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1.1.6.3 Global Change and Ecosystems

WORKPROGRAMME
2002-2006

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1. INTRODUCTION

Global Change and Ecosystems sub-priority is addressing seven areas relative to the issues of :

- I. Impact and mechanisms of greenhouse gas emissions and atmospheric pollutants on climate, ozone depletion and carbon sinks
- II. Water cycle, including soil-related aspects
- III. Biodiversity and ecosystems
- IV. Mechanisms of desertification and natural disasters
- V. Strategies for sustainable land management, including coastal zones, agricultural land and forests
- VI. Operational forecasting and modelling including global climatic change observation systems
- VII. Complementary research

The topics of each of the areas which will be subject of the call for proposals issued in 2002 are detailed in the following sections; indicative topics which will be subject of a second call at the end of 2003 are briefly mentioned.

A cross-cutting dimension of Sustainable Development horizontal to these areas and to the Energy and Transport sub-priorities is contained in the introduction of the Specific Programme for Global Change and Ecosystems; this dimension is also covered for research as indicated at the end of this sub-chapter.

The instruments to be used for the first call are indicated for each topic. Additional elements about the budget, deadline, evaluation of proposals, links with other priorities are indicated in the last sections of this sub-chapter.

2. OBJECTIVES, STRUCTURE AND OVERALL APPROACH

The research on global change and ecosystems has to be considered as a major support to the EU strategy for Sustainable Development which has been decided in 2001 at Göteborg and which has been enlarged to an international scale in the context of the Johannesburg Summit on Sustainable Development (SD) in 2002. The programme of activity offered by the Sub-Priority "Global Change and Ecosystems" will strengthen the necessary scientific knowledge for the future orientation of the SD strategy and the 6th Environment Action programme; it will also provide the socio-economic tools and assessments and the overall management practices. Furthermore it will ensure their implementation at the enlarged EU level and, when relevant, at the world level.

The aim of the research activity is to assemble a critical mass of resources helping to integrate and strengthen the European Research Area; for this purpose new instruments will be widely used, namely Networks of Excellence (NoE) and Integrated Projects (IP). These new instruments will be complemented by Strategic Targeted Research Projects (STREPs), Co-ordination Actions (CA) and Specific Support Actions (SSA); they will be implemented by means of three calls for proposals. An additional call continuously open until 2005 will cover the Specific Support Actions. Priority will be given to the use of the new instruments.

3. TECHNICAL CONTENT

The Work Programme is structured according to "areas" and "topics". The following section describes the topics which will be subject of the first call for proposals with a deadline in 2003. The expected instruments are indicated for each topic; in general, up to one Network of Excellence or Integrated Project will be selected for those topics associated to a new instrument; the number of Strategic Targeted Research projects (STREPs) or Co-ordination Actions, Specific Support Actions according the other topics is not fixed and will depend of excellence and budget availability; the topics for Specific Support Actions are presented separately at the end of this section.

In order to achieve its objectives and contribute to an advancement of sustainable development, the research actions will have the possibility to tackle cross-cutting issues, which address several topics within the same area or from different areas; it will also be possible to address topics of other priorities but it will have to be indicated in the proposal.

I. Impact and mechanisms of greenhouse gas emissions and atmospheric pollutants on climate, ozone depletion and carbon sinks

The objective is to detect and describe global change processes, associated with greenhouse gas emissions and atmospheric pollutants from all sources, including those resulting from energy supplies, transport and agriculture, to improve prediction and assessment of their global and regional impacts, evaluate mitigation options and improve the access of European researchers to facilities and platforms for global change research.

Research will concentrate on carbon and nitrogen cycle, atmospheric pollutants and their regional impacts, climate dynamics and variability, prediction of climatic change and its impacts, stratospheric ozone and climate interactions and adaptation and mitigation strategies.

Topics

I.1. Carbon and Nitrogen cycles: sources and sinks

Research will focus on integrating observations, process studies and modelling of the budgets of carbon and nitrogen to better quantify the biospheric carbon and nitrogen sources and sinks for terrestrial, aquatic and marine ecosystems. Furthermore, effects of human induced and natural disturbances of ecosystems and their impact on the carbon cycle and inter-annual variability and future projections of the carbon cycle are to be addressed. Emphasis will be placed on relevant ecosystems, bio-geochemical and hydrological processes and feed backs of potential significance for the climate system. Global integration of marine, aquatic and terrestrial carbon and nitrogen sources and sinks and exchanges between the reservoirs should be foreseen.

