EVALUATION OF PLANT SCIENCE IN FINLAND 2005–2009
Follow-up Report

Research Council for Biosciences and Environment

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Evaluation of Plant Science in Finland 2005–2009. Follow-up Report

Plant Science Evaluation1 Follow-up 18–19 September 2013

Background of the plant science follow-up

Evaluations of research fields are important research and science policy development tools, providing feedback to the scientific community and funding agencies as well as policy- and decision-makers. The aim of such evaluations is to identify areas of development and to give recommendations on how to proceed in the future. However, the evaluations have not been used as efficiently and their impact has not been as systematic as possible. Consequently, the Academy of Finland decided in 2012 to arrange a pilot follow-up study to analyse how the recommendations of the evaluation *Plant Science in Finland 2005–2009* (2011) have been implemented at different levels of research organisations, universities and research institutes. The rationale of this follow-up has been to strengthen the implications of that evaluation and to understand how different bodies in organisations cooperate when implementing the recommendations. Another aim has been to understand how different organisations cooperate. One of the well-known characteristics of the Finnish research system is its fragmentation. Finland has many universities and research institutes compared to the size of the country. Many research units need to cooperate with other organisations to reach a critical mass and to use facilities efficiently.

The discussions between the panel and the research organisations took place on 18–19 September 2013 in Helsinki. Representatives from different levels of the organisations participated in the discussions. University rectors, research directors from institutes, deans and researchers were present (see Appendix 1), and the overall attitude towards the follow-up was positive and enthusiastic.

Generally, plant science is a strong field in Finland and it has a high success rate in Academy of Finland funding compared to the total average success rate (see Fig. 1)[2]. For example, the 2013 success rate for applications representing plant science was 45%, compared to the average success rate of 21%. Table 1 below shows the overall funding and success rates for different research organisations participating in the evaluation and this follow-up.

[1] *Plant Science in Finland 2005–2009*: www.aka.fi/Tiedostot/Tiedostot/Julkaisut/03_11_Plant%20Science.pdf
[2] Success rate refers to the ratio of allocated/applied funding (%).

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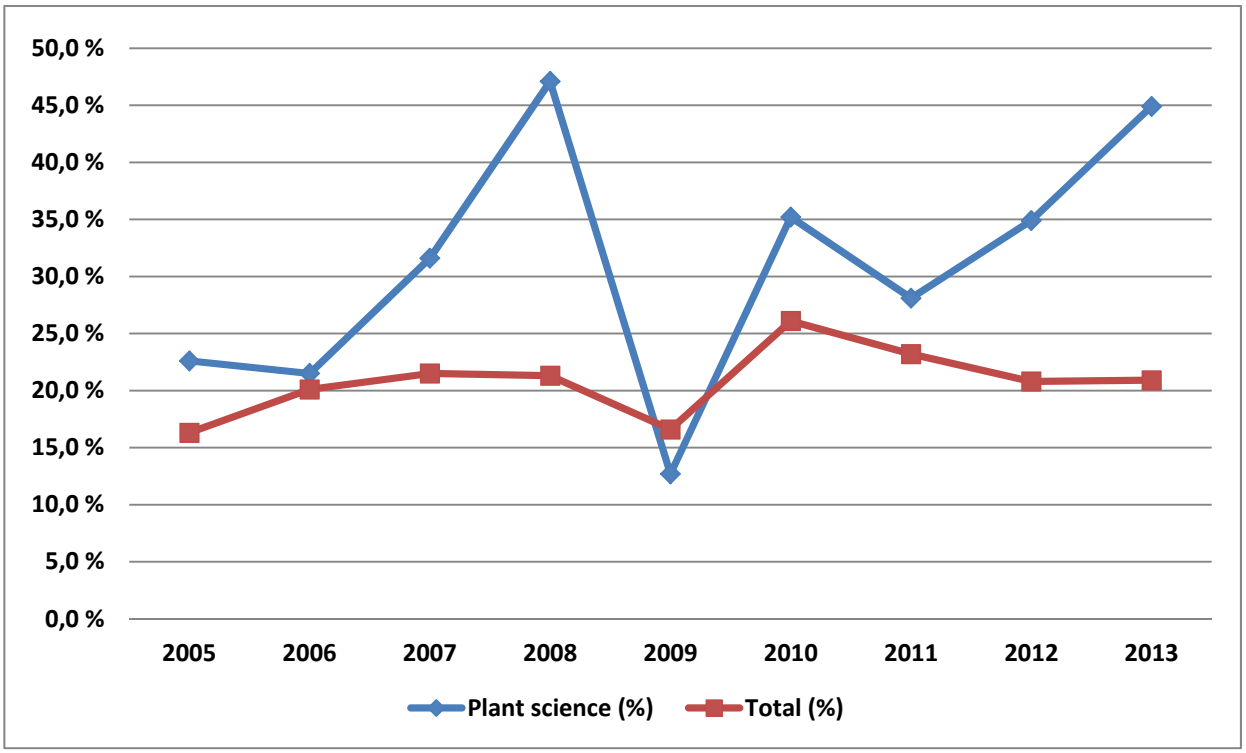

