Important processes are going on, both natural and in politics, which influence local level.

The interaction in Sweden between social sciences and natural sciences could be improved. Natural and social scientists should learn from each other. Problem-based research is the way to form these alliances. Not seeing "how can I make economics out of this", but "how can economics contribute to solving this problem". Also need a way to attract more women to research. Men more interested in technical things, women more creative. But there is a need for positions after graduation. Many cannot find a position after PhD.

Linnaeus University, Kalmar

Anders Forsman[R,H], *Marie-José Gaillard-Lemdahl*[H], *Åke Hagström*, *Bengt Persson*, *Jarone Pinhassi*[H], *Department of Natural Sciences, Linnaeus University Kalmar*

Science Committee review:

Biodiversity research at Linnaeus University is broad with projects ranging from those examining molecular/microbial levels of diversity through to whole-organisms. Both marine and terrestrial ecosystems are studied. Overall the focus of the research in this entity is process-orientated, that is, understanding the ecological and evolutionary processes that generate and maintain diversity rather than determination of spatial/temporal patterns of diversity; two exceptions to this are the development of a new palaeo-ecological tool (in collaboration with colleagues at Earth and Ecosystems Sciences at Lund University) to enable determination of biodiversity patterns through time at landscape scales, and an assessment of global patterns of diversity and community structure in marine bacterioplankton.

Results from some of this work has direct application to biodiversity conservation, for example, research into the association of colouration mode with endangerment in Australian frogs, and understanding the relationship between fire regimes and beetle diversity in Swedish forests, but the majority of the research is basic. For some of the research it is also unclear as to why this work has been funded under biodiversity rather than other areas such as biochemistry and cellular biology.

Judging by the number of publications, international collaborations, and reported 'key-findings' the research appears to be **very good** to **excellent** with particular biodiversity strengths in marine biodiversity and palaeoecology. The relevance of the research in a biodiversity science perspective is **medium** to **high**.

Relevance Committee review:

Relevance assessment: **Insufficient** to **Good**

A small reporting entity, yet covering a broad range of subjects. Most of the work is basic ecology, with applications in different areas such as conservation. External contacts have been limited, except with media etc. To interact more additional time would be needed. Maybe universities could link research and stakeholders in a better way.

Communications strategy includes press releases, forwarded to traditional channels and semi-popular pages on website. There is an increasing demand to know what is going on, but scientists do not prioritise it or have time for it.

Stakeholders have interest at the beginning, but they disappear after the first meeting. They do not have the time nor the duty to do this – are not allowed to work with the project. It seems to be either science without stakeholders, or stakeholders without science. Only money will encourage stakeholder participation. County administrations, municipalities, museum people, active people on Öland, all turn up but then do not return. They were paid for first two days.

Forest companies using managed fires in forestry are another example, yet interest has declined – they lose money by interacting. Those fires are needed for biodiversity management, but why should forest companies pay for this?

Marine science: mainly basic research with possible consequences for instance human health and fish farming. A project is trying to find small molecules in Arctic bacteria, in cooperation with Umeå. Here funds can be sought for the development of antibiotics. Also work on how bacteria get energy, Department of Energy in the US describes diversity of these bacteria (unfortunately patented). How it should be built/designed is not patented, but not yet operational. But young scientists are 'out of this business' if they spend too much time with stakeholders – there is a penalty on interaction.

Marine and Limnic Sciences at Stockholm University and Örebro University

Ragnar Elmgren[R,H], *Elena Gorokhova, Department of Systems Ecology, Stockholm University*

Lillemor Asplund[H], *Bengt-Erik Bengtsson*[H], *Department of Applied Environmental Science, Stockholm University*

Per-Erik Olsson, School of Science and Technology, Örebro University

Margareta Törnqvist, Department of Materials and Environmental Chemistry, Stockholm University

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Science Committee review:

This reporting entity includes a variety of projects with the loose common theme of interactions between human activities and environmental impacts. These include production and distribution of natural algal toxins, chemical impacts on sex determination and endocrine disruption in fishes,

impacts of invasive species on trophic processes in Baltic pelagic food webs, and role of biodiversity in mediating trophic transfer in benthic food webs.

The project leaders generally have solid to strong records of publication in international journals. One noteworthy feature is the rapporteur's conclusion that the biodiversity grants, though a small part of total funding, were considered instrumental in influencing the research directions of several project leaders, and that those directions are continuing. The support also facilitated closer interactions among biologists and chemists. A number of PhD students were trained with expertise in biodiversity-related fields.

Although the researchers judged the impact of their research as falling primarily within science so far, much of this work has clear potential connections to applications and management, particularly regarding pollutant effects and invasive species. For example, research on endocrine disruptors in fish have already influenced the Swedish EPA's list of priorities. Broader outreach efforts include contributions by several project leaders to popular publications and interactions with managers and the Swedish EPA.

Overall, research by this reporting entity is **very good**. All project leaders have solid publication records, with papers generally appearing in respected international journals, albeit most of these are discipline-specific and few have appeared in the top general journals. Relevance in the context of biodiversity science is **high** to **medium**.

Relevance Committee review:

Relevance assessment: **Good**

The main focus of this reporting entity is within ecotoxicology, mainly in the Baltic Sea. This is an area for which there is a large societal interest, and the Swedish EPA was seen as one of the main stakeholders. There have also been contacts with the US EPA regarding work on indicators for pollutants, using Swedish species.

The work of this entity frequently questions and complicates existing notions of environmental problems. One example is the research showing that not all chlorinated compounds in the Baltic are man-made; another the demonstration that naturally occurring toxic substances can be produced in higher quantities because of climate change. Both these findings are considered to have consequences for policy makers; yet it remains unclear what the necessary action would be.

Despite some of the research being applied, and despite some work connected with both the Helsinki Commission (HELCOM) and the Institute for Environmental Protection and Research (ISPRA), most results of the work in this entity have other scientists as their main user. Attempts to be-

come more applied are hampered by the following factors, several of which are related to publication opportunities:

- The major scientific journals are more interested in publishing basic research than applied;
- Scientists feel the need to publish their results in the scientific press before any stakeholder interaction can take place – results leaked to the general press may become unpublishable in scientific journals;
- It is difficult to publish results that show that a problem is not as severe as previously thought, or that run against established knowledge;
- the Swedish Research Council favours research that is not too applied (however, Formas generally favours more applied research).

The funding has changed research patterns, providing new opportunities and encouraging new developments. Many continue working in their new directions, that is, with a stronger focus on biodiversity, after funding ended.

Marine ecology at University of Gothenburg

Kerstin Johannesson[H], *Per Jonsson*, *Henrik Pavia*[H], *Rutger Rosenberg*, *Michael Thorndyke*[+], *Gunilla Toth*[R,H], *Matti Åhlund*, *Department of Marine ecology, University of Gothenburg*

Malte Hermansson, *Department of Cell and Molecular Biology, University of Gothenburg*

Science Committee review:

Research in this reporting entity involves a broad spectrum of questions, issues, and approaches in marine ecology, evolution, and environmental biology. Research ranges from microbiology, though speciation in marine snails and algae, to biodiversity effects on ecosystem functioning, and chemical defences and signalling. The projects span a broad range of taxa from bacteria to large seaweeds, diverse approaches (microbiological, genetic, chemical, experimental, and theoretical), and processes at widely different spatial scales.

Several of the project leaders are international leaders in their fields, and the entity as a whole has been highly productive of publications, including many high profile papers in leading international journals (for example Ecology, Ecology Letters, PNAS, Molecular Ecology, and Evolution), and results of broad interest and significance. Results from several projects have been publicized through popular scientific publications and media reports. Highlights include documentation of an internationally recognized model

system for understanding origin of new diversity via speciation, chemical mediation of ecological interactions, and experimental studies of how biodiversity influences ecological processes.

The several practical benefits of the research include a patented chemical cue that may enhance the yield of a potent sodium-channel blocker with potential biomedical applications, greater understanding of the genetic basis for antibiotic resistance in microbes, web-based decision support tools for marine managers, and synthesis of global data that raised the public profile of hypoxic 'dead zones' in oceans and estuaries.

Biodiversity funding provided an important bridge that allowed a group of young marine ecologists to transition into more permanent positions, and also fostered new directions by encouraging researchers to focus on processes at larger organizational scales, and helped seed work that ultimately established the Centre for Marine Evolutionary Biology. Support also contributed to training of several PhD students. Although none of the research themes are unique to Sweden, several are well known and leading internationally.

Overall the research by this reporting entity is considered **excellent**, with some groups rated as good or very good. Relevance in the context of biodiversity science is **high** to **medium** among the research efforts. Despite this heterogeneity in research output, the entity as a whole is very strong, highly productive, and widely recognized for innovative original research.

Relevance Committee review:

Relevance assessment: **Good**

The main focus of the entity is marine biodiversity. The interest of this entity is strongly within basic science, to such a high degree that questions about direct relevance for society were not easily answered. Other scientists were seen as the main users of the results produced in the entity. Despite this, researchers within the reporting entity have participated in several projects with strong relevance for society and stakeholder interactions are frequent – however, this was not reflected properly in the documentation and not at all during the interview.

The entity considers its main relevance for society to consist in the provision of new knowledge and insights, allowing for earlier detection of possible problems and greater awareness of their several probable causes. The question how this knowledge can be used to inform societal choices and to adapt management of biodiversity was not given much attention. Examples include the finding that copepods can be the direct cause, rather than eutrophication, of algal blooms turning more toxic, and the discovery that species evolution sometimes can be very rapid. Both findings were seen as very relevant for society, but the question how management should act was not answered.

There was a strong objection to the division between basic and applied research; the only interesting division was said to be good and bad research. The entity also made a strong point about the necessity that policy makers not only ask for science to deliver tools, but should also accept critical science questioning some of the assumptions within the policy making field.

The entity assessed the additional funding to have been helpful because it allowed the development of new useful basic science projects; it allowed for the inclusion of new aspects, for instance of societal relevance, into this and existing research.

Microbiology at Stockholm University, Royal Institute of Technology, Södertörn University and Karolinska Institutet

Elisabeth Haggård[R,H], *Genetics, Microbiology and Toxicology, Stockholm University*
Eugene Zabarovsky, Akira Kaneko[H], *Microbiology Tumor and Cell Biology, Karolinska Institutet*
Anthony Poole, Molecular Biology & Functional Genomics, Stockholm University
Peter Savolainen[H], *Biotechnology, Royal Institute of Technology*
Magnus Johansson[H], *School of Life sciences, Södertörn University*

Science Committee review:

Research at this reporting entity is extremely diverse and part of the research straddles across the borderline between biodiversity and medicine. Thus research is done in the following very different areas: Phage-mediated horizontal gene transfer as a mechanism for microbial biodiversity, biodiversity of TBE viruses in Sweden, biodiversity of malaria and immunity in isolated areas, the origin of the eukaryotic cell, genetic origin of the domestic dog, and quantification of species composition in the gut microbial flora. Three of the projects have only had support for 2.5 year and were terminated when funding ran out. It is difficult to characterise most research at this entity as biodiversity research and equally hard to judge if biodiversity funding has had any direct influence on research – only two of the projects will be continued – both biodiversity projects.

The scientific output is highly variable, but there are several publications in high ranking journal (for example, Ecology, Nature, PNAS, and Science). The number of trained PhD students is not impressive.

Overall, the research at this reporting entity varies from the **excellent** to the clearly **insufficient**. The relevance to biodiversity science is **medium** to **low**.

Relevance Committee review:
Relevance assessment: **Very Good**

A mixed entity, but little common thread – included prey-predator relations, evolution, socially relevant studies.

For example, there were clear linkages to societal relevance for the project on the origin of the domestic dog is central part of human history. There is a large interest across the world for this work. Domestic animals and plants are central in human life – everything we eat is domesticated. It is history, not natural science. But history should also be funded as Interdisciplinary research.

Often, malaria is part of global health paradigm, particularly in Africa. But malaria is different in Asia, Australia, Pacific Islands and Africa, so different approaches are needed. Malaria is a very ancient disease with 150 000 years history. Humans were already infected when they left Africa. Human genes selected the parasite and vector genes, so there are different relations in different environments. This affects how parasites respond to drugs and how humans respond to anti-malarial drugs.

New techniques play a crucial role. Core facilities for DNA sequences have been lagging behind, but becoming better now. All sequencing work is sent to Korea – cheapest place. Genetic data is fundamental for malaria, but much had already been sequenced. Phenotype relation with genetic data is becoming more and more difficult. Not many people are interested – field work is not appreciated.

The microbial world is often forgotten when talking about biodiversity, but here we have the highest diversity (measured as gene contents). There is considerable DNA sequencing – how to put the money to do biodiversity research based on this is a key question. There is horizontal gene transfer all the time. We have to differ between core genes and gene flow.

Mycology and Pathology at Swedish University of Agricultural Sciences

Frederick Asiegbu, Malin Elfstrand[+], *Nils Högberg, Björn Lindahl*[H], *Anna Rosling, Jan Stenlid*[R,H], *Andrew Taylor*[*], *Rimvydas Vasiliauskas*[H], *Department of Forest Mycology and Pathology, Swedish University of Agricultural Sciences*

[*]Macaulay Land Use Research Institute, UK

Science Committee review:
This team is part of a larger forest mycology and plant pathology department very active in the forestry sector. The additional targeted biodiversity funding was relatively minor in comparison with their overall research funding and the presented material that encompassed research highlights across a broad spectrum of funding sources and research areas made a full analysis of value somewhat difficult.

However, this is a very strong department very relevant to a major part of the Swedish economy and environment. They have real strengths in forest pathology and have built an impressive reputation in mycorrhizal ecology and functional responses. They do have good capability is some areas of microbial systematics and the additional funding has enabled connections between species-based taxonomy and those more interested in functional ecology. This is often an area of some debate in ecological research and the capability of researchers in this entity to contribute to international developments is very high.

To date there is limited evidence that the biodiversity focus to their funding has substantially changed thinking and scientific paradigms. In some cases it was a 'windfall' to enable more depth to ongoing research. However the entity has recognised the need to take a broader view of biodiversity-related science and incorporate more social and other sciences into future proposals. The entity is well placed to play a leading role in raising the profile of microbial processes in biodiversity management especially when linked with the other high profile ecological work at the university.

While the assessment of performance may have included outputs beyond those funded by the targeted biodiversity call, the entity has a number of publications in influential and high quality journals. While there is a range of quality, their overall performance is regarded as being **excellent**. The relevance to biodiversity science is **high** to **medium** .

Relevance Committee review:
Relevance assessment: **Very Good**

The mycorrhiza work has tight contacts with group in Lund. Taxonomic work is coordinated on Nordic-Baltic group plus some others. Recently there has been a step towards more active stakeholder involvement with the forest company Sveaskog and the Swedish Forest Agency. This involves investigating mycorrhizal activity and decomposition in forest soils.

Key person in department, half time employed by Swedish Species Information Centre (ArtDatabanken), having a broad network with agencies and

NGOs, helping them to get the results out to stakeholders. Current projects initiated by stakeholders. According to Formas new directions, they have a communication panel. There is work with the Swedish Forest Agency on national and international level, Russia. Additionally, PhD students are financed by industry, for instance genetics of resistance.

Too much stakeholder involvement has been a problem earlier on in other projects. Small companies want to use the university as their research unit – this can also block scientific thinking. More problematic is when the major part of funding gets directed to stakeholders' needs, forcing researchers to do things that are not programmed as part of the research. There is a need for simpler messages for decision makers and citizens. But no connections to the Forest Stewardship Council (FSC) work.

Plant Biology at Lund University

Stefan Andersson[R,H], *Hans Henrik Bruun, Tina D Hertefeldt, Mikael Hedrén, Pål Axel Olsson, Honor C. Prentice, Björn Widén, Department of Ecology, Lund University*

Cecilia Emanuelsson, Per Kjellbom, Department of Biochemistry, Lund University

Torbjörn Säll, Department of Cell and Organism Biology, Lund University

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Science Committee review:

Research at this reporting entity falls broadly speaking in two separate areas: Plant genetics and evolution, and diversity and ecology. However, most research has a solid foundation in plant genetics in a broad sense, which is a considerable strength of the group. The group is primarily involved in evolutionary and genetic aspects and studies questions involving genetic and experimental adaptive diversity, hybridization and gene flow, and polyploid evolution. The group focusing on ecology is less focused on genetics and looks at three applied problems: The links between mycorrhizal fungi and diversity in grasslands, the problem of population bottlenecks, and a specific problem of restoring a declining species.

The biodiversity programme has significantly added volume to the research of this entity, not least by hiring of PhD students, but has also been instrumental in directing research into new areas for instance, habitat fragmentation, soil acidification, and conservation biology.

Future research will include questions maintaining the strong relation between genetics and diversity and ecology and will focus on habitat frag-

mentation, effects of climatic change, genetically modified (GM) organisms, and invasive species.

Members of the entity have published in high ranking journals, both disciplinary and general (for example, Nature and PNAS) Overall the scientific quality of the work is somewhat heterogeneous and ranges from the **excellent** to **good**, whereas its relevance for biodiversity science is **very high** to **high**.

Relevance Committee review:
Relevance assessment: **Very Good**

A very heterogeneous reporting entity. Biodiversity can mean many things, and so can its relevance. There are a number of different relevant findings in this entity. Several projects focus on threats to biodiversity. Identification of threats, including introduced species, acidification and habitat fragmentation. Some of these are relevant for society.

Some projects even propose specific management actions to conserve specific habitats. One systematist uses genetic methods to define suitable conservation units beyond species, so that "we know what we conserve" although there was some reservations on the application of these methods.

Many of the projects have done a good job in dissemination and raising public awareness. Long list of different channels used; contact with land owners, participation in expert panels etc. Systematic findings disseminated in floras. Several people have produced government reports, including seed-mediated escape of transgenes.

Prentice's project on landscape on Öland focuses on how fragmentation influences biodiversity. Project was set up together with land owners, who have continued to be involved during project, and results will be disseminated to them and to county councils etc.

One project is on sandy grasslands in close cooperation with county administration. It was important to have the cooperation in order to establish experiments in these threatened habitats, using bulldozers etc. Report will include recommendations on how to handle this habitat in the future.

There is considerable cooperation on mycorrhiza with other entities, but details hazy.

Plant Breeding, and Protection and Biotechnology at Swedish University of Agricultural Sciences

Hilde Nybom[R], *Kimmo Rumpunen, Gun Werlemark, Plant Breeding and Biotechnology, Swedish University of Agricultural Sciences*
Peter Anderson, Plant Protection Biology, Swedish University of Agricultural Sciences
Karin Persson, Swedish Biodiversity Centre, Swedish University of Agricultural Sciences and Uppsala University

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Science Committee review:

Research at this reporting entity is focused on two areas: Genetic variation in cultivated and ornamental plants and chemical defence against insect pests. Sweden does have some climatic advantages for a number of horticultural crops and it is only natural to focus research on them. The issues of genetic variation and chemical defences are critically important to gaining a better understanding of how ecosystems function and their resilience in the face of climate change, but there are profound risks that a strong focus on cultivated plants alone may limit the ability of the entity to contribute to wider biodiversity research.

This reporting entity has had very substantial funding, mainly from Formas, and also has been able to attract considerable other funding. This has enabled hiring of former PhD students and has clearly increased the research volume.

Future research will continue to have a very strong focus on plant breeding, but will be enlarged to embrace biomedicine, phytopathology, and plant genomics.

The entity has delivered a range of research outputs, but the output does not compare to the amount of funding received and the entity appears to have had a relatively modest throughput of PhD students which is somewhat surprising given the expected demands from industry in this area. The overall assessment of the quality of the research in this reporting entity would be from **good** to **insufficient**, and with a relevance **low** for biodiversity science.

Relevance Committee review:

Relevance assessment: **Good**

None of the project leaders were able to attend the hearing session, but background data provided showed that projects were all centred on plant

breeding, on for example fruit crops, currants and oilseed rape which society can benefit from. Thus, these projects are highly focussed on applied research to build a baseline on which to help adapt present genetic plant material to human needs in future.