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

I.1.a) Assessment of the European carbon balance. Research should quantify the European carbon balance from local ecosystem to regional and continental scale to support the implementation of sinks in the Kyoto Protocol and should verify the effective CO₂ reduction in the atmosphere. The assessment should include how external parameters such as changing nitrogen deposition, climate change and variability and changing land management affect the European carbon balance and future projections of the carbon cycle. Methods to be applied should be established in close collaboration with international programmes such as the International Geosphere and Biosphere programme (IGBP).

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

I.1.b) **Assessment of marine carbon sources and sinks.** Research should quantify the carbon sources and sinks of the ocean at a regional and global scale with focus on the Atlantic and the Southern Ocean. Studies of biogeochemical processes in the ocean as well as air-sea exchange processes constraining the carbon up-take and release, should be carried out in critical areas. Finally, carbon observations should be integrated into an ocean-modelling framework. Co-ordinated activities with the National Science Foundation (NSF) are foreseen.

1.2. Atmospheric pollutants and their regional impacts

Research will focus on chemistry of atmospheric pollutants and greenhouse gases, formation of aerosols and ozone, and their impact on regional air quality and climate. The quantification and prediction of the emissions and long range transport of these atmospheric constituents will be a target. The effects of aerosols on the climate system, either directly through radiative effects, or indirectly, through interactions with the hydrological cycle will be quantified. Atmospheric chemistry-climate interactions, including their links with land and ocean processes at regional and global scale are to be investigated.

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

I.2.a) **Integration of European atmospheric composition research.** A common framework of co-ordination and communication to study regional and global change atmospheric processes, in particular those linked to biosphere/atmosphere exchanges, aerosols/clouds interactions and long range transport of pollutants. Assessment of the impact of pollutants on the regional air quality

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

I.2.b) **Atmospheric pollutants and climate forcing.** Impacts and rational mitigation strategies, in particular quantification of the role of aerosols on climate forcing.

Quantitative understanding of key processes which determine natural variability and human-induced changes in the chemical composition of the atmosphere. A co-ordinated activity on aerosols/climate interactions with US National Science Foundation (NSF) is foreseen.

1.3. Climate dynamics and variability

Research efforts should be concentrated on climate dynamics, climate variability, the hydrological cycle, feedback processes and rapid climate changes. Significant physical, chemical and biological processes as well as their interactions with the oceans, cryosphere, land and biosphere need to be quantified and be included in modelling work. Past climate variations, events and forcing factors should be investigated. Climate and environmental conditions should be reconstructed for periods that are relevant for the understanding of climate change and of climate system dynamics. The understanding of fundamental modes in the coupled climate system, in particular the ocean-atmosphere system (e.g. ENSO, NAO) is essential and should be advanced further.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

I.3.a) **Hot spots in the earth system.** Dynamics and processes in regions of particular importance and sensitivity (e.g. Polar, tropical and Mediterranean areas) should be better quantified. The focus will be on processes responsible for climate variability regionally and on larger scales (e.g. the drivers of the thermohaline circulation, feedback processes between atmosphere and biosphere, solar variability).

Indicative topics for STREPs and Co-ordination Actions to implement in 2004

I.3.b) Coupled climate system. Improving the understanding of the coupled climate system, in particular the coupled ocean-atmosphere system and dynamics of El Niño Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO).

I.3.c) Novel palaeoreconstruction methods. Development of novel palaeoreconstruction methodologies and multidisciplinary approaches for past climate conditions and climate dynamics.

I.4. Prediction of climatic change and its impacts

The research should be performed on a global to regional scale. The physical impacts in view include sea-level change, changes in storminess and precipitation, drought severity and frequency. Models for predicting climatic change and its impacts need to be further developed. Uncertainties in the predictions, in particular those linked to earth system processes, should be quantified. The limits of predictability of climate should be quantified

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

I.4.a) Integrated climate change scenarios. Earth system modelling and integrated climate change studies for the prediction of climatic change and regional impacts and scenarios. Ensemble based probabilistic methods should be used and modelling systems should be developed to predict climate changes on seasonal, decadal and longer timescales. Models should include the important earth system processes and where appropriate the human dimension aspects. Attention should be given to the prediction of probability of extreme events and related consequences.