Figure 1. Success rate of plant science and total funding decisions 2005–2013 (%)

Organisation	Applications, €	Applications, pcs	Allocated, €	Allocated, pcs	Success rate, %
University of Helsinki	47,452,097	115	16,822,535	48	35.5
University of Eastern Finland	17,460,262	43	3,918,371	11	22.4
Agrifood Research Finland (MTT)	4,358,838	9	1,889,656	4	43.4
Finnish Forest Research Institute (Metla)	1,561,837	4	0	0	0.0
University of Oulu	10,878,205	35	1,632,641	12	15.0
Technical Research Centre of Finland (VTT)	2,095,887	5	385,493	1	18.4
University of Turku	22,153,470	58	6,758,867	26	30.5
Other organisations	2,629,604	37	413,291	26	15.7
All total	**108,590,200**	**306**	**31,820,854**	**128**	**29.3**

Table 1. Academy of Finland: Funding for plant science 2005–2013

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The plant science evaluation follow-up took place 2.5 years after the in-depth evaluation in 2011.The panel members were the same as before, with two members of the 2011 panel being absent. The panel members were still familiar with the strengths and weaknesses of the research units. This allowed the members to efficiently address the important points over a discussion. The interval of 2.5 years allowed the units to reflect on the evaluation and to set up new strategies and directions for future research based on the recommendations. The review panel is aware that 2.5 years is not a sufficient amount of time to significantly improve publication records. This would require a longer time and may only be possible by new appointments in some cases. However, the recommendations should have laid a good foundation to plan new appointments and structural reorganisations. All units, with some exceptions, had discussed the recommendations and made efforts to respond to them.

Three issues, namely doctoral training, the tenure-track system and bioinformatics, are relevant to all units and are discussed below.

Doctoral training

All plant science units are actively involved in training doctoral students, but in different ways, as noted previously. The most pertinent problem identified in the 2011 review was the fact that the period for completion of PhD studies was too long and above the average time in other countries. In consequence, the average age of graduating PhD students is higher in Finland than in other countries. The main reason for the long duration of PhD studies is the requirement for a high number of published papers. The previous recommendation was to reduce the length of PhD studies and the demand for published papers. The implementation of this recommendation was discussed with the research units.

One major change has taken place since the last evaluation. The national PhD programmes do not exist anymore and have been replaced by local graduate programmes. This could be a disadvantage in particular for small universities, as there are fewer possibilities for graduate students in plant science to interact and cooperate with students from other universities and fewer courses dedicated to plant science. With the recent change, the responsibility for PhD studies has been transferred to the universities, and the universities define the requirements for a PhD degree independently. Some universities have used this opportunity to adjust the requirements and realised that one first-author paper published in a high-impact-factor international journal can be an acceptable result from a four-year PhD programme. However, the implementation varies a lot across plant science units. Some units have not changed at all, or have not been able to change due to regulations within the university faculties. The panel considers that one first-author publication in a high-impact-factor journal together with a middle-author publication is perhaps sufficient for a PhD degree.

