



*International Group of
Funding Agencies for
Global Change Research*

National Updates

University of East Anglia
Norwich, United Kingdom
October 23 - 25, 2002

The goal of the **International Group of Funding Agencies for Global Change Research (IGFA)** is to foster Global Change Research. IGFA is a forum through which national agencies that fund Research on Global Change identify issues of mutual interest and ways to address these through national and when appropriate through coordinated international actions.

Important issues for consideration in IGFA include:

- information exchange about national global change research programs, as well as about supporting initiatives and facilities;
- approaches to the integration and implementation of global change research;
- optimal allocations of available resources for global change research and its international coordination;
- infrastructural topics of mutual interest, including data accessibility and observation systems;
- ways to improve the interaction between science and policy; and
- possible fields of action for the future in the light of a constantly changing scientific landscape, e.g. changing scopes of the international research programs.

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INTRODUCTION

The IGFA Plenary 2002 took place in Norwich, United Kingdom, October 23rd – 25th 2002.

Presentations on relevant developments in the countries have a prominent place on the agenda of the annual plenary meeting of IGFA. Representatives submit brief written communications and deliver brief oral presentations. The presentations give insight in the position of global change research on the national policy agendas, in funding structures and trends in funding of global change research in IGFA member countries.

Following the decision that a “Resource Assessment *light*” should be conducted every other year, members were asked to report on funding levels of 2001. Specified National Updates were received from 16 countries and the EC. It has to be noted that these reports are informal and indicative best estimates of a nation’s contribution to global change research funding. The definition of “global change research”, and therefore the amounts included, may differ from country to country, which is why direct comparisons should be used carefully.

The following questions were asked for the National Updates 2002:

1. Funding levels for GCR

At the 2000 plenary meeting in Zurich, the first “Resource Assessment *light*” (RAL) was presented, providing the funding agencies’ spending on global change research, and implementing the decision to not continue with the extensive data acquisition characterizing the 1995 “Resource Assessment”. According to the consensus that the RAL should be held every other year, last year’s plenary only gave trends in funding as compared to the numbers in 2000; therefore the National Updates 2002 should again provide an estimate of amounts spent on global change research.

It is desirable that figures presented by the IGFA members are as comparable as possible both between countries and between different years. Therefore we kindly ask you to provide, to the extent possible, the following information:

- A. What was the *total amount of funding* of global change research (GCR) in 2001 by funding agencies in your country (in US-\$, interbank exchange rates as of December 31st 2001)?
- B. Indicate whether the figures *include overhead costs or not* and specify the typical *cost of a man-year* for a global change scientist.
- C. Name the *funding agencies involved* and indicate the *mechanisms* by which GCR is being funded (e.g. special programs).
- D. Indicate your funding agency’s approximate *percentage of the total national spending* on GCR including the overhead.
- E. Specify the proportion of the funding agencies’ total GCR spending dedicated to *research coordinated by the four international programs* WCRP, IGBP, IHDP and DIVERSITAS.
- F. What percentage of the funding agencies’ spending on GCR was support for international integration and coordination activities (*Program Secretariats, International Project Offices, and other glue money*)?

G. Finally, please also indicate *trends in the funding levels* (up, down, stable compared to previous years)?

2. Infrastructural investments

“Infrastructures” are here defined as any large-scale experimental facilities related to GCR (e.g. ships, aircraft, supercomputers,...).

Please give an indication of your country's/agency's *recent investments or plans for investment* in such infrastructures. Do you see any *potential for cooperation* with other funding agencies in this respect? If yes, please specify.

3. Recent news and developments

All recent highlights that might be of interest to other IGFA members can be included under this heading (everything from policy issues via organizational/structural issues to interesting new research results), but please be brief.

1. Funding levels for GCR

- A. The total amount of funding global change research in 2001 (as for 1999) still cannot exactly be quantified, since we do not have an accounting system spanning the range of different funding agencies and different areas of research efforts. Global change research is widespread over institutions and underlies different goals and processes, respectively (core and contributing GCR research, basic vs. applied research, bottom up vs. top down driven research, see also point C). Nevertheless, we estimate the total national spending dedicated to GCR relevant issues (third party funds) to be approximately 10 Mio. € (8.9 Mio USD). This substantially higher amount than reported for the year 1999 is due to a more detailed review and inclusion of some research contributing to GCR. The indirect support of GCR via basic funding of institutions concerned with GCR (e.g., Central Institute of Meteorology and Geodynamics, university institutes...) can't even roughly be quantified, as a clear accountability to GCR is impossible. (1 € = 0.8822 USD, as of 31 December 1999).
- B. Figures do include overhead costs. The typical personal costs of a man-year for a global change scientist are approximately € 45000. Overhead varies between +20% to + 50%.
- C. Funding agencies involved and mechanisms by which GCR is being funded:

<u>Main funding agencies</u> (third party funds)	Share of total	Mechanisms
Private principals	Low	Private order
Universities	Low	Stimulation programmes
Austrian Academy of Science	Low	Basic research according to WCRP, IGBP, IHDP
Provincial governments	Medium	State-Province Research Programme; Individual project funding
Ministry of Education, Science and Culture	High	Oriented research (basic and/or applied) according to specific programmes (Austrian landscape research programme, Remote Sensing Programme, International Cooperation Programme)
Ministry of Agriculture, Forestry, Environment and Water Management (including federal research agencies)	High	Applied research according to policy requirements; Individual project funding according to the research framework plan "PFEIL 05"
Ministry of Transport, Innovation and Technology	High	Austrian Space Programme, Remote Sensing Programme
Austrian Science Fund	High	Basic research, bottom up initiated Mainly individual project funding Special Research Programs (SFBs, interdisciplinary research programs concentrated at a single location. Maximum duration 10 years)

		Joint Research Programs (FSPs, interdisciplinary approach to problem solving, distributed over several research institutions in Austria. Maximum duration 5 years.)
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- D. The funding of the Federal Ministry of Education, Science and Culture (FMESC) represented approximately 25 % of the total of GCR third party funds in Austria in 2001.
- E. Only few Austrian GC research projects are coordinated by one of the four international GC programs, mainly those of the Austrian Academy of Science. Many researcher's do not see a direct benefit of coordination for themselves. We estimate the share to be approximately 2 %.
- F. The FMESC contributed approximately 0.4 – 0.5 % of it's GC relevant funding to the international IHDP and DIVERSITAS program secretariats. The Austrian contribution to WCRP is indirect via WMO member fee (0.33 M€). The Austrian Academy of Science contributed 10% of it's GCR funds to the international IGBP secretariat. On national level, approximately 15% of GCR funding of the FMESC were dedicated for coordinating a large share of the total GCR funding in selected priorities in Austria.
- G. The funding trend is clearly going down (see Paragraph 3 for details).

2. Infrastructural investments

No large directly GC relevant infrastructures have been established in 2001. However, in Mai 2002, the so-called "Conrad observatory", located in the province of lower Austria, has been made operational. The observatory allows (will allow) very precise measurements of seismic, gravimetric (a.o. tides, cold air fronts) and geomagnetic events or conditions, respectively.

3. Recent news and developments

As reported last year, the FMESC planned to establish a new long term research programme entitled „EcoForesightsAustria“, which, to a large degree, was intended to concentrate on regional global change monitoring, mitigation and adaptation. However, the Council for Research and Technology Development recommended to integrate the programme into the ongoing agenda of the Ministry of Agriculture and Forestry, Environment and Water Management (FMAFEW), yet without an increase of the FMAFEW research budget. From the viewpoint of the FMESC, this recommendation will for several reasons mean the early off for the programme. In addition, also due to a decision of the research council, commissioned research per se has been cut nearly zero. In conclusion, this will lead to a 25% cut of GCR third party funds in Austria in 2002 and 2003 respectively.

As an example for a positive development, a number of Austrian climate and climate impact researchers are elaborating a proposal for establishing a Special Research Program (SRP, interdisciplinary research program concentrated at a single location; maximum duration 10 years). It is planned to submit the proposal to the Austrian Science Fund in Autumn 2002. The final funding decision is expected for late 2003 then.

The GLORIA initiative (Global Observation Research Initiative in Alpine Environments), funded by and/or embedded into IGBP, GTOS, The European Commission, European Environment Agency, DIVERSITAS, Austrian Academy of Sciences, Aus-

trian Federal Ministry of Education, Science and Culture is extending its network by establishing new target regions in Switzerland, Italy, New Zealand, Australia, USA and Peru. A further extension is planned via a “network of excellence” in the 6th European Framework Programme for RTD (FP6).

The ANER node (<http://nuf.boku.ac.at>) LTER-Austria will take the lead in establishing an informal long term ecological research network for Austria in October 2002. The node also plays a vital role in setting up a European LTER network in FP6.

The deadline for submissions for prizes for the „Best Human Dimensions Doctoral Thesis“ was 30th June 2002. The interest of young researchers was high. The results of the peer-review are expected for October 2002. The prize has been awarded by the ANER node „Human Dimensions of Global Change Austria“ and aims at directing socio-economic doctoral theses towards the „Human Dimensions“ field. Therefore, to gain the desired effect, the best concepts and not the finished theses, will be rewarded.

1. Funding Levels for GCR.

- A. The Federal Science Policy Office (FSPO) is not in a position to provide the IGFA with a complete and detailed information on the spending on GCR.

The FSPO inventory of research project information is based on the OECD and EC requirements and is not adapted to the needs of the IGFA. It is only possible to give overviews of the government budget of the different Belgian authorities by socio-economic objectives.

This is available in thousand EURO and Current prices, from 1989 to 2001.

We can offer an estimate on what FSPO spends for research programmes in the framework of the SPSP I (Global Change and Sustainable development, Sustainable management of the North Sea (1997-2000), Scientific research programme on the Antarctic – phase IV- 1997-2000 and TELSAT earth Observation by satellite) and SPSP II (Global Change, Biodiversity and Ecosystems) and glue money for LUCC, IPCC, supporting actions and NDSC.

1999 US \$	2000 US \$	2001 US \$
6.974.915	7.762.001	7.019.088

The difference with previous reported amounts is due to a more detailed review.

The budget does not include relevant space activities, the basic funding of the universities, the management budget, nor the external funds from e.g. the E.C.

It thus includes however financial contributions for campaigns in Antarctica.

2001 may not be a good reference year since

- most of the projects of the SPSP I programme “Global change and Sustainable development” took an end, depending of the project between December 2000 and June 2001.
- projects within the new SPSP II started in 2001, some in the beginning, some rather at the end
- and the calls for SPSP II are spread over several years.

It is to be noted that the FSPO funds the LUCC core project office and has the intention to continue to do so until 2005.

The FSPO also contributed financially to the Open Science meeting in Amsterdam in the summer of 2001.

The budget, which is granted via these FSPO programmes and -activities should be seen rather as "incentive" to orient research, to participate in international programmes, to support decision making, to give an added value to individual research which is directly funded through the universities, Fund for Scientific Research etc.

- B. The figures include maximum 5 % of overhead calculated on the basis of personnel and consumables expenditure. A typical cost of a man year for a global change scientist is **38 000 EUR**.

A lot of the FSPO-funded GCR projects are relevant for IGBP, WCRP and DIVERSITAS, few projects are relevant to IHDP. The efforts are scattered over different areas: IGBP (LUCC, IGAC, PAGES, GCTE...), WCRP (SPARC, CLIVAR, ACSYS), EISMINT,...

Trend: budget – glue money

The funding of the co-ordination of the Belgian contribution to NDSC (network for the detection of stratospheric changes) as such has stopped but will start from end 2002 on (till end of 2004). At the other hand, since the April 2002 IPCC plenary, Prof. Jean –Pascal van Ypersele has been elected as a bureau member of WG II. The FSPO provides the budget for travel and accommodation. It is hoped that his presence in the bureau will increase the Belgian participation to IPCC activities.

Soon the FSPO will evaluate the funding of the LUCC core project office. It is hoped to continue this funding until the end of 2005.

Because one of the objectives of the SPSP is to promote integration of Belgian researchers into international research and assessment activities, the FSPO is prepared to provide for glue money for it. This is evaluated case by case and depends also on the initiative of the scientists.

- C. The Federal Science Policy Office (FSPO) is the main funding agency that funds GCR programme-wise. In 2001, the Second Scientific Support Plan for a Sustainable Development Policy SPSP II (2001-2005) consisting mainly out of two parts: "Global Change, Biodiversity and Ecosystems" and "Sustainable Consumption and Production Patterns", was launched.

Projects are selected after calls for proposals, peer review by foreign experts and the advice of the plenary accompanying/steering committee. The Minister for Science Policy takes the final decision. Projects are required to be multidisciplinary networks and to involve users of the results (other scientists and/or decision makers).

To promote the European Research Area, since 2002, the calls are open for other European research teams. This participation is limited up to 10% of the total requested budget and is based on the principle of 50% co-funding.

Research projects may be extended to a complementary international research. This complementary research may be carried out in the context of commitments that the federal authority has made within international organisations (UN, UNESCO, IPCC,...), as well as under the bilateral science and technology agreements that have been signed with China, Argentina, Russia, Bulgaria,...

- D. The FSPO is not in a position to provide the IGFA with complete and detailed information on the spending on GCR. It must be noted that only FSPO funds Global Change Research through programmes. It supports moreover the LUCC-core project office, Earth Observation, international programmes and committees (GBIF, SCAR, SCOR, SCOPE, WCRP, ICSU,...), the participation of experts in IPCC activities,....

Moreover, the budget, which is granted via these FSPO programmes and -activities should be seen rather as "incentive" to orient research, to participate in international programmes, to support decision making, to give an added value to individual research.

-
- E. Without a detailed survey it is not possible to identify what research is co-ordinated by the four international programmes.
- F. In 2000, the FSPO spent 847.850 US\$ to support international integration and co-ordination activities (LUCC core project office, IPCC participation, NDSC activities, the Amsterdam Open Science meeting, and contribution to international programmes and organisations)

This is in 2001 about 15% of the total amount that FSPO spent for GCR.

The increase is due to the efforts with respect to biodiversity (Belgian platform).

1999	2000	2001
8 %	9%	15 %

- G. It is difficult to identify a trend without a very detailed analysis. A great deal of the global change oriented research in the framework of SPSD I activities took an end in 2000. This explains probably the slightly increase in expenses in 2000. In 2001 and 2002 new projects started based on sequenced calls for proposals. Some projects started with a delay because of the difficulties to find adequate scientists. That is most probable why the spending in 2001 decreased.

2. Infrastructural investments

No investments in large scale experiments were made in 2001.

3. Recent news and developments

The FSPO funds GCR through programmes. The SPSD Plan is ongoing until 2006.