Plant Science at Umeå University and Swedish University of Agricultural Sciences

Rishikesh Bhalerao, Stefan Jansson[H]*, Annika Nordin, Göran Samuelsson*[R]*, Anita Sellstedt, Umeå Plant Science Centre, Umeå University and Swedish University of Agricultural Sciences*
Ulrich von Pawel-Rammingen, Department of Molecular Biology, Umeå University

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Science Committee review:
Research in this reporting entity is a varied collection of programmes mostly focusing on eco-physiological aspects of metabolism in algae, terrestrial plants, and bacteria, but also includes areas like genetic variation in poplar and enzymes of importance for degradation of pathogens. Highlights of the research include descriptions of complex effects of nitrogen fertilization on host-pathogen dynamics in forests; description of a new type of N_2-fixing symbiosis between a moss and cyanobacteria in forests; and progress in identifying the molecular genetic basis of cold hardiness in trees, carbon pumping in algae, and evolutionary selection on phenological traits in poplar. The research is also intriguing in that several aspects of these basic research programmes have produced results with significant promise in applied science and management.

In most research groups, the biodiversity programme has primarily added funding to existing research, but the new direction in poplar genetics has clearly been facilitated by this funding.

Future research at this reporting entity will to some extent maintain a clear biodiversity aspect, as biodiversity related research plays a role for some but not all involved researchers.

The publication record of this entity is generally excellent with several papers in top ranking, disciplinary journals and more general high ranking journals (for example, Nature, PNAS, and Science). The output of PhD students is not impressive. Although there is some heterogeneity in quantity and quality of research output, the entity as a whole is very strong, and productive. Overall, the research by this reporting entity is **excellent** to **very good**, with a **high** to **medium** relevance for biodiversity science.

Relevance Committee review:
Relevance assessment: **Very Good**

The funding was helpful in focussing on the biodiversity research but with some projects only changing slightly. There was much difference between ecosystems reacting to fertilization.

Forest fertilization depends not on free inorganic Nitrogen but as amino acids, Arginine being used as a fertilizer, which causes further eutrophication.

Carbon sequestration an important issue, with forest companies as stakeholders.

Technology important for research, but unclear who the entity saw as the stakeholders or what their role was.

Spruce genome sequence now possible to undertake this – after work for many years on aspens, even if they are not currently seen as useful for forestry.

Dormancy is more important in spruce, but the question is to get the right genetic markers. Forest genetics is very complex so we have to use model systems.

Swedish Museum of Natural History (NRM)

Arne Anderberg, David Cantrill, Per Ericson[H], *Else Marie Friis*[R], *Ulf Jondelius, Anders Tehler, Mats Wedin*[H], *Lars Werdelin*[H], *Swedish Museum of Natural History*

Science Committee review:
Research at this entity is primarily collection-based (NRM stores ca 10 Million specimens), systematic research and falls into three broadly defined categories; namely biology (botany, mycology, and zoology), palaeontology, and geology (not included here). Biodiversity research at this entity is highly focused on i) classification of present day diversity through taxonomy (both at the whole organism and molecular level) ii) reconstructing the Tree of Life, and iii) determination of evolutionary changes through time leading to present day diversity. Beyond any doubt it has world class recognition in many aspects of this research and a key player in international collaborations.

The biodiversity funding has been a highly needed input in an often neglected area of outmost importance for biodiversity research.

NRM has clearly formulated idea where to go in the future: Evolution and diversity of Life, Ecosystems and Species History, Man and the Environment, and The Changing Earth. However, several pressing infrastructure needs must be meet, if NRM is to maintain its international position. The applied aspects of the research output from NRM are also well recognized and this facility plays an extremely important role in the public understanding of science through its museum collections and outreach programmes.

Overall all research groups are doing research of a high quality – some of the research groups are among the very best on the Globe. This, in combination with a large international collaborative network and excellent publication record, results in an **outstanding** research record and biodiversity science of a **very high** relevance.

Relevance Committee review:
Relevance assessment: **Good**

NRM is one of the museums under the Ministry of Culture. Its research covers mineralogy to systematics, and also environmental pollution, with 50 researchers. The main research focus is however on taxonomy and systematics.

Research output leads to increased knowledge about species. This is relevant for legislation, as species lists in different parts of the world relate to species conservation. Many projects at NRM have direct relevance for conservation, by describing biodiversity but also by assessing threats towards the (newly discovered) species. Taxonomy is never finished; many new species are being described even in Sweden every year.

There are many stakeholders in this research. The conservation community as a whole is one stakeholder. General public is another, who wants to know about nature through exhibitions at the museum. Phylogenetic studies enable follow-up research that can be more applied, in fields such as community ecosystem ecology. In future phylogeny will more clearly pervade all fields of biology, both basic and applied. Some very tenuous links between phylogenetics and ecosystem service delivery were described.

Species description serves one purpose, looking at history another. History helps us to predict what will happen with biodiversity over time. Invasive species are not favoured by funding direction as the Swedish Research Council's biodiversity funds cover only 50 percent of the research that is important for biodiversity, so a lot of research is not attempted

NRM is a member of the International Union for Conservation of Nature (IUCN) and the Swedish IUCN Committee is chaired by the museum. The museum states it cannot work without conservation dialogue. They are

members of IUCN specialist groups – but this is not dialogue. They have enormous amounts of dialogue with amateurs and professionals, who deposit collected materials in the museum. Cryptogrammic botany is an accepted field of conservation in Sweden, can also be used as an indicator for biodiversity in general.

The additional funding has helped a lot. It has increased the amount of research, but not changed its direction drastically. It has added components not dealt with before.

Swedish University of Agricultural Sciences, Umeå

Anders Granström, Joakim Hjältén[H]*, Hjalmar Laudon*[R]*, Marie-Charlotte Nilsson, David Wardle, Lars Östlund, Forest Ecology & Management, Swedish University of Agricultural Sciences*

Lars Edenius, Göran Ericsson, Inga-Lill Persson, Wildlife, Fish and Environment, Swedish University of Agricultural Sciences

Anna Ringvall, Forest Resource Management, Swedish University of Agricultural Sciences

Anna Shevtsova[+]*, Department of Medical Biochemistry and Biophysics*

Science Committee review:

This is a multi- and sometimes interdisciplinary research entity with as overarching objective to provide a scientific basis for understanding environmental responds to, and interaction with, natural and anthropogenic drivers. Their focus on past and current human nature interactions and biodiversity is very practical and relevant. The strong aspects of their research are participation in six long term chronosequences worldwide and local long-term experiments in Swedish forests. The proposed link between above and belowground communities has lead to a world leading publication. The research output by this project is coherent and of outstanding quality. The work in this entity is very collaborative, with notable international collaborations.

The biodiversity funding has influenced the direction of research and increased the focus on biodiversity. There is an increase in focus on interdisciplinary work, and collaboration between projects and the possibility for more 'holistic' approaches, for example involvement of social sciences (economics) and more applied research.

Overall the research conducted in this entity is **excellent**. The relevance to biodiversity science is **very high** to **high**.

Relevance Committee review:
Relevance assessment: **Very Good – Excellent**

A strong focus is on forest ecosystems, and the Mistra project Future Forests is important to the entity. Much of their work is management driven.

A diverse entity, differing in aspects of the societal relevance of its science. As a whole the entity covers aquatic and terrestrial forest ecosystems, with a strong focus on human use or influence on biodiversity, including involvement with Sámi.

There has been a fluctuating emphasis on relevance and science. In an earlier period the emphasis was strongly on relevance, and now relevance is more important again, but during activities covered by the review period science was most important.

Stakeholders tend to be mostly not involved in planning of projects, but where they have, leads to extremely useful results. There is increasing interest in stakeholder involvement. The main stakeholders for lake management are both the National Board of Fisheries and counties. Stakeholder involvement has worked both ways – for forest companies. Bergvik Skog (a company) developed a strategy about future conservation, including set asides for all forests > 150 years. This initiative was taken by Bergvik Skog on the basis of the research results. Any relationship with the FSC has yet to be clarified. The new large Mistra project Future Forests may change the current level of cross-institutional co-operation which at present is rather low.

There will be increased interest in GM trees in future but there seems no likely commercial use for another 20–25 years. But more and more tree lines will become available. Environmental impacts and benefits should be compared with current forestry, and for instance alien species. At present there are few stakeholders for GM trees – with little interest from forestry companies, and negative from public. Producers of GM trees and government are, however, interested.

Zoology at Lund University

Thomas Alerstam, Staffan Bensch, Christer Brönmark, Bengt Hansson, Christer Hansson, Katarina Hedlund, Jon Loman, Jan-Åke Nilsson, Sven G Nilsson, Ola Olsson, Lars Bertil Pettersson, Henrik Smith[R,H]*, Erik Svensson, Torbjörn von Schantz, Susanne Åkesson, Department of Ecology, Lund University*
Axel Janke, Department of Cell and Organism Biology, Lund University

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Science Committee review:

This entity contains a broad and vibrant collection of zoological disciplines, with the biodiversity funding facilitating some clear emergent strengths in biodiversity science. Evolutionary biology and ecology, including creative use of molecular genetic tools, forms the core, with additional contributions ranging from chemical (pollution ecology) to parasitology (especially avian malaria) and animal behaviour. The taxa studied range from soil microbes to fish, wasps, butterflies, amphibians, and birds. In many cases the target species were chosen because they were important in aquatic and agricultural systems (for example fish, butterflies, and birds), or because they were ideal model organisms to test theory in free-living populations. Some of the particular strengths for biodiversity science emerging from this entity include exploration of ecosystem services, investigation of persistence of small populations faced with inbreeding depression or stressors from land use or climate change, and explorations specifically connecting avian behavioural and population dynamic studies to policies and human dimensions of agriculture and forest landowners. Some of the investigations into evolutionary (physiological) ecology of birds and behavioural ecology of insects had strong potential to advance biodiversity science that was not exploited or explained by the investigators in their reports. Overall, across the entity, publications are numerous and high in quality and international appeal.

Several investigators in this entity are beginning to make real contributions to biodiversity conservation by reaching across disciplinary lines to collaborate with social scientists and economists; future funding will be required to enrich and broaden these important nascent collaborations. These infrastructure needs are underscored by the observation that the biodiversity funding allowed several promising young researchers to enter the field, and absence of the funding has caused others to have to leave the field or leave Sweden.

Overall, quality of the research is **excellent** to **outstanding** overall, and application of the research to biodiversity science is **very high** to **medium**.

Relevance Committee review:

Relevance assessment: **Good**

The focus on malaria in animals, giving information on speciation in malaria is important. Also important information on biodiversity effects under climate change – malaria may change distributions in wild species. The stakeholders here may be the Swedish EPA and possibly the veterinary authorities, but it is developing basic understanding of biodiversity. Stakeholders may rather be European or global.

The limnology work is investigating top-down relationships, modified by looking at more detailed mechanisms. New work is a more detailed understanding of lakes-stakeholders but general results have been used in lake restoration etc. Limnology has particularly strong interaction with stakeholders.

To stakeholders each individual piece of research may not be interesting, but results can be packaged together to make it interesting. Sometimes afterwards, stakeholders are not always involved in the whole processes. But now there are also projects where stakeholders have been involved more from the beginning. More people are available with superficial knowledge that can contribute. Sometimes interaction with stakeholders is difficult because they are too far away from science. Of course the same holds for scientists not understanding the policy process. Sometimes stakeholders have very strong views based on practice, earlier results or exaggerated results from other groups. Those views have to be changed.

Zoology at Stockholm University and Linköping University

Anders Angerbjörn[H], *Niklas Janz*, *Bengt Karlsson*, *Cecilia Kullberg*, *Linda Laikre*, *Sami Merilaita*, *Sören Nylin*[R,H], *Nils Ryman*[H], *Niklas Wahlberg*, *Department of Zoology, Stockholm University*
Fredrik Ronquist, Swedish Museum of Natural History
Per Jensen , IFM Biology, Linköping University

Science Committee review:
The biodiversity research conducted by this entity builds on and extends a strongo foundation in basic science. Evolutionary ecology forms the core strength of the entity, with particular focus on butterflies as focal species. Other globally competitive research programmes in this entity include ecology, genetics, and systematics on species ranging from foxes to birds, wasps to fish. Some of the areas with highest impact for biodiversity research include mechanisms of insect diversification; temperature-related butterfly life history traits responding to climate change; community and population dynamics across large and complex systems with high profile endangered species such as Arctic fox; behaviour and taxonomy of domestic and wild fowl; and application of population genetics principles to designate species and subspecies into management units for conservation decision-making. The entity as a whole has demonstrated high productivity, with numerous publications of high impact in top international journals, and impressive

training of young researchers who are being hired by agencies needing expertise in biodiversity science.

The funding for biodiversity research has helped direct this entity to uncover mechanisms maintaining biodiversity, and the scientific basis of biodiversity conservation. To sustain the world-class progress made by this entity – including the unravelling of complex relationships across large spatial and temporal scales that contributes in unique ways to a more unifying theory of biodiversity – will require substantial future investment into long-term research programmes. Likewise, the global contributions in taxonomy, evolutionary biology and conservation genetics will require continued investment in DNA technologies and analytical tools.

Overall the quality of the ecological and evolutionary biology research in this entity is **outstanding** to **excellent**, with a **very high** to **high** relevance of the research to biodiversity science.

Relevance Committee review:

Relevance assessment: **Good**

The research set-up is the same as it has been over the decades, although as research approaches and methods have changed, this has led to changed attitudes and perspectives.

But the same basic problem remains; a threatened species is a threatened species.

Interest for Arctic and Subarctic regions has increased to a higher level with political interest in the Arctic, and from NGOs and civic society. The research on butterflies is basic, but has informed more applied research.

The focus is to understand and help manage change, as well as helping conservation. Results which interpret change are always useful. It is often difficult to convince people of the importance of genes in addition to species and populations. Genetic techniques are not straightforward. Now there are new targets, so the forest people must be convinced that forest trees also have genes. Same for fish, mammals (wolf), etc.

Stakeholder dialogue is not strong: Some links to the European Environment Agency (EEA). Many meetings to dialogue with authorities, but seemingly forestry agencies are not especially interested. Actions promoted by CBD are seen as too difficult or expensive to implement by foresters. Some policy involvement in forestry issues but this is difficult.

Students are taught the language of policy etc. so that they can continue into this direction. One needs to produce PhD students in order to receive funding. The PhD students are doing well, but it takes money out of other possible subjects.

Zoology at University of Gothenburg

Malte Andersson, Staffan Andersson, Donald Blomqvist, Torgny Bohlin, Christer Erséus[H], *Lars Frölin, Frank Götmark*[R,H], *Susanne Holmgren, Johan Höjesjö, Christoffer Schander, Bengt Silverin, Per Sundberg, Department of Zoology, University of Gothenburg*

Bengt Gunnarsson, Plant and Environmental Sciences, University of Gothenburg

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Science Committee review:

The research in this entity is eclectic and diverse, spanning ecology, evolution, animal physiology, and classic forest ecology and conservation biology. Many of the researchers are recognized as leaders in evolutionary ecology – from animal behaviour, to limnology and aquatic ecology, to use of phylogenies in comparative biology, to mechanisms of metapopulation persistence – as a result of high profile journal and book publications. The biodiversity funding has trained numerous young scientists across these subdisciplines, and in some cases has reinvigorated more senior scientists to pursue new biodiversity-related directions. A striking example of how the biodiversity funding has transformed research directions includes the adoption of molecular tools by several ecologists and classical taxonomists to produce novel insights into structure and function of biodiversity. Several workers used the biodiversity funding to simply continue the trajectory of their previous work that was already relevant to biodiversity research (for example effects of pollution on fish dynamics, bird molecular phylogeny, role of coarse woody debris in forest ecology). A few others did not make clear connections between their work in behavioural, physiological, or evolutionary ecology and development of biodiversity science. Desired future directions for some in this entity include increasing capacity for bioinformatics, and increasing intersections between urban planning and forest and animal ecology. However, counter to this suggestion to increase funding for large-scale, collaborative science built around genomics technology and cross-linking collaborations, others argued that at least some funding should be retained to support creative, spontaneous investigations by single or small groups of investigators. A major opportunity exists within this entity to explicitly connect to biodiversity science some of the excellent basic research in fields from behavioural to physiological to evolutionary ecology.

Overall, the quality of science in this entity ranges from **excellent** to **good**, with relevance to biodiversity science being **high** to **medium**.

Relevance Committee review:

Relevance assessment: **Good**

The stakeholders depend on the subject. For basic research, media and general public are important. For conservation projects, county administrations, conservation boards, forest administrations, limnology offices etc. Networking with stakeholders is growing more today than during review period; *increasing requests for networking are becoming a problem*. A mix of partnership research is good, but must be within the science framework. If everything is interdisciplinary; then there is no focus. Interaction with stakeholders is not usually funded. Basic funding is being reduced, the funding that was used to finance teaching and basic research, in order to be more strategic. This is done in-house using bibliometrical analyses, ending up in groups that already have the big money from external sources.

The whole set of projects on forest management is based on stakeholders. The issue is the need to balance between basic and applied research. There has been progress with applied research in Sweden. The main problem is the connection with those responsible for management, for example protected areas. Some research has little empirical basis. In systematics there has been a revolution, from being a supportive science working on patterns to a process-oriented molecular science not only working for museums, but dealing with tools useful to other biologists etc. So even without funding there was more interaction with stakeholders.

The main effect of increased biodiversity funding was more research, good research, but for individual projects. It shows that this kind of research can be successful too. But not much happened. Some question on the whole value of biodiversity concept.

Communication can be important, including a newsletter with broad circulation, taken up by magazines, leading to contacts from journalists etc.