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The panel's recommendation is that it should be possible for PhD students to complete their studies within four years and that funding should be available for these four years. It can be expected that PhD studies result in one or two very good publications. The objective should be to publish complete papers in very good journals rather than to produce a high number of low-impact manuscripts. This would strengthen the international visibility and the scientific impact of Finnish plant science.

In the original evaluation, the panel recommended an increase in the mobility of graduate students on the national and international level. However, there were no reports from any units on the implementation of this recommendation.

Tenure-track system

The previous evaluation recommended that tenure-track systems be implemented at university levels.

This recommendation has been accepted by some units, but it has not yet been widely implemented. The possibility of employing young expert personnel through the tenure-track system should be much more widely utilised and should become general practice for professor-level appointments.

Bioinformatics

The previous evaluation recommended that infrastructures and training for bioinformatics and modelling be strengthened.

Although the necessity for bioinformatics has been recognised by all units, this recommendation has hardly been implemented. The panel strongly recommends that plans be made to develop a solid bioinformatics infrastructure. When new appointments can be made due to retirement, the possibility of redirecting appointments to the field of bioinformatics should be seriously considered. Bioinformatics cannot be managed by Master's or doctoral students without long-term support from permanent, skilled staff. Bioinformatics is a very recent and rapidly developing subject area required in modern biology – not only in plant science – and it is therefore in high demand. Accordingly, it is important that bioinformatics become an integrated subject in biology education to meet this demand.

Evaluation of plant science research units

University of Helsinki

The three departments evaluated (Agricultural Sciences, Forestry and Biosciences) have outstanding research profiles and continued success at the highest international level. Their facilities, research outputs and training are all excellent. The panel was informed

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about new scientific results, collaborations and translational opportunities that are of the highest calibre.

The comments by the university representative were supportive. However, the university's commitment to sustaining and building on its great strengths in plant science was not obvious to the panel.

Analysis of the extent to which the previous recommendations have been followed:

- At the time of the evaluation, plant scientists at the University of Helsinki were setting up the Viikki Plant Science Centre (ViPS), a virtual centre designed to promote collaboration and facility sharing. The panel was strongly supportive of this move. The subsequent development of ViPS has been very successful on several fronts. So far, its main activity has been to reorganise teaching, eliminate overlaps and streamline plant courses across departments. Although the centre has not yet started in-depth work on research issues, its existence has already promoted greater collaboration and awareness of research among plant scientists in different departments. ViPS also has strong potential to lobby for further resources such as better bioinformatics support and an agreed scheme for tenure-track appointments (as opposed to one-off opportunities).

- The evaluation identified concerns as regards continued funding. These seem to have been largely solved, and there was little discussion of current problems in funding research. A recent tenure-track appointment in translational biology had in part been made possible by the positive evaluation of the university's plant science. However, a few concerns still exist. First, there is no agreed strategy or long-term support for tenure-track appointments to ensure the continuity of excellent plant science. The funding for such appointments seems to be dependent on the finances of the departments. Second, the termination of the Centre of Excellence in Biosciences was not well managed and several groups suffered from a shortage of funds because of it. It appears that the university and the department failed to put in place a satisfactory exit strategy. Such situations are avoidable. The panel recommends that departments be made aware of the funding profiles and forward plans of their research groups, and that they provide appropriate advice and support to ensure the continuity of funding where possible.

- The panel previously recommended that greater collaboration within departments be initiated to fully maximise the funding opportunities, including strategic discussions for the unit as a whole and reviews of grant proposals prior to submission. This suggestion has not been acted on. Researchers felt that it would potentially interfere with academic freedom and with the flat structure that promotes open collaboration. The panel appreciates these concerns. However, other institutions' experiences of grant proposal reviews have been positive. The review process has led to greater

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rather than reduced collaboration, and has substantially increased application success rates. Further consideration should be given to the panel's recommendation.

