

Self-evaluation report

Mid-term review 2006-2008

Institute for Biodiversity and Ecosystem Dynamics

Faculty of Science

University of Amsterdam

November 2009



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## Foreword

It is a pleasure to present this Self-Evaluation Report of the Institute for Biodiversity and Ecosystem Dynamics (IBED), of the Faculty of Sciences (FNWI) of the University of Amsterdam (UvA). The report is part of the mid-term review of the Standard Evaluation Protocol 2009-2015 (SEP) as organised by the Association of Universities in The Netherlands (VSNU), the Royal Netherlands Academy of Arts and Sciences (KNAW), and The Netherlands Organisation for Scientific Research (NWO). The SEP prescribes that a mid-term review take place roughly three years after the last full research assessment. For IBED the last complete assessment took place in 2006 and covered the time period 2000-2005.

As stipulated by the SEP, the mid-term review has both a retrospective and prospective nature and is envisaged as a light procedure. The main objective as defined by the SEP is to review the follow-up of recommendations from the last external evaluation and to formulate future actions. The SEP does not give specific guidelines for the conduction of the mid-term review. Instead, the board of the research organisation decides how the review is conducted and what documentation is provided by the institute. In case of the FNWI, the Dean decided that the mid-term review of its institutes shall consist of: i) the tables with information required for the self-evaluation report for a full research assessment, ii) a short evaluation of the trends in the data presented, and iii) a SWOT analysis. We attempted to be concise, and added a list of the abbreviations/institutes to direct you to relevant websites, should you need more background information. In the subsequent chapters, we provide the specified data and analyses for IBED for the time period 2006-2008. The main recommendations for improvement upon the evaluation in 2006 and the progress that has been made with their implementation over the last three years are discussed, together with some new developments. The report's last two sections are devoted to the priorities and planning of the next period. We hope that with this information the reader will be able to form an opinion on the current state of the institute, and comment on the planned developments.

*Prof. dr. Peter van Tienderen*  
*Director of IBED*

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## List of acronyms/organisations

UOC	University Research Committee, advisory council for the Board of the University, with members from all Faculties.
BSc	Bachelor of Science
CARMABI	Caribbean Research and Management of Biodiversity: a non-profit organisation and marine research institute based on Curaçao ( <a href="http://www.carmabi.org/">http://www.carmabi.org/</a> )
CWI	The national research center for mathematics and computer science in the Netherlands ( <a href="http://www.cwi.nl">http://www.cwi.nl</a> )
Deltares	Dutch institute for applied research and specialist advice in the field of water, soil and the subsurface ( <a href="http://www.deltares.nl">http://www.deltares.nl</a> )
ESA	European Space Agency ( <a href="http://www.esa.eu">http://www.esa.eu</a> )
ESFRI	European Strategy Forum for Research Infrastructures ( <a href="http://cordis.europa.eu/esfri/">http://cordis.europa.eu/esfri/</a> )
EU	European Union
FNWI	Faculty of Science of the University of Amsterdam ( <a href="http://www.science.uva.nl">http://www.science.uva.nl</a> )
FTE	Full-time Equivalent
FP7	Seventh Research Framework Programme of the European Union
GAN	Dutch Nature Data Authority ( <a href="http://www.gegevensautoriteitnatuur.nl">http://www.gegevensautoriteitnatuur.nl</a> )
GPS	Global Positioning System
IBED	Institute for Biodiversity and Ecosystem Dynamics ( <a href="http://www.science.uva.nl/ibed">http://www.science.uva.nl/ibed</a> )
IvI	Informatics Institute ( <a href="http://www.science.uva.nl/ii">http://www.science.uva.nl/ii</a> )
KNAW	Royal Dutch Academy of Arts and Sciences ( <a href="http://www.knaw.nl">http://www.knaw.nl</a> )
KWR	KWR Watercycle Research Institute ( <a href="http://www.kwrwater.nl">http://www.kwrwater.nl</a> )
LifeWatch	EU ESFRI initiative: e-Science and Technology Infrastructure for Biodiversity Research ( <a href="http://www.lifewatch.eu/">http://www.lifewatch.eu/</a> )
METIS	Inter-university database of research input and output
MSc	Master of Science
NCB-Naturalis	Netherlands Centre for Biodiversity (under construction, location Leiden) merger of Zoological Museum Amsterdam, Naturalis, National Herbarium
NFI	The Netherlands Forensic Institute ( <a href="http://english.forensischinstituut.nl/">http://english.forensischinstituut.nl/</a> )
NIOO	Netherlands Institute for Ecology ( <a href="http://www.nioo.knaw.nl">http://www.nioo.knaw.nl</a> )
NIOZ	Royal Netherlands Institute for Sea Research ( <a href="http://www.nioz.nl">http://www.nioz.nl</a> )
NISB	Netherlands Institute for Systems Biology ( <a href="http://www.sysbio.nl">http://www.sysbio.nl</a> )
NWO	The Netherlands Organisation for Scientific Research ( <a href="http://www.nwo.nl">http://www.nwo.nl</a> )
RIVM	Dutch National Institute for Public Health and the Environment ( <a href="http://www.rivm.nl">http://www.rivm.nl</a> )
SAC	External Scientific Advisory Committee
SARA	Computing and Networking Services Company ( <a href="http://www.sara.nl">http://www.sara.nl</a> )
SEP	Standard Evaluation Protocol, developed by the VSNU
SILS	Swammerdam Institute of Life Sciences, UvA ( <a href="http://www.science.uva.nl/sils">http://www.science.uva.nl/sils</a> )
UvA	University of Amsterdam ( <a href="http://www.uva.nl">http://www.uva.nl</a> )
VOFF	Dutch Flora and Fauna Research Society ( <a href="http://www.voff.nl/">http://www.voff.nl/</a> )
VSNU	Association of Universities of The Netherlands ( <a href="http://www.vsnu.nl">http://www.vsnu.nl</a> )
Waternet	Company responsible for drinking water, waste water, surface water and security from high water in the Amsterdam area of The Netherlands ( <a href="http://www.waternet.nl">http://www.waternet.nl</a> )

## 1. Mission and structure of the Institute

### 1.1. IBED's mission

At the broadest level, the mission of IBED is to increase our understanding of the diversity and dynamics of ecosystems from the level of molecules and genes to entire ecosystems. Our aim is to unravel how ecosystems function in all their complexity, and how they change due to natural processes and human interference. The focus in IBED lies on the study of two interlinked aspects: (i) how do organisms interact with one another and with their abiotic environment, and (ii) what are the dynamics that emerge from these interactions, both in space and in time.

### 1.2. Research structure

The research programme of IBED comprises three research Themes. Each Theme consists of different Research Groups, typically with a Full Professor and two tenured Associate Professors (UHD) or Assistant Professors (UD), plus Post-Docs and PhD students. In addition, there are several Special Chairs, usually scientists with an appointment elsewhere or paid by an external organisation. Special Chairs do not have a research group or tenured staff of their own, but contribute to the research of IBED through collaboration with other IBED members and by supervising PhD students. In most cases, Special Chairs also participate in the teaching programme of the University.

The three IBED research Themes are:

Theme 1: Biodiversity and Evolution

Theme 2: Geo-Ecology

Theme 3: Community Dynamics

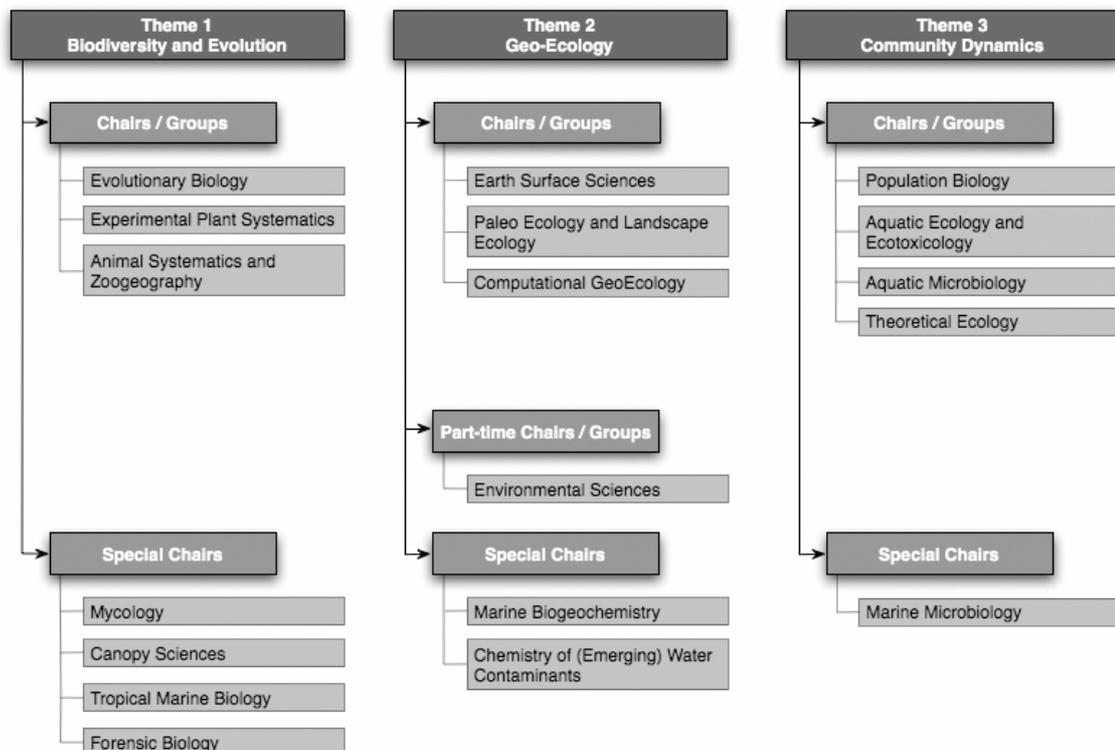


Figure 1: Research structure of IBED

## **Theme 1: Biodiversity and Evolution**

The fundamental question in Theme 1 is: What are the mechanisms that create and maintain biodiversity in an evolutionary context? Phylogenetic and biogeographical patterns are studied to infer the underlying processes; experiments are conducted to test evolutionary hypotheses, with special emphasis on the driving forces behind speciation and the emergence of evolutionary novelties. A novel development in Theme 1 is an increased focus on functional biodiversity that take advantage of modern developments in genomics research for the analysis of biodiversity. Figure 1 depicts the current Research Groups and Special Chairs of Theme 1. Five key publications from the last three years exemplify the research achievements of each of the Groups in the period 2006-2008:

### Animal Systematics and Zoogeography (Chair currently vacant)

- Böhning-Gaese, K., Caprano, T., Van Ewijk, K. & Veith, M. (2006). Range size: Disentangling ecological, biogeographic and phylogenetic factors. *The American Naturalist*, 167: 555-567.
- Faubel, A., Sluys, R. & Reid, D.G. (2007). A new genus and species of polyclad flatworm found in the mantle cavities of gastropod molluscs in the high-intertidal zone of the Pacific coast of Central America. *Journal of the Marine Biological Association of the United Kingdom*, 87, 429-434.
- Sluys, R. (2007). Annotations on freshwater planarians (Platyhelminthes Tricladida Dugesiidae) from the Afrotropical Region. 20: 229-257. *Tropical Zoology*, 20, 229-257.
- Aliabadian, M., Sluys, R., Roselaar, C.S. & Nijman, V. (2008). Species diversity and endemism: Testing the mid-domain effect on species richness patterns of songbirds in the Palearctic region. *Contributions to Zoology*, 77, 99-108.
- Hillers, A., Veith, M. & Rödel, M.-O. (2008). Effects of forest fragmentation and habitat degradation on West African leaf-litter frogs. *Conservation Biology*, 22, 762-772.

### Evolutionary Biology (Chair Prof. dr. Stef B.J. Menken)

- Cleary, D.F.R., Fauvelot, C., Genner, M.J., Menken, S.B.J. & Mooers, A.O. (2006). Parallel responses of species and genetic diversity to ENSO-induced environmental destruction. *Ecology Letters*, 9: 301-307.
- Peijnenburg, K.T.C.A., Fauvelot, C., Breeuwer, J.A.J. & Menken, S.B.J. (2006). Spatial and temporal structure of the planktonic *Sagitta setosa* (Chaetognatha) in European seas as revealed by mitochondrial and nuclear DNA markers. *Molecular Ecology*, 15: 3319-3338.
- Grill, A., Ginkel, W. van, Gkioka, E., Raymann, L.E.L. & Menken, S.B.J. (2007). Genetic differentiation and natural hybridization between the Sardinian endemic *Maniola nurag* and the European *Maniola Jurtina*. *Journal of Evolutionary Biology*, 20, 1255-1270.
- Fredriksson, G.M., Danielsen, L.S. & Swenson, J.E. (2007). Impacts of El Nino related drought and forest fires on sun bear fruit resources in lowland dipterocarp forest of East Borneo. *Biodiversity and Conservation*, 16, 1823-1838.
- Ros, V.I.D., Breeuwer, J.A.J. & Menken, S.B.J. (2008). Origins of asexuality in Bryobia mites (Acari: Tetranychidae). *BMC Evolutionary Biology*, 8, 153.

### Experimental Plant Systematics (Chair Prof. dr. Peter H. van Tienderen)

- Cascante-Marin A., Wolf, J.H.D., Oostermeijer, J.G.B., Den Nijs, J.C.M., Sanahuja, O. & Duran-Apuy, A. (2006). Epiphytic bromeliad communities in secondary and mature forest in a tropical premontane area. *Basic and Applied Ecology*, 7: 520-532.
- Asch, M. van, Tienderen, P.H. van, Holleman, L.J.M. & Visser, M.E. (2007). Predicting adaptation of phenology in response to climate change, an insect herbivore example. *Global Change Biology*, 13, 1596-1604.

- Hooftman, D.A.P., Jong, M.A. de, Oostermeijer, J.G.B. & Nijs, J.C.M. den (2007). Modelling the long-term consequences of crop-wild relative hybridization: a case study using four generations of hybrids. *Journal of Applied Ecology*, 44, 1035-1045.
- Kantama, L., Sharbel, T.F., Schranz, M.E., Mitchell-Olds, T., Vries, S. de & Jong, H. de (2007). Diploid apomicts of the *Boechera holboellii* complex show large scale chromosome substitutions and different aberrant chromosomes. *Proceedings of the National Academy of Sciences of the United States of America*, 104(35), 14026-14031.
- Stift, M., Luttikhuisen, P.C., Visser, E.J.W. & Tienderen, P.H. van (2008). Different flooding responses in *Rorippa amphibia* and *Rorippa sylvestris*, and their modes of expression in F1 hybrids. *New Phytologist*, 180, 229-239.

## **Theme 2: Geo-Ecology**

The main focus in Theme 2 concerns the question: How do abiotic and biotic processes interact to determine the dynamics of ecosystems? Studies range from a micro scale, for instance the fate of pollutants in a system, to a global scale, for instance the reconstruction of the Earth's climate in the past. New developments that are being implemented are the use of advanced analytical methods, spatial modelling using distributed data, and integration of data from different sources for the reconstruction of the Earth's past. Figure 1 depicts the current Research Groups and Special Chairs of Theme 2. Five key publications from the last three years exemplify the research achievements of each of the Groups in the period 2006-2008:

### Computational Geo-Ecology (Chair Prof. dr. ir. Willem Bouten)

- Vrugt, J.A., Gupta, H.V., O'Nualláin, B. & Bouten, W. (2006). Real-time data assimilation for Operational Ensemble Streamflow Forecasting. *Journal of Hydro-Meteorology*, 7: 548-565.
- Belle, J. van, Shamoun-Baranes, J., Loon, E.E. van & Bouten, W. (2007). An operational model predicting autumn bird migration intensities for flight safety. *Journal of Applied Ecology*, 44, 864-874.
- Cleary, D.F.R., Boyle, T.J.B., Anggraeni, C.D., Loon, E.E. van, Menken, S.B.J. (2007). Bird species and traits associated with logged and unlogged forest in Borneo. *Ecological Applications* 17, 1184-1197
- Gustavsson, M., Seijmonsbergen, A.C. & Kolstrup, E. (2008). Structure and contents of a new geomorphological GIS database linked to a geomorphological map - With an example from Liden, central Sweden. *Geomorphology*, 95, 335-349.
- Shamoun-Baranes, J., Bouten, W., Buurma, L., DeFusco, R., Dekker, A., Sierdsema, H., Sluiter, F., Belle, J. van, Gasteren, H. van & Loon, E. van (2008). Avian information systems: Developing web-based bird avoidance models. *Ecology and Society*, 13, 38.

### Earth Surface Sciences (Chair Prof. dr. Karsten Kalbitz)

- Van der Meulen, E.S., Nol, L. & Cammeraat, L.H. (2006). Effects of irrigation and plastic mulch on soil properties on semi-arid abandoned fields. *Soil Science Society of America Journal*, 70: 930-939.
- Botton, S., Hamelen, M., Braster, M., Parsons, J.R., Röling, W.F.M. (2007). Dominance of Geobacteraceae in BTX-degrading enrichments from an iron-reducing aquifer. *FEMS Microbiology Ecology*, 13, 101-130.
- Nierop, K.G.J., Tonneijck, F.H., Jansen, B. & Verstraten, J.M. (2007). Organic matter in volcanic ash soils under forest and páramo along an Ecuadorian altitudinal transect. *Soil Science Society of America Journal*, 71, 1119-1127.
- Sowerby A., Emmett, B.A., Tietema, A., Beier, C. (2008). Contrasting effects of repeated summer drought on soil carbon efflux in hydric and mesic heathland soils. *Global Change Biology*, 14, 2388-2404.

Lesschen, J.P., Cammeraat, L.H., Nieman, T. (2008). Erosion and terrace failure due to agricultural land abandonment in a semi-arid environment. *Earth Surface Processes and Landforms*, 33, 1574-1584.

#### Paleoecology and Landscape Ecology (Chair Prof. dr. Henry Hooghiemstra)

- Hooghiemstra, H., Wijninga, V.M. & Cleef, A.M. (2006). The paleobotanical record of Colombia: implications for biogeography and biodiversity. *Annals of the Missouri Botanical Gardens*, 93: 297-324.
- Weng, C., Hooghiemstra, H. & Duivenvoorden, J.F. (2007). Response of pollen diversity to the climate-driven altitudinal shift of vegetation in the Colombian Andes. *Philosophical Transactions of the Royal Society B-Biological Sciences*, 362, 253-262.
- Yeloff, D. & Geel, B. van (2007). Abandonment of farmland and vegetation succession following the Eurasian plague pandemic of AD 1347-52. *Journal of Biogeography*, 34, 575-582.
- Kooijman, A.M., Kooijman-Schouten, M.M. & Martinez-Hernandez, G.B. (2008). Alternative strategies to sustain N-fertility in acid and calcaric beech forests: Low microbial N-demand versus high biological activity. *Basic and Applied Ecology*, 9, 410-421.
- Mauquoy, D., Yeloff, D., Geel, B. van, Charman, D.J. & Blundell, A. (2008). Two decadal resolved records from north-west European peat bogs show rapid climate changes associated with solar variability during the mid-late Holocene. *Journal of Quaternary Science*, 23, 745-763.