APPENDIX 3: LIST OF PROJECTS, PRINCIPAL INVESTIGATORS AND REPORTING ENTITIES

Botany and Mycology at University of Gothenburg

Main grant holder	Source	Title	Amount (SEK)	Duration
Larsson, Ellen	Formas	Diversity, host specificity and ecological preferences in ecto-mycorrhizal fungi.	715 000	2005–2007
Molau, Ulf	Formas	Indicator ecosystems in the northern Scandes: sensitivity analysis in a changing climate	1 416 000	2005–2007
Oxelman, Bengt	VR*	Evolution of the RPB2 gene in flowering plants	390 000	2002–2002
Oxelman, Bengt	Formas	Molecular taxonomy of Silene (Caryophyllaceae)	1 040 000	2002–2004
Oxelman, Bengt	Formas	Molecular taxonomy of Silene (Caryophyllaceae)	1 080 000	2004–2006
Oxelman, Bengt	VR	Genome evolution within flowering plants as revealed by RNA poly-merase gene sequences	2 025 000	2004–2006
Oxelman, Bengt	Formas	Informatics, taxonomy, and phylo-genetics of Silene (Caryophyllaceae)	1 899 450	2006–2009
Oxelman, Bengt	VR	Gene phylogenies as a means for the detection of reticulate evolutionary relationships and positive selection in flowering plants	2 532 000	2007–2009
Persson, Claes	VR	Publication of Flora of Ecuador	1 176 240	2003–2005
Persson, Claes	VR	Neotropical plants: cladistic bio-geography and molecular syste-matics	1 215 000	2005–2007

* *Swedish Research Council (VR)*

Botany at Stockholm University and Bergius Botanic Garden

Main grant holder	Source	Title	Amount (SEK)	Duration
Bergman, Birgitta	VR	Marine nitrogen-fixing cyano-bacteria: diversity and significance	1 105 000	2002–2003
Birgersson, Katariina Kiviniemi	Formas	Population dynamics of annual grassland species, from local to regional scale.	337 000	2002–2006
Birgersson, Katariina Kiviniemi	Formas	Population dynamics of annual grassland species, from local to regional scale.	1 432 000	2004–2006
Bremer, Birgitta	VR	Equipment for the biodiversity study of the plant family Rubiaceae	1 050 000	2002–2002
Bremer, Birgitta	VR	Biodiversity studies of a large tropical plant family – rubiaceae	2 025 000	2005–2007
Ehrlén, Johan	Formas	Can we trust the predictions of population viability analysis? – An empirical assessment for perennial plants	1 170 000	2002–2005
Ehrlén, Johan	Formas	Land use, genetic differentiation and viability of plant populations	1 014 000	2004–2007
Ehrlén, Johan	Formas	Modelling plant population via-bility in changing environments	1 295 000	2005–2007
Ehrlén, Johan	Formas	Land use, genetic differentiation and viability of plant populations	2 447 550	2007–2009
Eriksson, Ove	VR	Plant invasions and diversity – experimental studies in marine and terrestrial systems	384 800	2002–2002
Eriksson, Ove	Formas	Biological diversity values in traditionally managed grasslands: indicators, landscape context and restoration	1 170 000	2002–2004
Eriksson, Ove	Formas	Biological diversity values in semi-natural grasslands: indicators, land-scape context and restoriation	1 080 000	2004–2006
Eriksson, Ove	VR	Recruitment processes in plant communities and their implications for invasion, species richness and evolution of seed size	1 620 000	2005–2007

Main grant holder	Source	Title	Amount (SEK)	Duration
Eriksson, Ove	Formas	The value of forest grazing and previously cultivated grasslands for plant biodiversity in semi-natural grasslands	1 456 000	2005–2007
Eriksson, Ove	Formas	The role of propagule pressure for shifts in vegetation composition: niche vs dispersal assembly of semi-natural grasslands and deciduous forest communities	2 170 000	2007–2009
Eriksson, Torsten	VR	The role of Allopolyploidy in the Evolution and Biodiversity of Potentilleae (Rosaceae)	1 215 000	2005–2007
Hambäck, Peter	Formas	Marine influences on coastal food webs: predicting the importance and effects of chironomids and algal driftwalls on shore-line species composition.	2 695 000	2005–2007
Hambäck, Peter	VR	From behaviour to community patterns: The role of search modality for the species density-distribution and community composition	2 303 000	2007–2009
Jerling, Lenn	Formas	Exploateringen av stränder i Stockholms skärgård – effekter på biologisk mångfald	1 080 000	2004–2006
Schönenberger, Jürg	VR	Floral diversity and evolutionary history in Ericales	1 215 000	2005–2007

Cell and Molecular Biology and Microbiology at Uppsala University

Main grant holder	Source	Title	Amount (SEK)	Duration
Andersson, Dan	VR	Genomic variation and stability	1 890 000	2004–2006
Gyllensten, Ulf	VR	Assessing human genetic variation at a global scale	1 352 000	2003–2003
Gyllensten, Ulf	VR	Assessing human genetic variation on a global scale – Genomics perspective on human evolution	3 865 000	2004–2006
Gyllensten, Ulf	VR	Identification of genetic determinants (QTL) for quantitative clinical traits in European populations – part of the project "EUROSPAN – quantifying and harnessing genetic variation for gene discovery"	2 400 000	2007–2009
Hellman, Lars	VR	Evolution of diversity and complex effector functions in the immune system of vertebrates	650 000	2002–2002
Hughes, Diarmaid	VR	Bacterial microevolution: genetic responses to impaired growth potential.	1 200 000	2006–2008
Kirsebom, Leif A.	VR	tRNA as a tool to study molecular biodiversity	390 000	2002–2002
Larhammar, Dan	VR	Gene duplications in chordate evolution: co-evolution of receptors and ligands	3 645 000	2004–2006
Larhammar, Dan	VR	Gene duplications in chordate evolution: co-evolution of receptors and ligands	2 700 000	2007–2009
Ohlsson, Rolf	VR	Meiotic drive and genetic diversity in animal populations	975 000	2002–2002

Earth and Ecosystem Sciences at Lund University

Main grant holder	Source	Title	Amount (SEK)	Duration
Broström, Anna	Formas	Revealing the dynamics of discontinuous management and biodiversity at different spatial and temporal scales in the traditional cultural landscape	1 768 500	2006–2009
Smith, Benjamin	VR	Combining climate modelling and dynamic ecosystem modelling to investigate climate changes and their impacts over northern europe	1 215 000	2004–2006
Ström, Lena	VR	The impact of vascular plant diversity on the functioning of wet tundra environments	811 200	2003–2003
Sykes, Martin	Formas	Species diversity in a changing landscape	810 000	2004–2007
Sykes, Martin	VR	Biodiversity, ecosystem function and the role of long term land use	810 000	2005–2007
Sykes, Martin	Formas	Species diversity in a changing landscape	2 190 000	2007–2009

Ecology and Evolution at Uppsala University

Main grant holder	Source	Title	Amount (SEK)	Duration
Bertilsson, Stefan	Formas	Cyanobacterial blooms and diversity of associated bacterioplankton: phylo-genetic and functional coupling	850 000	2002–2004
Bertilsson, Stefan	VR	Linking microbial diversity and individual populations to hetero-trophic ecophysiology in freshwater systems	405 600	2003–2003
Bertilsson, Stefan	VR	Heterotrophic Microorganisms and the Carbon Cycle: Linking Bacterial Diversity to Ecosystem-Scale Processes	270 000	2005–2005
Bertilsson, Stefan	Formas	Influence of solar radiation on bacterial community composition in lakes	2 000 000	2006–2009
Björklund, Mats	Formas	Patterns of speciation in Swedish Cyprinid fish	1 300 000	2002–2003

Main grant holder	Source	Title	Amount (SEK)	Duration
Björklund, Mats	Formas	Genetic variasion of otters (Lutra lutra) in Sweden	1 080 000	2004–2006
Björklund, Mats	Formas	Patterns of speciation in Swedish Cyprinid fish	900 000	2004–2006
Björklund, Mats	VR	Ecology of speciation	2 160 000	2005–2007
Björklund, Mats	Formas	Evolutionary response to climate change	2 065 000	2007–2009
Eklöv, Peter	Formas	Ecological and evolutionary processes affecting biodiversity in fish communities	1 690 000	2002–2006
Eklöv, Peter	Formas	Ecological and evolutionary processes affecting biodiversity in fish communities	1 560 000	2004–2006
Eklöv, Peter	VR	Mechanisms behind phenotypic divergence and genetic differentiation in fish populations	1 215 000	2007–2009
Ekman, Jan B	VR	Cooperation in kin groups; the role relatedness, ecology and evolutionary history	910 000	2002–2002
Ekman, Jan B	Formas	Unhatched eggs and risk analses of population decrease in Tree Sparrows in Sweden – a problem related to agriculture?	1 144 000	2002–2004
Ekman, Jan B	Formas	Hunting efficiency of visual predators in thinned forests	1 170 000	2002–2004
Ekman, Jan B	Formas	Unhatched eggs and risk analses of population decrease in Tree Sparrows in Sweden – a problem related to agriculture?	1 208 000	2004–2006
Ekman, Jan B	Formas	Thinning practices and the role of visually hunting predators – birth/death processes in forest habitat	1 208 000	2004–2006
Gunnarsson, Urban	Formas	Diversity of Swedish mires: peat accumulation, regionality, conservation and response to environmental change	2 025 000	2004–2009
Gustafsson, Lars	Formas	Genetic variation, heterozygoti, inbreeding and gene flow in relation to population size and environmental variation	1 690 000	2002–2004

Main grant holder	Source	Title	Amount (SEK)	Duration
Gustafsson, Lars	Formas	Genetic variation, heterozygocity, inbreeding and gene flow in relation to population size and environmental variation	1 100 000	2002–2007
Höglund, Jacob	VR	Phylogenetic Ecology	390 000	2002–2002
Höglund, Jacob	Formas	Cumulative impact assessment of local landscape change on habitat connectivity for black and hazel grouse	1 040 000	2002–2004
Höglund, Jacob	Formas	Cumulative impact assessment of local landscape change on habitat connectivity for black and hazel grouse	1 144 000	2004–2006
Höglund, Jacob	Formas	Genetic variation and conservation biology: studying adaptive genetic variation in Swedish natterjack toad populations	1 782 000	2006–2009
Laurila, Anssi	Formas	Effects of human-induced environmental change on a long-lived vertebrate: mechanisms of local adaptationand acid stress tolerance in the moor frog	425 000	2002–2003
Laurila, Anssi	VR	Adaptation along latitudinal gradients: an evaluation of physiological mechanisms and ecological constraints	520 000	2002–2003
Laurila, Anssi	VR	Adaptation along environmental gradients: an evaluation of physiological, behavioural and life-history mechanisms	703 040	2003–2004
Laurila, Anssi	Formas	How adaptable are threatened populations?	1 880 000	2005–2007
Laurila, Anssi	VR	Adaptation along latitudinal gradients: integrating genetic and physiological mechanisms into studies of life history variation	2 430 000	2005–2007
Lindström, Eva	VR	Are local or regional forces shaping local microbial community structure and function?	1 215 000	2006–2008

Main grant holder	Source	Title	Amount (SEK)	Duration
Qvarnström, Anna	Formas	Replacement of species: interaction between hybridization and interference competition	2 362 500	2006–2008
Qvarnström, Anna	VR	Speciation and evolution in hybrid zones	2 835 000	2007–2009
Rydin, Håkan	Formas	Modelling epiphytic diversity in the forest landscape	2 020 000	2002–2006
Rydin, Håkan	VR	The role of Sphagnum in biodiversity switches	1 215 000	2006–2008
Rydin, Håkan	Formas	Mire bryophytes as environmental indicators	1 822 500	2006–2008
Stenøien, Hans Kristen	VR	Molecular basis of ecological adaptation in the model organism Arabidopsis lyrata (Brassicaceae)	1 487 200	2003–2004
Tranvik, Lars	VR	Microbial diversity and ecosystem functioning – experimental studies of aquatic microbial communities	910 000	2002–2002
Tranvik, Lars	VR	Microbial diversity and ecosystem functioning: the degradation of aquatic organic matter	2 025 000	2004–2006
Tranvik, Lars	VR	Microbial diversity and ecosystem functioning: redundancy and resilience in communities degrading aquatic organic matter	2 430 000	2007–2009
Ågren, Jon	VR	Ecological genetics of plant adaptation	2 430 000	2004–2006
Ågren, Jon	Formas	Functional and adaptive significance of genetic variation in natural plant populations	2 145 000	2005–2007
Ågren, Jon	VR	Ecological genetics of plant adaptation	2 430 000	2007–2009
Ödeen, Anders	VR	The roles of inbreeding and the rare-male effect for evolution in small, peripheral populations	390 000	2003–2003

Ecology at Lund University

Main grant holder	Source	Title	Amount (SEK)	Duration
Brodin, Anders	VR	Is neurecology a valid approach or not?	270 000	2004–2004
Hansson, Lars-Anders	Formas	Effects of seasonal migration in fish on alternative stable states in shallow lakes and wetlands	2 340 000	2002–2003
Hansson, Lars-Anders	Formas	Effects of seasonal migration in fish on alternative stable states in lakes and wetlands	2 294 000	2005–2006
Johansson, Tomas	VR	The ectomycorrhizal symbiosis: Characterization of symbiosis-related genes and assessment of functional diversity	910 000	2002–2003
Kelber, Almut	VR	Visual ecology – how animals use their eyes to discriminate colour and space	2 430 000	2004–2006
Lundberg, Per	VR	Visiting scientist grant, NCEAS, Santa Barbara, USA	390 000	2002–2002
Lundberg, Per	VR	Communities, food webs and networks	1 822 500	2005–2007
Löfstedt, Christer	VR	Evolution of novel pheromone systems – linking molecular insight with fundamental ecological and evolutionary questions about speciation	2 025 000	2005–2007
Löfstedt, Christer	Formas	Assortative mating and speciation among host plant races and pheromone strains of the European corn borer Ostrinia nubilalis – a genomic approach	1 782 000	2006–2008
Nilsson, Dan-E.	VR	Eye design and the evolution of vision	4 867 200	2003–2005
Persson, Anders	Formas	The functional diversity of wetlands – linking community organisation and nutrient retention	1 144 000	2002–2003
Persson, Anders	Formas	The functional diversity of wetlands – linking community organisation and nutrient retention	1 110 000	2004–2006

Main grant holder	Source	Title	Amount (SEK)	Duration
Persson, Anders	Formas	Ecosystem responses to estrogen: A field experiment	2 975 000	2007–2009
Rengefors, Karin Elisabeth	VR	Are freshwater algae cosmopolitan? – A study of biodiversity and biogeography	811 200	2003–2003
Rengefors, Karin Elisabeth	VR	Biogeography in aquatic eukaryotic microorganisms: evolutionary jumps between limnic and marine systems	1 215 000	2007–2009
Romare, Pia	Formas	Konsekvenser av förändringar i sjöars strandnära områden för akvatiska organismers beteendesamspel och artdiversitet. Repatrieringsbidrag	312 000	2003–2004
Romare, Pia	Formas	Linking climate change, cascading behavioural interactions and the spring clear water phase	1 380 000	2006–2009
Tunlid, Anders	VR	Genomic adaptations in symbiotic fungi	2 025 000	2005–2007
Warrant, Eric	VR	The diversity and evolution of vision in animals from different marine habitats	1 300 000	2002–2003
Warrant, Eric	VR	Seeing in the dark: the diversity and evolution of vision in nocturnal and deep-sea animals	2 025 000	2004–2006
Weisner, Stefan	Formas	Interactions between biodiversity, plant composition and ecosystem functioning in constructed wetlands	1 140 000	2004–2006
Weisner, Stefan	Formas	Interactions between biodiversity, plant composition and ecosystem functioning in constructed wetlands	1 100 000	2006–2007
Åbjörnsson, Kajsa	Formas	The importance of predator-prey interactions to the diversity and functioning of aquatic systems	3 196 750	2006–2009

Ecology at Swedish University of Agricultural Sciences

Main grant holder	Source	Title	Amount (SEK)	Duration
Angelstam, Per	Formas	Forest habitat thresholds for biodiversity management in stands and landscapes – analyses of species and habitats in European forest history gradients	1 296 000	2002–2004
Angelstam, Per	Formas	Forest habitat thresholds for biodiversity management in landscapes – analyses of species and habitats in European forest history gradients	1 648 000	2003–2007
Angelstam, Per	Formas	Two-dimensional gap analysis of formal and voluntary forest protection for biodiversity conservation	3 930 000	2007–2010
Bengtsson, Jan	Formas	Biodiversity and resilience: Ecological and institutional mechanisms	2 115 000	2002–2005
Bengtsson, Jan	Formas	Biodiversity and resilience: Institutional and ecological mechanisms	1 844 000	2002–2006
Bengtsson, Jan	VR	Biodiversity, spatial dynamics and ecosystem resilience	1 622 400	2003–2005
Bengtsson, Jan	Formas	Den ekologiska odlingens landskapsekologi: Biodiversitet, ogräsevolution, biologisk kontroll och brukarmedverkan (FORSKNINGSTEMA)	2 814 000	2004–2007
Bengtsson, Jan	VR	Biodiversity, spatial dynamics and ecosystem resilience	3 240 000	2006–2008
Gustafsson, Lena	Formas	Biodiversity and economy – balance between protected areas and management of matrix	195 000	2002–2003
Gustafsson, Lena	Formas	Biodiversity and economy – balance between protected areas and management of matrix	3 600 000	2003–2005
Gustafsson, Lena	Formas	Biodiversity and economy – balance between protected areas and management of matrix	4 600 000	2005–2008
Gustafsson, Lena	Formas	Set aside of young forest – biodiversity and economy	3 028 000	2007–2010

Main grant holder	Source	Title	Amount (SEK)	Duration
Jonsell, Mats	Formas	Effects of distribution and predictability of dead wood substrates on saproxylic insects	2 067 000	2002–2005
Jonsell, Mats	Formas	Effects of distribution and predictability of dead wood substrates on saproxylic insects.	1 044 000	2003–2007
Lennartsson, Tommy	Formas	Plant population viability in managed seminatural grasslands: Significance of spatio-temporal variation in habitat & management	1 300 000	2003–2005
Lundhagen, Anna	Formas	Genetic and morphologic variability in core, peripheral and isolated populations of the scarce heath; a rare butterfly in Western Europe	810 000	2004–2006
Långström, Bo	Formas	Interdependence between secondary and primary insect colonizers of fire-damaged trees	208 000	2002–2004
Persson, Tryggve	Formas	Soil fauna diversity in response to wildfire and prescribed burning in forest systems	1 112 000	2002–2004
Persson, Tryggve	Formas	Effekter av skogsbrand och kontrollerad bränning på markfaunadiversitet i skogsmark	1 418 000	2004–2006
Pärt, Tomas	Formas	Agricultural intensification and the demise of farmland birds – from individuals to landscapes to cost effective management	1 170 000	2002–2004
Pärt, Tomas	VR	Constraints and strategies of habitat selection and dispersal and their consequences for long-term persistence of populations	2 028 000	2003–2005
Pärt, Tomas	Formas	Agricultural intensification and the demise of farmland birds – the importance of landscape heterogeneity	1 188 000	2005–2007
Pärt, Tomas	VR	Dispersal, habitat selection and population dynamics	1 620 000	2006–2008

Main grant holder	Source	Title	Amount (SEK)	Duration
Ranius, Thomas	Formas	Economic analysis of a bio-diversity-oriented forestry in Sweden	1 980 000	2002–2005
Ranius, Thomas	Formas	Predicting extinction risks for threatened wood-living insects in dynamic landscapes	1 701 000	2005–2008
Ranius, Thomas	Formas	Predicting extinction risks for threatened wood-living insects in dynamic landscapes	1 722 600	2007–2008
Ranius, Thomas	Formas	Evaluation of strategies to maintain lichen populations connected to oak using metapopulation and landscape modelling	1 830 000	2007–2009
Sand, Håkan	Formas	Wolf re-colonisation in Scandinavia – consequences for ecosystem processes and species diversity	1 618 000	2005–2008
Snäll, Tord	Formas	Predictive models for meta-population dynamics in continuously changing landscapes	2 045 250	2006–2010
Snäll, Tord	Formas	Effects of a changed climate on species persistence and dispersal	1 786 500	2007–2010
Söderström, Bo	Formas	Urban biodiversity	2 250 000	2002–2004
Söderström, Bo	Formas	Are tree retention clearcuts benefical for birds?	780 000	2002–2005
Söderström, Bo	Formas	Urban biodiversity	853 000	2002–2006
Weyhenmeyer, Gesa	VR	Predictability of abrupt ecological shifts in lakes induced by climatic changes	800 000	2006–2008
Wikars, Lars-Ove	Formas	Recently burned as habitat for threatened wood-living beetles	1 035 000	2002–2005

Ecology at Umeå University and Mid Sweden University

Main grant holder	Source	Title	Amount (SEK)	Duration
Englund, Göran	Formas	Effects of habitat fragmentation and species introductions on fish diversity	1 170 000	2002–2005
Englund, Göran	Formas	Effects of fragmentation and species introductions on the distribution of freshwater fish	2 423 000	2005–2007
Englund, Göran	VR	Spatial heterogeneity, functional responses and the dynamics of predator-prey interactions	810 000	2005–2007
Ericson, Lars	VR	The importance of biotic interactions for plant population dynamics	1 215 000	2005–2007
Esseen, Per-Anders	Formas	Edge effects in fragmented forests: predicting long-term ecological consequences	1 188 000	2002–2007
Esseen, Per-Anders	Formas	Sustainable management of pendulous lichens in continuity forests	3 153 050	2007–2010
Giles, Barbara	Formas	Coevolution and the maintenance of genetic diversity in shifting genetic landscapes.	1 800 000	2005–2008
Jansson, Mats	VR	Climate impact on productivity and biostructure of high latitude lake ecosystems	1 620 000	2005–2007
Jansson, Roland	Formas	The relative importance of dispersal and local site conditions for plant species diversity in riparian zones	1 566 000	2004–2006
Johansson, Frank	VR	The evolution of phenotypic plasticity in frogs	1 215 000	2004–2006
Johansson, Frank	Formas	Adaptive population divergence in frog populations	1 643 000	2005–2007
Jonsson, Bengt Gunnar	Formas	Prescribed fires as a conservation tool in boreal forests	1 782 000	2006–2008
Malmqvist, Björn	Formas	Adaptation to natural acidity in lotic ecosystems	1 560 000	2002–2005
Malmqvist, Björn	Formas	Adaptation to natural acidity in lotic ecosystems	1 485 000	2003–2007