- The evaluation suggested that work in biosciences be widened to include commercially relevant models. The panel commends the expansion of research on birch and spruce, especially the strongly collaborative nature of these projects, including the use of germplasm resources available at Metla and the links to applied science in other institutions. An example of exciting progress is found in the manipulation of ethylene signalling for greater wood production.

Other concerns and opportunities:

The major reorganisation of research institutes to form the Natural Resources Institute has direct implications for research in the Forestry Department in particular. There was some concern that researchers had not been informed about the reorganisation and did not know what its consequences might be.

The proposed collaborative development of a phenomics infrastructure on the Viikki campus could provide important new research opportunities. However, it is not yet clear how this facility could be used for multiple, different species. Clear management structures and strong academic leadership will be required if all of the partners are to benefit.

University of Oulu

The unit is relatively small, containing only 20 people, with one of the two professors about to retire. The University of Oulu strongly supports the unit's research, particularly its exploitation of the unique local Nordic environment. It is important to have in place a replacement strategy for the retiring professor. It is hoped that any replacement has a research focus on problems associated with Nordic species in order to maintain and hopefully increase the unit's critical mass and strength in this subject. The unit should continue and further exploit its unique Nordic environment. However, the unit's suggestion of appointing a professor with specific interests in the molecular biology of berries is perhaps too narrow and inflexible, as it may be difficult to identify suitable candidates. A more flexible thinking about the nature of the replacement may be beneficial with serious consideration given to the possibility of early-career tenure-track appointments.

The problem with the low visibility of plant science research from Oulu nationally and internationally results at least in part from the small size of the unit, together with the fragmentation of plant science. Therefore, it is essential that scientists cooperate with other units and become an integral part of larger research projects. The small size is also a great disadvantage for the educational programme, as there is only a narrow offer of

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courses in plant science. The abolishment of national graduate schools is a particular disadvantage for small units like this one.

Analysis of the extent to which the previous recommendations have been followed:

The unit still needs to develop a more focused strategic plan and actively lobby for the university to support it. In planning, consideration should be given to a reduction in the number of species being studied and to a focus on the use of second-generation model plants, such as bilberry. The unit appears to be rather isolated within the department and should take steps to prevent this. No evidence was found demonstrating an improvement of publication in top-quality journals.

The unit has the potential to improve and make a major contribution to understanding the adaptation of species in the Nordic environment. The will require a focused strategy and support from the university.

The University of Oulu has large-scale and ambitious plans to reform its research and its structures, which could be very positive for plant science if the scientists themselves choose to take advantage of them. The scientists had made efforts to focus and develop strategies in response to the report. However, they need to be encouraged to think more broadly about how they recruit excellent plant scientists within their remit of northern distinctiveness, and how they respond to the opportunities presented by the changes at university level. There is a danger that plant science research at Oulu could fall below a critical mass.

University of Turku

This unit has continued to produce outstanding, internationally important science. The unit has a very high international profile and benefits from excellent leadership. They have continued to build on the excellence identified in the previous review. They have maintained a clear focus on their research and teaching objectives. It is important that serious considerations must be given to planning in order to maintain and further develop the quality of the research and the important international contacts in the mid- and long-term futures.

The prominent visibility of the strong support by university representatives for the unit was impressive, assuring that the unit was well supported by the university administration.

Analysis of the extent to which the previous recommendations have been followed:

- It is evident that the unit has maintained and successfully extended its research strategy.

- Successful efforts have been made to publish more papers in top-quality journals.

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- Part of the unit has been successfully relocated into refurbished facilities that have enabled the whole unit to be located more closely together on campus. This, together with the transfer of the unit into the Department of Biochemistry, has facilitated improvements in research and teaching activities.

- It was evident that the unit has considered possible ways to disseminate outcomes of their research on alternative fuel production to industry. The university has an office that can support potentially successful commercial ventures.

Overall, the performance of this unit has been excellent. One reason for this is the strong and efficient leadership in this unit at present. To maintain the status of excellence the unit should make strategic plans for preserving this culture also in the future. The senior scientists should be involved in the future planning.