#### Environmental Sciences (Chair Prof. dr. Lucas Reijnders)

- Huijbregts, M.A.J., Rombouts, L.J.A., Hellweg, S., Fischknecht, R., Hendriks, A.J., Van der Meent, D., Ragas, A.M.J., Reijnders, L., & Struijs, J. (2006). Is cumulative fossil energy demand a useful indicator for the environmental performance of products? *Environmental Science & Technology*, 40: 641-648
- Reijnders, L. (2006). Conditions for sustainability of biomass based fuel use. *Energy Policy*, 34: 863-878.
- Mohr, N.J., Schermer, J.J., Huijbregts, M.A.J., Meijer, A. & Reijnders, L. (2007). Life cycle assessment of thin film GaAs and GaInP/GaAs solar modules. *Progress in Photovoltaics: Research and Applications*, 15, 163-179.
- Reijnders, L. (2008). Do biofuels from microalgae beat biofuels from terrestrial plants? *Trends in Biotechnology*, 26, 349-350.
- Reijnders, L. & Huijbregts, M.A.J. (2008). Palm oil and the emission of carbon-based greenhouse gases. *Journal of Cleaner Production*, 16, 477-482.

### **Theme 3: Community Dynamics**

The main question in Theme 3 is: What are the driving forces behind changes in populations and communities? A wide range of systems is studied in terrestrial, marine and freshwater environments, using a combination of mathematical models, laboratory experiments and field research. Major scientific discoveries were made on the complexity of ecological and evolutionary dynamics (chaos, cycles, multiple stable states, regime shifts). Figure 1 depicts the current Research Groups and Special Chairs of Theme 3. Five key publications from the last three years exemplify the research achievements of each of the Groups in the period 2006-2008:

#### Population Biology (Chair Prof. dr. Maurice W. Sabelis)

- Rueffler, C., Egas, M. & Metz, J.A.J. (2006). Evolutionary predictions should be based on individual-level traits. *American Naturalist*, 168: E148-E162.
- Magalhaes, S., Fayard, J., Janssen, A., Carbonell, D. & Olivieri, I. (2007). Adaptation in a spider mite population after long-term evolution on a single host plant. *Journal of Evolutionary Biology*, 20, 2016-2027.

- Egas M, Riedl A (2008) The economics of altruistic punishment and the maintenance of cooperation. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 275, 871-878.
- Grosman, A.H., A. Janssen, E.F. de Brito, E.G. Cordeiro, F. Colares, J. Oliveira Fonseca, E. Lima, A. Pallini & M.W. Sabelis (2008). Parasitoid Increases Survival of Its Pupae by Inducing Hosts to Fight Predators. *PloS One* 3, 1-7. e2276 doi:10.1371/journal.pone.0002276
- Kant, M.R., M.W. Sabelis, M.A. Haring & R.C. Schuurink (2008). Intraspecific variation in a generalist herbivore accounts for differential induction and impact of host-plant defences. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 275, 443-452.

Theoretical Ecology (Chair Prof. dr. André M. de Roos)

- M. Jansson, L. Persson, A.M. de Roos, R.I. Jones & L.J. Tranvik, 2007. Terrestrial carbon and intraspecific size-variation shape lake ecosystems. *Trends in Ecology & Evolution*, 22, 316-322.
- L. Persson, P.A. Amundsen, A.M. de Roos, A. Klemetsen, R. Knudsen & R. Primicerio, 2007. Culling prey promotes predator recovery - Alternative states in a whole-lake experiment. *Science*, 316, 1743-1746.
- Bezemer, D., Wolf, F. de, Boerlijst, M.C., Sighem, A. van, Hollingsworth, T.D., Prins, M., Geskus, R.B., Gras, L., Coutinho, R.A. & Fraser, C. (2008). A resurgent HIV-1 epidemic among men who have sex with men in the era of potent antiretroviral therapy. *AIDS*, 22, 1071-1077.
- Roos, A.M. de, (2008). Demographic analysis of continuous-time life-history models. *Ecology Letters*, 11, 1-15.
- Roos, A.M. de, Schellekens, T., Kooten, T. van & Persson, L. (2008). Stage-specific predator species help each other to persist while competing for a single prey. *Proceedings of the National Academy of Sciences of the United States of America*, 105, 13930-13935.

Aquatic Microbiology (Chair Prof. dr. Jef Huisman)

- Huisman, J., Pham Thi, N.N., Karl, D.M. & Sommeijer, B. (2006). Reduced mixing generates oscillations and chaos in the oceanic deep chlorophyll maximum. *Nature*, 439: 322-325.
- Stomp, M., Huisman, J., Pick, F.R., Laamanen, M., Haverkamp, T. & Stal, L.J. (2007). Colourful coexistence of red and green picocyanobacteria in lakes and seas. *Ecology Letters*, 10, 290-298.
- Stomp, M., Huisman, J., Stal, L.J. & Matthijs, H.C.P. (2007). Colorful niches of phototrophic microorganisms shaped by vibrations of the water molecule. *ISME Journal*, 1, 271-282.
- Benincà, E., Huisman, J., Heerkloss, R., Jöhnk, K.D., Branco, P., van Nes, E.H., Scheffer, M. & Ellner, S.P. (2008). Chaos in a long-term experiment with a plankton community. *Nature*, 451, 822-825.
- Paerl, H.W. & Huisman, J. (2008). Blooms like it hot. *Science*, 320, 57-58.

Aquatic Ecology and Ecotoxicology (Chair Prof. dr. Wim Admiraal)

- Droge, S.T.J., Leon Paumen, M., Bleeker, E.A.J., Kraak, M.H.S. & Van Gestel, C.A.M., (2006). Chronic toxicity of polycyclic aromatic compounds to the springtail *Folsomia candida* and the enchytraeid *Enchytraeus crypticus*. *Environmental Toxicology and Chemistry*, 25: 2423-2431.
- Pieters, B.J., Jager, T., Kraak, M.H.S. & Admiraal, W. (2006). Modeling responses of *Daphnia magna* to pesticide pulse exposure under varying food conditions: intrinsic versus apparent sensitivity. *Ecotoxicology*, 15: 601-608.
- Drabkova, M., Admiraal, W. & Marsalek, B. (2007). Combined exposure to hydrogen peroxide and light - selective effects on cyanobacteria, green algae and diatoms. *Environmental Science and Technology*, 41, 309-314.
- Guasch, H., Lehmann, V., Beusekom, B. van, Sabater, S. & Admiraal, W. (2007). Influence of phosphate on the response of periphyton to atrazine exposure. *Archives of Environmental Contamination and Toxicology*, 52, 32-37.
- Leon Paumen, M., Steenbergen, E., Kraak, M.H.S., Straalen, N.M. van & Gestel, C.A.M. van (2008). Multigeneration exposure of the springtail *Folsomia candida* to phenanthrene: From dose-

response relationships to threshold concentrations. *Environmental Science and Technology*, 42, 6985-6990.

## 1.2. Management structure

IBED is led by a Director, a role currently fulfilled by Prof. dr. Peter H. van Tienderen. The Director is given a wide-ranging mandate by the Dean of the Faculty of Science to run the Institute. The Director is responsible for the scientific programme and its quality, the contributions to the Faculty's educational programme, and for human and financial resource management. As such the Director's mandate includes the development of the scientific programme and profile of the Institute, the hiring of new personnel, the financial planning and control, and the decisions concerning investments in facilities and instrumentation.

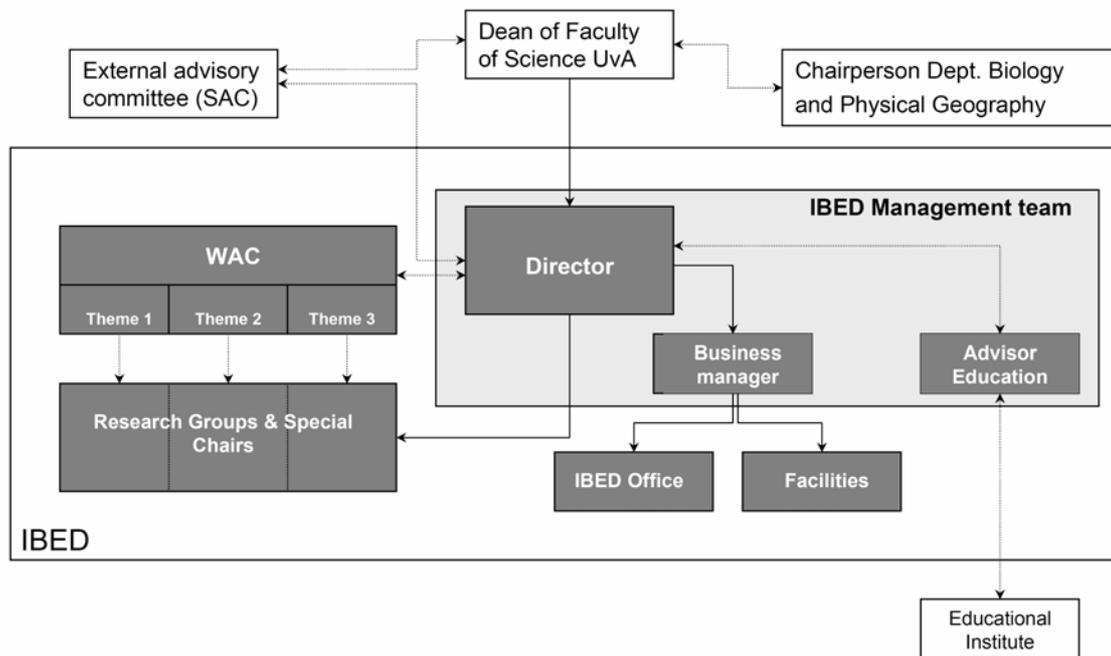


Figure 2: Management structure of IBED

The actual day-to-day financial and personnel management is delegated to the Business Manager of the Institute, a role currently fulfilled by Frank Hammecher. He is responsible for the daily administrative processes, finances and personnel, and the shared facilities of the Institute. Together with the Director, the Business Manager oversees the yearly budget development of the Institute and works out the allocation of resources to the different Research Groups, facilities and labs. The Business Manager also controls the income and expenditure of IBED and makes assessments of the actual spending of research projects given the financial conditions set by the Institute and/or granting bodies. In addition to the Director and the Business Manager, the IBED Management Team consists of an Advisor for educational issues and is supported by a Management Assistant. The Director is further supported by a (part-time) Science Officer who is responsible for internal and external PR of the research of the Institute, and who plays a supporting role in IBED's policy development. In matters concerning research priorities, mid-term policies and project applications that require substantial matching from the Institute, the Director is advised by the internal Scientific Advisory Committee (WAC). The WAC comprises two representatives of each of the three IBED research Themes as well as a Secretary. The Director seeks the WAC's opinion on important

developments concerning IBED research, but the WAC itself can also take the initiative to advise the Director on any topic it considers important.