Main grant holder	Source	Title	Amount (SEK)	Duration
Moen, Jon	VR	The ecological significance of light-harvesting and light-dissipation in plants	810 000	2004–2006
Nilsson, Christer	VR	Prediction of the Global Losses of Freshwater Fish Resulting from River Channel Fragmentation and Flow Regulation	1 215 000	2005–2007
Nilsson, Christer	Formas	Identification of the most appropriate locations for restoration of stream ecosystems	2 671 650	2007–2009
Oksanen, Lauri	Formas	Fjällämmeln – en nyckelherbivor inom våra fjällekostystem?	2 025 000	2004–2007
Oksanen, Tarja	VR	Causes and consequences on bio-diversity of changing microtine dynamics in northern Fennoscandia	2 501 200	2003–2005
Oksanen, Tarja	VR	Niche structure and coexistence of herbivorous and predatory endo-therms in northern taiga and tundra environments	550 000	2007–2007
Olofsson, Johan	Formas	Effects of reideer grazing on bio-diversity at different spatial scales	780 000	2002–2005
Olofsson, Johan	Formas	Effects of reindeer grazing on bio-diversity in arctic-alpine plant communities	1 566 000	2005–2006

Evolution, Genomics and Systematics at Uppsala University

Main grant holder	Source	Title	Amount (SEK)	Duration
Andersson, Siv	VR	Microbial Genome Diversity: Population Biology of Intracellular Parasites	3 412 500	2002–2005
Andersson, Siv	VR	A metagenomics approach to alpha-Proteobacterial diversity	3 000 000	2006–2008
Andreasen, Katarina	VR	Molecular evolutionary processes at lower taxonomic levels in flowering plants: Heterogeneous nuclear DNA and variation in substitution rates	3 808 012	2002–2006
Andreasen, Katarina	VR	Molecular evolutionary processes at lower taxonomic levels in flowering plants: Heterogeneous nuclear DNA and variation in substitution rates	810 000	2005–2006
Bernander, Rolf	VR	Biodiversity: archaea and extremophiles	650 000	2002–2002
Bernander, Rolf	VR	Archaea and extremophiles	1 620 000	2004–2006
Engström, Peter	VR	Evolution of control mechanisms for eproductive development in plants	3 650 400	2003–2005
Götherström, Anders	Formas	Cattle breeding in prehistory: Origin of genetic diversity among European cattle	325 000	2002–2003
Götherström, Anders	VR	Genetic diveristy, domestication and prehistoric cattle breeding	1 216 800	2003–2005
Jazin, Elena	VR	Behavioral Genetics in the Canidae family	2 028 000	2003–2005
Lagercrantz, Ulf	Formas	Gene expression variation in natural populations of plants	1 661 000	2006–2008
Lascoux, Martin	VR	Genetic resources and the understanding of molecular adaptation	650 000	2002–2002
Lascoux, Martin	Formas	Conservation units and speciation: the case of orchild populations	520 000	2002–2004
Lascoux, Martin	Formas	Species hybrids as a result of human mediated introductions and reintroductions – a transient problem?	1 315 000	2002–2007
Thulin, Mats	VR	Plant diversity in the Horn of Africa region	650 000	2002–2004
Thulin, Mats	VR	Plant diversity in the Horn of Africa region	1 215 000	2005–2007

Humanities and Social Science (PI:s)

Main grant holder	Source	Title	Amount (SEK)	Duration
Balfors, Berit	Formas	Impacts of region-wide urban development on biodiversity in strategic environmental assessment	3 168	2005–2009
Duit, Andreas	Formas	Contested Species. An Inter-diciplinary Approach for Under-standingConflict Dynamics in Wildlife Management	1 620 000	2006–2008
Gren, Ing-Marie	Formas	Evaluation of alternative institutions for provision of non-marketed eco-system services	1 498 000	2005–2009
Hahn, Thomas	Formas	The role of dynamic institutions for sustaining biodiversity and resilience of ecosystems: comparing local management in KV and National-stadsparken (NP)	1 860 000	2002–2005
Johansson, Maria	Formas	Biodiversity in the public's mind	370 000	2002–2003
Johansson, Maria	Formas	Public perception of local bio-diversity conservation measures	771 850	2007–2009
Melin, Anders	VR	Biodiversity and ethics – philo-sophical and theological perspectives	3 080 000	2006–2009
Michanek, Gabriel	Formas	New Approaches in Law to Manage Diversity of Species	730 000	2006–2010
Stenseke, Marie	Formas	Local Community participation and learning for enhanced biodiversity	1 555 000	2002–2005
Tunlid, Anna	VR	Biodiversity: establishment and legitimation of a research field	3 080 000	2006–2009
Widgren, Mats	Formas	Wetlands of today – a landscape history	1 000 000	2002–2005
Widgren, Mats	Formas	Wetlands of today – a landscape history	972 000	2004–2007

Landscape and Ecosystems at Stockholm University and Linköping University

Main grant holder	Source	Title	Amount (SEK)	Duration
Cousins, Sara	Formas	Past, present and future land cover change and effects on plant species diversity patterns	1 625 000	2002–2005
Cousins, Sara	Formas	Past, present and future land cover change and effects on plant species diversity patterns.	1 182 000	2002–2005
Cousins, Sara	Formas	Using historical sources and geography to analyse land use influence on dispersal of grassland species and its consequences for diversity in future rural landscapes	1 619 500	2007–2010
Ebenman, Bo	Formas	Community viability analysis: biodiversity and the response of ecological communities to species loss	1 300 000	2002–2005
Ebenman, Bo	Formas	The response of ecosystems to species extinction: vulnerability and sensitivity analysis of model ecosystems	810 000	2004–2006
Ebenman, Bo	Formas	Sårbarhetsanalys av ekologiska samhällen: Biodiversitet och ekologiska samhällens reaktion på artutdöende	1 012 000	2004–2006
Ebenman, Bo	Formas	Biodiversity and robustness of ecological communities in fragmented landscapes: the role of local and regional processes in the response of meta-communities to species loss	2 187 000	2006–2009
Ebenman, Bo	Formas	Ecological community risk assessment: using community viability analysis and sensitivity analysis to assess the robust-ness of ecological communities to biodiversity change	2 755 000	2007–2010
Elmqvist, Thomas	Formas	Are urban ecosystems sinks for animal and plant populations? – surveys and experimental tests along an urban-rural gradient	1 243 000	2004–2006
Elmqvist, Thomas	Formas	Are urban ecosystems sinks for animal and plant populations? – surveys and experimental tests along an urban-rural gradient	1 080 000	2006–2007

Main grant holder	Source	Title	Amount (SEK)	Duration
Elmqvist, Thomas	VR	Structure and dynamics in plant-pollinator networks in fragmented landscapes	1 417 500	2006–2008
Norberg, Jon	VR	Ekonomiska och institutionella instrument för långsiktig förvaltning av biologisk mångfald	845 000	2002–2004
Norberg, Jon	VR	A general trait-based approach for ecology: Understanding ecosystem dynamics and implications for climate impact predictions	364 500	2005–2005
Norberg, Jon	VR	A general trait-based approach for ecology: Understanding ecosystem dynamics and implications for climate impact predictions	540 000	2006–2006
Skånes, Helle	Formas	Landscape memory as means to deal with human impact on biotype resilience and potential biodiversity. Development of integrated methods based on remote sensing	1 765 000	2002–2005

Landscape Architecture, Planning and Management at Swedish University of Agricultural Sciences

Main grant holder	Source	Title	Amount (SEK)	Duration
Berg, Per G	Formas	The importance of Biodiversity in Outdoor Environments, for Personal Development and Well-being	260 000	2002–2003
Florgård, Clas	Formas	Indicators for valuation of bio-diversity in developed areas	250 000	2002–2005
Florgård, Clas	Formas	Preserving and enhancing bio-diversity in urban areas. Edge and Trampling (ET) effects in urban forests at Järvafältet, Stockholm	533 000	2007–2008
Gustavsson, Roland	Formas	Plants and planting design for urban dynamic systems and structures of vegetation – a pilot project on the basis of north-chinese flora and plant communities	2 400 000	2002–2004

Main grant holder	Source	Title	Amount (SEK)	Duration
Lieberg, Mats	Formas	Park Management and Urban Biodiversity. Communication and dissemination of knowledge in Swedish Park Administrations.	1 503 000	2004–2006
Lieberg, Mats	Formas	Park Management and Urban Biodiversity. Communication and dissemination of knowledge in Swedish Park Administrations.	1 080 000	2007–2008
Ljung, Magnus	Formas	Communicating biodiversityh – finding rhetorical tactics in conceptual ambiguity	950 000	2002–2004
Skärbäck, Erik	Formas	Instruments of control as related to Biological Diversity in the Agricultural Landscape	1 115 000	2002–2005

Linnaeus University, Kalmar

Main grant holder	Source	Title	Amount (SEK)	Duration
Forsman, Anders	VR	Ecological and evolutionary consequences of colour polymorphism	975 000	2002–2004
Forsman, Anders	VR	Ecological and evolutionary consequences of colour polymorphism	1 215 000	2005–2007
Gaillard-Lemdahl, Marie-José	VR	The role of natural and human-induced disturbances on landscape and ecosystem dynamics on short to long time scales – "Lessons from the past" for climate risk analysis and landscape-management	1 620 000	2006–2008
Hagström, Åke	Formas	Airborne seeding: a factor influencing bacterioplankton diversity	1 226 000	2002–2004
Hagström, Åke	VR	Bacterioplankton functional diversity and global distribution	2 295 000	2006–2008
Persson, Bengt	VR	Characterization of sensors and signal transduction in regulation of phosphate uptake systems.	272 800	2004–2005
Pinhassi, Jarone	VR	Role of resource availability as a structuring force on bacterioplankton composition	3 672 000	2004–2007

Marine and Limnic Sciences at Stockholm University and Örebro University

Main grant holder	Source	Title	Amount (SEK)	Duration
Asplund, Lillemor	Formas	Effects of naturally produced toxic polybrominated compounds on biodiversity in the Baltic Sea	1 500 000	2002–2005
Bengtsson, Bengt-Erik	Formas	Endocrine disrupting substances in effluents from sewage treatment plants and pulp industry – chemical analysis and effects studies on fish	1 300 000	2002–2004
Elmgren, Ragnar	VR	Biodiversity effects on organic matter processing by deposit-feeding macrofauna.	810 000	2005–2007
Elmgren, Ragnar	Formas	Biodiversity effects on processing of phytodetritus from plankton blooms by deposit-feeding invertebrates	740 000	2006–2008
Gorokhova, Elena	Formas	Cercopagis pengoi – an invander threatening the biodiversity of the Baltic Sea and inland waters	1 957 000	2002–2004
Gorokhova, Elena	Formas	Cercopagis pengoi – an invader threatening the biodiversity of the Baltic Sea and inland waters	1 188 000	2005–2006
Gorokhova, Elena	Formas	What feeds the fish? Zooplankton abundance and productivity in the northern Baltic proper: implications for fish feeding conditions	1 150 000	2006–2008
Olsson, Per-Erik	VR	Zebrafish as a model system for the elucidation of conserved and diverged functions of fushi tarazu factor-1 genes	1 622 400	2003–2005
Törnqvist, Margareta	Formas	Potential danger to ecosystems and biological variation: Development of system for quantitative measurement of exposure to reactive compounds in fish	1 148 000	2002–2005

Marine ecology at University of Gothenburg

Main grant holder	Source	Title	Amount (SEK)	Duration
Hermansson, Malte	VR	Conjugative plasmids involved in horizontal gene transfer in marine bacterial communities – An eco-ligical and functional genomics approach	975 000	2002–2002
Hermansson, Malte	VR	Plasmids as vectors for horizontal gene transfer in bacteria – A study using experimental and bio-informatic tools	1 200 000	2007–2009
Johannesson, Kerstin	VR	Ecological mechanisms of speciation	2 835 000	2005–2007
Johannesson, Kerstin	Formas	Incipient speciation in a marine algal genus (Fucus) and its implications for conservation of a marginal marine area	2 281 500	2007–2009
Jonsson, Per	VR	Behavioural ecology of ciliates in the benthic boundary layer: effects on population dynamics and sediment carbon turnover	1 216 800	2003–2005
Jonsson, Per	Formas	The role of biodiversity for multiple ecosystem functions	707 500	2007–2010
Pavia, Henrik	VR	Inducible chemical defenses in sea-weeds: selective agents, mechanisms and consequences	1 300 000	2002–2004
Pavia, Henrik	VR	Enemy release or intrinsic chemical resistance in invasive versus native biotop-forming seaweed species	2 025 000	2005–2007
Rosenberg, Rutger	Formas	Functional marine biodiversity	1 066 000	2002–2004
Rosenberg, Rutger	Formas	Professur i marin ekologi	2 887 200	2002–2005
Rosenberg, Rutger	Formas	Functional marine biodiversity	972 000	2002–2006
Thorndyke, Michael	VR	Neural regeneration and stem cells in echinoderms	2 028 000	2003–2005
Toth, Gunilla	VR	Herbivore-induced chemical resi-stance in seaweeds – effects of water-borne signals and increasing nutrients	3 623 600	2004–2007
Toth, Gunilla	Formas	Effects of seaweed genetics and hybrid zones on associated bio-diversity, defensive chemistry, and resistance	805 000	2005–2008

Main grant holder	Source	Title	Amount (SEK)	Duration
Toth, Gunilla	VR	Evolution of parasite transmission and host resistance strategies in marine host-trematode interactions	810 000	2006–2007
Åhlund, Matti	Formas	Dynamics of coastal bird populations: long-term effects of nesting-islands with restricted public access	1 498 500	2006–2008

Microbiology at Stockholm University, Royal Institute of Technology, Södertörn University and Karolinska Institutet

Main grant holder	Source	Title	Amount (SEK)	Duration
Haggård, Elisabeth	VR	Bacterial diversity mediated by bacteriophages through horizontal gene transfers	1 137 500	2002–2004
Johansson, Magnus	VR	Characterisation of the biodiversity within the flavivirus genus.	3 095 300	2002–2006
Johansson, Magnus	VR	Characterisation of the biodiversity within the flavivirus genus.	810 000	2005–2006
Kaneko, Akira	VR	Malaria biodiversity and immunity in isolated areas: co-evolution of human, parasite and mosquito on Island Melanesia	900 000	2006–2008
Poole, Anthony	VR	The origin of the eukaryote cell and biodiversity of ribonucleotide reductases	3 808 012	2002–2006
Poole, Anthony	VR	The origin of the eukaryotic cell	702 000	2005–2006
Savolainen, Peter	VR	Towards a comprehensive picture of the genetic origin and history of the domestic dog; analysis of mito-chondrial, Y chromosomal and autosomal DNA, in dogs worldwide	4 052 000	2005–2008
Savolainen, Peter	VR	A study of the earliest genetic history of the domestic dog; colonisation of all continents and development of morphologic variation	1 080 000	2007–2008
Zabarovsky, Eugene	VR	Development of new techniques to quantify the species composition of complex microbial systems, e.g. the normal flora of the gut.	1 800 000	2006–2008

Mycology and Pathology at Swedish University of Agricultural Sciences

Main grant holder	Source	Title	Amount (SEK)	Duration
Asiegbu, Frederick	VR	Fungal Diversity: A Comparative Functional Approach	585 000	2002–2003
Elfstrand, Malin	VR	Molecular control of recognition and developmental processes in arbuscular mycorrhiza	338 000	2003–2003
Högberg, Nils	Formas	Interactive effects of environmental perturbations and functional biodiversity of wood decay fungi – an experimental approach.	1 512 000	2006–2008
Lindahl, Björn	Formas	Functional diversity in basidiomycetous soil fungi with emphasis on chitin degradation	1 820 000	2002–2005
Rosling, Anna	Formas	Functional diversity of ectomycorrhizal fungi in mineral soil	1 522 800	2006–2009
Stenlid, Jan	VR	Fitness and genetic variation of wood-decay fungi in fragmented habitats	1 137 500	2002–2004
Stenlid, Jan	VR	Fitness and genetic variation of wood-decay fungi in fragmented habitats	1 080 000	2005–2007
Stenlid, Jan	Formas	Dieback of common ash (Fraxinus excelsior L.): distribution, characterisation of causal organism and factors influencing disease development	1 969 000	2007–2009
Taylor, Andrew	Formas	Determinants of ectomycorrhizal biodiversity	838 500	2003–2005
Taylor, Andrew	Formas	A mechanistic approach to understanding fungal response to nitrogen fertilization	1 923 000	2005–2008
Taylor, Andrew	Formas	Functional biodiversity of ectomycorrhizal fungi	1 415 000	2007–2008
Vasiliauskas, Rimvydas	Formas	Genetic diversity and ecology of wood-decay fungi: large-scale biocontrol organism in managed stands versus endangered species in fragmented habitats	2 766 000	2002–2005

Plant Biology at Lund University

Main grant holder	Source	Title	Amount (SEK)	Duration
Andersson, Stefan	Formas	Effekter av markkemisk stress på växters genetiska diversitet	2 376 000	2002–2005
Andersson, Stefan	Formas	Kvantitativa genetiska effekter av habitatfragmentering i två gräs-marksväxter	810 000	2004–2007
Bruun, Hans Henrik	Formas	Asian invasion – causes and consequences of the Rosa rugosa invasion	1 478 250	2006–2010
DHertefeldt, Tina	Formas	Insect resistance and life history evolution in wild and feral Brassicas: integrating key processes in population establishment and persistence	1 556 000	2003–2007
Emanuelsson, Cecilia	Formas	Evaluation of strawberry genetypes for selection of future breeding material – stawberry allergy	1 170 000	2002–2005
Emanuelsson, Cecilia	Formas	Evaluation of strawberry genotypes by proteome finger-printing for selection of future breeding material – strawberry allergy	1 620 000	2005–2008
Hedrén, Mikael	Formas	Detailed patterns of speciation and phylogeography in the dactylorhiza incarnata/maculata polyploid complex – a northern European perspective	1 275 000	2002–2005
Hedrén, Mikael	Formas	Genome restructuring and diversity patterns in allotetraploid Dactylorhiza (Orchidaceae) – comparison between glaciated and non-glaciated areas	1 052 000	2005–2007
Hedrén, Mikael	VR	Fine-scale spatial genetic patterns and processes in allopolyploid Dactylorhiza (Orchidaceae)	1 014 000	2007–2009
Kjellbom, Per	Formas	Exploiting natural allelic variation among Arabidopsis ecotypes to identify marker genes for water use efficiency	1 170 000	2002–2004