University of Eastern Finland

Major reorganisations are in progress at this institution involving the creation of a new Faculty of Science and Forestry in which a Department of Biosciences has been formed. The department is based in Joensuu and incorporates plant scientists from the old Departments of Biology in Joensuu and Biosciences in Kuopio and the School of Forest Sciences in Joensuu. The plant scientists in the Department of Environmental Science will remain in Kuopio. The submissions and presentations made by these units were independent, uncoordinated and failed provide an integrated overview of plant science activities at the University of Eastern Finland. This situation appears to have arisen from a lack of communication by the Faculty with the plant scientists regarding the future of the subject. It appeared that plant scientists in the old Department of Biosciences in Kuopio have had limited opportunities to contribute to discussions with the Faculty about the reorganisation and their potential physical move to Joensuu, and are unaware of some decisions that have been made. Recognition of plant sciences by the Faculty was poor and there was little evidence of support. This must have a strong negative impact on the enthusiasm and ability of the scientists to develop future research strategies.

Analysis of the extent to which the previous recommendations have been followed:

There is little evidence of improvements in strategic planning with definition of focused objectives. An attempt has been made to develop bioinformatics expertise, but further appointments at senior level are required. There are ambitious plans to develop imaging techniques and spectral analyses for studies of plant stress and to link with metabolomic studies of natural products. For their successful development as cutting-edge research programmes, major investments in equipment and personnel training will be required together with well-focused objectives. There appears to have been a decline in the breadth of basic plant science research in the unit. The forestry research programme has no future plans to include such activities and a decline in their breadth appears to have

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occurred in the Department of Environmental Science. These developments will limit potential research collaborations within the unit.

There is an urgent need for the University and the Faculty, after discussions with plant scientists, to develop a clear strategy for the future of plant science at the University of Eastern Finland. A possibility to resolve this problem could be to establish an independent, external scientific advisory board, which would help with the necessary reorganisation and planning.

In conclusion, the exceptionally poor attitude and practice of the administration go a long way towards explaining the lack of progress towards the steps we recommended – better integration of plant science research, more leadership and strategic thinking. Clearly, it is not possible for the scientists to do this when the Faculty takes decisions affecting their work without any consultation and refuses to consider changes in the structure of PhD training. The move of plant science to a single site could be positive in the longer term, but the way the university has imposed this on the scientists without consultation is likely to be upsetting. Obviously, a reorganisation on this scale will drastically affect plant science research, and the Academy of Finland could perhaps ask the university about its strategy for the maintenance of scientific excellence in this field following the move.

Finnish Forest Research Institute (Metla)

Since the evaluation in 2011, major changes have taken place. Recently, a new structure was formed by merging three institutes: the Finnish Forest Research Institute (Metla) merged with Agrifood Finland (MTT) and the Finnish Game and Fisheries Research Institute. In consequence, a new organisation will be effective as of 2015. The financing structure of these institutes has been reorganised and will lead to a reduced budget funding for Metla by about 20%. These changes have generated uncertainties about the future and have constrained positive actions and decisions relating to the issues raised during the 2011 evaluation. The new structures should provide a platform for more cooperation within Metla. Efforts have been made to improve organisation and planning, but even better planning and coordination is clearly required. Three research areas have been identified for future research: tree growth, stress physiology and vegetative propagation. The panel agrees with these priority areas. However, to perform competitive research in these areas Metla needs to make links with relevant university departments to successfully utilise modern genomic and other omics approaches. Metla plant scientists have to engage with geneticists and breeders to make better use of their potential. Metla has valuable genetic resources and there is an excellent potential to utilise these resources in collaborative translational research that makes use of genomic expertise for future tree improvement.

Opportunities for stronger cooperation between the new research institute and universities will appear in 2015 when a new funding instrument for strategic research will be launched by the Academy of Finland. The strengths of Finnish plant science are:

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ecophysiology, research in forestry, climate change, plant adaptation to low temperatures and natural compounds in Northern plants, which are very relevant for Arctic research and global grand challenges.