Earlier this year the Antarctic research programme and the Marine sciences programme have been evaluated. In 2003, the of the global change programmes (themes atmosphere, climate and biogeochemical cycles) since 1990 will be evaluated.

The aim of the evaluation is to help preparing future research effort in the area of Global Change.

1. Funding levels for Global Change Research (GCR)

Funding for GCR in Canada is spread amongst many federal departments and agencies, e.g. Environment Canada and Natural Resources Canada being the major ones. Support for federal research and laboratories is provided through the federal departments. The **Natural Sciences and Engineering Research Council (NSERC)** is the main federal granting council that supports GCR and provides support for university research and training. The other two granting agencies are the Social Sciences and Humanities Research Council and the Canadian Institutes of Health Research, however, their focus is far from GCR. Granting councils only support the direct costs of research as the indirect costs are covered by the universities. This year, funds have been provided made by the federal government for the indirect costs of research and this could become a permanent program in the future. Salaries of investigators are mostly covered by the provinces and universities. This report contains figures for the Natural Sciences and Engineering Research Council only and focuses on support to university researchers.

NSERC has many programs in the areas of Natural Sciences and Engineering (NSE) through which GCR can be supported. The Discovery Grants program funds individual researchers in universities. The Collaborative Research Opportunity (CRO) program supports collaborations for national or international opportunities, while the International Opportunity Fund (IOF) supports the establishment of new international collaborations and funds interactions more than the research. NSERC's Strategic Projects focus on areas of strategic importance with one of the areas identified being Environment and Sustainable Development. The Collaborative Research and Development grants support University-Industry Collaborations. Research Networks focus on small networks of researchers on a common theme in NSE. The Networks of Centres of Excellence support large national networks in all research areas and is a joint program with the other two granting councils. NSERC has a program with industrial partners to support Industrial Research Chairs in specific areas. The focus of these programs is broader than just GCR, and decisions are made on relative merit.

NSERC support for GCR. Figures are for the direct costs of research only for fiscal year 2001-2002. Conversion is at the rate of \$1Can = \$0.63USD (Dec. 31, 2001).

	<u>Can</u>	<u>US</u>
Research Grants	\$7.3 M	\$4.6 M
CRO/IOF	\$2.0 M	\$1.3 M
Strategic Projects	\$0.9 M	\$0.6 M
Collaborative Research and Development	\$1.4 M	\$0.9 M
Industrial Research Chairs	\$2.0 M	\$1.3 M
Research Networks	\$6.9 M	\$4.3 M
NCE (includes funding from 3 granting councils)	\$3.4M	\$2.1 M
TOTAL	\$23.9 M	\$15.1 M

The total funding provided by NSERC was \$577M (\$364M USD) in fiscal year 2001-02. As various sources across Canada fund GCR, it is difficult to estimate NSERC's percentage of total national spending on GCR including the overheads. NSERC supports two Research Networks (SOLAS and GEWEX) that are directly related to research coordinated by the four international programs (WCRP, IGBP, IHDP, DIVERSITAS) and this represents about 5% of NSERC's total GRC funding. NSERC has one program that deals with international integration and co-ordination activities, the International Opportunity Funds which currently provide approximately \$100K to activities related to GCR. Over the past few years, there has been an upward trend with regards to funding level in GCR with NSERC increasing its support and with federal departments introducing new initiatives.

2. Infrastructure investments

Major infrastructure investments have been provided over the past few years by a national foundation, the Canada Foundation for Innovation (CFI). This Foundation was created in 1998 and has invested over \$1.5B (\$0.9B USD) to support university infrastructure. As CFI only contributes 40% of the costs of the infrastructure, this represents over \$3.8 B (\$2.4B USD). Major direct investments in GCR by CFI include \$5.9M (\$3.7M USD) for a water initiative, \$21.4M (\$13.5M USD) for 2 biodiversity initiatives, and \$1M (\$0.6M USD) for environmental change impact. Recently, CFI has awarded funds for the retrofit of an icebreaker for the study of "changing Arctic ocean and global climate change issues". This is a total investment of probably over \$20M (\$12.6M USD). Researchers funded through the NSERC funded Research Network "Canadian Arctic Shelf Exchange Study" (CASES) will be working on this icebreaker.

3. Recent news and developments

NSERC's Partnership directorate has recently reorganized along three main areas with one area being Environment and Natural Resources. NSERC only has one new specific program targeted at an area related to GCR. The program is in partnership with one of the federal departments, Natural Resources Canada. This program is the "Novel Next Generation Technology Initiative in Energy Research and Technology Related to Greenhouse Gas (GHG) Mitigation." This program is one of the initiatives launched as part of the Canadian Federal Government Climate Change Action Plan 2000.

NSERC has created a new program of Northern Research Chairs that supports polar research. Of the six Research Chairs, four relate to GCR issues and represent over \$3.5M (\$2.2M USD) over the next five years. NSERC also has a program for Chairs in Design Engineering and two are in environmental design representing \$2M (\$1.3M USD) over 5 years.

The Government of Canada Action Plan 2000 on Climate Change is a major commitment to addressing issues related to GCR and was launched in 2000. This is a \$425M (\$268 M USD) package of initiatives on reduction of greenhouse gas emissions and complements investments of \$625 M (\$394 M USD) over 5 years announced separately. These investments include the funding of the Climate Change Action Fund at \$50M (\$31 M USD) per year from 2001 to 2004 which include components related to Science, Impacts and Adaptation and Foundation Analysis. Details can be found at

http://www.climatechange.gc.ca/english/actions/action_fund/index.shtml.

Other investments as part of these commitments include \$20M for Climate Science as it relates to systematic climate observation and biological greenhouse gases sources and sinks, and a further \$30M to support the Canadian Climate Impacts and Adaptation Research Network (C-CIARN at <http://www.c-ciarn.ca/home.asp>) and other impacts and adaptation research.

BIOCAP Canada, a new foundation, has just been launched. The BIOCAP Canada Foundation, a national university research organization, is bringing together leading researchers and decision-makers from across the country to find biology-based solutions to the challenges of climate change. The Federal Departments of Natural Resources Canada, Environment Canada and Agriculture and Agri-Food Canada are partners along with universities and industry. The Government of Canada will be investing \$6M (\$3.8M USD) over the next three years. More information is available at <http://www.biocap.ca/homepage.htm>.

Further research on GCR is being coordinated through the new Canadian Foundation for Climate and Atmospheric Sciences (CFCAS at http://cfcas.org/index_e.html) which received \$60M (\$38 M USD) in 2000. Research themes of CFCAS include climate change, air quality, extreme weather and marine environmental prediction. CFCAS along with NSERC and BIOCAP Canada approved support for a major research network FLUXNET-Canada which represent \$7.9M (\$5 M USD) over the next three years. The network will examine the influence of climate and disturbance on carbon cycling in forest and peatland ecosystems.

The Canadian Government has also launched through the three Granting Councils, the Canada Research Chairs to support up to 2000 Chairs in Canadian Universities valued at an average of \$150K (\$94K USD) per year and includes salary and research support. Some of these chairs are in the area of GCR such as for impact of climate change on freshwater populations, climate change research, models of global change, water resources and environment change.

Supplement to Canada's National Update – 2002

The National Update described the establishment of the **Canadian Foundation for Climate and Atmospheric Sciences**. The importance of the Foundation warrants further information.

CFCAS is an independent body, established by the Canadian Meteorological and Oceanographic Society in 2000 with support of \$60 million (CAD) from the Canadian government. It fosters and funds university-based research in:

- Climate change and climate modelling
- Air quality
- Extreme weather
- Marine Environmental Prediction

Its goal is to strengthen Canada's scientific capacity, improve scientific understanding of climate processes and predictions, provide relevant science to policy makers and improve understanding of how climate affects human health and the natural environment. CFCAS funding complements support from other sources. The CFCAS mandate does not extend to climate impacts, adaptations, scholarships or major infrastructure: it thus encourages partnerships, and facilitates access to major experimental or computing facilities in other sectors. CFCAS-funded initiatives provide poli-

cymakers with scientific data for sound policy development, and/or enhance the security and well being of Canadians.

1. Funding levels for Global Change Research (GCR)

The Natural Sciences and Engineering Research Council (NSERC) is the federal council most involved in the support of GCR in universities. The Social Sciences and Humanities Research Council (SSHRC) and the Canadian Institutes of Health Research also support work in areas relevant to their mandates: e.g., SSHRC encouragement for development of electronic research materials and a national data management strategy. SSHRC has just completed a major consultation with the National Roundtable on Environment and the Economy, to develop a research agenda on 'Environment and Sustainability'¹: climate change is a major component. The research agenda includes legal, social, cultural and managerial aspects of environmental policy development and community involvement. The program will focus on issues in 3 key areas: governance; stewardship and innovation; living in nature (conceptual frameworks for understanding environmental problems).

The Canadian Institutes of Health Research are funding research on the health implications of environmental phenomena, including those related to global warming (e.g. the changing global distribution of many insect-borne infections) and air pollution.

The federal granting councils support direct costs of research: the provinces contribute to the indirect costs by funding university operations. Three provinces (Ontario, Quebec, New Brunswick) will fund indirect costs. In 2001, the federal government channelled additional funds to the universities to assist with indirect costs of research. Investigators' salaries are mostly covered by the provinces through their funding of the universities.

The **Canadian Foundation for Climate and Atmospheric Sciences** supports direct costs of research through project and network grants. The following figures relate to 2001-2002.

	<u>CAD</u>	<u>US</u> (\$1 CAD = \$0.63 USD)
CFCAS Research Grants (Climate)	\$ 8.43 M	\$ 5.3 M
CFCAS Research Networks (Climate)	\$12 M	\$ 7.6 M
TOTAL	\$20.4 M	\$12.9 M

During 2001 and 2002 CFCAS made strategic commitments to 32 climate projects and 7 climate networks. Total commitments (all areas) are \$35M (\$22M USD). CFCAS has determined that its awards are matched dollar for dollar with cash or in-kind contributions from other funding agencies, universities, federal departments or the private sector. Three national networks are funded jointly with NSERC: SOLAS², CLIVAR³ and Fluxnet-Canada. The latter network also benefits from a grant of \$1M from the BIOCAP Canada Foundation. If one includes the matching support provided by other bodies, the total support generated by CFCAS for climate research, exceeds \$40 million (\$26M U.S.).

¹ "Nature and Society: Environment and Sustainability Research Program", NRTEE, October 2002

² Surface Ocean Lower Atmosphere Study

³ Climate Variability

Building Canadian Expertise

It is critical that Canada have access to a pool of high calibre experts and leading researchers. More than half of CFCAS awards help support the training of graduate students or provide postdoctoral fellows with research experience. This represents over \$17.2 million (CDN).

3. Recent news and developments: Canadian Climate Strategy

In March 2002 CFCAS co-hosted a Climate Research Workshop in partnership with the Meteorological Service of Canada (Climate Research Branch). This fostered a dialogue between scientists and policy/decision makers that resulted in development of a draft Climate Science Agenda 2002-2012. The workshop report was released by Environment Canada in September 2002. Environment Canada has proposed four priority areas for science initiatives:

- Overcoming uncertainties in climate models;
- Comprehensive regional information on vulnerabilities to climate change
- Examination of climate change in Canada's Arctic
- Analyses of past climate records for a better understanding of climate variability and extreme events.

Upcoming events

The Arctic is warming at an alarming rate. The Canadian Foundation for Climate and Atmospheric Sciences is hosting a Workshop on Arctic Climate, February 20-21, 2003.

New federal funding initiative

The Federal Government recently announced a new \$15 million initiative to combat climate change, under Canada's 'Action Plan 2000'. 'Pilot Emission Removals, Reductions and Learnings' (PERRL) will give Canadian companies and organizations an economic incentive to make immediate greenhouse gas (GHG) emissions reductions through projects in strategic sectors.

1. Restructure of Global Changes Studies in China

In China, funding agencies relative to Global Change Research include the National Natural Science Foundation of China (NSFC), Ministry of Science and Technology, Chinese Academy of Science (CAS) and several other administrations. The funded projects cover nearly all the themes in the Global Change Sciences and most of them are centered on studies relative to GCTE, GLOBEC, WCRP, PAGES, DIVERSITAS, LOICZ, and LUCC. In 2001, a total of 30 millions USD was funded to Global Change Research in the country. This sum does not include overhead costs and the typical costs of a man-year for global change scientist.

After the 2001 Amsterdam IGBP Congress, efforts have been made to re-orient the global change studies in China. These include:

- a) Strengthening of the studies on carbon cycles, with special emphasis to the terrestrial ecosystem in China and in the surrounding oceans. Since a series of geological processes in China, such as tectonic and karstic processes, may have played an important role in the global carbon cycle, these factors are also considered.
- b) Encouraging interdisciplinary studies on hydrological cycles at catchment, continental and global scales. Special emphases are given to the monsoon circulations in Asia and to the role of the South China Sea on regional and global water cycles.
- c) Promoting the studies on human-environment interactions. Because China has a very long history of human activity, these kinds of projects are expected to provide good models on how climate changes have affected human society in the past and how human activity has changed the environments, including desertification, dust storms, ecosystems and hydrological patterns.
- d) Exploring the possible impacts of future global change on China' regional environments. These include the evaluation on the impacts of global warming/CO₂ changes on agriculture, desertification, soil carbon budget and hydrological responses to global change etc.

2. Global Change Program of the National Natural Science Foundation of China

In the recent years, the National Natural Science Foundation of China has designed a special program on global change studies titled "Global Change and the Regional Responses". The program has been launched in early 2002 and is expected to fund a series of projects at different funding levels within its framework. The key scientific questions of the program are centered on:

- a) Variations of marine environments and the responses to global climate change: These include the studies on ocean circulation changes at annual and decadal time scales, transport and budget of fresh water, heat, sediments relative to marine processes, marine changes in the past, and sea-level changes.
- b) Evolution of the Asian monsoon environments and global climate change: Under the umbrella of this theme mainly related with past global change, the formation and major shifts of the monsoon climates, its evolution at different time scales, the impacts of geological and ecological processes in the monsoon regions on

carbon cycles, spatial variations at key boundaries and paleoclimates modeling will be addressed.

- c) Interaction of land-sea-atmosphere and impacts on water cycles: This theme aims at exploring the sea-atmosphere coupled processes, land-atmosphere coupled processes, impacts of global change on the water cycles in China/surrounding regions, and also developing the climate models more adoptive to China.
- d) Ecological processes and ecological security in China under the background of global change: This theme is mainly centered on the bio-geochemical processes of the lift-supporting elements in terrestrial and marine environments, response and adaptation of key ecosystems in China to global climate changes, and temporal/spatial changes of terrestrial ecosystem in China in the past and future.