I.5. Stratospheric ozone and climate interactions

Research will focus on future stratospheric ozone levels affected by halogens, aerosols, water and greenhouse gas emissions and how physical, radiative and chemical changes in structure and circulation in the global stratosphere will be affected by climate change. UV radiation fluxes reaching the ground and the factors affecting their transfer in the atmosphere as well as the effects of surface pollution, aviation and natural factors on the upper troposphere and lower stratosphere will be studied in the context of ozone-climate interactions.

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

I.5.a) Ozone-climate links. Quantification of the links between the stratospheric ozone depletion and climate change, particularly how the ozone layer and UV fluxes will respond under decreasing halogen and increasing greenhouse emissions in the atmosphere. Improvement of predictive capability of the interactions between the Montreal and Kyoto Protocols and their joint effect on the stratosphere. Accurate knowledge of the long-term biologically and photochemically relevant UV radiation and its changes due to ozone, clouds and aerosols.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

I.5.b) Aviation and surface transport impacts¹. Quantification of the importance of aviation and surface transport pollution sources on the tropopause region and their impact on global climate.

I.6. Adaptation and mitigation strategies

Research will focus on the development of strategic policy options in the context of international agreements on global change. Scenarios of impacts of global change focusing

¹ Mitigation technologies for aviation pollutant emission will be dealt under priority 1.1.4.

on socio-economic and societal impacts should be developed. Emphasis will be placed on the development of methodologies under the condition of uncertainty in the prediction of global change and its impacts and the development and analysis of tangible adaptation and mitigation strategies. Analysis is required of the compatibility of international conventions with global change.

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

I.6.a) **Adaptation and mitigation strategies.** Adaptation and mitigation strategies in particular focusing on the recommendations of the IPCC Third Assessment Report. Emphasis will be on the quantitative assessment of the adaptive capacity and vulnerability of natural and human systems to climate change. Emphasis should also be placed on development of improved strategies to include scientific information on adaptation, mitigation and vulnerability in decision-making processes aiming at low cost solutions. Adaptation strategies to cope with changes in the range of climate variation and extreme events and their impacts on socio-economic sectors (e.g. agriculture, viticulture) should be developed.

II. Water cycle, including soil-related aspects

The objective is to understand the mechanisms and assess the impact of global change and in particular climate change on the water cycle, water quality and availability, as well as soil functions and quality to provide the bases for management and technological tools for water systems to mitigate the impacts.

The research will focus on hydrology and climate processes, the ecological impacts of global change, soil functioning and water quality, integrated management strategies and mitigation technologies, and scenarios of water demand and availability.

Topics

II.1. Hydrology and climate processes

Climate change has a profound impact on the components of the water cycle; very relevant research challenges still exist with regard to climate change modelling to make them compatible for river basin or catchment management. There is a need to develop downscaling methods and improved modelling approaches to translate the results of global and regional climate change modelling studies to hydrological studies at spatial and temporal scales relevant for water management, and to develop up-scaling methods for water cycle parameters and related data assimilation techniques. Forecasting of climate change impacts on hydrology should give special attention to possible changes in frequency and severity of droughts and floods and on the development of forecasting technologies and systems. The research will focus on climate modelling at catchment and regional scale as well as on climate variability, floods and drought.

II.1.1) Climate modelling at catchment-regional scale

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

II.1.1.a) **Improved modelling of climate-water interactions at catchment-regional scale.** Development of advanced modelling approaches at scales relevant for assessing the potential effects of climate changes on water resources management, their validation and application for major impact and mitigation studies. This should consider the various atmospheric, surface and sub-surface hydrological processes and their temporal and spatial scale of occurrence, and should take into consideration recent advances in climate and hydrological modelling and advances in observation techniques.

II.1.2) Climate variability, floods and droughts

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

II.1.2.a) Development of a European (Virtual) Centre for Flood and Drought Studies, through the development of long-term integrated research activities on the main drivers, with emphasis on data collection and exchange, information management, comparison of forecasting methods, evaluation of flood warning and drought monitoring systems, linking different disciplines and providing interaction with major stakeholders. This should complement and link with related activities of the JRC².