Finally, IBED has an external Scientific Advisory Committee (SAC) consisting of Peers from international sister Institutes. The SAC has an advisory role, and is called upon whenever the Director feels an independent, external reflection on the past performance and future direction of IBED is needed. As such the SAC also plays an active role during research assessments such as the present mid-term review.

## 2. Implementation of previous recommendations

The overall assessment of IBED in 2006 was very positive. The Institute was assessed by the Peer Review Committee as being of high quality, highly productive and highly relevant. The Committee described the research of IBED as unique for The Netherlands and exceptional internationally, and indicated the research program of IBED as a whole to be functionally coherent, with the three Research Themes offering many possibilities for co-operation. The Committee saw the sound mixture of experimental work, theoretical work and strong conceptual thinking as a strong point of IBED. In addition to its praise, the Peer Review Committee made several recommendations to further strengthen the Institute. In the next paragraphs, the three main concerns and several minor points raised by the Committee are listed together with the actions taken by IBED over the last three years.

### 2.1. New Chair in Earth Surface Sciences

The greatest concern of the Peer Review Committee was the long standing vacant Chair in Earth Surface Sciences. a Chair that the Committee described as absolutely essential for studying ecosystem dynamics. IBED is pleased that after an extensive and thorough selection procedure it succeeded to fill the Chair as of 1 January 2009 in the person of Prof. dr. Karsten Kalbitz. Prof. Kalbitz joined IBED after working at the Centre for Environmental Research (UFZ) in Leipzig-Halle (Germany) from 1993-1998 and subsequently at the University of Bayreuth (Germany), where he completed his Habilitation in 2004 and held a position until his move to IBED. Prof. Kalbitz's research background lies in the dynamics of matter fluxes and their controlling factors and processes in natural and anthropogenic ecosystems. In the capacity of Chair of Earth Surface Sciences, Prof. Kalbitz will work towards an improved understanding of geo-ecological systems in a changing environment. His domain will be the interface of soil, air and water in the landscape. Prof. Kalbitz will investigate interrelationships between biogeochemical and geomorphological processes in terrestrial and adjacent aquatic ecosystems at different scales from the molecular scale to the landscape level. Multidisciplinary approaches, innovative experiments and application of modern tools of analytical chemistry are essential preconditions if the scientific challenges of climate change and other human-made impacts are to be met, and will form the core of the research of the Group. With the arrival of the new Chair, IBED invested in the Earth Surface Sciences Research group by improving the lab infrastructure and making internal funds available to hire a PhD candidate and a Post-Doc researcher. Both positions are now filled. IBED also funded the promotion of an existing half-time Post-Doc researcher of the group to a tenured half-time Assistant Professor (UD) position. The group was further extended with two PhD students from Prof. Kalbitz's previous group that are funded by the Deutsche Forschungsgemeinschaft (DFG) and accompanied him to his new position with IBED. They will complete their PhD work, including their obtaining of a doctorate degree, at the UvA. At the same time, the group was extended by four PhD students and a Post-Doc researcher appointed within the framework of three large projects funded in 2008 within the seventh Research Framework Programme of the European Union (EU-FP7). Altogether this has made the Earth Surface Sciences Research group a very viable group that holds great promises for the future.

### 2.2 Integration of e-BioScience

The Peer Review Committee expressed concern about the way IBED as a whole deals with bioinformatics, complex data handling and mathematical modelling, collectively called "e-BioScience". In response to this, IBED followed two approaches to stimulate the e-BioScience

approach in IBED research. One of the strength of IBED is the combination of concept-driven and data-driven approaches. On the one hand we can learn from theoretical models that show us the complex behaviour of systems and implications of networks of cause-and-effect relations. On the other hand observations of spatio-temporal patterns of individuals, species groups or communities provide the means to confront theoretical models with field observations and generate the inspiration for new hypotheses. Both approaches profit extensively from the developments in e-Science, the increasing computing power and new methodologies for virtual collaboration and information management in distributed data bases as well as for visualization and data analysis. The eScience activities profit from co-operation with institutes outside the UvA (like CWI, mathematics and SARA, computing) located at Science Park Amsterdam.

To strengthen the e-BioScience approach within IBED, part-time professors of Computational Geo-Ecology, Aquatic Biology and Theoretical Ecology have been upgraded to full professorships and new permanent staff has been appointed (or is being attracted) in these research groups. International acknowledgement of IBED's e-BioScience activities is enhanced by the many and high ranking publications (including 2 papers in Nature and 1 in PNAS in the period 2006-2008), international scientific collaboration, a guest professorship, and international summer courses<sup>1</sup>.

An e-BioScience approach requires investments in new infrastructure, new tools and methodologies, and education. e-BioScience projects are used to speed up such developments. Former projects ICES-biodiversity, BSIK-Virtual Lab e-Science (1.25M€), and recently BigGRID (0.3M€) have contributed to a better infrastructure needed for compute intensive modelling. Spatial explicit modelling of population dynamics, spreading of viruses or Bayesian inverse modelling are examples of our research with a clear need for an optimal infrastructure for parallel computing.

Projects like Data Authority for Nature (GAN, 1.8M€), FlySafe (ESA, 0.9M€), and LifeWatch (5M€), in which IBED plays leading roles, are strategic initiatives to strengthen the data-driven modelling approaches. These projects aim to build distributed infrastructures to access, explore, visualize and analyse observations of spatio-temporal distributions and behaviour of species, in relation to environmental conditions. GAN is a national infrastructure for the NDFF, the national Database for Flora and Fauna, and EcoGRID the e-Science infrastructure to access the data and analyse the dynamics in relation to environmental conditions. IBED is architect of NDFF-EcoGRID. The infrastructure is "under development", but since this year already in use by universities (for ecological niche modelling and nature conservation) and by commercial enterprises and public authorities. FlySafe is a research infrastructure for bird migration in which GPS-tags and European military and weather radars are used to monitor bird migration. FlySafe is used for research of bird migration in relation to weather and landscape properties. LifeWatch is a EU funded ESFRI research infrastructure that aims at constructing facilities, hardware, software and governance structures for all aspects of biodiversity research. A total of 30 universities and research institutes from 18 countries participate in the LifeWatch preparatory phase. IBED is initiator and co-ordinator of LifeWatch (see section 3.3).

In the past years, collaboration between IBED and its sister institutes for Informatics (IvI), and Life Sciences (SILS) of the Faculty has been intensified. This has led amongst others to active

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<sup>1</sup> IBED organizes yearly summer courses for PhD-students and PostDocs  
Geostat2008: Spatio-temporal data analysis: R + SAGA + Google Earth (27 participants of which 16 from abroad);  
SCGE2009: Inverse Modelling for Improving Environmental and Ecological Models (27 participants of which 18 from abroad)

participation in the preparation of a Faculty of Science Research Priority “eScience”, which means that (limited) extra funds will become available from the Faculty to stimulate eScience research. The three main UvA institutes involved, IvI (Informatics), SILS (Life Sciences) and IBED have proposed to focus the profile of eScience at the University of Amsterdam on Decision Support Systems based on complex and heterogeneous data, in fields as epidemiology, spatial planning/biodiversity, and forensics. This fits very well in IBED’s activities and mission and the implementation of the Research Priority will start in 2010.

### 2.3 Maintaining enough critical mass

The third concern of the Peer Review Committee dealt with the critical mass needed to perform the ambitious mission of IBED. The Committee indicated that attempts to attract externally funded staff to maintain the necessary critical mass should not come at the expense of the quality of the fundamental research. IBED agrees that this is a delicate balancing act. Given the steadily decreasing amounts of direct funding, the Institute intensified its pursuit of external funds and has successfully done so in the last three years. However, all applications for external funding are critically evaluated and care is taken to ensure externally funded research programmes fit well within the mission and scope of IBED. In this respect the societal relevance of IBED’s research is a great advantage. Nevertheless, direct funding will always be necessary to maintain enough critical mass and pursue more fundamental research lines. As such structural budget cuts in direct funding announced by the University in 2009 are a great point of concern for IBED. Within the context of maintaining critical mass, the Committee also recommended that to guarantee the viability of IBED’s Research Theme of Community Dynamics (Theme 3), it is urgent to extend the small staff of the Theoretical Ecology (TE) Research Group. In response, IBED created a new tenured research position in this group. A first application round was not successful, but filling the vacancy has a high priority for IBED.

### 2.4 Other recommendations

In addition to the previous three main concerns, the Peer Review Committee saw some more minor points of attention. Firstly, the Committee recommended pursuing a more active role of the external Scientific Advisory Committee (SAC). Due to various reasons this has proven to be difficult to organize, although the SAC has an active role in the current mid-term evaluation. Together with the Chair of the SAC, IBED will discuss the future role of the SAC. Secondly, the Committee expressed some concern about matching requirements for external funds attracted by the Institute. Fortunately the matching requirements of the important personal grant system of the Dutch government (NWO ‘Vernieuwingsimpuls’) have been relaxed as of 2009. In addition, the Faculty has provided more transparency in the way in which the university matches funds obtained from external sources (grants and contracts) so that IBED can base its policies on clear considerations of the expected costs and output. Thirdly, the Committee recommended exploring the possibility of installing an independent PhD mentor. A PhD mentor was indeed installed in the person of Prof. dr. N. Nanninga, a retired professor from IBED’s sister institute SILS, in 2007. Finally, the Committee advised to organize outreach activities in the form of IBED symposia and Master Classes for MSc students. IBED recognizes the importance of such outreach activities, especially given the societal relevance of its research, and organized several in the last three years. Examples are the IBED Open House in 2008 specifically aimed at various societal stakeholders of IBED, as well as several MSc masterclasses, and other meetings together with external organisations such as the Netherlands Institute for Ecology (NIOO).