1. Funding Levels for GCR

The National Science Council (NSC) is the main funding agency for global change research (GCR) in Taiwan. The principal offices of the NSC that run GCR programs include the Natural Science and Mathematical Division (NSMD), Life Science Division (LSD), Humanity and Social Science Division (HSSD) and the Commission on Sustainable Development Research (CSDR). The former three Divisions support fundamental research, and the CSDR actively promotes interdisciplinary-integrated programs and international collaboration in GCR. Other funding agencies, including the Environment Protection Administration, Ministry of Economics Affairs, Council on Agriculture, Ministry of Communication and Transportation, all carry out their own intramural or extramural research related to global change, and follow the guidelines of the Intergovernmental Panel on Climate Change (IPCC) to meet the United Nations Framework Convention on Climate Change (UNFCCC).

This report only presents the budget for GCR funded by the NSC. Annual budgets allocated to GCR programmes and related research projects by the NSC have remained at US\$ 3.5-5.0 M in FY 2001-2002. Table 1 shows the distribution of the funding across fundamental research, policy-making projects, and international collaboration. Funding of the core projects of international programs (which include IGBP, IHDP, WCRP, and DIVERSITA) has been significantly increased from US\$ 3.0 M in FY 2001 to US\$4.1 M in FY 2002, while funding of strategic projects has remained steady. However, the budget for international collaboration significantly increased in FY 2002 owing to the support for START/SARCS (Southeast Asia Regional Committee for START), including operational cost of Secretariat Office, 6 research grants which are related to sustainable development indicators and funded to the research institutes of Southeast Asian countries, and a capacity building program (through training courses). Besides, Academia Sinica has allocated approximately US\$150 K annually for IGBP/IGAC (International Global Atmospheric Chemistry) Project Office. Other funding agencies contributed around US\$ 6.0-7.0 M each year. In summary, the total national budget for GCR is about 10 M.

Table 1 also shows that the budget for IGBP in FY 2002 is about double that in FY 2001, owing to a new project initiated for the study of marine environment of Taiwan Strait and biological change, while the budgets for WCRP decrease. The budget related to DIVERSITAS gains an increase of 24%. Total amount of GCR funds remains in an increasing trend.

Table 1. Annual budget (in US\$) for GCR funded by the National Science Council in FY 2001 and 2002 (Currency exchange rate as of December 31 2001).

	FY 2001 (8/2001–7/2002)		FY2002 (8/2002–7/2003)	
	<i>Budget</i>	<i>% of TOTAL</i>	<i>Budget</i>	<i>% of TOTAL</i>
<i>Research grants</i>				
IGBP	1099 K	31	2096 K	55
IHDP	58 K	2		
WCRP	413 K	12	267 K	7

DIVERSITAS	1428 K	40	1771 K	20
Subtotal	2998 K	85	4134 K	86
<i>Cost per project</i>	27 K		41 K	
<i>International integration</i>				
SARCS research grants	171 K	5	171 K	4
SARCS/START Training/Fellowship	106 K	3	106 K	2
SACRCS Secretariat	86 K	2	86 K	2
IGBP/IGAC Secretariat*			150 K	3
Subtotal	363 K	10	513 K	11
<i>Strategic projects</i>				
	156 K	4	154 K	3
TOTAL	3517 K	100	4801 K	100

* denotes the contribution from Academia Sinica.

The information requested by IGFA 2002 follows:

- A. About US\$ 3.5 M in FY 2001, and US\$ 4.8 M in FY2002, respectively.
- B. Overhead cost is included in aforementioned annual budget, and it accounts for only 8% of the total amount. The typical cost of a man-year for a scientist who ranks from a post-doctor to a full-professor ranges in US\$ 22-40K (salary only).
- C. Table 1 lists only the budget for GCR funded by NSC, and partly by Academia Sinica. As mentioned earlier, the CSDR of NSC actively promotes interdisciplinary programs and international collaboration, and other divisions support fundamental research. The CSDR solicits proposals annually, for projects with a duration of one to four years. Scientists can integrate their efforts to initiate a new program, or submit individual proposal to other divisions.
- D. The NSC accounts for approximately 35% of the total national spending on GCR in FY2001.
- E. According to Table 1, 85 and 86% of the NSC's budgets for GCR in FY 2001 and 2002, respectively, is allocated to these four programs. Other funding agencies mainly follow the guidelines of the Intergovernmental Panel on Climate Change (IPCC) to meet the United Nations Framework Convention on Climate Change (UNFCCC).
- F. About 10 and 11% of the NSC's budgets for GCR in FY 2001 and 2002, respectively, contributed to international research grants, and co-ordination activities. The Program Secretariats of START/SARCS and IGBP/IGAC are supported by the NSC and Academia Sinica, respectively. Section 3 provides further details.
- G. Funding levels have been markedly increased, but the change to individual programs varies. However, the funding for international collaboration dramatically increased since Taiwan has strengthened its role in the Asian region.

2. Infrastructural Investments

The National Space Program Office (NSPO) of NSC has launched one science satellite, and another two will be launched in the next three years. They are briefly described below:

- ROCSAT-1 is a low-earth orbiter that was launched on December 27, 1999 for scientific missions. It is designed to conduct ocean color imaging, experiments on ionospheric plasma and electrodynamics, and experiments using Ka-band (20-30 GHz) communication payloads.
- To be launched in late 2003, ROCSAT-2 is designed to perform near real-time remote sensing of the ocean and landmass near Taiwan. Data from the ROCSAT-2 mission can be applied for land use, agriculture and forestry, natural disaster evaluation, environmental monitoring, education, and support of international cooperation in various scientific researches.
- ROCSTA-3/COSMIC (Constellation Observing System for Meteorology, Ionosphere and Climate) is planned for launch in 2005. Its purpose is to establish a real-time global atmospheric watch system for collecting global meteorological data for weather prediction, environmental application and long-term climate research.

3. Recent News and Developments

In February 2002, the National Council for Sustainable Development (NCSD) was reformed. Mr. Shyi-Kun Yu, the Premier of the Executive Yuan (the Cabinet of Taiwan) became the Chairman of the Council, whereas, in the past, the Vice Premier had convened the Council meetings. This change symbolizes a new vision of national development based on environmental sustainability.

Other recent developments for GCR are highlighted below:

- *New Secretariat Office of SARCS in Taiwan*

Beginning in May 2001, the SARCS Secretariat was moved from Bangkok to Taipei. The NSC entirely funds the Secretariat's operation, and will continue to do so over the next few years. The CSDR of NSC is taking the lead in setting up the regional research team to study indicators of sustainable development. In FY2001, an integrated study of "Sustainable Development Indicators for the Southeast Asia Region", consisting of six projects proposed by research institutes of Southeast Asian countries, was funded. A research fund to sponsor the regional carbon study has been secured and will be initiated soon.

- *New Secretariat Office of IGAC in Taiwan*

In March 21-27, 2002 the IGBP/IGAC Scientific Steering Committee (SSC) met at Kruger National Park in South Africa and elected Prof. Shaw C. Liu of Academia Sinica, Taiwan, Dr. Timothy Bates of the United States, and Prof. Sandro Fuzzi of Italy as co-chairs of IGAC-II for a six-year term, starting January 2003. The IGAC project office is to be located in Academia Sinica, Taipei, Taiwan. The office will have one full-time project officer and one administrative secretary. Major activities at the office will include promoting and coordinating international research projects, organizing and running SSC meetings and international scientific conferences, publishing newsletters, communicating and coordinating with other IGBP core projects, and reporting to IGBP. Funds for the SSC activities will be provided

by IGBP. Taiwan will contribute about US\$150,000 annually to support other operations of the IGAC office.

- *New Biodiversity Section in NSC*

A new Biodiversity Section under the Life Science Division of the NSC, was established in January 2002 to increase and integrate research of biodiversity. In addition to supporting individual projects, the Section supports a major program of five biological networks, as part of International Long Term Ecological Research (ILTER). A strong link to DIVERSITAS is expected.

- *The Environmental Change Research Project (ECRP)*

ECRP was established in November 1999 in the Institute of Earth Sciences of Academia Sinica. ECRP is envisioned to develop into an independent Research Center in Academia Sinica by 2004. ECRP has already grown to 24 researchers and staff. About half of them are PhD-level scientists, and ten are supporting researchers. The overarching goal of ECRP is to understand the fundamental physical and biogeochemical processes of environmental changes. Research will focus on regional environmental problems around Taiwan and East Asia, including regional climate change and changes in water resources, air quality, and ecology.

European Union's Research on Global Change, Climate and Biodiversity

The aim of this Report, is to give a view of EU's spending on "Global Change, Climate and Biodiversity"(GCR) research, for the year 2001. The 5th Framework Programme has consolidated a European dimension of research through a "specific Key Action" on Global Change, Climate and Biodiversity and by "the Development of Generic Earth Observation Technologies".

KEY ACTION 2, Third deadline (Call of 15 February 2001)

Concerning Key Action 2, Call of February 2001, a total number of 157 proposals were evaluated, out of which 74 were considered for funding. 3 of these were concerted actions, 144 were RTD proposals and the rest were accompanying measures. Given that the available budget for the year 2001 was about ½, of the total amount requested for proposals on the list of the eligible proposals, stringent choice had to be made. **Finally 46 proposals, plus 5 Accompanying Measures (Open Call 2001), were financed. The total amount spent, regarding these two Calls, sums 70.8 Million € (69.8 Million € + 955.906 €).**

Proposals were invited for six different sub-themes:

2.1 To understand, detect, assess and predict global change processes

- 2.1.1 Atmospheric composition change
- 2.1.2 Stratospheric ozone depletion
- 2.1.3 Climate change prediction and scenarios

2.2 To foster better understanding of terrestrial (including freshwater) and marine ecosystems and their interactions

- 2.2.2 Interactions between ecosystems and the carbon and nitrogen cycles
- 2.2.3 Assessing and conserving biodiversity

2.3 Scenarios and strategies for responding to global change issues

- 2.3.3 Fighting land degradation and desertification
- 2.3.4 Compatibility between EU and international environmental policies and links with trade

The results are as follows:

2.1.1 (Atmospheric composition change): There are 11 proposals funded, including an Accompanying Measure "ACES", concerning the "IGAC Conference, International Global Atmospheric Chemistry – Crete". These proposals cover all subtopics of the Atmospheric Composition area, i.e. ozone budget, aerosols, oxidation processes, sources of pollutants and chemistry/climate interactions, and in particular, the aero-

sols area which was not well represented before in the 1st call in 1999, is now well covered.

2.1.2 (Stratospheric Ozone Depletion): 13 proposals are funded. This area obtains the highest amount of funds in the present call (about 20 M€). These projects cover all sub-areas of stratospheric ozone depletion area, i.e. stratospheric losses, stratosphere/troposphere exchange studies, UV radiation fluxes, aircraft impact studies and ozone-climate interactions.

There is also one Accompanying Measure “SESSO”, from the Open Call of 2001, to be added, dealing with the organisation of a major stratospheric symposium in Gøttenburg.

2.1.3 (Climate change prediction and scenarios): Within this area 7 proposals are funded. The top rated proposals “ENACT” deals with ocean data assimilation for seasonal prediction. The second on the list “PHOENICS” deals with aerosol direct climate effects and is a partial continuation of “SINDICATE” project of FP4. The rest “PRUDENCE, MICE and STARDEX”, are projects dealing directly with scenarios of climate change and impacts studies.

Among these proposals, there is a contribution to the AM “GCOSC Conference”, and a contribution to an Advanced Study Course “IRISEN II”.

2.2.2 (Interactions between ecosystems and the carbon and nitrogen cycles): Within this area, 5 proposals are funded. The proposals “GREENGRAS”, “NOCES”, “CARBOMONT” and “T-COS” are addressing the carbon budget of the terrestrial biosphere and fit well into the existing CARBOEUROPE cluster (closing of existing gaps). Proposed for funding is also “ORFOIS”, which will provide closed carbon and nitrogen budgets for the ocean.

“T-COS” and CARBOMONT” include a contribution of NAS I (Call of February 2002).

There is 1 Accompanying Measure “WASAC” to be added, from the Open Call of 2001.

2.2.3 (Assessing and conserving biodiversity): 7 proposals are funded. 5 of these are RTD projects and 1 is a Thematic Network. There is also one Accompanying Measure. All 5 proposals for research work were re-submissions. These 5 successful proposals would establish the criteria, methods, indicators and strategy that will help to conserve biodiversity and to encourage the sustainable use of biological resources in a context of changing land use patterns and global change. The thematic network “BioPlatform” will help to add value to existing Community-funded research. “Bio-Platform” and FRAXIGEN include a contribution of NAS I (Call of February 2002).

2.3.3 (Fighting land degradation and desertification): In this area 3 proposals are funded. One of the proposals is of high interest for the UN Convention to Combat Desertification and the evaluation panel has asked to concentrate the activity and objectives of this proposal mainly on the core issue of indicators. If one considers the importance of desertification issues, the area still remains with a significant deficit regarding the importance of scientific input needs, in relation to the UN Convention to Combat Desertification.

There is also 1 Accompanying Measure “CLEMDES” to be added, from the Open Call of 2001.

2.3.4 (Compatibility between EU and international environmental policies and links with trade): In this area there is 1 project, “Concerted Action – CAT & E” financed concerning trade and environment, following the conclusions of the Uruguay Round. The agenda of the WTO expanded to incorporate a number of environmental related issues.

KEY ACTION 2, Fourth deadline (Call of 15th October 2001)

In this Call a total number of 189 proposals were evaluated, out of which 60 were considered for funding. Only 9 of these are concerted actions, 168 RTD proposals and the rest are thematic networks.

Given that the available budget for the 4th deadline is about 1/2 of the total amount requested, stringent choice has to be made considering the ratings of the proposal, available budget for each topic and the balanced financial and topical coverage of the work programme of the Call. **Finally 44 proposals of this Call were financed. The total amount spent, regarding this Call, sums 67. 5 Million €**

Proposals were invited for seven different sub-themes:

2.1 To understand, detect, assess and predict global change processes

2.1.4 Climate dynamics and abrupt climate changes

2.2 To foster better understanding of terrestrial (including freshwater) and marine ecosystems and their interactions

2.2.1 Ecosystem vulnerability

2.2.2 Interactions between ecosystems and the carbon and nitrogen cycles

2.3 Scenarios and strategies for responding to global change issues

2.3.1 Mitigation of and adaptation to climate change and ozone depletion
Mitigation

2.3.2 Reconciling the conservation of biodiversity with economical development

2.4 European component of the global observing systems

2.4.1 Better exploitation of existing data and adaptation of existing observing systems

2.4.2 Development of new long-term observing capacity

The results are as follows:

2.1.4 (Climate variability and abrupt climate changes): 13 proposals are funded with a proposed budget of about 21 M€. This area, therefore, will receive the highest amount of funding. Two projects proposed for funding add important new perspectives to the area by addressing the ocean carbon chemistry and methane seeps and their possible links to climate dynamics. The Arctic region and climate dynamics related to the thermohaline circulation remains an important issue with three new projects well complementing the three projects supported after the first call. Four projects will address different aspects of climate feedback processes through modelling work using palaeodata and in situ observations. Three projects on climate reconstruction will concentrate on recent climate variability (last few thousand years) complementing the longer term approach of the projects previously funded. One project will develop methods for better assessment of small glaciers' contribution to sea-level change.