Main grant holder	Source	Title	Amount (SEK)	Duration
Kjellbom, Per	Formas	Exploiting natural allelic variation among Arabidopsis ecotypes to identify marker genes for water use efficiency	2 264 000	2004–2006
Kjellbom, Per	Formas	Natural allelic variation among Arabidopsis ecotypes – Using biological diversity to identify marker genes for drought stress tolerance	2 205 000	2007–2009
Olsson, Pål Axel	Formas	Soil disturbance impact on mycorrhizal fungal diversity and function	1 248 750	2006–2008
Olsson, Pål Axel	VR	Carbon cycling and plant functions in acid and alkaline grasslands	2 133 000	2007–2009
Prentice, Honor C.	Formas	Landscape, species and genes: diversity and history in fragmented grasslands	1 040 000	2002–2005
Prentice, Honor C.	Formas	Plant hybridization in space and time: evolution and conservation bioilogy	930 000	2003–2005
Prentice, Honor C.	Formas	Landscape, species and genes: diversity and history in fragmented grasslands	1 190 000	2005–2006
Prentice, Honor C.	VR	History and hybridization: racial differentiation and speciation in diploid plants	1 012 500	2006–2008
Säll, Torbjörn	VR	Tracing the evolutionary history of a chromosome segment in a species with a unique origin: Arabidopsis suecica	1 622 400	2003–2005
Widén, Björn	Formas	The relative importance of genetics and environment in population restoration programs	1 560 000	2002–2005
Widén, Björn	Formas	Population restoration viability analysis (PRVA) of a threatened plant	1 739 000	2005–2007
Widén, Björn	VR	The role of postglacial migration and natural selection in shaping morphological and molecular diversity in two plant species	550 000	2007–2007

Plant Breeding, and Protection and Biotechnology at Swedish University of Agricultural Sciences

Main grant holder	Source	Title	Amount (SEK)	Duration
Anderson, Peter	VR	Trade-offs in host plant choice and the influence of damage-induced volatiles in an insect	1 215 000	2004–2006
Nybom, Hilde	Formas	Genetic diversity in a national heritage – the Swedish apple	1 950 000	2002–2005
Persson, Karin	Formas	Diversity of and conservation strategies for Swedish narcissi	1 528 000	2002–2005
Rumpunen, Kimmo	Formas	Estimating useful diversity in apple varieties	1 700 000	2002–2005
Rumpunen, Kimmo	Formas	Estimating useful diversity in apple cultivars	1 890 000	2005–2006
Werlemark, Gun	Formas	Inventory, evaluation and preservation of valuable, old, naturalized Rose genotypes	1 950 000	2002–2004

Plant Science at Umeå University and Swedish University of Agricultural Sciences

Main grant holder	Source	Title	Amount (SEK)	Duration
Bhalerao, Rishikesh	VR	Analysis of growth and hardening cycles in boreal trees from bio-diversity perspective	390 000	2002–2002
Jansson, Stefan	VR	Genetic marker development in aspen	811 200	2003–2003
Nordin, Annika	Formas	Processes delaying or preventing boreal forest vegetation recovery following decreased nitrogen input	1 566 000	2006–2008
Samuelsson, Göran	VR	The functional diversity of ccm in evolutionary defined groups of brackish water and marine phyto-plancton	650 000	2002–2002
Sellstedt, Anita	Formas	Biodiversity of hydrogenases and sustainable nitrogen fixation	1 560 000	2002–2004
Sellstedt, Anita	Formas	Biodiversity of hydrogenases and sustainable nitrogen fixation	1 215 000	2005–2007
von Pawel-Rammingen, Ulrich	VR	Dissection of microbial proteinase profusion: Insights into proteinase function, evolution, and specificity	600 000	2006–2008

Swedish Museum of Natural History

Main grant holder	Source	Title	Amount (SEK)	Duration
Anderberg, Arne	VR	Phylogeny and character evolution in the Ericales	3 109 600	2003–2005
Anderberg, Arne	Formas	Flora Nordica – a scientific flora of the vascular plants of the Nordic countries	2 025 000	2004–2007
Cantrill, David	VR	Evolutionary history of diversity and biogeographic patterns in amphitropical angiosperms	1 980 680	2003–2005
Cantrill, David	VR	The historical basis for present day patterns of biodiversity and endemism in eastern Gondwana (Australia, New Zealand, New Caledonia)	608 000	2006–2008
Ericson, Per	VR	Evolution, biogeography and adaptations in birds	1 620 000	2005–2007
Friis, Else Marie	VR	Palaeobotanical evidence for the origin and spread of open, savannah-mosaic habitats in western Eurasia during the Miocene	2 272 000	2004–2005
Jondelius, Ulf	VR	Phylogeny and taxonomy of free-living flatworms	1 620 000	2005–2007
Swenson, Ulf	VR	Phylogenetic studies of Sapotaceae biodiversity in New Caledonia	520 000	2002–2003
Swenson, Ulf	VR	Historical biogeography and phylogeny of some Gondwana elements exemplified by Australasian Sapotaceae	1 215 000	2005–2007
Tehler, Anders	Formas	Diversity and function of Swedish arbuscular-mycorrhizal fungi	1 469 000	2002–2004
Tehler, Anders	Formas	Diversity and function of Swedish arbuscular-mycorrhizal fungi	1 458 000	2005–2006
Tehler, Anders	VR	Phylogeny, speciation and dispersal strategies among fungi.	1 620 000	2006–2008
Wedin, Mats	VR	Fungal phylogeny and evolution	975 000	2002–2002
Wedin, Mats	VR	Fungal phylogeny and evolution	2 025 000	2004–2006
Wedin, Mats	VR	Fungal phylogeny and evolution	2 430 000	2007–2009
Werdelin, Lars	VR	Biodiversity of the mammalian order Carnivora: species richness and morphological disparity in the Tertiary	780 000	2002–2002

Swedish University of Agricultural Sciences, Umeå

Main grant holder	Source	Title	Amount (SEK)	Duration
Edenius, Lars	Formas	Interactions between large ungulates, aspen and associated biota	1 690 000	2002–2004
Edenius, Lars	Formas	Interactions between large ungulates, aspen and associated biota	1 216 000	2004–2006
Ericsson, Göran	Formas	Integrating Biological and Socio-logical Methodology to Predict Feasible Areas for Re-Colonization	1 788 000	2002–2005
Ericsson, Göran	Formas	Integrating Biological and Socio-logical Methodology to Predict Feasible Areas for Re-Colonization	852 000	2002–2008
Granström, Anders	Formas	Interactions between stand structure and fire. Natural patterns and solutions for ecosystem restoration	1 434 000	2002–2005
Hjältén, Joakim	Formas	Resilience of saproxylic coleopterans and parasitic hymenoptera communities to disturbance by modern forest practise: implications for conservation strategies	1 752 000	2005–2007
Hjältén, Joakim	Formas	Genetically modified trees: conse-quences for biodiversity and eco-system processes	1 579 500	2007–2009
Hjältén, Joakim	Formas	Transgenic trees: a multidisciplinary approach to problems related to public attitudes, social acceptance and ecological risks	3 650 000	2007–2011
Laudon, Hjalmar	Formas	Quantifying the regional linkage between episodes of acidity and the occurrence of fish	1 440 000	2002–2004
Laudon, Hjalmar	Formas	Quantifying the regional linkage between episodes of acidity and the occurrence of fish	1 486 000	2002–2006
Laudon, Hjalmar	Formas	Forestry and sustainable water quality: Linking long-term forest planning and watershed management	2 021 000	2007–2009
Nilsson, Marie-Charlotte	Formas	Relationships between substrate heterogeneity, plant diversity and soil microbial communities	1 848 000	2002–2006
Persson, Inga-Lill	Formas	Impact of Cervids on Biodiversity and Ecosystem Processes	1 566 000	2005–2008

Main grant holder	Source	Title	Amount (SEK)	Duration
Persson, Inga-Lill	Formas	Impact of cervids on biodiversity and ecosystem processes	1 935 000	2006–2008
Ringvall, Anna	Formas	Objective inventory methods for non-wood forest resources	1 196 000	2003–2005
Shevtsova, Anna	Formas	Ecological effects of chemical and morphological variation in Empetrum hermaphroditum	1 430 000	2003–2005
Wardle, David	VR	The influence of island area, plant community structure and biodiversity on colonisation by new species	2 970 000	2004–2006
Östlund, Lars	Formas	Pristine forest landscapes in boreal Scandinavia – past human use, ecosystem changes and their value as ecological references	3 900 000	2005–2008

Zoology at Lund University

Main grant holder	Source	Title	Amount (SEK)	Duration
Alerstam, Thomas	VR	Flight strategies and orientation of migrating birds	1 300 000	2002–2003
Bensch, Staffan	VR	Biodiversity in a parasite host system: Blood parasites, culicoides vectors and avian hosts	975 000	2002–2002
Brönmark, Christer	Formas	Biodiversity and ecosystem function in shallow, eutrophic lakes	2 145 000	2003–2006
Hansson, Bengt	VR	Experimental and genomic evaluation of inbreeding depression: from pedigree to gene expression	4 160 000	2006–2009
Hansson, Christer	VR	Tropical Biodiversity	540 000	2004–2005
Hedlund, Katarina	Formas	Diversity of soil food webs	1 822 500	2006–2008
Janke, Axel	VR	Vertebrate evolutionary relationships as reconstructed by phylogenetic analysis of nuclear sequences	975 000	2002–2004
Loman, Jon	Formas	Landscape ecology and pond quality – field experimental studies of frogs in an agricultural landscape	1 404 000	2002–2005
Nilsson, Jan-Åke	VR	Metabolic constraints on the evolution of life history strategies	910 000	2002–2002

Main grant holder	Source	Title	Amount (SEK)	Duration
Nilsson, Sven G	Formas	Critical threshholds for biodiversity preservation in mixed forest-agricultural landscapes in southern Sweden	1 158 000	2002–2004
Nilsson, Sven G	Formas	Kritiska tröskelnivåer för bevarande av biologisk mångfald i blandade skogsjordbrukslandskap i södra sverige	1 134 000	2004–2006
Olsson, Ola	Formas	A predictive habitat distribution model for the white stork in Sweden – consequences for reintroduction and wetland restoration	1 508 000	2002–2005
Olsson, Ola	Formas	A predictive habitat distribution model for the white stork in Sweden – applications for reintroduction and wetland restoration	1 430 000	2002–2006
Olsson, Ola	Formas	More biodiversity at less cost: an integrated ecological-economic approach to preservation of small landscape elements	4 940 000	2007–2009
Pettersson, Lars Bertil	VR	Population divergence, fitness and the evolution of reaction norms: integrating local adaptation and developmental processes	3 483 012	2002–2006
Pettersson, Lars Bertil	VR	Population divergence, fitness and the evolution of reaction norms: integrating local adaptation and developmental processes	810 000	2005–2006
Smith, Henrik	VR	Long-term fitness-consequences of growth conditions during early ontogeny in birds	811 200	2003–2003
Smith, Henrik	Formas	Population dynamics and persistence of birds in heterogeneous agricultural landscapes	2 020 000	2004–2007
Smith, Henrik	Formas	Consequences of organic farming and farmland heterogeneity on foraging, fitness and species richness of bumblebees and solitary bees	1 998 000	2006–2009

Main grant holder	Source	Title	Amount (SEK)	Duration
Smith, Henrik	Formas	Population dynamics and persistence of birds in heterogeneous agri-cultural landscapes	2 763 450	2007–2009
Svensson, Erik	VR	The role of competition and frequency-dependent selection for adaptive population differentiation and speciation	2 025 000	2004–2006
Svensson, Erik	Formas	Ecological genetics and population biology in Swedish damselflies (Zygoptera): sexual isolation in relation to genetic and ecological distances between populations	930 000	2005–2007
von Schantz, Torbjörn	Formas	Genetic diversity of the ah receptor and evolution of tolerance to persistent pollutants in atlantic salmon (salmo salar) in the Baltic Sea	3 312 000	2002–2004
Åkesson, Susanne	Formas	Geographical origin and migration in insects	1 170 000	2002–2004
Åkesson, Susanne	Formas	Geographical origin and migration in insects	1 216 000	2004–2006

Zoology at Stockholm University and Linköping University

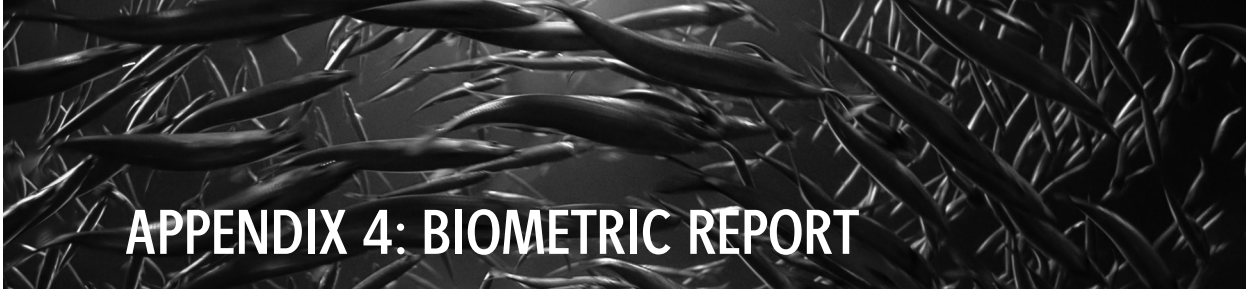
Main grant holder	Source	Title	Amount (SEK)	Duration
Angerbjörn, Anders	Formas	Mesopredator release – a large scale community ecological field experiment with a removal of red foxes.	2 160 000	2005–2008
Janz, Niklas	VR	Cause and consequence of host range dynamics	810 000	2002–2005
Jensen, Per	Formas	Behavioural and genetical aspects on conservation of small populations of animals in zoos – the red jungle fowl (Gallus gallus) as a model species	1 066 000	2002–2004
Jensen, Per	Formas	Behavioural and genetical aspects on conservation of small populations of animals in zoos using the red jungle fowl (Gallus gallus) as a model species: continuation of ongoing project	1 236 000	2005–2006

Main grant holder	Source	Title	Amount (SEK)	Duration
Karlsson, Bengt	VR	Developmental trade-offs, life history and biodiversity in insects	260 000	2002–2002
Karlsson, Bengt	Formas	Consequenses of climate change on butterfly reproduction and biodiversity	866 000	2002–2005
Kullberg, Cecilia	VR	Magnetic coil systems simulating changes in the geomagnetic field: the significance of geomagnetic cues for fuelling decisions in migratory birds	548 000	2004–2004
Laikre, Linda	Formas	Genetic dynamics of introgressed populations: Implications for conservation of biodiversity on the gene level	1 620 000	2004–2006
Laikre, Linda	VR	Detecting cryptic genetic structuring in natural populations	550 000	2007–2007
Merilaita, Sami	VR	The evolution of protective coloration	3 168 880	2003–2007
Merilaita, Sami	VR	The evolution of protective coloration	607 500	2006–2007
Nylin, Sören	VR	Evolution of insect plasticity and host plant utilization	2 704 000	2003–2005
Nylin, Sören	VR	Evolution of insect plasticity, host plant utilization and diversity	2 835 000	2006–2008
Ronquist, Fredrik	VR	Taxonomy, systematics and conservation of a group of parasitic wasps	650 000	2002–2002
Ronquist, Fredrik	Formas	Systematics and conservation of Diptera-parasitic braconids	1 670 000	2005–2008
Ryman, Nils	VR	Statistical and theoretical developments in conservation genetics: detecting heterogeneity and estimating effective population size	650 000	2002–2002
Ryman, Nils	VR	Genetic variation in natural populations	2 430 000	2007–2009
Wahlberg, Niklas	VR	Molecular systematics of nymphalid butterflies: a phylogenetic appraisal of times and rates of speciation	3 170 128	2003–2006
Wahlberg, Niklas	VR	Molecular systematics of nymphalid butterflies: a phylogenetic appraisal of times and rates of speciation	1 080 000	2005–2006

Zoology at University of Gothenburg

Main grant holder	Source	Title	Amount (SEK)	Duration
Andersson, Malte	VR	Evolutionary aspects of social behaviour: ecology and evolution of colour signals in birds, and conspecific brood parasitism	1 300 000	2002–2003
Andersson, Staffan	VR	Evolution of Colour Communication in birds: Carotenoid metabolism and adaptive radiation	2 430 000	2005–2007
Blomqvist, Donald	Formas	Preserving biodiversity in fragmented landscapes: population dynamics and genetic variability in a metapopulation of dunlins	1 365 000	2003–2005
Blomqvist, Donald	Formas	The influence of genetics and predation on extinction of small populations: experiments using the southern dunlin as a model	1 579 500	2006–2008
Bohlin, Torgny	Formas	Restoration of zooplankton biodiversity in limed lakes. How do we know that we have reached the goal?	1 026 000	2003–2007
Erséus, Christer	VR	Molecular systematics of Clitellata	2 025 000	2005–2007
Erséus, Christer	Formas	Systematics of Swedish Enchytraeidae (Clitellata)	1 835 000	2005–2007
Förlin, Lars	Formas	Disturbed sex ratio in aquatic organisms exposed to pulp mill effluents	520 000	2002–2003
Gunnarsson, Bengt	VR	Environmental impact on sex ratio adjustment in spiders	650 000	2002–2004
Gunnarsson, Bengt	Formas	Management of suburban forests: effects on biodiversity and recreation	2 092 000	2007–2009
Götmark, Frank	Formas	Biodiversity in deciduous forest: experimental studies of management, the role of landscape composition, and the use of indicators	1 575 000	2002–2005
Holmgren, Susanne	VR	The biodiversity of bioluminescence	2 028 000	2003–2004

Main grant holder	Source	Title	Amount (SEK)	Duration
Höjesjö, Johan	Formas	Behavioural variation in salmonids; implications for performance in the wild and stocking	1 575 000	2006–2008
Schander, Christoffer	VR	Molluscan – Metazoan Relationships	650 000	2002–2004
Silverin, Bengt	Formas	Global warming, biodiversity and predicatability of the breeding season	1 740 000	2005–2007
Sundberg, Per	VR	Fylogeni och molekylär systematik på olika taxonomiska nivåer hos fyra djurgrupper	3 042 000	2003–2005



APPENDIX 4: BIOMETRIC REPORT

Brief bibliometric analysis of the group of researchers that has obtained biodiversity funding from the Swedish Research Council or Formas

Staffan Karlsson
Swedish Research Council, Dept of Research Policy Analysis

This paper present some basic bibliometric statistics for the group of researchers that obtained funding for biodiversity research from the Swedish Research Council and/or Formas. The report presents methods and results, but the bibliometric statistics is not commented or evaluated, All statistics presented is aggregated based on subject fields (based on the journal where respective paper is printed), other subject groupings or university affiliations. All statistics presented are based on groups of researchers no statistics is presented for individuals.

The analysis is based on publication lists obtained from 165 persons evaluated (out of the 220 persons included in this evaluation). The group was asked to report publications indexed in Web of Science printed in 1999 or later. Although some persons reported publications printed earlier than 1999 the statistics presented is restricted to publications printed between 1999 and 2008. In total the reported publication lists included 4250 items and 3793 unique publications; some publications where thus collaborations by two or more persons in the evaluated group.

The funding started in 2002, publications printed this year or earlier, i.e., 1999–2002 is considered separately from those published latter. Most statistics is therefore split into two periods; period 1 covering 1999–2002 and period 2 covering 2003–2008. Period 1 corresponds relatively closely to the publications the applicants had when applying for the funding. While the second period mainly contains publications produced while being funded by this program.

All bibliometric statistics is compiled using the publication database at the Swedish Research Council. This database contains the same publications as Web of Science and is obtained from Thomson Reuters.

Most statistics reported is based on so called fractional counts, i.e., each author is credited a fraction of each publication in proportion to the number of addresses on the publication (fraction = 1 / number of author addresses given on respective paper). When subject specific statistics is calculated

the authors fraction of a publication is split also between the different subject the publication is assigned to (fraction = 1 / number of addresses * number of subjects). Statistics based on whole, not fractionalised, publications is called "whole counts" (the only whole count statistics presented are found in figure 1 and table 1 and 2).

Self citations are excluded and the number of citations are summed using an open citation windows, i.e., all citations received at the last update of the database (the 1st quarter update for 2009) are included. All citation statistics are field normalised, which means that the number of citations is divided by the world mean number of citations in the same subject field, the same year and type of publications (article or review see below).