Analysis of the extent to which the previous recommendations have been followed:

- A positive outcome of the previous evaluation is the improved support for EU applications within Metla. Metla plant scientists have also increased their international visibility through participation in international programmes such as EU-funded COST Actions. It is strongly recommended that applications for funding be made to the Academy of Finland to compensate budget cuts and to establish new projects. Co-applications with universities could strengthen the quality and scope of the applications.

- The panel recognises that some efforts have been made to improve organisation and planning, but more strategic planning and better implementation of actions as pointed out above are required for successful future research and exploitation of the potential in tree research within Metla.

- It is important that the plant scientists develop plans for organisation and implementation of their research in the new institute. There is a need to identify stumbling blocks and evolve strategies to overcome them. It is important that a critical mass be maintained and research priorities clearly defined. A disadvantage is the present geographical dispersion of plant scientists within Metla, therefore links to local universities and research institutes are important to reach a critical mass.

In conclusion, the situation at Metla had not improved since our report because of complex and unhelpful administrative changes. The future of plant science in this organisation seems uncertain, especially following the current merger of several institutes. The panel recommends that the Academy of Finland take a close look at the role and importance of plant science in the new institutional structure.

MTT Agrifood Research Finland

The MTT plant genomics group remained productive and focused on their expertise in retrotransposons and crop plant genomics. The group has been successful in obtaining funding and establishing collaborations with others who are interested in their genomic and genetic marker expertise. This has led to extending their research species to some legumes and trees, with the latter providing interaction with colleagues from Metla. The group foresees no problems, only added value, from the merger with the two other institutes in the coming years. The further collaboration with the genomics groups in the Helsinki is especially attractive. The group will benefit from such collaboration and sharing infrastructure including phenotyping. The interaction with other groups is based on helping and harvesting knowledge, often based on the specific retrotransposon know-how of the group.

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Analysis of the extent to which the previous recommendations have been followed:

The need for more bioinformatics support should be implemented by appointing a co-worker in this field and by collaborating with the University of Helsinki.

The group is involved in large genomic projects through collaborations with other (often foreign) groups to whom they provide their specific expertise, which is a sound attitude.

MTT has been represented by one successful group during the evaluations. However, the focus on one group is rather narrow considering the scope of MTT.

VTT Technical Research Centre of Finland

The plant biotechnology research at VTT continues to be of high quality. The science is underpinned by strong, high-quality leadership and an excellent research strategy that has been updated since the last evaluation. Present outputs are very good and of high quality. Although being heavily involved in applied research, the unit continues to produce an impressive number of publications in high-impact-factor journals and to utilise new opportunities. Effective collaborations have been established and maintained with other research groups inside and outside the country. The group also continues to be successful in obtaining external competitive funding, which has allowed for a constructive approach to be developed in order to deal with future budget cuts. VTT representatives evidenced strong institutional support for the unit.

Recommendations by the panel:

- The functioning of this unit over the past two years has been excellent and the panel recommends continuation of such high-quality research. Next January, VTT will undergo some structural reorganisations that will affect its strategic objectives. Consequently, the unit is expected to move towards more industrially-orientated research. Attention should be paid to avoiding that such changes will significantly reduce the capacity to publish high-quality research papers.

- Metabolomics is a priority in the current research strategy of the unit and state-of-the-art approaches, including synthetic biology, are being considered as future objectives. The panel encourages further developments and collaborations in these areas.

- The panel also encourages collaboration with universities as a very valuable way of underpinning future research. Furthermore, the panel perceives the fusion of different Finnish institutes that is foreseen in the coming years as an excellent opportunity to establish closer connections to Metla and MTT colleagues to explore further unique-to-Finland products, especially in the area of wood products.

Conclusions of the follow-up evaluation

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The evaluation reveals the situation of plant science in Finland at both global and organisational level and, consequently, makes it possible to establish scientific policies in the field. The evaluation is a useful procedure to identify strengths and weaknesses as well as discussing possible solutions to problems with persons outside the Finnish system.

It was informative to hear the administrators' and the scientists' point of view on the different issues that were raised during the first evaluation. It was clear that in some cases – for example the University of Turku – the administration valued its plant scientists and took the report seriously. In other cases, the opposite was true: The administration did not consult and inform the scientists about major decisions affecting their research and it ignored the report because the recommendations did not fit in with its traditions and plans.