2.2.1 (Ecosystem vulnerability): 8 proposals are funded. The topics covered deal with: ecosystems and landscape evolution (2 proposals), vulnerability of forest ecosystem to ozone impact (1 proposal) and of timberline ecotone to global change (1 proposal). The vulnerability of Nordic arctic regions are also covered by 2 projects. Finally, the Mediterranean ecosystem vulnerability and its relationship to drought is addressed by a proposal and the European soil conservation issues will be covered by one concerted action. Connected to this Action, there are also 2 Accompanying Measures financed, one concerning the creation of a social environmental research network "EU-TSERNET" and the other "Forum Alpinum 2002" related to the natural environment of the Alps, covering 8 countries.

2.2.2: One proposal "Concerted Action: Synthesis of the European Greenhouse budget" has been submitted under the area 2.2.2.

This "CA" will establish a synthesis of the three main "Kyoto greenhouse gases" based on current research results of the European greenhouse gases budget for a multi-disciplinary integration. The final goal is to provide the scientific basis for a full greenhouse gas accounting and monitoring system by 2010. This CA is complementary to the CarboEurope research cluster.

2.3.1 (Mitigation and adaptation to global change): Within this area only 1 proposal is funded. This RTD project ATLANTIS, deals with the adaptation issue related to the possible rise of Atlantic sea-level due to climate change.

2.3.2 (Reconciling the conservation of biodiversity with economic development): 8 of the proposals are funded. Four of these are cost-shared projects and three are thematic networks and lastly one is a concerted action "CA". They cover the topics of mountain biodiversity, soil biodiversity, biodiversity indicators, conservation of large vertebrates, endangered species, the European biodiversity data, and reestablishment of peatland biodiversity.

2.4.1 (Better exploitation of existing data and adaptation of existing observing systems)

and

2.4.2 (Development of long-term new observing systems): In these two areas, 12 proposals are funded. The proposals retained for the funding list satisfactorily cover the domains corresponding to the European contribution to the global observing systems: terrestrial, including carbon fluxes and sinks (4 proposals); oceans (4 proposals); atmosphere, including clouds (3 proposals). In addition, about half of the proposals contain work packages of direct relevance to the initiative for the establishment of a European capacity for Global Monitoring of Environment and Security (GMES).

Participation from associated and third countries

Several associated countries (e.g. Iceland, Norway, Israel, Slovenia, Rumania, Hungary, Poland, Latvia, Lithuania, Czech Republic, Estonia) and Switzerland are participants of the short list proposals.

Other financed activities:

Development of generic Earth observation technologies (Call 2001)

Objectives:

The aim of this activity is to extend the European capacity in Earth observation (EO) technologies to monitor, understand and protect the environment, to develop a market for new operational products and services, and hence foster a sustainable European capability in operational services for monitoring the Earth from space. **Finally 14 proposals of this Call were financed. The total amount spent reaches 22.8 Million €**

Proposals were invited for three different sub-themes:

- 1- Introduce scientific results into new or existing applications;
- 2- Improve the exploitation of Earth observation;
- 3- Create favourable conditions to develop the market;

The results of the three Calls (Feb 2001; Oct 2001; + Accompanying Measures 2001) are the following:

Call February 2001 - In this area, 6 proposals were funded, their aim being to investigate techniques and algorithms in order to develop new Earth observation products in support of:

- flood forecasting and prediction of droughts event (ELDAS)
- snow mapping and run-off prediction (ENVISNOW)
- sustainable farming and agriculture (ISOCROP)
- wave and weather forecasting and nowcasting (ENVIWAVE)
- monitoring the eutrophication of the North Sea (REVAMP)
- Viability of full carbon accounting (SIBERIA-II).
- monitoring CO₂ concentrations and fluxes in relation to climate change (COCO).

The main bio-geophysical parameters retrieved from Earth observation data are crop biomass, soil moisture, snow cover area, snow water equivalent, snow wetness, albedo, snow surface temperature, wave heights, wind fields over the ocean, Chlorophyll concentration in sea and atmospheric CO₂ concentrations. To achieve these retrievals, data from various existing or secured Earth observation missions are planned to be used such as MSG, Envisat, Terra, ADEOS II, NOAA. The intensive use of Envisat data is worth to be mentioned. Four out of the six projects propose core activities, where data from SCHIAMACHY, MERIS, AATSR, ASAR, RA-2, play a central role. Another characteristic of most of these projects, is the inclusion of validation activities in support of product development.

Call of October 2001 - In this area, 7 proposals are funded, these proposals investigate further techniques and algorithms in order to develop new Earth observation products in support of:

- Ocean circulation in the North Atlantic (GOCINA)
- Detecting and identifying marine traffic from space (DECLIMS)
- Inventory and management of vineyard (BACCHUS)
- Optimal use of GPS Humidity measurements in meteorology (TOUGH)
- Observing Greenhouse gases emissions (EVERGREEN)

-
- Routine irrigation of crops (DEMETER)

Detecting land use changes and estimating terrestrial carbon fluxes (CYCLOPES).

The main bio-geophysical parameters to be retrieved from Earth observation data, are sea surface height and topography, water vapour, precipitation, regional and seasonal trace gas distributions (e.g. CO₂, CH₄, N₂O), Kc maps, global LAI, fAPAR, fCover. To achieve these retrievals, data from various existing or secured Earth observation missions are planned to be used, mainly ENVISAT, MSG, Terra, ERS, NOAA, Landsat, SPOT-VEGETATION and IKONOS.

To conclude, 109 proposals are funded regarding E U's Global Change Research in 2001 (Key Action 2 "Global Change, Climate and Biodiversity" and "the Development of Generic Earth Observation Technologies") for a total amount of 161.2 Million €

1. Funding levels for GCR

- A. The total funding for GCR can be estimated only, as funding comes from so many sources and different funding agencies define GCR in different ways. However, a rough approximation for the total GCR funding in Finland is at least 24 million USD for 2001.
- B. The overhead costs are only partially included in the above figures. In the year 2001, overhead costs were not yet included in the Academy of Finland funding (currently they are). In Tekes and ministry funding, a 15 % overhead is normally included.

A typical cost of a person-year for a global change scientist varies considerably depending on the research institution. In a university the cost varies between roughly 40000 (post-doc) and 85000 USD (professor).

Private foundations offer personal research grants (tax-free); typically 13500 USD

- C. **The Academy of Finland** (incl. four research councils): Research programmes (specific programmes for GCR (<http://figare.utu.fi>)), Biodiversity (<http://fibre.utu.fi>), Sustainable Use of Natural Resources (SUNARE); direct project funding; researcher posts (post-doc, mature scientists etc.); centers of excellence.

Technology Development Agency Tekes: Research Programmes (e.g. Climate change and Technology CLIMTECH); direct project funding

Ministries (direct); Ministry of the Environment, Ministry of Trade and Industry, Ministry of Agriculture and Forestry, Ministry of Transport and Communications, and Ministry of Foreign Affairs; participation in research programmes co-ordinated by the Academy of Finland; direct project funding

Other governmental organizations (funding allocated via ministries): Finnish Environment Institute; Geological Survey of Finland; Forest Research Institute; Finnish Marine Research Institute, Finnish Meteorological Institute, Finnish Geodetic Institute etc.; normal budget line research

Private foundations, e.g. Maj and Tor Nessling Foundation (<http://www.nessling.fi>), Alfred Kordelin Foundation (<http://www.kordelin.fi>), Wihuri Foundation (<http://www.wihurinrahasto.fi>), Emil Aaltonen Foundation (<http://personal.eunet.fi/pp/eas>), Finnish Cultural Foundation (<http://www.skr.fi>); direct project funding; personal research grants; participation in research programmes co-ordinated by the Academy of Finland

Other national organisations, e.g. Finnish Forest Industries Federation (<http://www.forestindustries.fi>), Central Union of Agricultural Producers and Forest Owners (<http://www.mtk.fi>)

International sources, e.g. EU FP 5, Nordic Centres of Excellence, Nordic Arctic Research Programme; direct project funding

- D. The Academy of Finland is estimated to cover ca. 50% of the total national spending on GCR.

Others:

-
- Ministries (direct funding) 30%
 - Technology Development Agency 10%
 - Private foundations 10%

E. This proportion is difficult to assess precisely. A rough estimate is ca. 80%.

F. The amount of glue money is difficult to assess. Funding for individual research projects includes e.g., travel costs, costs for organizing seminars and inviting foreign researchers. The international GCR integration at the level of EU is supported by the joint EU projects. In addition, the Academy of Finland grants subsidy for organizing international conferences in Finland.

The total amount is ca. 110 000 USD.

G. The trend in GCR is stable at the moment.

2. Infrastructural investments

Currently, there are no plans for any major investments in infrastructures.

3. Recent news and developments

- 1) Finnish Global Change Research Programme and Finnish Biodiversity Research Programme are now coming to an end and the results will be issued in the first half of 2003.
- 2) Two new programmes in GCR are under way; Sustainable Use of Natural Resources (SUNARE 2001-2004) with a total funding of 10 million USD, and Baltic Sea Research Programme (BIREME 2003-2005) with an estimated total funding of ca. 5 million USD.
- 3) The first Nordic Centres of Excellence programme launched in 2002 will be coordinated by the Academy of Finland.

1. Funding levels for GCR

- A. Funding of GCR in Germany amounted to 260 Mio. US-\$ (290 Mio. €) in 2001.
- B. This figure only partly includes overhead costs. The average costs of a man-year for a global change scientist are 70k US-\$ (80k €).
- C. BMBF (German Federal Ministry of Education and Research) creates dedicated programs; DFG (Deutsche Forschungsgemeinschaft) judges independent applications in the field of global change research by scientific excellency.
- D. Funding agencies' approximate percentages of the total national spending are:

	Mio US-\$	Mio €	% of total national GCR spending
BMBF:	204	230	78%
DFG:	36	40	14%
others:	20	20	8%
TOTAL	260	290	100%

- E. Grossly estimated, the proportion of the funding agencies' total GCR spending dedicated to *research coordinated by the four international programs WCRP, IGBP, IHDP and DIVERSITAS* is 40%.
- F. The following table gives the percentages of the funding agencies' spending on GCR that was support for international integration and co-ordination activities (*glue money*):

	Mio. US-\$	Mio €	% of agency's total GCR spending
BMBF:	2,2	2,5	1%
DFG:	0,4	0,4	1%
others:	0,2	0,2	1%
TOTAL	2,8	3,1	1%

- G. In comparison with previous years, the trend in funding levels is slightly upwards when regarding spending in Euro (National Update 2000: total spending 520 Mio. DM = 270 Mio. €).

2. Infrastructural investments

BMBF funded the new super-computer for climate modeling at the Max-Planck-Institute for Meteorology in Hamburg with 30 Mio. € in the initial period. A second period is envisaged.

The thin-ice-breaker "Maria Sybilla Merian" is funded with 50 Mio. € and will be ready by 2004. It will be used to conduct research close to the ice edge in the northern North Atlantic.

In addition, there are considerations on the European level (coordinated with the European Polar Board) to fund the drilling ship "Aurora Borealis" with a total of 250 Mio. €. This would be an international effort contributing to the Integrated Ocean Drilling Program (IODP).

The options for the BMBF funding a "High-Altitude-Long-Range" research aircraft (HALO) are being investigated, but no decision has been made so far.

3. Recent news and developments

The overall trend of funding by the DFG is up. New programs on biodiversity have started. As a member of the ESF the DFG is involved in implementing a new European program on high resolution palaeo-climatic reconstructions ("EUROCLIMATE") through the new funding mechanism EUROCORES.

BMBF is currently preparing a research program dealing with climate protection.

The National Committee for Global Change Research is currently working on recommendations to redesign the strategies for global change research in Germany. Besides strengthening the participation in the Global Change Programs and the developing crosscutting themes, special emphasis is put on a new program to develop a "Geoscope" as an integrated methodology to assess global change.

Climatic variations on decadal and century time scales are well known to Icelanders and the country and its economy is highly vulnerable to the impact of such variations due to its dependence on natural resources, both of the land and the sea.

In practice The Icelandic Research Council (IRC) regards “global change research” as all research with strong relevance to understanding the underlying processes of climate variability and change, natural and anthropogenic, and the impact of such variability/change on the biosphere, the economy and society.

Much proxy data information exists on previous climatic changes and their effects on natural resources and the life of Icelanders.

In recent years a substantial part of the national efforts in natural (physical and life sciences) and environmental sciences, fisheries and agricultural research has direct and indirect implication for global change research. This effort, however, is divided between a number of sectoral institutions with other objectives and attention to global change issues has depended on the initiative and interest of individual scientists more than concerted national efforts. Institutions in Iceland directly or indirectly involved in research on global change are: Icelandic Meteorological Office, the National Energy Authority, the Marine Research Institute, the Agricultural Research Institute, the Institute of Freshwater Fisheries, the State Forestry Research Centre at Mógilsá, the Environmental & Food Agency of Iceland, the Icelandic Museum of Natural History, the Nordic Volcanological Institute, the Stefansson Arctic Institute and the University of Iceland.

There is no formal global change research program in Iceland. IRC took the initiative a few years ago to evaluate the need and formulate an overall strategy in the field of global change research. The recommendations called for a co-ordinated and cross-disciplinary effort by a number of institutions. However, the limitation of financial resources for R&D in the small economy of Iceland presents a problem in pursuing a concerted strategy. The recommendations have never been implemented.

1. Funding levels for GCR

The IRC is the only research funding organisation with global change research on its agenda but individual ministries fund related research directly and indirectly through institutional funding (see institutions above). The financial instruments within IRC to support basic science research are mainly two funds; the Science Fund and Fund for Facilities and Equipment. On an annual basis the resources in these two funds are only around 3 M\$. Furthermore IRC has received earmarked national funds for the period 1999-2004 to finance increased research efforts into the area of environmental research. The Government of Iceland provided a total of 1 M\$ for the year 2001 to fund research in information technology (0,6 M\$) and environmental research (0,4 M\$). Parts of these funds are directed at research themes relevant to global change research. The grants already awarded in the area of information technology include development of comprehensive natural database (GIS) on natural resources and natural phenomena essential to follow long-term changes. Paleoclimatic research is also currently funded under the environmental part. It is impossible to name an exact figure for IRC funding of global change research in 2001, but a figure between 50-100.000 \$ is probably not far from the reality. A typical cost of a man-year for a scientist in Iceland is around 50-60.000 \$.