The Peer Review Committee also made several recommendations on the level of the three Research Themes of IBED. The most important ones are listed below.

Within Theme 1, the Peer Review Committee commended all participating Research Groups for their scientific quality and relevance. For both the Evolutionary Biology and the Experimental Plant Systematics groups, the Committee concluded that the range of research topics was rather broad, and these considerations are taken into account in the further planning in these groups. The committee also indicated that in particular the research of Theme 1 necessitates further developments of IBED within the field of eBioScience, as described above in section 2.2. Finally, the Committee recommended that specifically Theme 1 would benefit from collaboration with the new Netherlands Centre for Biodiversity (NCB) in Leiden. This is dealt with in the next section.

Within Theme 2, again all research groups were considered scientifically relevant and of high quality. The main recommendation of the Peer Review Committee concerned the vacant Chair in Earth Surface Sciences as described in section 2.1. In addition, the Committee indicated that, analogous to Theme 1, further clarity in the developments in eBioScience were relevant for Theme 2 as well.

The Population Biology, Theoretical Ecology and Aquatic Microbiology Research Groups of Theme 3 were considered truly excellent by the Peer Review Committee. The actions taken upon the recommendation of the Committee to expand the small staff of the Theoretical Ecology Research Group in this Theme were described in section 2.3. Also, a new Tenure Track position was created in the group of Aquatic Microbiology (filled by Dr. Maayke Stomp).

The Committee's evaluation of the Aquatic Ecotoxicology group deserved some extra attention. First of all, the group's focus is somewhat different than that of the other groups, with a closer link to applications and collaboration with external organisations, which may have affected the assessment. The group's output is sound, and the publications are of high quality and published in high ranked journals in the field (see section 1.2). Moreover, the group has started several new projects with in the last three years, including ones that make use of modern developments in, for instance, genomic research. Also collaboration with other IBED groups is being intensified. An example is increased collaboration with the Earth Surface Sciences group from Theme 2, as for instance in the large EU FP7 funded ENFIRO project that was acquired in 2008 and carries a total funding 3.4 M€.

### 3. New developments

A number of developments, some unforeseen, have taken place in the last couple of years and will be dealt with in this section.

#### 3.1. IBED and Systems Biology

Biological systems can be extremely complex. Their functioning often depends on processes that cross a wide range of spatial and temporal scales, from small-scale molecular interactions to large-scale ecosystem dynamics. Advances in technology (such as genomics, in-situ monitoring, remote sensing) and computational power are currently revolutionizing our understanding of biological systems. The University of Amsterdam aims to become a key player in this area, and in 2009 the Faculty of Science decided to invest in Systems Biology. Furthermore, in a competitive call for new university Research Priorities the Systems Biology proposal obtained the highest rank of the University Research Committee (AUC), the advisory committee of the central University Board. The Board indeed decided to grant the proposal, and in total 1.67 M€ will be invested in Systems Biology in the coming 5 years. Research will focus on the dynamics of biological systems, using a combination of mathematical models, laboratory experiments, observational studies and data analyses. The program will comprise all levels of biological organization, including molecular, physiological and ecological studies, and will be carried out by the institutes IBED and SILS. IBED's role in the University Research Priority Systems Biology is mainly through development of the subprogram Eco-Systems Biology. This subprogram will investigate the dynamics of community and ecosystem processes, using a combination of theory and experiments. Major challenges include, for instance, (i) the study of species interactions in microbial communities, (ii) the impact of individual variation in physiology and life history on food webs, and (iii) the interplay between species traits and ecosystem processes. Different IBED research groups will participate in these developments, and Prof. Jef Huisman (Aquatic Microbiology) will coordinate IBED's role in the developments. The investments from UvA and FNWI will be used to attract a new staff member in systems biology of microbial communities, to hire PhD students and/or postdocs, and to invest in new research infrastructure. As already mentioned, IBED also intends to invest in a new staff member in theoretical ecology, strengthening the expertise on the analysis of complex food webs.

#### 3.2. NCB Naturalis Leiden and IBED's research

After a long process the Zoological Museum Amsterdam, Naturalis Leiden and the National Herbarium of the Netherlands will finally join forces in 2010. Substantial government funding will become available in the coming years to make this possible and concentrate all collections in Leiden under the (preliminary) name "NCB Naturalis". IBED participated in this development and the IBED director is part of the research committee that discusses the future research developments and investments. A (relatively small) part of the funds will be available for research. Nevertheless, IBED sees the foundation of the NCB Naturalis as an opportunity rather than a threat, as biodiversity research will become more prominent in the Netherlands. Research at the NCB will mainly concentrate on research associated with the available collections. IBED research concentrates on the underlying principles of the distribution and dynamics of biodiversity, combining field (and collection) data with experimentation, field observations and modelling. Thus, there are ample opportunities for collaboration.

The emergence the NCB Naturalis coincides with the biggest change in IBED in staff that occurred after the evaluation, with the departure of the Chair holder in Animal Zoology and Zoogeography, Prof. Michael Veith, who accepted a position in in Trier Germany, his home

country. The vacant position is not filled at the moment, greatly reducing IBED's expertise in animal biodiversity. But it also gives IBED the opportunity to reconsider its role in this field, and the relation to the NCB Naturalis.

It is not attractive to reinstall an IBED research group in Animal Systematics, knowing that the biggest concentration of this type of research will be in Leiden. Instead, IBED aims to strengthen its position in the analysis of biodiversity, and seek collaboration with the NCB Naturalis based on joint interests and complementary expertises.

This will entail the following elements:

- Collaboration will be set up between NCB and the appropriate IBED research groups (Evolutionary Biology, Experimental Plant Systematics, Computational Geo-Ecology). If suitable candidates are available, this could result in Special Chairs for leading NCB Naturalis scientists at the University of Amsterdam.
- At the moment two staff members from the institutes that are part of the NCB already work part-time at IBED (National Herbarium: Dr. Barbara Gravendeel, Naturalis: Dr. Kenneth Rijdsdijk). Such relationships and other types of (temporary) joint appointments might be expanded.
- A joint facility will be developed for the analysis of spatial data (using GIS), building forth on IBED's expertise. This involves hardware and training, and is also expected to result in collaborative projects.
- The special NCB facilities on ancient DNA and high throughput DNA barcoding will become available for IBED scientists.
- The IBED facilities for experimentation and analyses become available for NCB scientists.

Thus, IBED proposes to use the vacant position in Animal Systematics to strengthen its profile in the analysis of global biodiversity and evolutionary patterns, combining modern techniques (molecular genetic footprints, spatial analyses) and modelling of species distributions. This also fits with IBED's role in the development of eScience through the direct relationship with biodiversity conservation policies.

### 3.3. LifeWatch

The ESFRI LifeWatch project that was initiated by IBED can be seen as a logical result of the e-BioScience line of research of the Institute. A research line that revolves around a data-driven research approach that, in combination with a concept-driven research approach, forms the core of IBED's research philosophy as described in section 1.2. The LifeWatch concept is based on a three-step research strategy consisting of:

- (i) Collection and integration of new and existing biodiversity data from universities and (research) institutes of the participating countries.
- (ii) Construction of virtual 'e-laboratories' that enable access to and analysis of the collected data.
- (iii) Exploration of the collected data through data mining and advanced analyses with a goal of finding answers to existing research questions as well as generating new ones.

Once operational, LifeWatch intends to provide the research community with the tools and expertise needed for the exploration and analyses described under the third point.

On a smaller scale, IBED already successfully applied this strategy in the last few years in the EcoGRID and FlySafe projects where the first two steps are now completed and the third is currently in the process of being implemented. Only recently commenced, the larger scale LifeWatch project is currently in the phase of planning the first two steps. Once these are completed, the project will combine biodiversity data on an unprecedented scale that supersedes

boundaries of countries and organisations. For the first time this will allow for analysis, interpretation and prediction of global patterns of biodiversity data in a manner similar to the way that global meteorological data and models are currently combined, analyzed and applied. IBED will use the new data infrastructure to explore the response of biodiversity to external factors such as land-use practises and global change, and use the insights gained to develop and test new macro-ecological theories.

IBED's involvement in the current phase is two-fold: IBED's Wouter Los is conceiver and main driving force of the EU-funded preparatory phase that intends to deliver a 'signature-ready' document for the implementation in phase two. Willem Bouten en Peter van Tienderen play active roles in the contribution of the Netherlands in LifeWatch. Active lobbying is still needed to ensure that the Netherlands government will fully support LifeWatch. Two goals have to be reached: National (NWO) and international research and training programs (EU, including Marie-Curie) should be constructed that make use of the LifeWatch infrastructure, and Amsterdam should become the center of research at the interface of science and societal applications, in line with the emphasis on decision support systems of the eScience initiative. The preparatory phase ends in early 2011, and the European Commission will then decide on supporting the construction phase of LifeWatch.

Thus, the importance of LifeWatch for the university has two aspects. First, the university's profile in eScience will be stimulated by LifeWatch, and LifeWatch will profit from the strength of the area in eScience. Secondly, for IBED it will mean that the opportunities for research (and acquisition of projects) will be greatly enlarged.

## 4. Facts and figures

In the following paragraphs the tables required by the SEP protocol are provided and trends in the data evaluated. Analogous to the full evaluation in 2006, the three Research Themes of IBED are taken as the unit for evaluation as defined by the SEP protocol.

### 4.1. Personnel resources

Table 1 presents the division of IBED staff over various categories at Institute and Theme level in the last three years. The data show a decline in total research staff between 2006 and 2007. Between 2007 and 2008, while total fte's remained virtually the same, the absolute number of research staff increased. The latter is mainly the result of the substantial increase of the total number of PhD students in 2008. An increase that occurred after a dip in the preceding period and upon active promotion by IBED's management that sent out a clear message to all IBED scientists that more efforts in obtaining grants were needed. The latter was supported by making internal funds available for matching (e.g. matching of a fourth year for PhD students with a three year contract). The direct effect was an increased acquisition of external funding in 2007 specifically by attracting more PhD students. Given a continued success in acquiring external research projects in 2008, a further increase in the number of PhD students is expected in 2009.