Citation statistics are only presented when the volume of the analysed unit exceeds 25 publications (i.e. corresponding to 6.25 publications per year during period 1 or 4.2 publications per year during period 2). Two measures of highly cited publications are presented; the top 10% is the proportion of publications that is cited more than the 90th percentile in a particular year, publication type and subject field. The top 1% is correspondingly defined as those cited more than the 99th percentile. About 8–9% of all publications is found in the top 10% group and about 0.8–0.9% in the top 1% group (the exact number varies among years, publication types and subject fields).

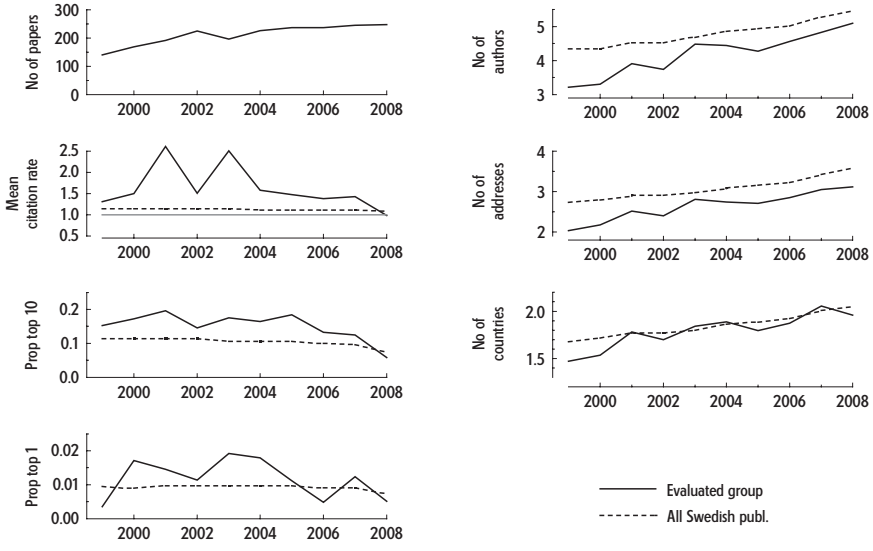
Table 1. Number of publications reported by the evaluated group

Type of publication	Number of publ./ year (whole counts)		Number of fractionalised publ./year		Mean citation rate	
	1999–02	2003–08	1999–02	2003–08	1999–02	2003–08
Article[2]	266.0	388.3	172.0	220.0	1.78	1.53
Review	14.0	22.7	8.9	11.0	1.25	1.35
Biographical item	0	0.5				
Book review	2.0	2.2				
Correction	1.8	12.3				
Editorial material	4.8	0.7				
Meeting abstract	3.0	10.8				
News Item	0.3	22.7				
Total	**291.8**	**460.2**	**180.9**	**231.0**	**1.76**	**1.52**

[2] The article type includes letters and notes.

In the following all statistics is based on articles and reviews only.

Figure 1. The first column of graphs show time series of the number of papers, mean field normalised citation rate and proportion papers among top 1% and top 10% and in the second column three measures on collabo-ration; number of authors per paper, number of author addresses per paper and number of countries that the authors represent (the three latter based on whole counts). The horizontal gray line in the graph showing mean citation rate indicate world average (1.0). For the collaboration measures, all publications with more than 200 authors are excluded from the statistics for all Swedish publications (maximum for the evaluated group was just below 200).



Note: The very high mean citation rates for 2001 and 2003 are largely due to one highly cited paper each year; excluding the most highly cited publication the mean for 2001 decreases to 1.68 and the mean for 2003 decreases to 1.81.

It should be noted that publications printed during 2008 had been available to be cited during less than one year, the citation statistics for this year should therefore be interpreted with great caution.

Table 2. The 15 most frequent collaboration countries 2003–2008 sorted by importance (proportion of publications involving collaboration with a particular country). Mean citation rate is based on whole counts. In total 75 countries were found among the author addresses of the evaluated publications. No citation statistics is give when the number of publications is less than 20. The last line in the table show number of publications and mean citation rate for publications without international collaboration (i.e. country=Sweden for all author addresses).

Collaboration country	1999–2002		2003–2008	
	Proportion of publ.[A]	Mean citation rate	Proportion of publ.[A]	Mean citation rate
United States	13.3%	5.75	14.8%	3.59
United Kingdom	10.4%	2.10	10.5%	2.18
Finland	6.3%	1.68	7.8%	2.15
Germany	4.2%	3.02	6.8%	2.50
France	2.7%	2.85	5.0%	2.95
Norway	2.1%	2.88	4.4%	1.59
Denmark	2.6%	2.06	4.3%	2.01
Netherlands	2.3%	3.40	3.9%	2.25
Spain	2.2%	1.98	3.6%	2.27
Canada	2.4%	2.39	3.2%	3.08
Australia	2.0%	2.66	2.9%	2.08
Russia	1.9%	1.39	2.7%	0.81
Switzerland	2.1%	1.99	2.6%	3.27
New Zealand	1.6%		2.5%	2.27
Italy	1.3%		2.4%	2.73
Sweden only	56%	1.18	49%	1.03

[A] *Note that the sum of proportions here is greater than the portion papers published in international collaboration since several countries could be involved in a single paper.*

Table 3. Number of publications and field normalized mean citation rate for the 15 largest subject fields. Publications were spread over 109 fields in total. For comparison, all Swedish publications in the same fields and periods are shown. The subject field belonging is defined by the journal where respective publication were printed according the journal subject field classification made by Thomson Reuters.

	Evaluated group				Sweden total			
	Volume		Mean citation rate		Volume		Mean citation rate	
Field	1999–02	2003–08	1999–02	2003–08	1999–02	2003–08	1999–02	2003–08
Ecology	41.2	50.3	1.51	1.37	139.1	143.4	1.22	1.15
Plant Sciences	22.7	23.8	1.06	1.13	139.8	122.9	1.13	1.19
Evolutionary Biology	10.8	16.0	1.24	1.18	34.0	43.6	0.98	1.10
Genetics & Heredity	11.9	12.5	0.71	0.73	129.8	132.9	0.88	1.07
Marine & Freshwater Biology	10.8	11.8	1.52	1.69	71.5	71.7	1.28	1.29
Biology	9.7	10.0	1.95	1.86	54.9	55.7	1.59	1.46
Forestry	6.4	9.8	1.30	1.42	96.4	88.9	1.05	1.03
Microbiology	5.3	9.3		0.98	142.8	143.5	1.00	1.04
Zoology	9.0	9.2	2.00	1.67	59.5	56.0	1.69	1.47
Biochemistry & Molecular Biology	5.9	9.1		1.04	516.7	471.6	0.91	0.96
Environmental Sciences	4.5	8.2		1.75	158.2	213.8	1.25	1.25
Ornithology	5.7	5.5		1.64	16.8	15.0	1.92	1.48
Entomology	1.6	5.1		1.69	27.6	33.4	1.33	1.49
Mycology	4.3	5.1		1.60	15.8	15.0	1.49	1.37
Biodiversity Conservation	3.2	4.9		1.90	9.9	14.3	1.79	1.79

Table 4. Number of publications and field normalized citation rate aggregated to the universities the applicants are affiliated to.

Organisation	Volume (publ/year)		Mean citation rate	
	1999–02	2003–08	1999–02	2003–08
Göteborgs universitet	22.7	26.4	1.25	1.26
Högskolan i Halmstad	0.8	0.1		
Högskolan i Kalmar	2.9	4.8		1.10
Karolinska Institutet	0.4	1.2		
Kungl Tekniska Högsk.	0.8	1.2		
Linköpings universitet	0.5	2.4		
Lunds universitet	44.0	51.5	1.42	1.39
Mitthögskolan	0.8	1.9		
Naturhistoriska riksmus.	13.3	12.6	5.51[A]	4.21[B]
Stockholms universitet	27.7	38.3	1.88	1.34
Sveriges Lantbruksuniv.	31.3	41.0	1.31	1.42
Umeå universitet	9.3	18.8	1.67	1.31
Uppsala universitet	26.3	39.7	1.26	1.22

[A] *Excluding the most highly cited publication the mean becomes 1.53*

[B] *Excluding the most highly cited publication the mean becomes 2.13*

The following groups are aggregated by scientific research area, based on classifications of the project leaders in the questionnaire. Note that these area groups are not directly comparable with the overall research areas evaluated in Chapter 3.

Table 5. Number of publications and field normalized citation rate aggregated by subject groups

Group	1999–2002				2003–2008			
	Volume (publ/ year)	Mean citation rate	Prop top 10%	Prop top 1%	Volume (publ/ year)	Mean citation rate	Prop top 10%	Prop top 1%
Ecology – broad	27.7	1.68	22%	2.7%	41.4	1.30	11%	1.14%
Limnic	15.4	1.51	19%	0.7%	25.8	1.45	18%	0.7%
Marine	19.4	1.55	19%	1.8%	21.2	1.41	13%	1.0%
Microbiology[C]	16.5	2.06	20%	3.7%	24.2	1.44	16%	1.56%
Mycology	13.0	0.87	5%	0.0%	20.1	1.24	10%	1.2%
Systematics[D]	22.1	3.56	13%	2.0%	26.4	2.31	9%	1.68%
Terrestrial Botany	43.6	1.21	14%	0.6%	46.6	1.23	14%	1.4%
Terrestrial Zoology	43.4	2.81	19%	0.6%	60.6	2.04	14%	1.1%

C Microbiology, Molecular biology and Chemical biology, etc

D Systematics and Taxonomy, etc

Table 6. Bibliometric statistics per funding organisation, aggregated by PI's with funding from Formas, the Swedish Research Council (VR), or both Formas and the Swedish Research Council.

		1999–2002				2003–2008			
Funding Source	No of indiv	Volume (publ/ year)	Mean citation rate	Prop top 10%	Prop top 1%	Volume (publ/ year)	Mean citation rate	Prop top 10%	Prop top 1%
Formas	54	46.9	1.74	22%	1.6%	55.2	1.42	14%	1.3%
VR	49	41.6	1.22	11%	0.4%	66.5	1.10	11%	0.3%
Formas and VR	62	92.4	2.00	16%	1.3%	118.0	1.73	14%	1.5%

Table 7. Mean total funding (2002–2009) per project leader.

Funding Source	Total funding (million SEK)
Formas	3.6
VR	3.2
Formas and VR	6.0

Note: Linneus grants from VR and Formas are not included.

APPENDIX 5: SHORT CV'S OF THE EVALUATION COMMETTEE MEMBERS

Personal Information

Name:	**Professor Ellen van Donk**
Affiliation:	Head of Department of Aquatic Ecology Netherlands Institute of Ecology (NIOO-KNAW) Rijksstraatweg 6, 3631AC Nieuwersluis The Netherlands
Phone:	+31294239353
Email:	e.vandonk@nioo.knaw.nl
Year of birth:	1953
Country:	The Netherlands
Academic degrees:	B.Med.Sc (Univ.Amsterdam)(1971–1973),B.Bio.Sc, M.Bio.Sc (Univ. Amsterdam) (1974–79) Ph.D (Limnology) (Univ. Amsterdam) (1979–83)

Employment history

1983–1990	Head of the Department of Water Research, Province of Utrecht, The Netherlands.
1990–1998	Associate Professor in Aquatic, Department of Aquatic Ecology and Water Quality Management, University of Wageningen, Netherlands.
1998–present	Head of Department of Aquatic Ecology, Netherlands Institute of Ecology (NIOO-KNAW), Nieuwersluis, Netherlands.
2000–2009	Professorship in Limnology, Radboud University Nijmegen, Netherlands.
2001–present	Professorship in Aquatic Ecology, University of Oslo, Norway.
2009–present	Professorship in Aquatic Ecology, University of Utrecht, Netherlands:

Special assignments

- Chair: Dutch Society for Aquatic Ecology (1985–1992)
- Editor: international journal Aquatic Ecology (1990–1994)

- Member: Governmental Advice Committee Deep Underground and Ground Protection, The Hague, Netherlands (1996–1999) and Govermental Health Council of the Netherlands (1996–present)
- Member: Board of ASLO (American Society of Limnology and Oceanography) (2004–2007)
- Associate Editor of international journals: Limnology and Oceanography (1994–1997), Ecosystems (1997–2000), Freshwater domain of " The Scientific World" (2001–present), Freshwater Biology (2004–2009); Ecological Informatics (2005–present); Research Letters in Ecology (2007–2010); International Journal of Ecology (2008–present)
- Executive Vice President of the SIL (Societas Internationalis Limnologiae). (2007–present)
- Advisor: for the South Florida Water Research District (1993–present)
- Elected Fellow: Research group "Food-webs, Stoichiometry and Population Dynamics" at the Centre for Advanced Study, Royal Academy of Sciences of Norway 2003/2004.
- Member: Scientific Advisory Board of the Institute of Freshwater Ecology and Inland Fisheries (IGB) at Berlin (2005–present).
- Member: Scientific Advisory Board of the Balaton Limnological research Institute, Hungarian Academy of Sciences (2007–present)
- Member: Scientific Advisory Board of the Mondsee Limnological Institute, Austrian Academy of Sciences (2008–present).

Activities and Interests

Prof van Donk began her research career in phytoplankton ecology and then moved into studies that elucidate how ecological mechanisms, evolutionary principles and abiotic factors govern the dynamics and structure of food webs in aquatic ecosystems. Research within her department links levels of organization, ranging from microevolutionary change in phytoplankton populations, through trophic and indirect interactions of food web modules, to the biotic and abiotic factors that structure aquatic communities in entire lakes. They focus on interacting ecological and evolutionary mechanisms that underlie the major patterns and processes in freshwater food webs. Examples of such mechanisms are inducible defenses, fungal parasitism of phytoplankton and keystone herbivory and predation by zooplankton, macrofauna, fish and birds. Many of their studies are of a fundamental nature, but have a strategic aspect in that they address questions and problems that are relevant for the sustainable use of freshwater ecosystems and predicting the impacts of global environmental change and other stress factors on these systems.

Personal Information

Name:	**Professor J. Emmett Duffy**
Affiliation:	Loretta and Lewis Glucksman Professor of Marine Science The College of William and Mary School of Marine Science & Virginia Institute of Marine Science Gloucester Point, VA 23062-1346, USA
Telephone:	804-684-7369
Email:	jeduffy@vims.edu
Year of birth:	1960
Country:	USA
Academic degrees:	1989 Ph.D. Marine Sciences, Univ North Carolina at Chapel Hill 1983 M.S. Zoology, University of Maine 1981 B.S. Biology, Spring Hill College

Employment history

2008–	Loretta and Lewis Glucksman Professor of Marine Science, College of William & Mary
2005–	Research Associate, American Museum of Natural History
1994–	Assistant, Associate, and Full Professor of Marine Science, The College of William and Mary, School of Marine Science and Virginia Institute of Marine Science
1992–1994	National Science Foundation Postdoctoral Fellow in Environmental Biology, Center for Population Biology, University of California, Davis

Special assignments

2009–	Panelist, COMPASS Ocean Climate Change Initiative
2009–	Co-Chair of Steering Committee, Workshop "Attaining Operational Marine Biodiversity Observations", US Federal Joint Subcommittee on Ocean Science and Technology – Ocean Partnerships, Biodiversity Working Group
2006–present	Faculty of 1000, Population Ecology section

2006–present	Editorial board, *Ecology Letters*
2006–	Editorial Board, *Encyclopedia of Earth*
2006–2010	Stewardship Council, Environmental Information Coalition
2006	Aldo Leopold Leadership Fellow
2005–	Editorial Board, *Journal of Ethology*
2005–2008	Chair, Dept Biological Sciences, School of Marine Science, College of William & Mary
2003–2007	Participant, National Center for Ecological Analysis and Synthesis, Working Group: "Linking marine biodiversity to ecosystem functions and services"
2003	Keynote Speaker, Workshop: "Marine Biodiversity, Patterns and Processes", Swedish EPA
1998–2002	Editorial Board, *Ecology and Ecological Monographs*
1989	Smithsonian Institution Postdoctoral Fellowship

Activities and Interests

Emmett Duffy is an ecologist with expertise in marine biodiversity and its importance to human society. His research ranges from the field discovery and description of new coral-reef species, through experimental study of how food webs function in coastal and estuarine ecosystems, to synthetic efforts to quantify the role of marine organisms in providing ecosystem services to society. His long-term research addresses how environmental change affects food-web interactions in Chesapeake Bay seagrass beds, and their implications for these economically important ecosystems. Recently he co-organized a new consortium of several universities and companies, based at the College of William and Mary, that is researching use of wild algae to couple remediation of coastal eutrophication with biofuel production. Prof Duffy is the author of over 80 peer-reviewed and popular-press articles, and an edited book on the social and sexual biology of crustaceans. His research has been featured in the BBC's Blue Planet series, on the Discovery Channel, in textbooks, and in other media outlets worldwide.

Personal Information

Name:	**Professor Robert Freckleton**
Affiliation:	Professor of Population Biology School of Animal and Plant Sciences, University of Sheffield, UK
Phone:	(03) 337 5648
Email:	r.freckleton@sheffield.ac.uk
Country:	United Kingdom
Academic degrees:	BA Zoology, Oxford Ph.D (Biology) University of East Anglia 1998.

Employment history

March 2006–present	Royal Society University Research Fellow and Professor of Population Biology, University of Sheffield
October 2004–March 2006	Royal Society University Research Fellow, Dept of Zoology, University of Oxford
October 2004–March 2006	Tutorial Fellow, Magdalen College, University of Oxford
May 2003–October 2004	Departmental Lecturer in Evolutionary Ecology, Dept of Zoology, University of Oxford

Special assignments

2009–present	Editor in Chief, *Methods in Ecology and Evolution*
2009–2010	Academy of Finland Grant Panel
2007–2010	External Examiner, Biology Degree, University of East Anglia
2008–2011	External Examiner, Zoology Degree, University of Newcastle
2010–2013	External Examiner, Biology, University of Bangor
2004–2009	Senior Editor, *Journal of Applied Ecology*
2008	NERC Ecology and hydrology funding initiative moderating panel
2008	Professorial appointment panel, NTNU, Norway
2004–2007	NERC peer review college
2005	NERC small & standard grants panels committee member
–	PhD external examiner (Imperial College, London; University of Birmingham; University of Aberdeen; University of Reading)

Activities and Interests

I am interested in Ecology and Evolution. My initial research was on plant ecology, specifically building data-driven models for population and community dynamics. I then embarked on research in evolutionary ecology, developing methods for comparative analyses and testing evolutionary models. My current research links macroecology, evolutionary biology and population ecology, including field systems in Belize, sand dune communities of northern Europe and arable weeds. All of these studies are driven by a focus on modelling.

Personal Information

Name:	**Professor Douglas C. MacMillan**
Affiliation:	Head of School, Anthropology and Conservation Marlowe Building University of Kent Canterbury, United Kingdom
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Email:	dcm@kent.ac.uk
Date of birth:	1961
Country:	Scotland
Academic degrees:	BSc Forestry (Hons) (University of Aberdeen) (1980–84) MS Operations Research and Forest Resources (Pennsylvania State University) (1984–1986) Ph.D (Environmental Economics) (University of Stirling) (1990–94)

Employment history

1987–1997	Economist/Senior Economist, Macaulay Institute, Aberdeen
1997–2006	Senior Lecturer/Reader in Economics, Aberdeen University
2006–present	Reader/Professor of Applied Resource and Conservation Economics, DICE, University of Kent
2008–present	Head of School, Anthropology and Conservation, University of Kent

Special assignments

1995–1997	Member, Scottish Land Use Commission
–	Review Panel for UK Research Councils and special research programme calls (RELU, ESPA)
2001–present	Advisor to Scottish Government: wildlife management and hunting
2000	Advisor to FAO: non-market valuation and agricultural trade
1984	St Andrews Society Scholar

Activities and Interests

Prof MacMillan began his research career in forest resources and operations research exploring conflicts and tradeoffs between timber production and biodiversity conservation. Research on valuing non-market benefits of forested and farmed landscapes followed, before developing a strong focus on human-wildlife conflicts with projects in India (tigers and elephants); Bangladesh (tigers), whale by-catch (Korea), and wildlife poaching (Mongolia and Scotland). Increasingly Prof MacMillan is interested in applying interdisciplinary and integrative research on biodiversity to contemporary policy concerns.