All grants from the funds mentioned above are awarded to applicants on the basis of reviews from independent advisory boards and other qualified referees. Grant applications to IRC in the field of global change are not given any priority, they compete on even basis with other fields of science, and no funds have been earmarked for any field in advance.

A total 206 M\$ were spent on R&D in 2001 in Iceland (estimation). This represents 2.86% of the Gross Domestic Product and is within top 5 reported among OECD countries. This is considerably higher than earlier forecast and can mainly be explained by new industrial R&D investments in human genomics and biotechnology.

The IRC does not finance any projects under any of the four international programs. However Icelandic science institutions do provide inputs into individual projects under WRCP, IGBP and IHDP, but nothing under Diversitas.

IRC does promote links between researchers in Iceland and increased links with international programs, such as IGBP, WCRP, IHDP, IASC, ODP and comparable parties. It certainly enhance the possibilities of Icelandic participation in regional and global research efforts for understanding of Earth's physical and biological process, climate variability and interaction with human activity but the Icelandic national resources are very small in international terms and in relation to the size of the problem. Iceland has difficulty in directly financing events and research work outside its own borders. It can to some extent finance international scientific workshops and similar events in Iceland and can possibly on a case by case basis find means to fund participants from countries outside Europe in such events. Iceland through IRC and other national institutions has many times hosted and co-sponsored such events on a case by case basis when the location in Iceland seems particularly relevant. IRC has funds for these purposes, but it is not earmarked for global change research.

In recent years, IRC have not received increasing resources. The IRC funds distribute only around 3-4% of the total funds devoted to R&D in Iceland.

2. Infrastructural investments

The Marine Research Institute in Iceland has a new research vessel, RS Árni Friðriksson, named after the well known Icelandic oceanographer/marine biologist, who became director of ICES. The vessel is built as a multipurpose research vessel and was delivered in April 2000. One of the main objects in the design of the vessel was having the ship as silent as possible. One of the main works of the vessel is fish stock assessment and it is outfitted with a Simrad EK 500 echosounder with three transducers, 18 - 38 and 120 kHz. The transducers are installed in a protrusible keel, which can be lowered 3.5 meters below the ship's bottom. The ship is also equipped with two Kaijo Denki Sonars, a low and a high frequency. Furthermore a multibeam echosounder is installed for mapping the sea bottom. The vessel is equipped with numerous winches for towing and scientific purposes.

3. Recent news and developments

- The Government of Iceland has announced its intention to present a bill to the Althing for the establishment of a **ministerial level science and technology policy council** headed by the Prime Minister. This is to replace the existing Icelandic Research Council. The new science and technology council will in addition to the Prime Minister include the Minister of Education, Science and Culture, the Minister of Industry and Commerce as well as the Minister of Finance. In addition 14 representatives of the science community will be nominated as follows:

4 by the Co-ordinating Committee of the Universities in Iceland,
4 by the main labour market organisations, employers and labour (two each),
6 by ministers with a science and research component in their portfolio, one each the Ministers of:

Education and Science,
Industry and Commerce,
Fisheries,
Agriculture,
Health and Social Security,
Environment

A separate but linked bill of law presented by the Minister of Education, Science and Culture calls for the merger of the existing Science Fund and the Technology Fund (under the present Icelandic Research Council) into a single Research Fund. Similarly a separate but linked bill is presented by the Minister of Industry and Commerce calls for the founding of a new Technology Development Fund under an autonomous grants board appointed by the Minister of Industry and Commerce. The chairman of the technology board will also chair the grants-board of this new Technology Development Fund. These three proposals have been debated in the spring session of the Althing, 2002, and are scheduled to take effect in the beginning of 2003, if accepted.

- IRC in co-operation with the ministry of education, National Science Foundation in USA and the US Embassy in Iceland prepared a US – Icelandic Science Day on the 13th of September 2001 in connection with an international symposium on geological aspects of Iceland. The theme of the Science Day was to be North-Atlantic Science Connections, i.e. science policy concerning research on environmental issues, and the genomics of human health in the North-Atlantic region. Due to the tragic events in USA on 11th of September, the meeting was cancelled. In May 2002 the parties organised a similar meeting or congress, on Trans-Atlantic science connection with special focus on environmental issues, such as global change issues, climate variability and change in the Arctic region.
- IRC announced in the fall of 2001 a change in its grant policies for the Science Fund. A new category of larger grants, 50-100.000\$, is now offered to outstanding research groups to promote research excellence and more ambitious projects in fundamental research with the view of meeting increasing international trends towards supporting "Centres of Excellence". The measure is also intended to counteract the eroding purchasing power of the traditionally small grants to individual scientists awarded by the Science Fund. The Council intends to reserve up to 25% of its available funds for this scheme, which will reduce the total number of other types of grants considerably unless further appropriations will be forthcoming. One of only four projects granted in 2002 is on environmental change in the Holocene Period - "Warm times/Cold times: Reconstructing Iceland's Climate and Environment since the last Glaciation to evaluate the impact of future change". The project is a collaborative research program between Iceland, the United States, Canada, and the United Kingdom, that aims to quantify the timing and magnitude of natural variability of Iceland's climate since the last Ice Age, and from this, to estimate the possible consequences of climate changes expected in the near future.

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- The Prime Minister, David Oddsson, in his policy speech to the public in connection with the convening of the fall session of Althing 2001 praised the results that investments in R&D have produced in recent years announced the governments intention to transfer the overall responsibility for science and technology policy to the Prime Ministers Office. A new structure (a science and technology policy council) would include ministers and representatives of the scientific community and industry. The economic policy document presented to the first session of the Althing last Monday with the budget proposal for 2002 is based on three explicit policy pillars: (1) state fiscal policies, (2) monetary policies, and (3) science, research and development. This represents a new stage for the science and technology in the economic policies of the Icelandic government.
 - The public laboratories involved with various aspects of exploring and researching the natural resources and features of Iceland have joined forces to establish a GIS-based national database. A similar effort is ongoing on a national cultural and archaeological database. This work is financed in part by the information and environmental technology programme of the Icelandic Research Council and the government ITC initiative. This may have important implications for future international exchange of scientific data.
 - Iceland places high priority on international co-operation in research. Nordic co-operation is a long-established tradition and covers a broad range of subjects and activities. Recently the Joint Committee of the Nordic Natural Science Research Councils in co-operation with the Nordic Council of Ministers decided to start a new program: *Nordic Centres of Excellence Pilot Program 2002-2007*. The research field will be: ***Basic science in the field of global change, especially in the context of ecosystem responses to climate change, atmospheric processes and oceanographic processes.***

THE NETHERLANDS

For a suite of years, science and science infrastructure are high on the political agenda in The Netherlands, but funding of science is not. In 2001, termination of the National Programme on Climate Change caused a substantial decline of the funding levels, which will be continued in 2002 due to delay of decisions about the planned continuation. Considerable amounts of new funds were anticipated to become available from a programme of the Ministry of Economic Affairs, but due to the unstable political situation this has become uncertain.

The good news is, that the Dutch knowledge infrastructure (institutes, universities and NWO) has integrated GCR in its regular programming of research. As a consequence, GCR is blooming, but it becomes increasingly difficult to produce figures.

1. Funding levels for GCR in The Netherlands in 2001

- A. Funding of GCR in The Netherlands by funding agencies (see below) amounted about M\$ 8 in 2001. This figure does not include overhead costs.
- B. The *costs of a man-year* for funded scientists amount k\$ 30 (PhD-student) to 50 (postdoc) per man-year excl. overhead. Overhead costs are estimated to double the figures.
- C. The national science foundation *NWO* acts as the main channel for additional funding, mainly by *special programmes on GCR issues*, including half of the National Programme on Climate Change, co-funded by NWO and the *Ministry of Housing, Spatial Planning and the Environment*, and the *Earth Observation programme*.

Other funding mechanisms by NWO for GCR involve: *personal grants* for excellent scientists in various stages of their career; grants for *investments*; *use of large facilities* (ships, supercomputing), *glue money* for international co-ordination and workshops; *contributions* for specific programmes (e.g. IODP).

In addition the marine institute *Royal NIOZ* and the *Free University* contributed in kind for offices they are hosting (LOICZ and IT).

- D. The NWO funding is about 25% of the total national spending on GCR including the overhead.
- E. A rough estimate is that 50% of the funding concerns research which is contributing to the four GCR programmes.
- F. About k\$ 500 (6%) was spent for international offices (IGBP-LOICZ and IHDP-IT), and about k\$ 50 (<1%) for other glue money. In addition, a one-time contribution for the 2001 Open Science Conference amounted to about k\$ 700 (10%). In the OSM more funders (Ministry of Education and Science, Royal Academy) were involved.
- G. The funding levels went slightly down. This is mainly caused by the termination of the National Programme on Climate Change in 2001. Also budgets of NWO are under pressure. On the other hand, an increased effort on CGR is included in the regular funding of research institutions and in other granting instruments, which are not specifically dedicated to GCR. It is estimated that about 800 Dutch scientists are involved in GCR.

2. Some highlights

Hosting the Open Science Conference in Amsterdam, July 2001, was a major event.

A successful second marine expedition around Africa was completed, which produced much novel insights, e.g. in the Agulhas current.

IGBP reported that the Dutch Glue Money for the first Carbon Workshop was very instrumental in triggering the development of the new Carbon Joint Project.

A bilateral Indonesian-Dutch programme on LOICZ in the Bay of Banten (Java) was concluded with a symposium which was mainly presented in Indonesian language and by Indonesian PhD-students. This was an unprecedented success.

One of the 2001 NWO Spinoza Prize ('the Dutch Nobel prize') winners was Hans Oerlemans, who is going to spend his grant of M\$ 1.5 on a thorough investigation of the temperature balance of the Greenland Ice-cap.

The January 2002 ESF meeting on the Forward Look on GCR was initiated and prepared by NWO.

The marine institute Royal NIOZ obtained an investment grant which enables it to join the UK-Norwegian programme on monitoring the North Atlantic currents. NIOZ will monitor currents in the Irminger Sea near Greenland, and in addition in Mozambique Channel and one the Indonesian gateways.

NWO plays an active role in the development of the ESF Eurocores Euromargins and Euroclimate.

NWO intends to actively promote and support a strong role of Dutch research groups in the new instruments of the 6th EU Framework Programme (Networks of Excellence and Integrated Projects).

Problems

In August 2002 an international evaluation was held of the Core Project Office of LOICZ, hosted by NIOZ. The evaluation was straight forward very positive. Also, IGBP indicated that over the past ten years, the LOICZ office was one the most effective and one of the best funded offices. Nevertheless, it is anticipated that it could be problematic to secure Dutch funding for the last three years of the office (2003-2005). We request colleague funding agencies to consider to contribute to support the office in order to facilitate it to complete its mission.

Figures are given only in Norwegian kroner (NOK). Exchange rate USD/NOK of 31.12.01: 9.0116.

1. Funding levels for global change research (GCR)

- A. We only have reasonably good figures for the Research Council of Norway's (RCN) spending. For 2001 the RCN's total amount of funding of global change research (GCR) is estimated at **NOK 144 M**.

Based on various recent surveys of funding of environmental research the RCNs fraction of Norway's total funding for GCR is estimated at 40%. Thus, the total amount of funding for GCR in 2001 can be estimated at **NOK 347 M**.

- B. The Research Council covers 15% overhead to the universities, and this is included in the figures above. As for funding through independent research institutes overhead is included in the cost of a man-year.

The cost of a man-year for a global change scientist varies, depending on type of research field/institution. As an average we would estimate around **NOK 1.161 M** for independent research institutes within the natural science/technology sector and a little less than **NOK 1.0** within the social science sector. We believe that the real cost of a man-year at a university is not too different from this.

- C. The main channels for GCR funding are:

- *The Research Council of Norway*. The Council gets its money from various ministries, of which the Ministry of Environment, Ministry of Education and Science and Ministry of Petroleum and Energy are the most important contributors to GCR.
- *Other public funding sources*. This is mainly direct funding from the ministries, the main part of which is core funding (universities, other FoU-institutions), but also funding of programs and projects commissioned by the ministries or other public agencies.
- *Other public international sources*, especially EU-funding.
- *Private sources*. This is mainly FoU conducted by industrial firms, some private organisations dedicated to health issues etc.

The mechanisms by which GCR is being funded differ between the agencies. *The Research Council* invites research groups and individual scientists to apply for funding through dedicated research programmes. The Council also accepts individual proposals without any programmatic limitations. In both cases the proposals go through an extensive evaluation process. GCR is also funded through the Council's core funding of independent research institutes.

- D. The RCN's fraction of the total national funding is estimated at **40%**, cf. Question A. The RCN's funding is channelled through various research programmes and other research activities. (GCR-relevant funding through independent research institutes (core funding) is not included). An overview of relevant research programs is enclosed.
- E. A recent survey has indicated that about 60% of the RCN's funding of GCR in 2001 were relevant to GCR co-ordinated by the four international GCR programs.

We lack data concerning other funding agencies and the relevance of their GCR-funding to the GCR international programs.

Percentage of the funding agencies' spending on GCR as support for international integration and co-ordination activities (glue money).

F. In 2001 the RCN spent around **NOK 8.0 M** or **5.8%** of its total funding for GCR as glue money. NORAD spent NOK 0,3 M. We lack data for other funding agencies. It is, however, reasonable to believe that their contribution to glue money is only marginal. Consequently, the glue money fraction of Norway's funding for GCR was **2.4%**. A detailed overview of support activities is enclosed.

G. The table below shows a clear upward trend in GCR funding in Norway.

	1999	2000	2001	2002	2003 (estimate)	Comments
RCN	110	132	144	174	192	
Glue money (RCN)	7	8	8	9	9	
Norway total	264	316	347	423	468	Estimated as RCN/0.4

2. Infrastructure investments

- A new Marine Laboratory is being planned at Ny-Ålesund. Funding is not yet secured.
- Institute of Marine Research (IMR) expects to have a new research vessel operating from 2003.