Table 1: Staff at Institute and Theme level

	2006	2007	2008
<b>Institute for Biodiversity and Ecosystem Dynamics</b>			
	persons / fte	persons / fte	persons / fte
Tenured staff <sup>1</sup>	38 / 31.6	42 / 31.0	42 / 30.1
Non-tenured staff <sup>2</sup>	27 / 14.8	22 / 12.4	24.5 / 14.0
PhD-students <sup>3</sup>	38 / 30.1	34 / 26.5	40 / 25.9
<b>Total research staff</b>	<b>103 / 76.5</b>	<b>98 / 69.9</b>	<b>106.5 / 70.0</b>
Support staff	41 / 30.1	46 / 33.0	45.5 / 32.0
<i>Visiting fellows</i>	<i>81 / 22.6</i>	<i>69 / 21.7</i>	<i>86 / 23.3</i>
<b>Total staff (excluding visiting fellows)</b>	<b>144 / 106.6</b>	<b>144 / 102.9</b>	<b>152 / 102.0</b>
<b>Theme 1: Biodiversity and Evolution</b>			
Tenured staff <sup>1</sup>	8 / 7.3	12 / 7.8	12 / 6.8
Non-tenured staff <sup>2</sup>	6 / 2.7	4 / 2.5	3 / 2.1
PhD-students <sup>3</sup>	10 / 8.4	10 / 7.8	9 / 7.4
<b>Total research staff</b>	<b>24 / 18.4</b>	<b>26 / 18.1</b>	<b>24 / 16.3</b>
<b>Theme 2: Geo-Ecology</b>			
Tenured staff <sup>1</sup>	18 / 14.2	18 / 13.3	18 / 12.7
Non-tenured staff <sup>2</sup>	15 / 8.0	10 / 6.3	10.5 / 5.1
PhD-students <sup>3</sup>	12 / 9.4	13 / 8.8	17 / 9.2
<b>Total research staff</b>	<b>45 / 31.6</b>	<b>41 / 28.4</b>	<b>45.5 / 27.0</b>
<b>Theme 3: Community Dynamics</b>			
Tenured staff <sup>1</sup>	12 / 10.1	12 / 9.9	12 / 10.6
Non-tenured staff <sup>2</sup>	6 / 4.1	8 / 3.6	11 / 6.8
PhD-students <sup>3</sup>	16 / 12.3	11 / 9.9	14 / 9.3
<b>Total research staff</b>	<b>34 / 26.5</b>	<b>31 / 23.4</b>	<b>37 / 26.7</b>

<sup>1</sup> Corresponds to WOPI categories HGL, UHD and UD; <sup>2</sup> Corresponds to WOPI category Onderzoeker, including PostDocs; <sup>3</sup> Standard PhD (employed) and Contract PhD's (externally or internally funded, but not employed)

The observed trends at research Theme level are similar to the ones at Institute level, with the exception of Theme 1 that did not see an increase in any of the staff categories between 2007 and 2008. An important reason for this lack is that the Chair of Animal Systematics and Zoogeography left IBED after accepting a position at the University of Trier. The fulfilment of his position was postponed due to imminent structural budget cuts in internal funding by the Faculty. These will inevitably impact the development of tenured staff size of IBED in the coming years and form a point of great concern for IBED. Particularly in the light of the recommendations by the Peer Review Committee in 2006 about maintaining enough critical mass within the ranks of internally funded staff.

Before the end of 2009 IBED is expected to complete a plan for the development of the Institute in the coming 5 years. This plan is still under discussion, but given budget cuts of approximately 10 per cent are difficult to realize without reductions in tenured positions. Goal is to maintain research groups of excellent quality and with adequate support, as spreading out the budget cuts evenly (the Dutch 'kaasschaaf' method) would erode the quality of all groups. Obviously, compensating budget cuts by other means is preferable and will receive much attention, as explained in sections 5 and 6.

## 4.2. Research output

In Table 2 the research output of IBED in the form of publications is provided at Institute and Theme level. The subdivision in non-refereed publications is less extensive than in the SEP protocol. Reason is that such an extensive subdivision is not very informative, nor is it an accurate representation as the registration of non-refereed publications of various kinds in the University's publication database METIS is not very reliable. The subdivision of PhD theses in different categories is more extensive than required by the SEP, but conforms to Faculty reporting norms. The most recent figures from the METIS database were used. These may differ slightly from the numbers reported in the annual reports of 2006 and 2007 as a result of minor additions and/or corrections in the database after completion of the report in a given year. IBED was commended for its productivity by the Peer Review Committee in 2006 and is pleased to have been able to maintain and even slightly increase the number of peer-reviewed publications over the last three years. In addition, it is noteworthy that each year several of the peer-reviewed publications appeared in top-rank journals such as Nature, Science and PNAS. Both facts bear witness to the continued healthy academic status of the Institute. The trends in numbers of peer reviewed publications are similar in all of the three Themes. The overall higher number of publications in Theme 2 is explained by the larger number of staff in that Theme (see Table 1). Publications in the top-rank multidisciplinary journals originate in particular from Theme 3, the Theme that also received the highest marks in the peer review, with especially the Research Groups of Aquatic Microbiology (led by Prof. J. Huisman), Theoretical Ecology (led by Prof. A.M. de Roos) and Population Biology (led by Prof. M.W. Sabelis) showing an outstanding record.

After an increase in 2007, the number of PhD theses produced was substantially lower in 2008. The lower number of theses does not reflect a decreased success rate of IBED's PhD students, but rather a decline in the absolute number of PhD students enrolled in a given year. As discussed more extensively in section 4.4, the main cause of the decline is the decreased availability of internally funded PhD positions within the Institute over the last few years that was not compensated by the acquisition of external funding for the group of PhD students that graduated in 2006-2008. While there is obviously a time lag between appointment of a PhD student and the publication of his/her PhD thesis, the earlier mentioned increased inflow of PhD students in 2008 and 2009 will eventually lead to an increase in number of published theses. As

of 2009 the method of budget allocation from the Faculty to its Research Institutes incorporates the number of PhD defenses as a critical parameter. IBED has made a planning for the number of expected PhD defenses in the coming years, showing that while 2009 still is below the target number of around 12, a moderate increase is expected in the next few years.

Table 2: Main categories of research output at Institute and Theme level

	2006	2007	2008
<b>Institute for Biodiversity and Ecosystem Dynamics</b>			
Refereed articles	146	156	156
Book Chapters and Articles in Proceedings (refereed)	24	24	25
Monographs (refereed)	0	0	0
PhD-theses Category A	9	16	5
PhD-theses Category B	2	0	0
PhD-theses Category C	1	0	1
PhD-theses Category D	0	0	0
Other publications	32	30	30
<b>Total publications</b>	<b>214</b>	<b>226</b>	<b>217</b>
<b>Theme 1: Biodiversity and Evolution</b>			
Refereed articles	38	46	44
Book Chapters and Articles in Proceedings (refereed)	1	2	5
Monographs (refereed)	0	0	0
PhD-theses Category A <sup>a</sup>	2	7	3
PhD-theses Category B	0	0	0
PhD-theses Category C	0	0	0
PhD-theses Category D	0	0	0
Other publications <sup>b</sup>	9	2	4
<b>Total publications</b>	<b>50</b>	<b>57</b>	<b>56</b>
<b>Theme 2: Geo-Ecology</b>			
Refereed articles	66	67	66
Book Chapters and Articles in Proceedings (refereed)	21	18	13
Monographs (refereed)	0	0	0
PhD-theses Category A <sup>a</sup>	4	2	1
PhD-theses Category B	0	0	0
PhD-theses Category C	0	0	0
PhD-theses Category D	0	0	0
Other publications <sup>b</sup>	18	26	23
<b>Total publications</b>	<b>109</b>	<b>113</b>	<b>103</b>
<b>Theme 3: Community Dynamics</b>			
Refereed articles	42	43	46
Book Chapters and Articles in Proceedings (refereed)	2	4	7
Monographs (refereed)	0	0	0
PhD-theses Category A <sup>a</sup>	3	7	1
PhD-theses Category B	2	0	0
PhD-theses Category C	1	0	1
PhD-theses Category D	0	0	0
Other publications <sup>b</sup>	5	2	3
<b>Total publications</b>	<b>55</b>	<b>56</b>	<b>58</b>

<sup>a</sup> Categories: A = UvA dissertation, both research and doctorate degree at the UvA; B = Dissertation, research at the UvA, dissertation external; C = Dissertation, research external, dissertation at the UvA; D = Dissertation, both research and dissertation external, (co)-promoter UvA.

<sup>b</sup> This category includes all non-refereed publications, with the exception of abstracts.

### 4.3. Research funding

Table 3 presents information about the research funding of IBED at Institute and Theme level. Funding figures in fte are based on research input according to Faculty standards, i.e. 0.5 fte for tenured scientific staff, 0.75 fte for PhD students with educational tasks, 0.9 fte for PostDocs and 1.0 fte for researchers and PhD students exempted from educational tasks, all based on full-time employment. Please note that the funding percentages at Institute level reflect the absolute division of funding over the four funding categories. Because of differences in salaries and in the earlier mentioned research fte's assigned to the various employee types, the observed trends in percentages and fte's may differ. For instance the differences in percentages between the categories 'direct funding' and 'research grants' is much greater than the differences in fte's between the same two categories. This is the result of the generally higher salaries and lower research input in fte's according to Faculty standards of the senior tenured staff present in the 'direct funding' category.