Personal Information

Name:	**Professor L. Scott Mills**
Affiliation:	Wildlife Biology Program University of Montana Missoula, MT 59802 U.S.A.
Phone:	(01) (406) 243-5552
Email:	Lscott.mills@umontana.edu
Year of birth:	1961
Country:	United States
Academic degrees:	B.S. Zoology (North Carolina State University) (1979–1983). M.S. Wildlife Science (Utah State University) (1984–1987) Ph.D (Biology) (University of California Santa Cruz) (1989–1993).

Employment history

Jun. 1995–present	Assistant, Associate, Full Professor Wildlife Biology Program, University of Montana
June 2003 and 2004	Invited Lecturer, 4 week Conservation Biology Course, Mountain Lake Biological Station (University of Virginia)
Aug. 1993–May 1995	Visiting Assistant Professor University of Idaho, Moscow, ID

Special assignments

2000–2001	Associate editor of *Ursus*, The Journal of the International Association for Bear Research and Management.
2002–2004	Elected as one of nine Members of the North American Section Board of Governors for the Society for Conservation Biology.
March 6, 2002	Invited testimony to U.S. Congress (House Committee on Resources) regarding ethics in non-invasive genetic sampling and conservation science.
Spring 2004–Fall 2006	Associate Editor of *Journal of Wildlife Management*

Spring 2004–2007	Member, Research Subcommittee of the National Interagency Lynx/Wolverine Steering Committee.
October 2004, April 2006, April 2009	Panelist for National Science Foundation Evolutionary and Population Ecology Grant Review Panels, Washington, D. C.
2009	Invited to give Scientific Declaration to U.S. Federal court on genetic issues associated with delisting Northern Rockies Gray wolves in U.S.
2008	Invited Member of Western Governor's Association "Climate Change Working Group"
2007	Invited "Contributor" to North America section, 2007 Intergovernmental Panel on Climate Change (IPCC) Report.
2009	John Simon Guggenheim Fellow

Activities and Interests

Dr. Mills is an applied population ecologist whose research interests include population dynamics, viability analysis, conservation genetics, and responses of wildlife populations to human perturbations. His textbook, "Conservation of Wildlife Populations: Demography, Genetics, and Management" is widely used worldwide. Mills was a co-author on the North American section for the International Panel on Climate Change (IPCC), and has testified to the U.S. Congress on issues related to non-invasive genetic sampling. As a recipient of a 2009 John Simon Guggenheim Fellowship, he and his family are living in the Himalayan country of Bhutan for 6 months, where he is helping to build local capacity for applying ecological science to biodiversity conservation in Bhutan.

Personal Information

Name:	**Professor Ole Seberg**
Affiliation:	Keeper Botanical Garden and Museum The Natural History Museum of Denmark Sølvgade 83, opg. S. DK-1307 Copenhagen K
Phone:	(+45) 3532 2195
Email:	oles@snm.ku.dk
Year of birth:	1952
Country:	Denmark
Academic degrees:	M. Sc (University of Copenhagen) (1971–82) Ph. D (Systematic Botany and Biogeography) (University of Copenhagen) (1982–85) Dr. Sc. (Botany) (University of Copenhagen) (2005)

Employment history

1985–88	Post doc. financed by the Danish Natural Sciences Research Council, University of Copenhagen
1988–1992	Assistant Professor, Botanical Laboratory, University of Copenhagen:
1992–2005	Associate Professor, University of Copenhagen
1997–1999	Director, Botanical Institute, University of Copenhagen
2005–	Professor, Institute of Biology, then at the Natural History Museum of Denmark, University of Copenhagen
2010–	Keeper, Botanical Garden and Museum, University of Copenhagen

Special assignments

PI of the EU funded project: "Rapid Molecular Screening in Cultivated and Wild *Hordeum* species." (1993–96). Chairman for the 1st International Triticeae Symposium, Helsingborg, Sweden (1991). President of the Willi Hennig Society (1997–1999). Member of the board of EU-initiative EBNIC – European Biotechnology Node for Interaction with China (1998–2001). Member of the Danish task force behind the successful application to house the GBIF secretariat (2001). Member of the advisory panel for the National Science Foundation (NSF) programme "Assembling the Tree of Life",

Washington (2002, 2004). Member of the governing board of University of Copenhagen (2003). PI of the SYNTHESYS (EU large-scale infrastructure) Network Activity E: Developing storage and retrieval systems for new types of collections and their products. (2003–2009).Participant in the inaugural meeting of "Consortium for the Barcode of Life", Smithsonian, Museum of Natural History, Washington (2004). Expert Evaluator for Högskoleverket (National Agency for Higher Education), Stockholm (2005–2006). President of the Organizing Committee of the "The Fourth International Conference on the Comparative Biology of the Monocotyledons & the Fifth International Symposium on Grass Systematics and Evolution", HCØ Institute, University of Copenhagen (2008).

Activities and Interests

Prof Seberg started his research career in classical systematics of higher plants and was instrumental in introducing phylogenetic systematics and vicariance biogeography in Denmark. He subsequently moved into the emerging field of molecular systematics doing phylogenies of the wild relatives of barley, rye, and wheat and in the monocotyledons in general. Current research is combining this field with studies of speciation and molecular evolution especially of organelles using whole genome sequencing. Prof Seberg has are large routine in research evaluation and experience in running research projects and research institutions.

Personal Information

Name:	**Professor Ian Swingland**
Affiliation:	Herons Hall, UK
Phone:	(+44) 7971 669915
Email:	ian@herons-hall.co.uk
Year of birth:	1946
Country:	United Kingdom
Academic degrees:	BSc in Zoology, University of London, UK (1969) PhD in Ecology, University of Edinburgh, UK (1973) DSc Biodiversity Conservation, University of Kent, UK (2005)

Employment history

Ian Swingland is a professor emeritus in Conservation Biology. He was elected to the first Chair in Conservation Biology in the United Kingdom, and was Director of the Durrell Institute of Conservation and Ecology (DICE) at the University of Kent, which he founded in 1989. He was educated at Haberdashers' Aske's School, London, Edinburgh and Oxford Universities. At London University, he read zoology and social anthropology and published his first scientific paper on the location of memory in a vertebrate in *Nature* in 1969 while an undergraduate. After working for Shell Research International for a short time, he took a Ph.D. in ecology in the Forestry and Natural Resources Department at Edinburgh University on an FCO/ODA Scholarship. He was then employed as a research and management biologist in the Kafue National Park, Zambia. In 1974 he joined Oxford University Zoology Department for five years funded by NERC and the Royal Society to work on the giant tortoises of Aldabra Atoll, Western Indian Ocean.

Special assignments

Consultant with 32 years experience in conservation and biodiversity management, and advises, or is a member of many governmental and non-governmental organizations in a number of countries. He has several visiting chairs developing international partnerships, joint postgraduate programs, and carrying on his research both in evolutionary ecology and biodiversity management.

He was awarded the Freedom of London 2001, made an Honorary Bioscience Fellow, Commonwealth Agricultural Bureau International 2002, and most recently accepted an invitation to the Advisory Board for the Centre for Biodiversity and Restoration Ecology, Victoria University of Wellington,

New Zealand. He has been a visiting professor at the Universities of Auckland, Florence, Manchester Metropolitan, and Michigan. He has worked extensively with the Asian Development Bank, the World Bank and GEF in establishing biodiversity projects in Asia and with most conservation bodies. Ian Swingland was made an Officer of the Order of the British Empire (OBE) recognising his services to conservation, and was also given an honorary Doctor of Sciences by Kent University for his service to biodiversity conservation.

Activities and Interests

His current conservation activities concentrate on sustainable conservation, agriculture and resource management particularly the institutional, policy, manpower, training, legal and commercialization aspects. Throughout his career Ian Swingland has been responsible for policy, planning, and implementation, and particularly in the last eight years for establishing and developing world-class initiatives and organizations.

Personal information

Name:	**Prof. Dr. Tom (A) Veldkamp**
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Year of birth:	1963
Country:	Netherlands
Academic degrees:	B.Agr.Sc, M.Agr.Sc (University of Wageningen) (1981–87) Ph.D (Environmental Sciences) (University of Wageningen) (1988–91)

Employment history

1993–1995	Post Doc researcher, Agronomy Wageningen University (WU)
1995–2000	Lecturer (Assistant Professor) Modelling landscape processes WU
2000–2002	Senior Lecturer (Associate Professor) Geomorphology WU
2002–2009	Full Professor, Chair Soil Inventory and Land evaluation later renamed Chair Land Dynamics group. Wageningen University
2008–2009	Interim Scientific Manager Centre for Geo-Information and Remote Sensing (Environmental Sciences Group WUR
2005–2009	Head of business unit, Landscape Centre, WUR
2010–	Rector/Dean ITC faculty University of Twente

Special assignments

- Member of the LUCC-SSC a joined IGBP and IHDP program. 2000–2005
- Chair of the interdisciplinary VICI committee of NWO.
- Member of the Scientific Steering committee SSC of GLP (Global Land Project) a joint IGBP and IHDP program.
- Member of the KNAW (Royal Dutch Academy of Sciences) commission and NVAO for the accreditation of Geosciences Research Masters

- Member of editorial boards of Ecosystems; Landscape Ecology; Agriculture Ecosystems and Environment; Agronomy for Sustainable Development; Netherlands Journal of Geosciences; Journal of Land Use Science; Netherlands Journal of Agricultural Sciences.
- Guest editor of seven different special issues on landscape and land use themes.

Activities and Interests

My research activities and interest include several overlapping fields. Land evaluation, Land use cover change modelling (spatially explicit modelling of land use/cover change); Coupled Human-Ecological systems (modelling of feedbacks and system analysis); Transition towards sustainable development and Competing Claims; Quaternary geology (analysing and modelling of landscape dynamics, fluvial systems); Geomorphology (modelling landscape processes, sediment geochemistry); Soil Science (soil-landscape system characterisation and impact of land use on soil dynamics). I due time I have come to enjoy multi- and interdisciplinary research.

Personal information

Name:	**Professor Katherine J. Willis**
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Year of birth:	1964
Country:	United Kingdom
Academic degrees:	B.Sc. Environmental Science, University of Southampton (1982–85) Ph.D. Sub-department of Quaternary Research, University of Cambridge (1985–88)

Employment history

2009–	Professorial Research Fellow (RSIV), School of Geography & Environment & Professorial Fellow, Jesus College, University of Oxford
2007–	Professor II, Biological Institute, University of Bergen, Norway
2006–2008	Professor of Long-term Ecology, School of Geography & Environment, and Tutorial Fellow, Jesus College, Oxford
2004–2006	University Reader, Oxford University Centre for the Environment, and Tutorial Fellow, Jesus College, Oxford
1998–2004	University Lecturer in School of Geography and the Environment and Tutorial Fellow at St Hugh's College, University of Oxford
1994–1998	Royal Society University Research Fellow, Department of Plant Sciences, University of Cambridge, Tutorial Fellow and Director of Studies, Selwyn College
1991–1994	NERC Postdoctoral Research Fellow, Department of Plant Sciences, University of Cambridge
1990–1994	Trevelyan Research Fellow, Selwyn College Cambridge (1990–1991 stipendiary, 1991–1994 non-stipendiary)
1988–1990	Plant Sciences Editor, Cambridge University Press

Special assignments

2008–	Trustee, WWF-UK
2008–	WWF Programme committee
2008–	Natural Environmental Research Council, College member, UK
2004–2007	National Science Foundation National Evolutionary Synthesis Center (NESCent), Duke University, USA, International board member
2007–	Commonwealth Scholarship Commission, international adviser
2009–	Governor, Highgate School, London
2004–	Governing Body, Jesus College, Oxford
1999–2004	Governing Body, St Hugh's College, Oxford
1992–1999	Governing Body, Selwyn College, Cambridge
2002–	Percy Sladon Memorial Fund, Oxford University Trustee
2000	Associate Editor, *The Holocene*
2003–2006	External examiner, MSc Environmental Management, University of Surrey
–	External PhD examiner (Hungary, Spain, Norway, Sweden, UK (Cambridge, Plymouth, Edinburgh)

Recent Awards & Professional Membership

2010–	Norwegian Academy of Sciences and Letters, Foreign Member
2008	Lyell Fund 2008, Geological Society of London
2008	University Teaching Excellence Award
2008–	Fellow of Royal Geological Society

Activities and Interests

The main focus of my research is on biodiversity responses to environmental change and the dynamic processes of species and their interactions with their environment over a range of timescales.

I established the Oxford Long-term Ecology Laboratory (OxLEL) in 2001 in order to create a hub of facilities and researchers in Oxford using long-term ecological datasets (those spanning >50 years) to address questions relating to biodiversity changes through time. Currently OxLEL has four postdoctoral researchers and nine Ph.D. students. Funded research projects currently underway include studies in S. America, Africa (Congo basin, Kruger, West Tsavo), Borneo, Galapagos, Hungary, India (Western Ghats), Lebanon, Madagascar, Mexico, Morocco, Mongolia, Romania, Slovenia, Tenerife and UK

Research topics covered fall broadly into four categories: i) reconstruction of biodiversity baselines and targets; ii) examination of ecosystem resilience, variability and thresholds; (iii) understanding drivers and rates of change to ecosystem services and (iv) biodiversity beyond reserves. Many of these research projects are based in protected areas and linked in with conservation organisations. I have recently also been developing an ecological footprinting tool to incorporate ecological and evolutionary processes into conservation planning and for the assessment of biodiversity beyond reserves.

Personal Information

Name:	**Professor David Penman**
Affiliation:	Director David Penman and Associates Ltd 40 Hanmer St Christchurch 8011 New Zealand
Phone:	(03) 337 5648
Email:	pendavid@gmail.com
Year of birth:	1947
Country:	New Zealand
Academic degrees:	B.Agr.Sc, M.Agr.Sc (University of Canterbury – Lincoln College) (1965–70) Ph.D (Entomology) (Washington State University) (1970–73)

Employment history

1973–1985	Senior Lecturer/Lecturer in Entomology, Lincoln University
1985–1993	Professor of Entomology, Head of Department of Entomology and Animal Ecology, Lincoln University
1993–1994	Pro Vice-Chancellor, Lincoln University (Research)
1994–1998	General Manager, Biodiversity & Conservation – Landcare Research
1999–2006	Research Manager, Landcare Research NZ Ltd
2006–2008	Assistant Pro Vice-Chancellor (Research), College of Science, University of Canterbury

Special assignments

2005–2009	Chair, Global Biodiversity Information Facility (GBIF) Governing Board
2009–2012	Executive Secretary, New Zealand Organisms' Register (NZOR)
2006–present	Chair, Outcome Based Investment Governing Bodies – Landcare Research (Biosystematics, Conservation Biology, Ecosystem Functions)
1998–present	*Ministry of Foreign Affairs and Trade*: Scientific advice to the UN Convention on Biological Diversity

2007–present	*Ministry of Economic Development*: Bioprospecting *advice*
1994–1996	*Ministry of Research, Science and Technology*: Biosystematics Review Panel
1995	National Science Priorities Panel – Convenor Land and Water Ecosystems
1996–1997	Knowledge Base Project – Biological Sciences
1998–1999	Biosecurity Research Strategy, Convenor
1999–2001	NZ representative – Global Biodiversity Information Facility
2004	Biosecurity Research Strategy
2006, 2007	Ministerial briefing papers on environmental research
2006	Transformational Research opportunities
2007	Barriers to integration report
2009	*Ministry of Agriculture and Forestry*: Biosecurity Coordination Toolbox (Biosecurity NZ)
1996–1997	*Ministerial Panel*: Chair – White-spotted Tussock Moth Independent Science Panel
Current	Royal Society of New Zealand, Member, Senior Editor
1981	Fulbright Research Fellow to USA
1991	Senior Canadian Commonwealth Research Fellowship

Activities and Interests

Prof Penman began his research career in behavioural ecology of spider mites and then moved into studies on biological control of agricultural and horticultural pests. Research on pesticide resistance and behavioural disruption followed before he moved into policy-related research around pesticide use policies and education. He then moved into research management especially in relation to biodiversity science and then into wider environmental management. Prof Penman now has interests in the governance models for science projects, informatics especially in relation to biosystematics and biological databases. He now chairs a number of groups guiding biodiversity science and end user linkages. He also has a growing interest in oil painting especially using biological and environmental images.

Personal information

Name:	**Dr. Anna Helena Lindahl**
Affiliation:	Deputy Director Natural Resources Department Swedish Environmental Protection Agency SE – 106 48 Stockholm
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Year of birth:	1951
Country:	Sweden (Country of birth: Finland)
Academic degrees:	M.Nat.Sci. (University of Helsinki, Finland) 1976 Ph.D. (/Fil.lic) (Ecological botany, University of Uppsala) 1986

Employment history:

1998–	Swedish EPA
2008–	Deputy Director, Natural Resources Department
2006–2008	Head of unit: Landscape
1998–2006	Head of unit: Water environment
1985–1998	County Board of Gävleborg
1996–1998	Head of unit: Nature conservation and Environmental monitoring.
1993–1996	Head of unit: Environmental monitoring,
1985–1993	Desk officer, mainly Water environment questions
1976–1985	Uppsala University, Ecological botany
–	Research assistant/Project leader for research dealing with eutrophication in the Baltic Sea and financed by the Swedish EPA

Special assignments:

2009–	Member of the "Panel of practitioners" for the Mistra-research program "Future Forests – Sustainable Strategies under Uncertainty and Risk"
2007–	Member of Terrestrial Ecosystem Group, a working group under the Nordic Council of Ministers
2002–2008	Member of the "The Progress review group" under the Environmental Objectives Council
1994–1998 i.a.	Member of the Environmental monitoring board of Swedish EPA

Activities and Interests:

After studies in natural sciences (microbiology, chemistry) at the University of Helsinki Anna Helena Lindahl moved to Sweden to join a research group on eutrophication in the Stockholm Archipelago. During the years at Uppsala University Anna Helena was responsible for different research projects with main focus on the ecology of blue-green algae and nitrogen fixation in the Baltic Sea. A particular interest in the connection between society and environment was manifested in studies in physical (land-use) planning at the KTH Royal Institute of Technology. That was followed by an employment at a County Board in Northern Sweden where she obatined a broad experience in land/water-use planning, environmental protection, environmental monitoring and nature conservation. Subsequently at the Swedish EPA Anna Helena was responsible for developing the work on conservation and management of water environments and later on with particular focus on landscapes. Anna Helena is now Deputy Director and as such has a broader responsibility for natural resources issues at the department. In her spare time she spends as much time as possible outdoors, skiing, walking and bird-watching. Anna Helena is also interested in building preservation and is the proud owner of an old cottage.