3. Recent news and developments

- *The Research Council of Norway* has launched a new 10 years research program on Climate/Effects of Climate Change. Budget allocation in 2002: NOK 20 M. A yearly budget increase is expected.
- *The Research Council of Norway* has launched a new research initiative 2002 – 2006 to strengthen Norwegian climate related polar research. Total amount: NOK 110 mill.
- *The Research Council of Norway* has recently established 13 Centres of excellence. Two of the centres are within the GCR area: Bjerknes Centre for Climate Research (100% GCR) and Centre for the Study of civil War (25 % GCR).

Enclosure

Overview of ongoing GRC-relevant research programmes

- Climate and Climate Change
- Impacts and adaptation to climate change
- Advanced research groups in Climate Research
- Centre of Excellence: Bjerknes Centre for climate research
- Centre of Excellence: Centre for the Study of Civil war
- Polar Climate Research
- Polar research (arctic)
- Biological Diversity – Dynamics, Threats and Management

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- Wild Salmon
 - MARE – Marine resources, environment and management
 - Industrial Ecology
 - Changing Landscapes
 - Social Science Research in Energy, Environment and Technology - SAMSTEMT
 - Towards Sustainable Development: Strategies, Opportunities and Challenges - RAMBU
 - Programme for Research and Documentation for a Sustainable Development
 - Co-operation Programmes for Eastern Europe (Russia, South Eastern Europe, EU Candidate Countries)
 - Globalisation and Marginalisation: Multi- and interdisciplinary research on development paths in the South
 - Independent researcher-initiated projects; other relevant research programmes

Overview of ongoing support for international integration and co-ordination activities (IPOs and other glue money, funding 2001)

- IHDP – core funding NOK 0,10 M (*Research Council*)
- IGBP – core funding NOK 0,17 M (*Research Council*)
- DIVERSITAS – core funding NOK 0,2 M from 2002 (*Research Council*)
- JGOFS/IPO - support to the Bergen-Secretariat – NOK 1,37 M (*Research Council*)
- ACSYS/CLIC/IPO – support to the Tromsø-Secretariat – NOK 0,3 M (*Research Council*)
- GLOBEC/IPO – support to the Danish secretariat NOK 0,1 M (*Research Council*)
- START – support to START activities in Africa NOK 0,3 M (*NORAD*)
- JGOFS/NGOFS – support to database NOK 0,57 M (*Research Council*)

Support to other global change related activities:

- IIASA – core funding NOK 5,0 M (*Research Council*)
- IASC – NOK 0,08 M (*Research Council*)
- Global Change Committee/Panel, smaller co-ordinating grants – NOK 0,63 M (*Research Council*)

I. General presentation of the National Plan for RTD and Innovation (Goal, programs structure, general objectives)

The **National Plan for RTD and Innovation**, introduced as a new system for RTD financing starting with 1999, is based on the following principles:

- **strategic planning** of objectives and activities;
- **program- based structuring of activities**,
- **multi-annual planning of activities and budgets**, based on long term objectives, with annual quantification and specific achievement indicators,
- **results-oriented monitoring and evaluation of activities**, according to objectives and achievement indicators;
- **annual up-dating of objectives and budgets**, according to performance results;
- **Fully competition-based financing** of projects.

Priorities and objectives for the programs in the Plan for RTD and Innovation were established and, respectively, up-dated in consultation with a wide range of actors involved, namely:

- *government authorities*, in first place all major economic ministries, which forward proposals for RTD priorities;
- *representatives of the scientific community, as well as of industry* (represented in the commissions of the Consultative College for RTD and Innovation, the specialized RTD consultative body assisting the Ministry of Education and Research)
- *social partners*, namely representatives of directors and unions of the RTD sector (represented in the Consultative Commission for Social Dialogue)

The Ministry of Education and Research establishes the breakdown by programs of the annual budgetary resources allocated for the Plan, according to the provisions of:

- Law 95/ 1998 which approves GO 8/ 1997 for the stimulation of research and development;
- The Government Decisions approving the up-dated forms of the Plan (including GD 556/ 2001).

The National Plan for RTD and Innovation was up-dated in 2001, through a very recently adopted Government Decision (556/ 7 June 2001, Of.J. 337/ 25 June 2001), according to which the Plan duration was extended till 2005.

The Plan in the initial form (Government Decision 562/ 1999), launched in the last term of 1999, included four programs:

- *Economic relaunch through research and innovation* (RELANSIN), supporting the modernizing and innovation of products/ technologies/ services delivered/ used by enterprises.
- *Quality and standards* (CALIST), supporting the up-grading of the qualitative and technical level of Romanian products/ technologies/ services;

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- *Consolidation of the infrastructures for standardization (INFRAST)*, which supports the policy of developing the infrastructures for quality, especially those for standardization;
 - *International S&T cooperation and partnership (CORINT)*, focused on stimulating the integration of the Romanian scientific and technical community into the international one.

The limited budget resources have not permitted to launch new programs in the year 2000.

According to the 2001 up-dating the Plan includes the following 10 new programs, for:

a) the modernization and relaunch of the *current economy*:

- **Agriculture and food**, supporting food security and the sustainable development of agro-food production;
- Life and Health, **promoting a better understanding of pathology mechanisms, the development of new therapeutically and prevention means**
- **Environment, energy and resources** oriented towards new technologies, systems and instruments for the protection and rational exploitation of the natural capital, for increased efficiency in energy production, distribution and use and for a better valorization of mineral resources;
- **Planning, infrastructures and transportation** oriented towards modern methods, technologies and instruments for balanced territorial planning, for ensuring the safety, utility and comfort of constructions, as well as the development of a safe, efficient and non-pollute system of transportation;
- **Stimulation of the application of inventions** (in support of individual inventors)

b) consolidating the elements of *the new knowledge-based economy*:

- **Information Society Technologies**, which stimulates a consistent and coherent development of the Information Society in Romania, in accordance with the provisions of the Europe documents and action plans;
- **Biotechnology**, supporting progress in modern biotechnology's and the achievement of new byproducts and their promotion in various fields (agriculture and food, including fisheries, medicine, pharmacy, environment);
- New materials, micro- and nanotechnologies, **supporting basic and applied research for new materials, micro and nanostructures, integrated micro-systems, high precision, miniaturized devices and instruments**;
- **Technologies for the space and aeronautics fields**, supporting basic and applied research in the respective fields;

II. Sector specific RTD policies related to sustainable development

Environment, energy and resources:

The surface of Romania's territory is comparable to that of Great Britain: 238.391 sq. km. Among the major elements of Romania's natural capital, we mention:

- 6.25 mil ha of forests (approx. 27% of the country's surface);
- 14.8 mil ha of agricultural soil;
- 4.864 water courses, with a total length of about 78.900 km
- Oil reserves of more than 200 mil t and gas reserves of about 400-bill cub. m
- coal reserves of about 3.4 bill t
- mineral reserves (metallic and non-metallic): more than 1000 mil t (more than 900 t of copper minerals)

One of the main program of the national plan is environment, energy and resources (MENER) of the National Plan is oriented towards the development of new technologies, instruments, systems and equipment for:

- the protection and rational exploitation of the **natural capital** (air, water, land, ecosystems), including as main issues: evaluation, monitoring, depollution, rehabilitation, management of waste, as well as the management of natural and anthropic risks and disasters;
- clean technologies and increased efficiency in **energy production, distribution and use**, including renewable and other non-conventional sources of energy;
- a better identification and a sustainable and competitive exploitation of **mineral resources**.

The program includes the following subprograms:

- Environment and climatic factors
- Management of risks
- Conventional, new and renewable energy forms
- Nuclear energy
- Mineral resources

The MENER budget share represents about 6% of the total National Plan budget.

Environment and Climatic factors	2001-2005	2002-2005
	47.000.000 Lei	13.400.000 Lei
	1.496.875 €	418.750 €
Total 2001-2005	61.300.000 Lei	
	1.915.625 €	

In the 2001 competition of projects launched for the programs of the National Plan MENER was classified second (after Relansin), according to the number of project proposals received - 714. After evaluation, only 132 were accepted for financing.

In 2001, the resources involved in the MENER program accounted for **300 researchers from 49 RTD units**.

In the 2002 competition, besides the „usual” bottom-up projects proposals received from the S/T community, a number of 14 priority projects, responding to specific

sector development demands, indicated by various ministries, were launched in a top-down tender regime. Almost **2/ 3 of the priority projects were dedicated to de-pollution and to waste management**, including nuclear waste.

Nuclear Energy:

Romania is among the founding members of the International Agency for Atomic Energy (IAAE). The nuclear sector activities developed in Romania comply with the provisions of IAAE statute. They fully respond to the requirements of environment and population protection.

In order to fulfill energy demands and to ensure sustainable development requirements, nuclear energy represents for Romania an optimal solution, both by the technical solution adopted (CANDU-type reactors) and by the technical and economical performance indicators attained in nuclear installations operation.

The option to building the nuclear-electric power plant of Cernavoda was also based on an adequate field specific RTD program, which also gave an important support to the industry involved in: the nuclear fuel cycle, nuclear equipment and materials development, industrial constructions and installations, services, aso.

The strategy and policies for the nuclear field activities are developed by the National Agency for Atomic Energy (ANEA), functioning within the Ministry of Education and Research.

The core of the nuclear field development strategy is represented by the National Nuclear Program (P.N.N.), which includes priorities related to:

- the regulation infrastructure
- radiological protection and health;
- management of radioactive waste and of used fuel;
- nuclear security of the Cernavoda power plant;
- RTD activities as a support for the National Nuclear Program.

The RTD activities specific to the field are developed through the “Nuclear Energy” subprogram of the MENER program, which includes, as main thematic issues:

- Security in nuclear installations functioning;
- Technological processes specific to nuclear plants;
- management of radioactive waste and of used fuel;
- evaluation of radiological impact on population and environment;
- Advanced technologies in the nuclear field: fusion, fission.

In 2001, the Ministry of Education and Research, through ANEA, promoted the drafts of:

- The Law for activities in the nuclear field;
- The Law on the management of used nuclear fuel and radioactive waste.

The drafts are now in the advising process at various ministries involved.

General

South Africa is a country whose economy depends heavily on agriculture and to a lesser extent on fisheries and tourism. Obviously global change and climate change *per se* have massive impacts on rainfall patterns and on the economy. They are also vital in terms of disaster management as witnessed by floods and droughts in recent years. Thus there is a strong need for the applied side of Global Change research, in terms of Vulnerability and Adaptation Studies. These need to be underpinned by fundamental Global Change Research and forecasts of regional and local climate change. It is clear that South Africa must be active in both these aspects of Global Change research.

We estimate that at least 300 South African scientists participate in Global Change Research. This is difficult to estimate because it is not being funded by a single programme within one agency but is executed across a broad spectrum of Universities, museums, government departments and other institutions and commissions.

It is also difficult if not impossible to put accurate figures to the support of GCR in South Africa because the boundaries of GCR are undefined and blurred within the wider scope of environmental research. Many national level South African environmental research programmes cover aspects of global change research and a few institutional programmes are focused on GCR from the climatic change perspective.

A single comprehensive national programme on global change is as yet an unlikelihood due to the shortage of research funds and researchers. International funding institutions are supporting global change research in South Africa and are already significant role players. These programmes are often based on the pre-determined interests of the funding institution and are therefore not comprehensive enough to be classified as national GCR programmes. It is also difficult to report on investments because many programmes are jointly funded and often supported by “in-kind” arrangements whereby the host institution provides resources that are not accounted for, e.g. equipment, staff and access to data and study areas. The figure provided hereafter for the national expenditure on GCR may in fact be a gross under-estimation.

1. Funding levels for GCR

- A. US\$ 830 000 from national resources.
- B. The figure does not include overhead costs. A mid-career global change scientist would probably cost US\$ 21,000.
- C. Some of the more prominent GCR funding agencies are:
 - **National Research Foundation** – Conservation and Management of Ecosystems and Biodiversity Programme, a broad focus on the natural environment and the human interface
 - **National Botanical Institute** – a. Climate Change Programme On Elevated CO₂ and UV-B Effects On Vegetation, b. Functional Changes In The Vegetation Of The Cape Region In Response To Global Change,

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- **South African National Antarctica Programme** – including the effects of climate change on a relatively pristine sub-Antarctic island environment,
 - **SAWS Meteorological Monitoring and Research** – nation-wide weather stations including on sub-Antarctic and Southern Ocean islands,
 - **ESKOM Climate Research** – predictive modeling of atmospheric systems and climate change

D. Rough estimate - 20%

E. Rough estimates of 30%, 30%, 10% and 30% respectively

F. Estimate 1.5%

G. Slightly up but in line with an inflation rate of 5–7%. International support is not accounted for here.

2. Infrastructural investments

No investments in large-scale experimental facilities were made. The potential for cooperation with other funding agencies is always there depending on mutual interest.

3. Recent news and developments

A South African National Disaster Management Centre (SANDMC) was brought to life to monitor local, regional and global information primarily on environmental changes and phenomena. The SANDMC links into several critical data sets including satellite images and employs software that can analyse and graphically illustrate the data. The SANDMC is web enabled and its facilities are available free of charge to global change researchers (<http://www.sandmc.pwv.gov.za>).

A southern African network called Environmental Long-Term Observatories of Southern Africa has been established and has seven member countries that have either established Long-term Ecological Research (LTER) Networks or have serious intentions of forming those networks. The member countries are South Africa, Namibia, Botswana, Zambia, Mozambique, Tanzania and Kenya.

The South African Institute for Aquatic Biodiversity (SAIAB, <http://www.nrf.ac.za/facilities/saiab/>) was launched out of the internationally renowned J.L.B. Smith Institute for Ichthyology.

The pilot phase of a German-funded research programme investigating the impact of climate change and land use on biodiversity began in March 2001. BIOTA Africa – Biodiversity Monitoring Transect Analysis in Africa – has three core projects in Southern, West and East Africa, with BIOTA Southern Africa focussing on a 2000 km-long transect that extends from Cape Town, South Africa, to the Namibia-Angola border. Remote sensing and GIS studies, validated by field research at 29 monitoring sites, are used to monitor changes to landscapes, vegetation and land use, and their influence on biodiversity. A number of South African researchers are involved in the pilot phase of Biota-Southern Africa, and local participation is expected to increase with the launch of the main phase in 2004.

South Africans are prominent in research programmes related to Global Change and serve on at least 16 international scientific committees. South African scientists featured prominently in the IGBP Open Science Conference held in Amsterdam in July 2001. Four South Africans were lead authors for the Intergovernmental Panel on Cli-

mate Change (IPCC) Third Assessment Report (TAR) published in 2001. Of particular importance is the international programme START that is developing a programme of sustainable capacity building. Generally, there has been good progress in capacity building in the Global Change research community in 2001.