II.2. Ecological impact of global change, soil functioning and water quality

Global change can exert severe impacts on the ecology of aquatic and wetland ecosystems, on the filter and transport functions of soils and on water quality. Assessments of these changes requires a better understanding of the consequences of major hydrological changes, to identify and quantify the key biogeochemical processes and to predict the consequences of global change at different scales. The integrated management of soil-water systems requires a detailed understanding of the properties and the functional role of soils, and the behaviour and fate of pollutants, in order to allow the development of risk-based management approaches. The research will focus on impacts of global change on the ecology of surface water bodies, and on water-soil system functioning and management.

II.2.1) Impacts of global change on the ecology of surface water bodies

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

II.2.1.a) Assessment of ecological impacts of global change on freshwater bodies, development of ecological indicators of ecosystem health and related remediation strategies. In a phased approach this action should integrate the wide range of expertise needed to assess the combined impacts of medium to long-term global climate and environmental changes on the quality of water, the structure and ecological functioning of surface water and marginal wetland ecosystems, in order to develop a set of representative and sensitive ecological indicators of the health of those ecosystems, and to identify best practices for re-naturalisation.

II.2.2) Water-soil system functioning and management

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

II.2.2.a) River-soil-groundwater system functioning. For an improved understanding of the functioning of 'river-sediment-soil-groundwater' systems, this action should focus on the changes of physical, chemical and biological properties of soils caused by changing climatic conditions, land use practices or other perturbations and their impact on water quality, water quantity, and on the development of integrated soil-water numerical models.

Indicative topic for STREPs and Co-ordination Actions to implement in 2004

II.2.2.b) Soil-groundwater protection. Research on improved and more economic remediation techniques for contaminated soils and groundwater, including monitored natural attenuation techniques. A specific involvement of SMEs in these actions is envisaged.

II.3. Integrated management strategies and mitigation technologies

Research will focus on the development of integrated approaches and tools for water-soil resources management in the context of global change – with its different components of climate change, land use change, other anthropogenic drivers, etc. - and integrated vulnerability assessments, taking also into consideration socio-economic and technological

² See also complementary activities on flood disasters under IV.2.

aspects of water use. Research will focus on the catchment scale, on the specific aspects of integrated urban water management and mitigation technologies as well as on the management of scarce water resources and mitigation technologies. Emphasis has to be placed on developing flexible adaptation strategies to change, in order to decrease vulnerabilities. This will require specific technological development, particularly for matching with longer drought periods and with more intense rainfall events, especially in urban areas.

II.3.1) Integrated water management at catchment scale³

Topic for STREPs and Co-ordination Actions to implement in 2003

II.3.1.a) **Twinning European/third countries river basins.** Specific integrated water resources management research activities in case studies, to be carried out on twinned catchments/river basins from Europe and from developing countries. This research activity will contribute to the objectives of the EU Water Initiative launched in Johannesburg at the World Summit on Sustainable Development. The participation of African and NIS countries is particularly requested. The participation of International Organisations is welcome, particularly for establishing interfaces with other bilateral or multi-lateral international co-operation actions.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

II.3.1.b) **Methodologies of Integrated Water Resource Management and Transboundary issues.** This action should be launched through an international partnership, involving European and developing countries, integrating engineering, natural and socio-economic sciences, for developing research activities on river basins in Europe and in different parts of the world, particularly on transboundary catchments.

II.3.2) Integrated urban water management and mitigation technologies.

Indicative topic for STREPs and Co-ordination Actions to implement in 2004

II.3.2.a) **Wastewater re-use.** Research on improved, simplified and cost-efficient municipal wastewater treatment processes for safe wastewater re-use in EU and developing countries.

II.3.3) Management of scarce water resources and mitigation technologies

Topic for STREPs and Co-ordination Actions to implement in 2003

II.3.3.a) **Technologies for monitoring and mitigating the impact of water scarcity.** Specific development of innovative and cost-effective mitigation technologies or improvement of existing methods (e.g. artificial recharge, water reuse, water conservation, desalination, etc.) and of technologies adapted to specific conditions of developing countries. The participation of third countries partners is encouraged.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

II.3.3.b) **New approaches to water stress.** Combating water stress requires the development of innovative management strategies, technologies and monitoring systems. Moreover better understanding of the relationships between surface water, soil and groundwater as well as between soils, plants and the atmosphere are needed. Participation of third countries should concentrate on the participation of Mediterranean countries suffering problems of water scarcity.