Personal Information

Name:	**Dr. Mark Marissink**
Affiliation:	Desk officer, biodiversity Swedish Environmental Protection Agency SE-106 48 Stockholm Sweden
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Year of birth:	1971
Country:	Sweden (Country of birth: Netherlands)
Academic degrees:	B.Sc., M.Sc. (Biology, Environmental Science) (University of Groningen, Netherlands) (1989–95) Ph.D. (Ecology and Environmental Research) (SLU Uppsala) (1997–2002)

Employment history

1995–1996 and 2002	Multimedia consultant, SLU Uppsala
2003–2005	Coordinating officer for the environmental objectives, County Administration of Västmanlands län, Västerås
2005–ongoing	Desk officer, biodiversity, Swedish Environmental Protection Agency, Stockholm
2007–2009	Secretary of the Swedish Scientific Council on Biological Diversity (c/o Swedish EPA)
2009–2010	Policy officer, nature and biodiversity, Directorate-General for the Environment, European Commission, Brussels

Special assignments

2006–2007	Appointed expert in government commission on environmental liability
2006–2009	Member of IUCN-CEM (Commission on ecosystem management, World conservation union
2010	Responsible for biodiversity chapter in OECD environmental review of Norway
from 2010	Swedish representative in Arctic Council Working Group on the Conservation of Arctic Flora and Fauna

Activities and Interests

After a broad BSc and MSc education in environmental science, with a base in biology but also including physics, chemistry, economics, philosophy, sociology etc., Mark Marissink studied the effects of elevated carbon dioxide on the vegetation of a semi-natural grassland in a six-year field experiment, which led to a PhD in 2002. After that he has been working for Swedish authorities, and is currently at the Swedish Environmental Protection Agency. The past five years his work has had a strong focus on biodiversity issues, both on a national level, where he is responsible officer for the environmental objective A rich diversity of plant and animal life, and on an international level, taking part in Swedish delegations at meetings of the Convention on biological diversity and its scientific subsidiary body. He has recently completed a year as a contract agent in the Directorate General of the European Commission, working on implementation of European nature legislation and on invasive alien species. In his spare time he likes enjoying and photographing nature and biodiversity – from a kayak or on foot. Singing in a choir provides the necessary cultural counterbalance.

Personal Information

Name:	**Dr. Lennart Nyman**
Affiliation:	Senior Scientific Adviser Man & Water AB International Network P.O. Box 19194 SE-104 32 Stockholm Sweden
	and Member elect of the Royal Swedish Academy of Agriculture & Forestry (and Fisheries) (KSLA) – since 1993
Phone:	+46 708 30 66 38
Email:	lennart.nyman@manandwater.com
Year of birth:	1940
Country:	Sweden
Academic degrees:	B.Sc 1963, M.Sc 1966, Ph. D 1972, Associate Professor of Genetics (docent) 1972, all at Uppsala University, Sweden

Employment history

1991–2005	Conservation Director World Wide Fund for Nature, Sweden
1980–1991	Director, Institute of Freshwater Fisheries, National Swedish Board of Fisheries, Drottningholm, Sweden
1976–1980	Regional Director of Fisheries, National Swedish Board of Fisheries, Gävle, Sweden
1975–1976	Chief Secretary, Governmental Inquiry Commission on Fish Production, Sweden
1974–1975	Coordinator, Freshwater Research, Swedish Environmental Protection Agency, Solna, Sweden
1970–1974	Research Scientist, Institute of Freshwater Research, Drottningholm, Sweden
1968–1970	Research Scientist, Fisheries Research Board of Canada, Biological Station, St. John's, Newfoundland, Canada
1970–present	Consultant, to international and national agencies, companies and organizations on various environmental issues, e.g. effects of nuclear and hydroelectric power plants on the aquatic biota, and effects of forestry, and over fishing in marine and freshwater habitats. See also below "special assignments".

Special present assignments

- Chair, Wildlife Committee (KSLA), Stockholm, Sweden
- Member, Fisheries Committee (KSLA), Stockholm, Sweden
- Chair, National NGO Wildlife Council, Öster Malma, Sweden
- Vice Chair, Swedish Ecotourism Society, Stockholm, Sweden
- Expert Member, Swedish Marine Council, Stockholm, Sweden
- Member, Swedish Wildlife Foundation, Stockholm, Sweden
- Expert Member, National Swedish species data bank's advisory scientific committee (ArtDatabanken) on fishes and cyclostomes, Uppsala, Sweden
- WWF Consultant, Marine Stewardship Council and Forest Stewardship Council, and Sustainable Fisheries Foundation (SFF), and Sida Framework issues

Selected former assignments

- Nordic Representative, WWF International's Programme Committee
- Chair, WWF International's Regional Advisory Board for Africa and Madagascar
- Chair, Annual Nordic conference on Large Carnivores (Jämtland)
- Vice Chair, World Ocean Network (Lisbon, UNESCO – Paris, Boulogne-sur-Mer, Malta)
- Vice Chair, European Inland Fisheries Advisory Committee (EIFAC – FAO)
- Vice Chair and Expert, Blue Planet Forum – Acting together for the future of EU Maritime Policy, Committee of the Regions, Brussels, Belgium
- Chair/Moderator in numerous international conferences, e.g. on Effects of nitrogen forest fertilization on eutrophication of the Baltic Ocean (Stockholm), Reform of the EU Common Fisheries Policy (Copenhagen), Use of freshwater pearl mussels as indicators of healthy running water ecosystems (Sundsvall), two conferences on potential developments and problems of Ecotourism Fishing (SeFF) (Stockholm), and, Celebrating the first ten years of activities by the Marine Stewardship Council (Stockholm).
- Consultancies, e.g. FAO, EIFAC, Sida, SAREC, IFS (International Foundation for Science), SJFR (former Swedish Research Council), FRBC (Canada), Canadian Government ,VBB/SWECO, State Power Board/SwedPower AB(Vattenfall), Ministry of Environment (Sweden), WWF-Sweden, SWEDMAR (National Swedish Board of Fisheries), Scientific Certification Systems, USA (SCS), World Commission on Dams (WCD), Coalition Clean Baltic (CCB), Swedish Forest Agency, Baltic Sea 2020, World Ocean Network (WON), Swedish Marine Council, SeFF (Swedish Society on Ecotourism Fishing), Calluna.
- Project Leader of long-term projects in Kashmir Valley, Sri Lanka and Zambia.

Activities and Interests

Dr Nyman's continuing research interests are in:

- Nature conservation and sustainable use of renewable natural resources by indigenous people world wide;
- Marine and Forest Stewardship Initiatives;
- International Environmental Governance;
- Aquatic Environmental Impact Assessment, including biological effects of nuclear power generation, hydropower generation, acidification and global warming, and freshwater fish ecology world wide.

He is very interested in writing short stories and fly fishing. He has also written 149 publications mainly on the subjects indicated above.

Personal Information

Name:	**Dr. Tania Runge**
Affiliation:	European farmers, European agri-cooperatives (Copa-Cogeca) Brussels
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Year of birth:	1968
Country:	Germany
Academic degrees:	M.Sc. (Agricultural economics) (Technical University of Berlin, Faculty of International Agricultural Development, 1993) Ph.D. (Landscape planning) (Technical University of Berlin, Faculty of Environment and Society, 2003)

Employment history

2007–	Senior Policy Advisor, the Copa-Cogeca Secretariat, Brussels
2004–2007	The German Federal Agricultural Research Centre (vTI)
2001–2004	Research assistant at the Justus-Liebig-University Giessen, Department of Regional- and Project-Planning
1997–2000	Scholarship from the German Environmental Foundation "Deutsche Bundesstiftung Umwelt, DBU"
1994–1997	Employee for urban planning at a Berlin based architect's office

Activities and Interests

Tania Runge has been working since October 2007 as senior policy advisor on environmental issues at the Copa-Cogeca Secretariat located in Brussels. Copa-Cogeca is the umbrella organization representing European farmers and European agri-cooperatives. Her responsibilities include biodiversity, water management and environmental sustainability. In addition she is the contact person for agricultural research. Her main task is to assure information flow on environmental topics to the 76 member organisations and to develop common positions.

She is member of the Steering Committee of the project "European Learning Network for Functional Agro-Biodiversity – ELN-FAB". She is involved

in the European Food SCP (Sustainable Consumption and Production) Round Table and she coordinates the subgroup "Agriculture" of the European Water Technology Platform – WssTP.

In her leisure time she does horseback riding and she likes taking nature photos as well as pictures from the agricultural landscape enjoying the enormous variety across Europe.

Personal Information

Name:	**Professor Peter Bridgewater**
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Year of birth:	1945
Country:	U.K.
Academic degrees:	B.Sc, Ph.D Durham Univ. 1964–1970 D.Res.Mgt. (h.c.) Univ. New England 1997

Employment history

2003–2007	Secretary General, Ramsar Convention. – Gland, Switzerland
1999–2003	Secretary, UNESCO Man and the Biosphere Programme and Director, Division of Ecological Sciences – Paris
1997–1999	Chief Science Adviser, Environment Australia, and Supervising Scientist, Alligator Rivers Region
1990–1997	Chief Executive, Australian Nature Conservation Agency (including the statutory appointments of Director National Parks and Wildlife Service)
1989–1990	Chief Scientist, UK Nature Conservancy Council
1988–1989	First Assistant Secretary, Australian Department of the Arts, Sport, the Environment, Tourism and Territories
1982–1988	Director, Australian Bureau of Flora and Fauna
1977–1982	Senior Lecturer, Environmental Science, Murdoch University
1976–1977	Lecturer, Plant Biology, Murdoch University
1970–1975	Lecturer, Botany, Monash University
1969, 1970	Consultant, Forestry Canada

Special assignments

2010	Chair, Integrated Biological Systems Review (Australia)
2009–2010	Chair, GBIF Review
2009	Chair, Pew Whales Commission
2008–	Visiting Professor, Beijing Forestry University
2008–2009	Chair, Biodiversa Evaluation Committee (EU project)
2007–	Member, International Model forest Programme Advisory Council
2006–	Chair, Working Group for Starlight initiative
2005–2008	Member, Jury, Ramon Margalef Prize for Environmental Sciences, Government of Catalonia
2005–2008	Member, International Steering Committee for the International Mechanism for Scientific Expertise on Biodiversity (IMOSEB)
2003–2004	Member, Screening Committee of the Cosmos Prize, Japan
2003–	Trustee, Parks Forum
2002–2009	Member Board of Fondation Total pour biodiversité et la mer
2000–2005	Member, Board of the Millennium Ecosystem Assessment
1998–2000	Member, Science and Technology Advisory Panel to the Global Environment Facility, UNEP
1998–2000	Commissioner, Commission on Genetic Diversity
1993–1999	Member, Australian National Commission for UNESCO
1997–1999	Commissioner, Parks & Wildlife Commission, Northern Territory
1996	Chair, Sixth meeting of the Conference of the Parties for the Convention on Wetlands, (Ramsar, Iran, 1971)
1995–1998	Chair, Inter-government Coordinating Council for the UNESCO Man and the Biosphere Programme
1995–1998	Commissioner, World Commission on the Oceans
1995–1997	Chairman, International Whaling Commission
1994–1997	Chair, Standing Committee Convention on Migratory Species

Activities and Interests

Dr Bridgewater's continuing research interests are in:

- The people/biodiversity interface;
- Connectivity in land and sea scapes;
- International environmental Governance;
- Coastal and marine Ecology, especially its role in sustainable development.

He is very interested in cooking and writing a cookbook, and a novel.

SAMMANFATTNING OCH REKOMMENDATIONER

Sverige har en lång och stolt historia inom biologisk och ekologisk forskning och har visat starkt engagemang genom att delta i internationella initiativ som Konventionen om biologisk mångfald och genom att spela en nyckelroll då partskonferensen (CoP) och dess underorgan för vetenskaplig, teknisk och teknologisk rådgivning (SBSTTA) bildades. Den svenska forskningen har varit särskilt framstående inom taxonomi, populationsekologi och genetik, samt inom ekosystem som nordliga/boreala skogar, sjöar, vattendrag och jordbrukssystem. Forskning om biologisk mångfald tilldelades år 2001 av den svenska regeringen särskilda anslag som skulle förvaltas av Vetenskapsrådet och Forskningsrådet Formas.

Forskningsråden tillsatte 2010 två kommittéer med uppgift att utvärdera rådens satsningar på biologisk mångfald när det gäller forskningens kvalitet och strategiska inriktning (Vetenskapskommittén) samt forskningens relevans (Relevanskommittén). Vetenskapskommittén bestod av tio internationella experter inom ett vitt spektrum av vetenskapsområden med relevans för biologisk mångfald. Relevanskommittén bestod av fem nationella och internationella experter som representerade intressentorganisationer med anknytning till frågor om biologisk mångfald.

Denna rapport sammanfattar de två kommittéernas analyser och resultat. Kommittéerna utvärderade de forskningsinstitutioner som tagit emot projektbidrag från 2002. Kommittéerna konstaterade att resultaten varierade, med några särskilt starka forskningsgrupper inom skogs-, sjö- och jordbruksekologi samt stor ämneskompetens inom taxonomi, evolutionsbiologi, populationsbiologi, bevarandegenetik, mikrobiell ekologi, klimat- och ekosystemmodellering, ekonomi och landskapsekologi. Kommittéerna fann också att satsningarna till största delen hade bidragit till att fördjupa redan existerande forskningsområden, medan verkligt integrerande tvärvetenskaplig forskning var mindre vanlig. Det fanns få tecken på att de mänskliga dimensionerna av biologisk mångfald blivit väl införlivade i projekten.

Kommittéerna drog slutsatsen att satsningarna sedan 2002 genererat starka, huvudsakligen ämnesspecifika forskargrupper och en rad doktorander som hittat anställning utanför den akademiska världen. För att underlätta att forskningsresultaten kommer till användning på ett effektivt och lämpligt sätt bör intressenter göras delaktiga i projektens utveckling och styrning där detta är möjligt. Framtida forskningssatsningar bör också syfta

till att fördjupa innovativa forskningsområden inom biologisk mångfald genom att koppla samman samhälls- och naturvetenskap.

Kommittéerna presenterade en rad slutsatser och följande rekommendationer för forskningsråden att ta i beaktande. Rekommendationerna anges inte i prioritetsordning.

Vetenskapskommitténs rekommendationer:

1 Forskningsråden bör fortsätta med öronmärkta satsningar på forskning om biologisk mångfald, men i framtiden bör dessa satsningar grundas i:
   - Utveckling av en tydlig strategi som motsvarar behoven hos en bredare svensk sfär inom biologisk mångfald.
   - En enhetlig definition av biologisk mångfaldsvetenskap.
   - Ökad tonvikt på större och mer långsiktiga forskningsprojekt med integrerande och tvärvetenskaplig inriktning.

2 Forskningsråden bör omvärdera hur satsningar fördelas för att gynna mer permanenta anställningar inom forskningsinstitutioner istället för att i huvudsak utbilda doktorander.

3 Forskningsråden bör utveckla sätt att stimulera ökat samarbete med internationella partner och uppmuntra mer samarbetsinriktade forskningsuppslag som försöker överbrygga ämnes- och institutionsgränser.

4 Förbättra samordningen av satsningar mellan Vetenskapsrådet och Formas samt skapa av en gemensam kommitté för forskning om biologisk mångfald där både forskare från relevanta ämnesområden och betydelsefulla intressenter och användare finns representerade.

5 Kommunikation och medvetenhet kring forskning om biologisk mångfald bör förbättras genom:
   - En konferens om svensk forskning kring biologisk mångfald som uppmuntrar till samarbeten över ämnesområden och institutioner.
   - Särskilda workshoppar som kan bygga tvärvetenskapliga broar, i synnerhet till samhällsvetarna.
   - Ett pris till en person som åstadkommit internationell betydelsefull forskning inom biologisk mångfald.

6 Svenska forskare bör uppmuntras att sammanställa mer av sin tidigare forskning i internationellt betydelsefulla tidskrifter, och forskningsråden bör särskilt främja sammanställningar liknande dem som National Center for Ecological Analysis and Synthesis i USA genererar.

7 Forskningsråden bör även i fortsättningen stödja utvecklandet av infrastruktur och kompetens inom genomik, bio- och biodiversitetsinformatik samt modellering, men också skapa lämpliga incitament och mekanismer för att lösa problemen med biologisk mångfald.

8 Forskningsråden bör se över sina utlysningstexter för att främja samarbete, tvärvetenskaplig samspel och kommunikation, och för att säkra att lämpliga prestationsmätningar är en del av projektkontrakten.

Relevanskommitténs rekommendationer:

9 På utlysnings- och ansökningsnivå bör definitionen av projekten om biologisk mångfald förtydligas. Med utgångspunkt i definitionen som används i Konventionen för biologisk mångfald (CBD) rekommenderar vi följande:
- Projekt om biologisk mångfald bör utgå från ett mänskligt perspektiv och verka integrerande genom att innefatta mångfald vad gäller genetik, artrikedom, ekosystem, landskap och marina miljöer, och svara mot forskningsbehoven för att hållbart och solidariskt bevara och nyttja allt liv på jorden.

10 Forskning om biologisk mångfald är ett tvärvetenskapligt ämne mellan naturvetenskap och samhällsvetenskap, och framgångsrika projekt bör finansieras med detta i åtanke, i synnerhet:
- Projektförslag som har ett bredare perspektiv än ren naturvård bör gynnas.
- Forskning om biologisk mångfald bör innefatta forskning på människors och djurs hälsa i relation till virus och parasiter.
- Traditionell och inhemsk kunskap är viktig för vissa projekts framgång, och bör införlivas där så är lämpligt.

11 Det behövs ökad insikt om att forskning som är specifik för Sverige även kan vara relevant för andra länder och globalt, och bör därför stimuleras. Då forskningens relevans bedöms bör resultatens internationella överförbarhet beaktas.

12 Sökande bör få hjälp att utveckla samhälleligt relevanta projekt.
- Viss tid bör sättas av i projekten för interaktion med intressenter, exempelvis genom workshoppar.
- Medel bör öronmärkas i ansökan för intressenters deltagande.
- Intressenters deltagande är ofta en flaskhals när det gäller statliga myndigheter och länsstyrelser.

13 Uppmuntra forskning som fokuserar på:
- Projekt som inbegriper ekonomiska aspekter och kostnadsanalys av ekosystemstjänster.
- Nya forskningsområden, till exempel modellering och då särskilt gränssnittet mellan data och modellutveckling, samt överbryggande forskning som inbegriper grundläggande, tillämpad och problemorienterad forskning.

- Förändringar av biologisk mångfald och långsiktig evolution, med markanvändnings- och klimatförändringar som drivkrafter, och med särskilt fokus på förvaltning för förändringar.
- Frågor kring biologisk mångfald knutna till fisk och fiskeriverksamhet i marina system och sötvattenssystem.

14 Användardriven forskning bör öka för att garantera att resultaten kommer till praktisk användning.

15 Ge information i utlysningen om hur utvärderingen efter projektets genomförande är utformad. En tematisk grund skulle troligen bidra till ökat utbyte och samarbete mellan forskare.

16 I synnerhet Formas, men även Vetenskapsrådet där det är lämpligt, bör öka värdet för forskare att engagera sig samhälleligt genom att:

- Lyfta fram samhälleligt engagemang som en indikator på framgång inom universitetssystemet.
- Samarbete med intressenter ses som en del av forskningsprojektet.
- Publicering av problembaserad och tillämpad forskning i tidskrifter med refereegranskning uppmuntras.

17 Undersöka vilka möjligheter som finns för att överbrygga gapet mellan forskarvärlden och intressenter, användare, politiker och statliga organisationer. Några möjligheter är:

- Tematiska möten/workshoppar mellan intressenter och forskare, exempelvis om forskning kring landskap och marina miljöer, mykorrhiza och ekosystemansatsen.
- Att skapa en sökfunktion på Formas webbplats för att underlätta identifieringen av forskare som arbetar med användarrelevanta projekt.
- Att hjälpa forskare att hitta det rätta tillfället att kontakta intressenter och att paketera information.
- Att ha det politiska sammanhanget i åtanke.

In 2001 the Swedish Government made a special allocation of funding for biodiversity research to be administered by the Swedish Research Council and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning. The research councils appointed 2010 two committees to evaluate their investment in biodiversity research from the perspectives of the quality and strategic direction of the science (Science Committee) and the relevance of the research (Relevance Committee). This report outlines the analyses and findings of the two committees.

Vetenskapsrådet

formas

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The Swedish Research Council is a government agency that provides funding for basic research of the highest scientific quality in all disciplinary domains. Besides research funding, the agency works with strategy, analysis, and research communication. The objective is for Sweden to be a leading research nation.

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