The Country Studies Programme on Climate Change is complete, but the final report will not be published in time for the WSSD in Johannesburg. Various Global Environmental Facility (GEF) development projects with research components are in development or are starting, supported by funding from the World Bank in southern Africa.

In the marine arena, the Benguela Environment Fisheries Interaction and Training programme (BENEFIT) between South Africa, Namibia and Angola is progressing very well and is likely to be the scientific and technical wing of the new BCLME (Benguela Current Large Marine Ecosystem) project of the GEF which commenced in 2002. The Benguela Ecology Programme has formed a partnership with IDYLE, a French-SA bilateral project. In this big strides are being made in developing a detailed 3-d model of the Benguela system to which biological Individual Based Models (IBM) are being coupled.

A national Global Change Conference is being planned for 2003 and a number of universities and individuals of high standing is cooperating on the formation of a multi-institutional Global Change Research Network.

General

Research funding for environmental issues, and in a broader context sustainable development related issues, has at the aggregated national level been stable for the last few years. It is reasonable to assume that the subpart of this broad research category that would fall in the more limited category “global change research”, or associated to it, would also be rather stable. It is however difficult to trace in detail as the label “global change research” is not used in a research administrative sense, and is only lightly touched upon in a research policy sense.

As a result of the major revision of the Swedish research funding system by the beginning of 2001, an institutionally new and more “concentrated” pattern has emerged. The basic science issues, mostly in disciplinary terms, has been allocated to the “Swedish Research Council” (SRC). Issues related directly to the environment and more broadly to sustainability issues in agriculture, forestry, fisheries and building research, including urban matters, are now housed in the “Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning” (Formas). Here, many items normally associated to “global change” have a strong locus, including the responsibility by the government to investigate the future in the Swedish system for climate change research (a multi-agency task). In addition, deliberate efforts to support biodiversity research are made, based on specific funds for this purpose from the Parliament (a special program of around 8 M USD annually for Formas, and 6 M USD specially designated to the SRC for the same purpose). Several other agencies are also involved in global change related research activities, such as the Swedish Environment Protection Agency (Naturvårdsverket), the Swedish National Space Board, the independent foundation MISTRA, the Swedish Energy Agency (Energimyndigheten) and the Swedish Meteorological and Hydrological Institute (SMHI) (more information below).

1. Funding levels for Global Change Research (GCR)

In the Swedish system there are thus several financial platforms for research with “global change” orientation. Although it is difficult to discern what part of the more general environmental research that belongs to that subcategory, maybe a third of the research funding to broad environmental matters (grossly around 100 M USD) could be attributed to “global change” related items. Added to that should come a figure of the same magnitude connected to research directly funded by the universities themselves on their regular budgets. In the Swedish structure projects in this domain are only indirectly linked to the international four major programs. Below, more specific information is given for the Swedish Research Council (SRC), for Formas and for other funders of GCR.

A) Total funding

A rough estimate of the total Swedish funding levels in GCR is around 30 M USD.

- a) SRC. The SRC comprises scientific sub-councils for various fields. Most of the GCR are financed via the Scientific Council for Natural and Engineering Sciences, although some of the socio-economic parts are financed from the social science and humanities of SRC. The majority of the GCR funding is within Earth Science i.e. climate related research (both on recent climate processes and past climate

change), and research on hydrological and biogeochemical processes and cycles. This research relates to the IGBP and WCRP programmes. The total budget for Geosciences is around 5 M USD. An estimate is that about half of the funding is for global change research (2,5 M USD as of 31st December 2001). All the money from the SRC is distributed after open calls. There is no earmarked money for GCR.

- b) *Formas*. Of its overall budget of 60 M USD maybe 12 M could be attributed to global change, including climate and biodiversity research.
- c) *Others*. In addition to the SRC and Formas, other financing activities should be mentioned, e. g. the Swedish Environment Protection Agency (Naturvårdsverket) with a total environment research budget of around 8 M USD, and the Swedish National Space Board which has a set of distinct environmentally motivated research projects (mostly remote sensing) in their portfolio, covering at least a few million USD for this purpose. We also have the independent foundation MISTRA operating in the environmental domain with an annual budget of around 20 M USD, mostly oriented towards strategic solutions. Also, the Swedish Energy Agency (Energimyndigheten) has an energy related research portfolio with a distinct compound of climate change research. The Swedish Environmental Institute also operates in the GCR arena, and the Swedish Meteorological and Hydrological Institute (SMHI) conducts climate research.

The majority of the global change research in Sweden is related to climate and biodiversity. According to Sweden's third national communication on Climate Change, under United Nations Framework Convention on Climate change, the Swedish contribution to climate-related research during the period 1998-2001 totalled at around 19 M USD annually. There is at the moment no national climate "program" in Sweden. However, work is going on to find a common platform for the co-ordination at national level for such research, which to a large extent already is conducted in "non-program" forms.

B. Overheads

The figures include overhead costs of 30%. The cost for a man-year is estimated to 75 000 USD.

C. Names of funding agencies and mechanisms of funding

Details on the funding agencies can be found under A).

D. Percentage of total national spending on GCR

SRC and Formas together cover about 50% of the national spending on GCR.

E. Percentage of GCR in international programs

A very limited part of the of the research supported by SRC, Formas or any other Swedish funder, is co-ordinated by the four international programs, mainly due to the fact that the mechanism of funding is generally "project by project" on a national competitive level.

F. Percentage of funding for international coordination

Around 50 000 USD are spent on international coordination activities. In addition, Sweden provides support directly to the international core office of IGBP in Stockholm.

G. Trends in the funding levels

The total trend for Swedish GCR funding is sustained levels.

- a) *SRC*. Funding levels for geosciences are decreasing and that also include funding for GCR.
- b) *Formas*. Funding level is sustained, maybe there is a relative shift in allocation, at the moment favouring biodiversity and maybe reinforcing climate change research for the future.
- c) *Others*. Sustained levels.

2. Infrastructural investments

- a) *SRC*. There were no large infrastructural investments made by SCR in 2001 related to GCR. There are no planned infrastructural investments related to GCR.
- b) *Formas*. Infrastructural investments are funded at a low level in the field of biodiversity where collections of material (plants) etc have been provided specific funds.
- c) *Others*. Investments in space related activities are continuously ongoing.

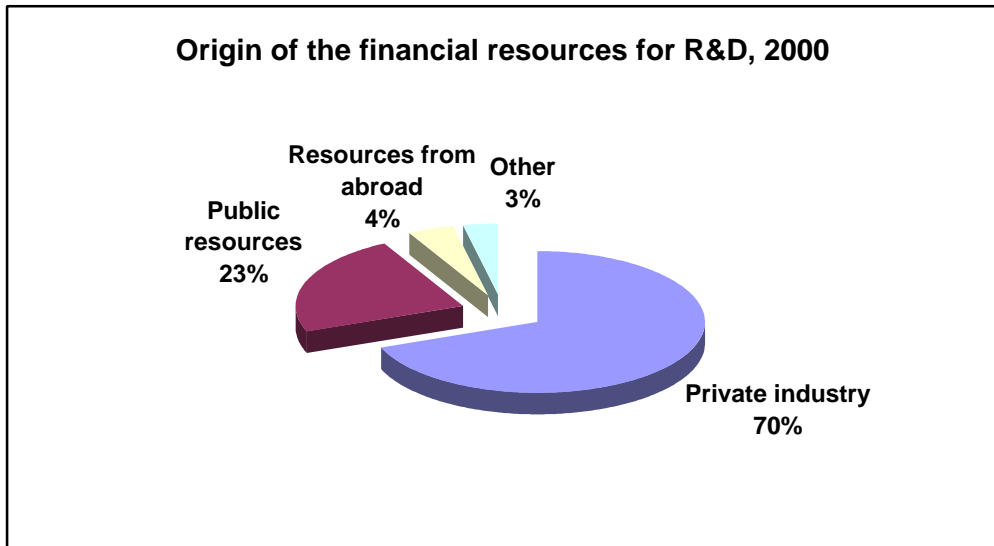
3. Recent news and developments

The first Nordic Centres of Excellence programme has been launched during 2002. Jointly administered by the Nordic Natural Science and Engineering Research Councils and the Nordic Council of Ministers, the pilot programme is primarily focused on basic natural science in the field of global change, specifically on ecosystems processes to climate change, atmospheric processes and oceanographic processes. The aim of the Nordic Centres of Excellence Programme is to raise the quality of Nordic research and to improve its international visibility. Additionally, the programme will contribute to researcher exchange and interdisciplinary as well as allow for the more efficient use of expensive research equipment. The purpose is not to set up new units or research groups, but that Nordic Centres of Excellence shall be based on existing high-quality research teams. At its pilot stage the Nordic Centres of Excellence Programme will be funded by the Nordic Natural Science and Engineering Research Councils and the Nordic Council of Ministers. More than 1 million EUR will be made available to the programme each year. This will be enough to support 3-4 units for a period of five years.

The specific biodiversity research funding has been mentioned above (new money of around 15 M USD). The continued interest in Swedish participation in the EU framework programme could also be reported. The presence in the 5th FP has been larger than the share expected on formal grounds. This also holds true in the environmental/global change domain.

1. Background

During the last 10 years, the public **financial resources for R&D** have been slowly shrinking in Switzerland.⁴ Comparatively, the private R&D financial resources (about 70% of the total) increased in a significant manner (from 3'665 millions USD to 4'409 millions USD). 92% of this private money is directly reinvested in the industrial re-search (chemical, pharmaceutical and mechanical sector).



This **trend** should change for the next financial period (2004-2007). The state is willing to invest more in R&D (from 4.5% to 6% annual increasing rate). GCR was relatively well off in the past period, and will probably remain on the top of the national research agenda for the years 2004-2007. New initiatives which are highly relevant for GCR have been started up in 2001: three National Centres of Competence in Research (NCCR) and one National Research Programme (NRP).

Regarding GCR, it is very **difficult to estimate the funding** for several reasons. First, most of the GCR research is done in the universities and SIT's (Swiss institutes of technology). They get a basic funding from the state and the cantons (1'459 millions USD/ 84% of the total budget) which is not allocated by specific science area or activity. We have only precise data for external funding related to a specific research project (for example SNSF subsidies). Second, the research activities in the private industry (70% of all investments) are not well documented. Some of them could be of interest for GCR. Third, different federal offices have research activities or fund projects of interest for their policy, but detailed figures are not available. A last reason is that GCR is classified under several categories (environmental, climatic research) and therefore it is difficult to provide precise data. Therefore, the data of the "resource assessment light" are not covering the complete field of GCR in Switzerland and have the status of rather rough estimations.

⁴ During the same period, the number of students at the universities and technical high schools increased in a important proportion.

2. Research projects and programmes

The major funding agency supporting research projects and programmes in Switzerland is the SNSF. To a lesser extent GCR research is also supported by the Federal Office for Environment, Forests and Landscape (BUWAL) and the Swiss Agency for Development and Cooperation (SDC). Some programmes are based on matching funds (e.g. NCCR).

- Basic research projects: 314 GCR projects were running during 2001 with an annual mean of 120'000 USD per project = 37'540'000 USD.⁵
- National Research Programme 48 – Landscapes and Habitats of the Alps: implemented in 2001, this National Research Programme aims to acquire the knowledge on goals and actions needed for a socially desired, economically acceptable and politically feasible landscape development. Endogenous and exogenous causalities of landscape development should be recognised, requirements and standards for a sustainable landscape development should be analysed and possible approaches in the relevant political fields and scopes of actions should be elaborated. Duration of the programme is 5 years with a financial basis of 9 millions USD (1.8 USD/year).

In order to strengthen research and the application of results to strategically important fields of research, the SNSF implanted the NCCR's (National Centres of Competence in Research). Each NCCR has to ensure the combination of basic research and practical application, the emphasis on multidisciplinary approach and the creation of links between research and teaching.

- NCCR-North/South: Research partnership for mitigating syndromes of global change with a 4'782'400 USD per year (19'000'000 USD for the first 4 years). This NCCR is co-financed by SNSF, Swiss Agency for Development and Cooperation, University of Berne and others. For more information: www.nccr-north-south.unibe.ch
- NCCR Plant survival in natural and agricultural ecosystems: 3'750'000 USD per year (15'000'000 USD for the first 4 years). This NCCR is co-financed by SNSF, home institution and others. For more information: www.unine.ch/nccr
- NCCR Climate Variability, predictability and climate risk: 3'200'000 USD per year (12'800'000 USD for the first phase of 4 years). This NCCR is co-financed by SNSF, University of Berne and others (e.g. Federal office for environment and forests, private insurances, etc.). For more information: www.nccr-climate.unibe.ch

⇒ **Total amount of funding in GCR projects and programmes for 2001: 54'283'400 USD (mostly without overhead costs)**

⇒ In comparison, the **average person-year cost** of an **experienced GCR scientist** in Switzerland lies **between 45'000 USD and 60'000 USD**

⁵ This estimation is based on the database of ProClim.

3. International integration and coordination activities

PAGES-IPO: the SNSF provides core funding (on an equal basis with the USA) of the PAGES-IPO located in Berne. The Swiss annual contribution is 245'000 USD.

MRI (Mountain Research Initiative) located in Berne: 108'000 USD (SNSF: 39'000 USD).

IGBP: financed by the Swiss Academy of Natural Sciences for an amount of 24'000 USD.

IHDP: financed by the Swiss Academy for Human Sciences for an amount of 6000 USD.

DIVERSITAS: SNSF annual contribution of 20'000 USD.

ProClim/OcCC: financed by the SANW and the BUWAL for an annual amount of 420'000 USD.

ODP: SNSF contribution for 2001 = 315'000 USD

⇒ **Total amount allocated to “glue money”**: 1'138'000 USD (approximately 2% of total GCR)

4. National mechanism for supporting GCR

There is no mechanism or no special budget line allocated to GCR. The promotion of **research projects** is the focal point of the promotion activities of the SNSF, taking up approximately 80 percent of the finances available to the Foundation (242'000'000 USD). Project promotion includes both **independent basic research without a pre-defined theme and targeted research (research programmes)** and extends to all scientific disciplines and specialist areas.

Independent basic research: Applications for support for research projects are submitted by the researchers themselves and then assessed by the Research Council. The researchers are free to choose their research topics. The assessment process considers the scientific value, originality and topicality of the project and the proposed methodology. In addition, the previous performance of the respective researcher is taken into account. Foreign experts are also involved in the examination procedure. Any researcher working in Switzerland is entitled to participate. Grants are awarded on a competitive basis, all the competitors having an equal chance. Applications may be submitted by 1st March and 1st October every year. Applicants are informed within 6 months of the submission deadline as to whether their application has been approved or refused. Research grants constitute approximately 70 percent, i.e. the vast majority, of the funds awarded by the Swiss National Science Foundation. Grants are awarded in principle for research in all scientific fields and are the responsibility of the three divisions of the Research Council.