Table 3: Research funding at Institute and Theme level (with fte's representing research input)

	2006	2007	2008
<b>Institute for Biodiversity and Ecosystem Dynamics</b>			
<i>Funding:</i>	<b>fte / %</b>	<b>fte / %</b>	<b>fte / %</b>
Direct funding <sup>1</sup>	22.6 / 77%	20.6 / 80%	20.8 / 70%
Research grants <sup>2</sup>	20.5 / 10%	15.4 / 9%	12.9 / 12%
Contract research <sup>3</sup>	9.6 / 10%	7.0 / 8%	11.0 / 16%
Other <sup>4</sup>	8.3 / 4%	9.3 / 3%	8.7 / 3%
<b>Total funding</b>	<b>12,669 k€</b>	<b>10,917 k€</b>	<b>12,239 k€</b>
<i>Expenditure:</i>	<b>k€ / %</b>	<b>k€ / %</b>	<b>k€ / %</b>
Personnel costs	7,837 / 67%	7,127 / 73%	8,149 / 72%
Other costs	3,810 / 33%	2,588 / 27%	3,125 / 28%
<b>Total expenditure</b>	<b>11,647 k€</b>	<b>9,715 k€</b>	<b>11,274 k€</b>
<b>Research Themes</b>			
<i>Funding:</i>	<b>fte / %</b>	<b>fte / %</b>	<b>fte / %</b>
Theme 1: Biodiversity and Evolution	15.6 / 26%	14.3 / 27%	15.3 / 29%
Theme 2: Geo-Ecology	22.6 / 37%	18.3 / 34%	18.1 / 35%
Theme 3: Community Dynamics	22.9 / 38%	20.8 / 39%	18.9 / 36%
<b>Total Funding</b>	<b>61.0 fte</b>	<b>53.4 fte</b>	<b>52.3 fte</b>

<sup>1</sup> Direct funding ('eerste geldstroom'); <sup>2</sup> Research grants obtained from the national science foundation ('tweede geldstroom'); <sup>3</sup> Research contracts for specific research projects obtained from external organizations, such as industry, government/aqaralahul ministries, European Commission and charity organizations ('derde geldstroom'); <sup>4</sup> Funds that do not fit the other categories.

The decrease in funding amounts between 2006 and 2007 visible in Table 3 can partially be explained by a change in the University's financial system but do correctly reflect a decline in funding in these years. Increased acquisition efforts in 2008 resulted in an absolute funding level on par with that of 2006, showing that IBED was able to compensate a steady decline in internal funding by acquisition of more external funds. The trend of increased external funding is also apparent from the marked increase in percentage of funding derived from Research Grants and Contract Research in 2008 as compared to both previous years. Particularly the percentage of funding from the last category increased sharply, doubling between 2007 and 2008. The success in acquisition is also expected to increase external funding in 2009 when acquired projects commence. However, once more it should be emphasized that there are limits to the decline in direct funding that an institute like IBED can endure before jeopardizing the critical mass needed

for its fundamental research, and external funding opportunities have a tendency to vary in time due to forces outside IBED's reach.

#### 4.4. PhD Candidates

In Tables 4 and 5, information is provided about the enrolment and success rates of the PhD candidates of IBED that started in the period 2000-2004. PhD candidates all have a primary aim of performing research to obtain a PhD degree from the University of Amsterdam. As stipulated by the SEP protocol, within the group of PhD candidates a subdivision into two categories is made. The first category contains standard PhD candidates, i.e. those with employee status under Dutch law. This includes candidates employed directly by the University of Amsterdam as well as those on secondment from an external employer, e.g. NWO. Please note that the majority of PhD candidates funded by research grants in (inter)national competition have employee status and as such fall under the first category. The second category contains contract PhD candidates, i.e. those without employee status but receiving external funding or a scholarship/stipend.

Table 4: Enrolment and success rates of Standard PhD Candidates

Enrolment			Success rates					
Starting year	Enrolment (male / female)	Total (male+ female)	Graduated after (≤) 4 years	Graduated after (≤) 5 years	Graduated after (≤) 6 years	Graduated after (≤) 7 years	Not yet finished	Discontinued
2000	7 / 4	11	3 / 27%	4 / 36%	5 / 45%	7 / 64%	1 / 9%	3 / 27%
2001	6 / 7	13	3 / 23%	6 / 46%	10 / 77%	11 / 84%	1 / 8%	1 / 8%
2002	7 / 1	8	3 / 38%	4 / 50%	4 / 50%	-	3 / 37%	1 / 13%
2003	2 / 4	6	3 / 50%	3 / 50%	-	-	2 / 33%	1 / 17%
2004	3 / 5	8	3 / 38%	-	-	-	5 / 62%	0 / 0%
<b>Total</b>	<b>25 / 21</b>	<b>46</b>	<b>15 / 33%</b>	-	-	-	<b>12 / 26%</b>	<b>6 / 13%</b>

Table 5: Enrolment and success rates of Contract PhD Candidates

Enrolment			Success rates					
Starting year	Enrolment (male / female)	Total (male+ female)	Graduated after (≤) 4 years	Graduated after (≤) 5 years	Graduated after (≤) 6 years	Graduated after (≤) 7 years	Not yet finished	Discontinued
2000	7 / 2	9	6 / 67%	6 / 67%	6 / 67%	7 / 78%	1 / 11%	1 / 11%
2001	8 / 5	13	9 / 69%	11 / 85%	11 / 85%	11 / 85%	0 / 0%	2 / 15%
2002	10 / 5	15	8 / 53%	10 / 67%	11 / 73%	-	3 / 20%	1 / 7%
2003	6 / 1	7	2 / 29%	2 / 29%	-	-	3 / 42%	2 / 29%
2004	4 / 4	8	3 / 38%	-	-	-	3 / 38%	2 / 24%
<b>Total</b>	<b>35 / 17</b>	<b>52</b>	<b>28 / 54%</b>	-	-	-	<b>10 / 19%</b>	<b>8 / 15%</b>

Table 4 shows that the enrolment of standard PhD students significantly declined in the period 2002-2004 compared to the previous two years. This decline affected the number of realized PhD graduations in the current evaluation period. As already mentioned, the decline in enrolment of standard PhD candidates in the period 2002-2004 was caused by a reduction in internal funding coupled with increasing matching requirements of externally acquired funding, and the total number of PhD candidates has increased again. A trend that most likely will be strengthened further by the appointment of the new Chair of Earth Surface Sciences in 2009, as well as through increased efforts by IBED to form strategic alliances with external partners. The

successful deflection of the decreasing enrolment figures is already visible in the increase in absolute number of PhD students working at the Institute in 2008 as compared to 2007 (see Table 1). The enrolment of contract PhD candidates fluctuated over the time period 2000-2004 (Table 5). This is caused by the fact that the funding of this heterogeneous group often depends on external factors beyond IBED's control, for instance, the ability of a potential candidate to acquire funding from his/her national government or local science foundation.

While fluctuating from year to year, the overall male/female ratio of standard PhD candidates enrolled in the period 2000-2004 was almost equal (Table 4). This is in line with the aspiration of the Faculty of Science to promote the employment of women in scientific positions. In contrast, the male/female ratio of contract PhD candidates shows a predominance of male candidates (Table 5). The main reason is that contract PhD candidates often independently seek out IBED to perform their research, and often come from foreign countries where equal representation of women in science education is not (yet) the norm.

Tables 4 and 5 show that the vast majority of standard as well as contract PhD candidates of IBED completed their PhD successfully. Of the contract PhD candidates the majority did so within the standard 4 years allotted to a PhD project in The Netherlands. Of the standard PhD candidates on average one third graduated within four years. The figures for contract PhD students are biased because this category includes candidates who have already done work for their PhD research before registering at IBED, and consequently need less time to finish. In addition, it should be noted that in both categories the figures have not been corrected for legitimate contract extensions, e.g. as a result of maternity leave or parental leave. With 50% of candidates graduated after 5 years in 2003 and 2004 compared to 46% and 36% in respectively 2002 and 2001, the time period standard PhD candidates need to graduate has declined somewhat. Nevertheless, IBED sees the average time period needed for completion of a PhD project as a point of attention and is actively taking measures to reduce it. Also the percentage of projects that do not lead to a successful PhD thesis is a point of concern. Measures taken include more intensive supervision of PhD candidates, and earlier detection of potential problems. In IBED's view the Faculty's policies on evaluations are not always helpful, creating many formal procedures rather than providing effective instruments that are appreciated by the PhD students and supervisors.

## 5. SWOT analysis

Based on our own performance assessment, the recommendations from the Peer-Review Committee in 2006 as well as those from our external Scientific Evaluation Committee (SAC) the following strengths, weaknesses, opportunities and threats for IBED can be identified.

### 5.1 Strengths

#### General

- The multidisciplinary research focus of IBED on ecosystem dynamics from molecule and gene to ecosystem level combining biology, physical geography, chemistry and mathematical modelling is unique in The Netherlands and exceptional internationally.
- The research programme of IBED has a well balanced mixture of experimental work, theoretical work and strong conceptual thinking.
- IBED's research programme has a high societal relevance that places IBED in an excellent position to substantially contribute to the scientific underpinnings of topical issues such as environmental change and sustainable use of natural resources.
- IBED's staff is highly skilled, motivated and committed to its mission. Staff members have a clear awareness of the unique scientific position of IBED.

#### Facilities

- The IBED-GIS studio and the state-of-the art computational facilities available at the Science Park offer excellent possibilities for the computational part of IBED's research, and the further development and implementation of the eBioScience initiative.
- IBED has state-of-the-art chemical and biological laboratories.
- In 2009 part of IBED moved to the new building at Science Park, and in the summer of 2010 the rest of IBED, now located in the city, will follow. The lab infrastructure at the new location is truly excellent.

#### Science

- The overall quality of IBED's research is very high and results in an excellent academic productivity in the form of peer-reviewed publications, contributions to conferences and relevant functions fulfilled by IBED staff.
- IBED is able to translate its fundamental research results to practical applications relevant to society such as a new cleanup procedure to combat cyanobacteria pollution of surface waters and a GPS tool to track animal movement.
- IBED succeeds in bridging the gap between science and society, as evidenced by a large coverage in the (inter)national media.
- IBED is flexible in applying its research philosophy and methodology to new fields. This is illustrated amongst others by the leading role of IBED in the upcoming fields of Systems Biology and e-Bioscience. Another example of a new field for IBED is Forensic Science, with the establishment of a new Chair in Forensic Biology, coupled to the successful MSc programme Forensic Science.