In general, the institutions evaluated better in the first review have continued to do well and have made use of our report to leverage new posts and facilities and to initiate some positive changes in PhD training and collaborations. They were on this trajectory already, but the report has supported their efforts and provided arguments for negotiations with administration and other decision-making bodies. The poorer institutions have for the most part made relatively little progress. In the case of the University of Eastern Finland, and probably Metla, we saw at the follow-up meeting that the lack of strategy and leadership at the upper levels of the organisations may be largely to blame, rather than the scientists themselves.

Research in plant science is quite fragmented in Finland, not only between but also sometimes within organisations, and would need more coordination. Probably, the communication between and within organisations is not fluent. The Academy of Finland and the other governmental agencies with responsibility for Finnish science could together develop policies to improve this situation.

For the preparation of the re-evaluation, it would have been helpful if the panel would have had some more new information from the units, for example, a list of publications and grants that were obtained since the last evaluation. This information would have allowed the panel to ask more specific questions. The Academy of Finland could specify the strategy for evaluations and follow-ups more clearly to strengthen the overall science-policy impacts that such measures have on Finnish science.

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APPENDIX 1

PLANT SCIENCE FOLLOW-UP MEETING 18–19 SEPTEMBER 2013: PARTICIPANTS

Panel

Chair:	
Dorothea Bartels	Professor, University of Bonn
Panellists:	
Neil Baker	Professor, University of Essex
Maarten Koornneef	Professor, Max Planck Institute
Julio Salinas	Professor, CIB, Plant Molecular Biology Laboratory
Alison Smith	Professor, John Innes Centre

University of Helsinki

Johanna Björkroth	Vice Rector

Faculty of Biological and Environmental Sciences:

Tapio Palva	Vice Dean
Pedro Aphalo	Senior lecturer
Kurt Fagerstedt	Professor
Yrjö Helariutta	Professor
Heikki Hänninen	Professor
Jaakko Kangasjärvi	Professor

Faculty of Agriculture and Forestry:

Marketta Sipi	Dean
Jaana Bäck	Professor
Paula Elomaa	Professor
Teemu Hölttä	Professor
Pasi Puttonen	Professor
Teemu Teeri	Professor

University of Eastern Finland

Timo Jääskeläinen	Dean
Jarmo Holopainen	Professor
Sirpa Kärenlampi	Professor
Jukka Mönkkönen	Academic Rector
Elina Oksanen	Department Head
Timo Tokola	Head of School, Professor

Finnish Forest Research Institute (Metla)

Taneli Kolström	Research Director, Professor
Marja-Liisa Sutinen	Senior Researcher
Elina Vapaavuori	Senior Researcher

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Agrifood Research Finland (MTT)

Markku Järvenpää	Director of Plant Production
Alan Schulman	Professor

University of Oulu

Taina Pihlajaniemi	Vice Rector
Jouni Pursiainen	Dean
Hely Häggman	Professor
Jari Oksanen	Deputy Director
Anna Maria Pirttilä	Adjunct Professor

University of Turku

Kalle-Antti Suominen	Vice Rector
Reijo Lahti	Dean
Yagut Allahverdiyeva	Researcher
Eva-Mari Aro	Professor
Peter Gollan	Postdoctoral Fellow
Saijaliisa Kangasjärvi	Academy Research Fellow
Eevi Rintamäki	Professor

VTT Technical Research Centre of Finland

Johanna Buchert	Vice President, Strategic Research, Bio- and Chemical Processes
Anu Kaukovirta-Norja	Vice President, R&D, Bio- and Chemical Processes
Kirsi-Marja Oksman-Caldentey	Technology Manager
Anne-Christine Ritschoff	Executive Vice President

Academy of Finland

Research Council for Biosciences and Environment:

Kai Lindström	Professor, Chair
Laura Raaska	Director
Timo Kolu	Senior Adviser
Marja-Liisa Liimatainen	Coordinator