Research programmes have politically defined aims and topics, run for a limited period, are inter- or transdisciplinary in their approach and are carried out in cooperation with non-academic partners with a direct or indirect interest in exploiting the research results. There are currently three different types of research programme: National Research Programmes (NRP) National Centres of Competence in Research (NCCR). Promotion in the field of targeted research also includes a number of special programmes (divisional research initiatives) and certain programmes intended to promote international research cooperation.

UNITED KINGDOM

1. Funding levels for Global Change Research (GCR) in 2001

Total funding

The following figures are best estimates and include overheads where it has been possible to ascertain them. The typical cost of a UK scientist man-year is £ 43k including an allowance for overheads.

It is difficult to estimate funding for GCR in universities through the Department for Education and Skills as it is not allocated by specific science area.

Agency	2001 Funding of GCR	
	£ million	US\$ million
Natural Environment Research Council (NERC) [Analysis by NERC issues ⁶]:		
GCR	52.6	76.3
Biodiversity	30.1	43.7
Total	82.7	120.0
Biotechnology and Biological Sciences Research Council (BBSRC)	2.2	3.2
Engineering and Physical Sciences Research Council (EPSRC)	15.0	21.8
Department of Environment, Food and Rural Affairs (DEFRA)	11.3	16.4
Meteorological Office Hadley Centre	10.0	14.5
Total for UK Funding Agencies (rounded):	121.0	175.9
<i>NERC as % of this total</i>		<i>68%</i>

Making the same assumption as in the 1999 survey that funding for GCR in universities from the Department for Education and Skills approximately matches that from the funding agencies, then

Rough estimate of total funding in the UK:	242.0	351.0
<i>NERC as % of this total</i>		<i>34%</i>

Breakdown by science area for NERC, plus trends

NERC spend in 1999 on IGBP- and WCRP-related research was

IGBP:	22.5	32.6
WCRP:	28.1	40.7

⁶ The NERC Science Budget is allocated against five Environment and Natural Resource Issues, which are Biodiversity; Environmental Risks and Hazard; Global Change; Natural Resource Management; Pollution and Waste.

The trend is stable in real terms.

If all NERC support for biodiversity is considered as underpinning DIVERSITAS, the spend amounts to around £ 30.1m (US\$ 43.0m).

Support for international glue money

NERC support for glue money in 2001 consisted almost entirely of support for International Project Offices (WOCE, CLIVAR, GLOBEC, GCTE focus 3), and totalled approximately £ 0.5m (**US\$ 0.7m**), which is 0.9% of our spend on IGBP/WCRP science.

NERC has no special budget or mechanisms for dealing with significant glue money requests. Any such request has to enter our usual grants/proposal systems. Very small requests (e.g. less than £ 10k = \$ 14.5k) are sometimes funded from a specific 'minor initiatives fund', but this fund has to cover many regular subscriptions (e.g. ESF, Arctic Science Forum etc).

2. Infrastructural investments

In 2001:

- Awards from the Joint Infrastructure Fund [JIF], a £ 750m partnership between the Wellcome Trust and government, of:
 - £ 4.5m to Southampton Oceanography Centre for a ROV (Remotely Operated Vehicle). It will be used for observational and experimental deep-sea oceanography, operated as part of the UK marine scientific services, and deployed from ships of the NERC fleet.
 - £ 2.8 m to the University of Wales, Bangor for the *Prince Madog*, a new research vessel, designed to take up to ten scientists and 20 students.
- *Argo*, a global array of temperature/salinity profiling floats that is building up to become a major part of the system to routinely observe the physical characteristics of the ocean, received a UK contribution of £ 777k (DEFRA £ 325k; Ministry of Defence £ 350k; NERC £ 102k).

Planned investments:

- Starting in 2002, as part of NERC's LOCAR (Lowland Catchment Research) programme three contrasting permeable lowland catchments will be established through a £5 million programme of equipment installation and maintenance, funded jointly from a £2 million JIF grant and from the £7.75 million allocated by NERC to LOCAR.
- The Meteorological Office's Hadley Centre for Climate Change research will receive funding under the Government's 2002 Spending Review for a supercomputer to strengthen the UK climate change research capability.
- CEFAS (Centre for Aquaculture and Fisheries Science), and agency of DEFRA, has signed a contract worth over £ 23 million for a new fisheries research vessel, planned for delivery in spring 2003.

3. Recent news and developments

- **The new NERC strategy document**, *Science for a sustainable future*, will encourage and grow three priority areas over the next five years: **Earth's life-**

support systems – biogeochemical cycles and biodiversity; **climate change** – predicting and mitigating the impacts; and **sustainable economies** – identifying and providing sustainable solutions to the challenges associated with energy, land use and hazard mitigation. An important aspect of delivering the strategy will be QUEST (Quantifying the Earth System), a programme that will provide a co-ordinated scientific effort whereby NERC-funded scientists can work together on quantifying and predicting future carbon budgets.

[<http://www.nerc.ac.uk/publications/strategicplan/>]

- **Two new NERC Centres of Excellence** in earth observation have been established, at a cost of £ 4m: the *Centre for Terrestrial Carbon Dynamics* (Sheffield University) will use remote sensing to achieve greater understanding of the Earth's carbon cycle; the *Centre for Observation and Modelling of Earthquakes and Tectonics* (Oxford University) will use new satellite techniques to measure and predict movements in the Earth's crust. [<http://www.shef.ac.uk/ctcd/>; <http://www.nerc.ac.uk/aboutus/researchcentres/sites-comet.shtml>]
- **NCAS**, the NERC Centres for Atmospheric Science, was formally launched in May 2002. It comprises a set of centres and facilities distributed across many UK universities and related institutions. [<http://ncas.nerc.ac.uk/>]
- **Impacts of extreme (high and low) precipitation on flooding, water resources and ecology:** NERC led a joint workshop on this topic with the Environment Agency and Meteorological Office in January 2002.
- **Carbon Trust:** Following a meeting in November 2001 with representatives of the Carbon Trust, EPSRC and ESRC (Economic and Social Research Council) to discuss how the Trust could best work with the Research Councils, NERC has signalled its intention to allocate £ 250k to the Trust's initiative to set up Centres of Excellence in Low Carbon Innovation. Information on the Carbon Trust is at <http://www.thecarbontrust.co.uk/>
- EPSRC has announced (August 2002) funding for research into predicting and preventing flooding, making available £ 4m from EPSRC, DEFRA, the Environment Agency and the water industry. [<http://www.epsrc.ac.uk/website/CommonPages/whatsnew>]
- DEFRA's Sustainable Development Strategy, "Foundations for our Future", was published in June 2002, and set out the principles and processes necessary to make sustainable development a reality within DEFRA. DEFRA has also established a Horizon Scanning Programme, concerned with future potential threats and opportunities. [<http://www.defra.gov.uk/corporate/index.asp>]
- The Environment Agency's Science and Innovation strategy was published in spring 2002.

Funding levels for global change research:

Research undertaken by the United States Global Change Research Program (USGCRP) supports research relating to improved projections of climate conditions and variations, learning how future conditions will impact natural resources and human activities, and to anticipate what will be required to prepare for the future.

The USGCRP focuses on four sets of interacting changes in the coupled human-environment system:

- Changes in the natural and human-induced forces affecting the Earth system;
- Changes and variability in Earth system attributes;
- Changes in ecosystems; and
- Changes in human communities, organizations, societies, and economies.

Upon taking office, President George W. Bush focused a great deal of attention on the issue of climate change. He sought the advice of leading scientists through the National Academy of Sciences to evaluate what is known and what is still uncertain in the science of climate change. He asked the Secretary of Commerce to identify steps to better coordinate climate change research programs of the Federal agencies and to develop plans to accelerate progress on still unanswered questions that are important for decision-making through the Climate Change Research Initiative (CCRI). These directives and activities will lead to important changes in the existing USGCRP. For FY 2003, the President has requested \$1.7 billion in research funding for the USGCRP, and a targeted \$40 million focused on initial start-up priorities for the CCRI. And he has established new management arrangements to ensure that the resources invested are used effectively in support of national needs.

In a report commissioned by the Bush Administration, *Climate Change Science: An Analysis of Some Key Questions*, the U.S. National Academy of Sciences (NAS 2001) evaluated uncertainties and research opportunities and made a number of recommendations. At the most fundamental level, the report indicated the need to have a better understanding of the causes of warming. The changes observed over the last several decades are likely mostly due to human activities, but cannot rule out that some other significant part of these changes are also a reflection of natural variability.

The report also identified areas where additional research is crucial. These included the magnitude and nature of future human-caused "forcings" such as emissions of greenhouse gases; the carbon cycle; "feedbacks" caused by water vapor, ice, and other factors that determine the response of the climate system; regional and local climate change consequent to an overall global level change; the nature and causes of natural variability; and the direct and indirect effects of the changing distribution of aerosols (including black carbon). In addition, the report also called for accelerated research on the interactions of environmental change and human societies, including interdisciplinary research on coupled human-environment systems; integration of knowledge, including its uncertainty, into decision support systems; and regional or sectoral research into the response of human and natural systems to multiple stresses. Finally, the report noted that an effective strategy for advancing the goal of understanding climate change will require enhanced global observing systems; large-

scale modeling; and more effective management of resources to ensure innovation, effectiveness, and efficiency.

These recommendations are designed to maintain the strength of the USGCRP while enhancing the focus on the new directions of the CCRI. Over the coming decade, the objective of Federally supported research programs will be to help government, businesses, and communities make informed management decisions about global environmental changes, such as climate change, given persistent uncertainties. The USGCRP and CCRI will also develop new ways to transform scientific information into products for routine use by government and the private sector for reducing risks and taking advantage of opportunities resulting from global change.

Working as a coordinated program, the USGCRP and CCRI will accelerate the transition of scientific knowledge to applications for use in resource management, disaster preparedness, planning for growth and infrastructure, and environmental and health assessment, among other areas.

The strength of the existing USGCRP has been to facilitate coordination across Federal departments and agencies with active global change research activities, drawing on the resources and expertise of both research and mission-oriented agencies. Participants in the USGCRP include the Departments of Agriculture (USDA), Commerce Department (National Oceanic and Atmospheric Administration) (DOC/NOAA), Department of Defense (DOD), Department of Energy (DOE), Health and Human Services (National Institutes of Health) (HHS/NIH), Interior (U.S. Geological Survey) (DOI/USGS), State (DOS), and Transportation (DOT), the U.S. Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), and the Smithsonian Institution (SI). The DOD research activities are conducted for defense-related missions and are not included in this USGCRP budget crosscut. Related DOD research does contribute to achieving USGCRP goals, however. The Office of Science and Technology Policy (OSTP), the Office of Management and Budget (OMB), and the Council on Environmental Quality (CEQ) provide oversight on behalf of the Executive Office of the President.

The **USGCRP** was funded for U.S. **Fiscal Year 2000** at a level of **\$1,687M**; for Fiscal Year **2001** at a level of **\$1,728M**; and for Fiscal Year **2002** at a level of **\$1,670M**. The **2003 Fiscal Year Request** is **\$1,714M**. This funding includes support for overhead costs. The funding can be broken out as follows (in millions (M) of dollars):

Scientific Research:	FY 2000	FY 2001	FY 2002	FY 2003 Request
USDA	56	51	56	66
DOC/NOAA	67	93	100	100
DOE	113	116	120	126
HHS/NIH	48	54	60	68
DOI/USGS	27	27	28	28
EPA	21	23	21	22
NASA	232	257	243	245
NSF	187	181	188	188

SI	7	7	7	7
Subtotal:	<u>758</u>	<u>809</u>	<u>823</u>	<u>850</u>
Observations and Data Systems:				
<u>NASA</u>	<u>929</u>	<u>919</u>	<u>847</u>	<u>864</u>

Over the three-year period from FY 2000 through FY 2002, funding for the USGCRP rose slightly and funding for FY 2003 is likely to remain at a similar level.

USGCRP-sponsored scientific research for FY 2002 and FY 2003 focus on the following; with funding requested in each area for FY 2003 in parentheses.

Climate Variability and Change – research and observations related to understanding climate variability and change (\$502M)

Atmospheric Composition – research and observations related to improving understanding of ongoing changes in atmospheric composition (\$275M)

Global Carbon Cycle – research and observations related to understanding the global carbon cycle (\$252M)

Global Water Cycle – research and observations related to understanding the global water cycle (\$311M)

Terrestrial and Marine Ecosystems – research and observations related to understanding changes in managed and unmanaged ecosystems (\$210M)

Land Use/Land Cover Change – research and observations related to understanding land use/land cover change (\$40M)

Human Contributions and Responses – study of the human contributions and responses to global change (\$122M)

The USGCRP sets priorities and carries out its activities in close association with, and in support of, coordinated science priorities of the national and international research community, particularly those advanced by the World Climate Research Program (WCRP), the International Geosphere-Biosphere Program (IGBP), and the International Human Dimensions Program (IHDP).

National mechanisms for supporting integration and coordination of international cooperation in global change research:

U.S. scientists and research institutions supported by the USGCRP agencies coordinate many of their programs with those of their counterparts in other countries, thus providing essential inputs to the increasingly complex models that enable scientists to improve analysis and prediction of global change.

A variety of mechanisms/processes are available to scientists and scientific programs to seek funding for integration and coordination activities through the USGCRP. Those seeking such funding can approach an individual agency directly; they can approach a group of agencies directly; or they can use either of these roads indirectly (e.g., an international research program can work through a "U.S. National Committee") for that program. U.S. scientists and scientific institutions are generally well aware of the various options available to them.

Most requests to U.S. agencies for integration and coordination activities of the organized international programs are handled by these agencies as a group, that is, through the interagency committee that coordinates the USGCRP. Most of these re-

quests are processed through one agency – the National Science Foundation acting in this area on behalf of the USGCRP – although other agencies provide substantial funds for specific programs of special interest to them.

Recent news and developments:

To improve the connection between research and decision-making, as well as to increase accountability, new arrangements for managing the research program are being developed. President Bush announced the first set of changes on February 14, 2002. These changes involve establishing a new high-level structure for coordinating climate change science and technology development.

The next steps in developing a program that refocuses research priorities will be to develop a budget initiative for the CCRI for FY 2004, and to resume strategic planning for the USGCRP and the CCRI. An integrated strategic plan that balances the need for long-term research on global change with requirements for accelerated programs to reduce uncertainty and support decisions on climate change is under preparation and will be released for review by the National Research Council and then by the public in FY 2003. When complete, this plan will form the basis for continuing investments in research that will support decisions that safeguard the environment and nurture the economy.