## 5.2 Weaknesses

### General

- The number of PhD theses showed a strong decline in 2008, in part due to the decreased availability of internally funded PhD positions (see Table 2). While the enrolment of externally funded PhD students currently shows an increasing trend again, and the average time period between enrolment and graduation has steadily decreased over the last few years, IBED should remain vigilant to ensure a larger output of PhD theses.
- The enrolment of MSc students in the existing biological and earth science tracks offered by IBED is relatively small. A critical evaluation of the programmes and intensified promotional efforts are needed. This will be done in the context of the new Amsterdam Graduate School of Science, (AGSS), a joint initiative of the University of Amsterdam and the Vrije Universiteit Amsterdam.

### Facilities

- Although state-of-the art equipment has been acquired by IBED with the help of external funding, the budget to update and renew such instrumentation and hire support staff to operate it is limited.

### Science

- While the level of integration of research within IBED is good, collaboration within IBED, in particular between the three Research Themes could be further strengthened.
- All IBED scientists have a dual task in teaching and research. Given IBEDs involvement in many curricula (biology, psychobiology, medical biology, earth sciences, beta-gamma, future planet studies, chemistry) the teaching load of many staff members is higher than desirable, impacting their scientific productivity. Moreover, organisational matters around teaching also take up too much time.
- The expertise in animal systematics within IBED largely disappeared after the Chair holder left. IBED was the only remaining institute in The Netherlands with a Chair in Animal Systematics.
- IBED is not (yet) recognized as a strong player in the study of broad patterns in biodiversity and ecosystem functioning, including human impacts. Elements are present in the different research themes (e.g. in the Paleo-Ecology and Landscape Ecology and Computational Geo-Ecology Groups of Theme 2), but coherence and visibility could be improved.

## 5.3 Opportunities

### General

- The housing of all IBED groups at one location as of the summer of 2010 offers a clear opportunity to further strengthen the internal collaboration between the Research Groups and Themes. The new location at the Science Park Amsterdam offers a very stimulating research environment and creates unique opportunities for collaboration with the other scientific institutes and spin-off companies.
- The increasing societal interest for issues such as global change and sustainability has sparked increasing demand for broad scientific education programmes that combine aspects from the social and natural sciences to tackle such issues. The expertise and

research mission of IBED place it in an ideal position to meet this demand. An example is the great success of the BSc programme Future Planet Studies that started in 2008 and was developed under the lead of IBED.

### Facilities

- Strategic alliances with other research institutes and companies that were initiated in the last few years (e.g. NCB, KWR, NIOO, NFI, Carmabi), amongst others in the form of Special Chairs, offer excellent opportunities for new research, sharing of research facilities and technical expertise. Such alliances can also increase the number of externally funded PhD theses.

### Science

- Increased societal and political awareness of the potential human impacts on climate and biodiversity have an already substantial and still increasing influence on the scientific research agenda. Its research expertise and track record give IBED a unique position to profit from these developments.
- IBED research is closely related to the main topics formulated by national (NWO) and international (EU) funding organizations, such as the new national research theme ‘Sustainable Earth’.
- IBED aims to play an active role in the development of Systems Biology in Amsterdam, with particular emphasis on the organism level and up. The acknowledgement of Systems Biology as Faculty and University Research Priority gives extra funds for research from 2010 onwards, and can make Amsterdam an international centre for Systems Biology.
- IBED has the lead in the preparatory phase of the LifeWatch program, a Research Infrastructure of the ESFRI program of the EU, focusing on Biodiversity assessment. If successful, this will greatly enhance the research opportunities for IBED in the construction and operational phase.
- The liaison of IBED with the NCB-Naturalis offers outstanding opportunities for collaboration in future biodiversity research.

## 5.4 Threats

### General

- The largest threat IBED faces is its dependence on internal funding from the Faculty of Science, given the structural budget cuts of the Faculty in the near future. For IBED this could amount to a reduction of 5-10 per cent. This may prevent the strategic appointment of tenured or tenure-track staff needed to maintain the critical mass of the Institute and to further integrate research lines. It will hamper efforts to keep qualified personnel in general and to increase the number of female scientists in permanent positions.
- Laboratory facilities are very good, but costs currently increase every year with approximately five per cent. The increasing burden on the limited internal funds of IBED comes at the expense of attracting new staff members. Although important steps to improve the situation have been taken by the Faculty in the last year, the transparency of how costs will develop and how IBED can influence them is still not optimal.
- Because other national and international institutes also suffer from decreased internal budgets, competition for external funding has steadily increased over the last few years.

As a result, a decreasing number of permanent staff members have to spend increasing amounts of time and effort to secure funding. This comes at the expense of time actually spend on research.

### **Facilities**

- Most grants and even contracts require matching in kind by delivering lab facilities and analyses. Insufficient budget for renewals is always a concern, for instance in case of calamities, as it is easier to get funding for new ‘toys’ than for maintaining existing equipment. Moreover, costs of (lab) facilities are part of the ‘integral costs’ for new projects, e.g. the costs of a PhD project. These costs are currently so high that they threaten to result in IBED/UvA no longer being competitive relative to other institutes. This will severely hinder participation in and negotiations with partners of collaborative projects as funded amongst others under the EU FP7 program.

### **Science**

- Funding agencies tend to support bigger consortia, creating virtual institutes, networks and centres of excellence. If participation in the initiatives in fields related to IBED’s central mission fail, the ambitions on acquisition of external funding will be difficult to achieve. However, participation in such consortia provides unique opportunities for IBED and is therefore actively pursued.
- As a result of decreasing internal funding, IBED increasingly depends on external funding that generally demands international rather than internal collaboration, and thereby threatens the coherence of IBED’s research.
- Several Special Chairs of IBED are close to retirement (Prof. dr. Rolf Bak, Tropical Marine Biology, Prof. dr. Remi Laane, Marine Biogeochemistry, and Prof. dr. Sybren De Hoog, Mycology). This poses the threat of losing vital scientific knowledge in specific fields if suitable replacements are not attracted.
- Many PhD projects are conducted by or in collaboration with external parties. However, such parties increasingly expect to receive part of the money received by the University for a PhD degree, posing yet another burden on the Institute’s internal funding.

## 6. Guiding principles and Actions

Based on the SWOT analysis and recommendations of the Peer Review Committee upon IBED's previous evaluation in 2006, IBED intends to follow the following guidelines, and implement a number of actions in the coming years.

### Guiding principles

- IBED should maintain sufficient critical mass to accomplish its mission. Groups should receive sufficient support in the form of staff, funding and facilities to maintain their excellence: strength and quality has priority over size.
- Maintaining critical mass given a decrease in direct funding means that other ways have to be found to safeguard IBED's research capacity. Such will be realized by extra funding from Research Priority programs and from external sources, and closer collaboration with partners.
- Although the quality of IBED's research is already very good, increasing scientific quality is a permanent goal of any scientific institute, and the best guarantee for a prosperous future. Policies will be implemented to more explicitly reward scientific excellence and success in external acquisition of funding by research groups and individual scientific staff members, in line with Faculty policies.
- In connection with the SWOT, a coherent plan for strategic appointment of new tenured staff is now being made for the coming six years (the budgetary conditions are not fully clear yet, so exact details can not be given). This will include the appointment of new scientists in emerging and promising fields and lab technicians trained in modern technologies. The financial means have to come from upcoming retirements of scientific and support staff in the coming years, plus additional external means.
- IBED aspires to maintain a steady level of external funding, aiming annually at 3.5-4.0 M€ in value, and approx. 15 new PhD projects starting each year.
- The main role of a research group leader (usually a full professor) should be to stimulate excellence in the research by the group members: her/his role is more a function as manager/coach than as a boss that takes all decisions. This also fits better with IBED's intention to use Tenure Track appointments as tool to attract top quality scientists that are given the opportunity to develop their own research lines.
- IBED intends to increase the number of tenured female scientists.

### Actions in this plan are

- The (small) group of Environmental Science will be discontinued upon retirement of the Chair holder.
- A new theoretical ecologist will be attracted to strengthen IBED's excellent profile in this field, and increase IBED's capacity in the analysis of complex ecosystems.
- Further investment in the field of Systems Biology will be made, and in particular in explaining the dynamics at the organismal level, in collaboration with SILS and the NISB. A new hire will be done in 2010, made possible by the university Research Priority funds.
- The number of female scientists will be increased either as part of a special Faculty Fellowship program (if this will be created) or by active scouting when filling vacant positions.

- The field of the analysis of patterns in biodiversity in space and time ('macro ecology') will be strengthened, building on existing expertise in Paleo- and Geo-ecology, and exploiting the possibilities offered by collaboration with NCB-Naturalis, the e-Science developments of EcoGrid/GAN, and LifeWatch.
- Measures will be taken to reduce the teaching load in several areas, but especially in the Earth Sciences, which is currently impeding scientific research capacity.
- To stimulate external acquisition of funds, IBED will continue to match such funds from internal funding where necessary (e.g. a fourth year of a three year externally funded PhD project, contributions to stay competitive, given the high integral costs/overheads at the UvA). This is of course not without costs in terms of a lower number of tenured positions in the Institute.
- As NWO and EU funding has its limits, non-traditional sources for research will have to be exploited more effectively. Two areas currently being explored by IBED are: i) developing research together with partners in and around Amsterdam (city, province, water authorities), and ii) attracting PhD students with external, foreign funding.
- The strengths of IBED will be augmented through strategic links with external partners such as NIOO, NIOZ, Deltares and RIVM. Such links will amongst others take shape in the form of exchange of staff members, joint appointments, and Special Chairs if suitable candidates are available at these institutes.
- In the coming years especially research collaboration with the NCB-Naturalis on biodiversity research will be developed.