³ Development of the next generation of software architectures and IT tools for generic environmental applications will be supported within Priority 1.1.2.

II.4. Scenarios of water demand and availability

With the aim of defining a sustainable development framework and to provide to policy-makers instruments in support of policy choices, more advanced analytical tools have to be worked out in order to define more realistic medium- and long-term scenarios of water demand and availability at a wide regional level. The research will concentrate on the development of scenarios for Europe and neighbouring countries.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

II.4.1.a) Water scenarios for Europe and for neighbouring countries. Development of medium-long term (25-50 years) scenarios, based on advanced policy, socio-economic and technological option design strategies, that should become a reference for large scale regional planning. The participation of third countries should cover in particular the areas surrounding the European borders.

III. Biodiversity and ecosystems

The objective is to develop a better understanding of marine and terrestrial biodiversity and of ecosystem functioning, to understand and minimise the negative impacts of human activities on them and to ensure sustainable management of natural resources and terrestrial and marine ecosystems (including fresh water systems) as well as the protection of genetic resources.

The research will focus on assessing and forecasting changes in biodiversity, structure, function and dynamics of ecosystems and their services, with emphasis on marine ecosystems' functioning, relationships between society, economy, biodiversity and habitats, integrated assessment of drivers affecting ecosystems functioning and biodiversity, and mitigation options and on risk assessment, management, conservation and rehabilitation options in relation to terrestrial and marine ecosystems

Topics

III.1. Assessing and forecasting changes in biodiversity, structure, function and dynamics of ecosystems and their services, with emphasis on marine ecosystems functioning

The research should focus on understanding biodiversity and ecosystems patterns, processes and dynamics at european and global scales, in a changing environment. Proposals should take account of developing earth systems analysis and modelling initiatives.

Topics for up to one Network of Excellence to implement in 2003

III.1.1 Developing an integrated network for European long-term terrestrial and fresh-water biodiversity and ecosystem research, based on existing facilities. The role of this network should be to structure and integrate research carried out to assess and forecast changes in biodiversity, structure, functions and dynamics of ecosystems and their services, and thus facilitate the development of conservation options. Research will focus on the interplay between species, biodiversity change (species and genetic levels) and on the interplays between biodiversity and ecosystems, considering the likely impacts of the main drivers (anthropogenic and natural). Socio-economic implications and especially public attitudes must be considered.

III.1.2 Developing an integrated network to structure and integrate European research on marine biodiversity and ecosystems. The objective of the research part of the network should be to understand, assess and forecast marine biodiversity (species and genetic levels) on a global scale, in an ecosystem context. The function of biodiversity and the

consequences of changes in biodiversity on marine ecosystem stability and functioning and on their ability to provide goods and services should be considered, as well as the combined effects of the main drivers (anthropogenic and natural). Socio-economic implications must be taken into account.

Topics for up to one Network of Excellence or Integrated Project to implement in 2003

III.1.3 Developing genomic approaches to enable the understanding of biodiversity and ecosystems structures and dynamics. Throughput sequencing, transcriptome analysis and proteomics, to investigate questions related to the protection of biodiversity and genetic resources and to the functioning of ecosystems, including the underpinning of ecological and behavioural research, the understanding of population structure, the identification of species and the understanding of evolutionary relationships. These approaches will be useful for developing new products and services in the area of environmental protection, in a complementary way to the work to be done in Priority 1.1.1.

Topics for STREPs and Co-ordination Actions to implement in 2003

III.1.4 Development of cost effective, reliable and efficient technologies for enabling progress in biodiversity and ecosystem science, in particular for observing, monitoring, surveying and forecasting of physical, biological and chemical parameters in marine ecosystems, ranging from very shallow to deep water, including technologies to get access to, and to explore extreme marine environments, (ocean drilling technologies are excluded), and in terrestrial and fresh-water ecosystems. This includes also underpinning mathematical developments, development of algorithms, modelling and data management systems.

Indicative topics for Network of Excellence or Integrated Project to implement in 2004

III.1.5 Integrated research on ecosystems lying in the deeper ocean section (ocean margin, including mediterranean margin). Understanding the interactions between deep-water circulation, the biosphere and the geosphere with a view to contributing to the assessment and the forecasting of global changes and to the development of concepts and strategies for the sustainable use of marine resources of the deep offshore. The emphasis should be on carbon sources and sinks, deep fluid flow, sedimentary systems and archives, stability of the seafloor, gas-hydrates, and the deep biosphere.

III.2. Relationships between society, economy, biodiversity and habitats

The research should focus on gathering data sets and developing models and tools for assessing and forecasting the impacts of socio-economic mechanisms on biodiversity and ecosystems, and so, contribute to the development of mitigation and restoration strategies.

Topic for STREPs and Co-ordination Actions to implement in 2003

III.2.1. Generating models of socio-economic impacts on biodiversity and ecosystems with a view to facilitating the development of integrated strategies for preserving/restoring their integrity. Economic mechanisms, institutional and legislative systems, industrial and commercial practices at European and global scales should be taken into account. This work should be envisaged in conjunction with the work to be done in the frame of Priority 1.1.7.

III.3. Integrated assessment of drivers affecting ecosystems functioning and biodiversity, and mitigation options

The research should be dealt with by implementing research initiatives aimed at developing models for assessing and forecasting the combined effects of the main biodiversity and ecosystems drivers, taking into account the natural variability and the various ecosystem types, the ultimate objective of these models being to facilitate the development of mitigation and sustainability strategies.

Indicative topics for Network of Excellence or Integrated project to implement in 2004

III.3.1 Develop models and simulations to assess and forecast changes in terrestrial and fresh water biodiversity and ecosystems, and changes in the ability of biodiversity and ecosystems to supply goods and services. The models should be sensitive to bio-geographical variations across Europe, and take into account the combined effects of the main drivers. They should be of use for developing ecosystem and biodiversity conservation and management strategies. The models should be developed and tested in key European ecosystems within a single project.

III.3.2 Develop a model for assessing and forecasting the impacts of climate and anthropogenic forcing on pelagic ecosystem (open ocean). In the context of biogeochemistry, biodiversity and ecosystem conservation and sustainable use, the food-web dynamics (structure, functioning diversity and stability) should be emphasised. This work will be synchronised with related initiatives in the US.

III.4. Risk assessment, management, conservation and rehabilitation options in relation to terrestrial and marine ecosystems

The research should be dealt with by implementing research initiatives to assess in an integrated way, large scale environmental risks impacting on biodiversity and ecosystems and to develop concepts and tools for risk management. The coastal zone management, based on integrated risk assessment is also considered here.

Topics for up to one Network of Excellence or Integrated Projects to implement in 2003

III.4.1. Assessing large-scale environmental risks to biodiversity and to terrestrial and freshwater ecosystems, including risks consequent on biological invasions (also by pathogens), climate change, environmental chemicals, rate and extent of loss of pollinators. The work should take into account regional ecological variability, and focus on methods to assess effects on biodiversity, ecosystem functioning and the dynamics of ecosystems. These various assessments will form modules in a single project. A key deliverable will be the description of tested methods and protocols that can be used to assess environmental risk in ecosystems.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

III.4.2. Develop model(s) for assessing and forecasting the impact of environmental pollution on fresh water and marine ecosystems and their biological diversity. This should be achieved using a multi-disciplinary approach including the ecotoxicological monitoring of the health status of fresh water and marine ecosystems and of the impact of pollutants based upon biological responses at different levels. Key pollutants, in particular heavy metals, dioxins and PCBs have to be considered as well as novel and emerging pollutants. Early-warning strategies should be developed together with state-of-the art risk-assessment techniques yielding improved management options, remedial action strategies and preventive policies for the mitigation of harmful effects.

Indicative topics for STREPs and Co-ordination Actions to implement in 2004

III.4.3. Create an inventory of invasive species that threaten European terrestrial, fresh-water and marine environments, and provide the basis to prevent and control biological invasions through the understanding of the biological, social, economic and other factors involved. The inventory should be established using common definitions and criteria, and aim to cover all taxa and all European countries, water bodies and seas. The work should also assess the ecological, economic and health impact of biological invasions in Europe.

III.4.4. **Harmful Algal Blooms in European marine and brackish waters.** Developing models to describe and quantify cause-effects relationships between bloom formation and the natural and anthropogenic forcings. An interdisciplinary and international effort is needed to understand the mechanisms of bloom formation, to distinguish between natural causes versus anthropogenic causes and to understand the mechanisms through which algal blooms are harmful, with a view to developing strategies to reduce the negative impacts. This work will be synchronised with related initiatives in the US and be a topic for a planned co-ordinated call.

IV. Mechanisms of desertification and natural disasters

The objective is to understand the mechanisms of desertification and natural disasters (such as those caused by seismic and volcanic activity), including their links with climatic change so as to improve risk and impact assessment and forecasting, and decision support methodologies.

The research will focus on mechanisms of desertification and natural disasters.

Topics

IV.1. Mechanisms of desertification

Research will focus on the study of driving processes in the framework of likely scenarios of multiple stresses driven by land use changes and climate change and the development of methods/tools to achieve an integrated assessment. Emphasis will also be put on desertification monitoring; the organisation and structuring of data and information; on criteria for mapping sensitive areas; the development of coupled advanced modelling tools (social/ecological systems); the identification of a thresholds-indicators framework; on the assessment of the effect of extreme climatic conditions on erosion processes, and land degradation, resilience of fragile ecosystems. Research will be performed on the development of innovative soft ecologically-based techniques and soil conservation measures and technologies for the prevention and mitigation of land degradation. Strategies have to be developed for land management in large representative pilot areas relevant to the UN Convention to Combat Desertification.

Topic for STREPs and Co-ordination Actions to implement in 2003

IV.1.a) **Research on mechanisms of desertification and soil quality.** To investigate how land degradation mechanisms affects the critical soil functions that are necessary for maintaining and restoring soil and land quality, and ecosystem health. It is necessary to define the thresholds and critical factors of degradation in order to allow successful restoration action and enable an early warning system. Develop and demonstrate ecotechnological innovation applied to land degradation management as methods and tools for landcare and mitigation of desertification.

Indicative topics for Network of Excellence or Integrated Project to implement in 2004

IV.1.b) **Assessment of the vulnerability to desertification.** Assessment of the land degradation/desertification processes combining the socio-economic and biophysical drivers and integrating multiple scales. Forecasting the phenomenon, trends and threats to resilience; development – improvement of an harmonised surveillance/monitoring system of land degradation and of the associated indicators and assessment capacities.

IV.1.c) **Combating desertification.** Organise, capitalise and develop concepts and actions for the restoration of fragile ecosystems; improvement and application of tangible management strategies, development of good practices, control measures, operational tools and techniques for the prevention and mitigation of land degradation in key regions.

IV.2. Natural Disasters

Research will focus on seismic hazard assessment, vulnerability, risk assessment and mitigation through earthquake resistant constructions. Mechanisms leading to landslides and avalanches will also be addressed as well as processes of volcanic eruptions, magma properties, magma storage and integration of data from multi-sensor permanent surveillance networks and by spaceborn platforms⁴. Prediction of inland and coastal floods (early-warning) and impact assessments considering climate change will be a target. Forest fire management⁵ through modelling of fire behaviour, propagation, mapping and suppression (including earth observation technologies) will be considered.

Topics for up to one Network of Excellence or Integrated Project to implement in 2003

IV.2.a) **Integrated earthquake and landslide disaster management methodologies⁶.** New methods and technologies for improving the earthquake resistant design of historic, existing, new constructions and geotechnical structures (including local ground motion variations). Evaluation of the intervention/implementation costs, social and economic impacts. Mechanisms and processes leading to landslides. Integration and accessibility of earthquake, landslide data and knowledge in particular for engineering purposes. Exchange and dissemination of related information to user communities in order to improve pre-disaster planning, preparedness, communication and risk awareness for formulation of mitigation policies.

IV.2.b) **Integrated flood risk management methodologies⁷.** Integrated strategies and tools for hazard, vulnerability and risk assessment, prevention and mitigation of flood risks in the coastal zone and the estuaries. Development of innovative design of sustainable flood defences and risk mitigation measures. Operationalisation of methods and technologies developed as well as their efficiency and cost of implementation. Understanding and prediction of coastal flood related extreme events, their interaction and synergetic effects with coastal morphodynamics. Exchange and dissemination of related information to user communities.

Indicative topic for STREPs and Co-ordination Actions to implement in 2004

IV.2.c). **Seismic hazard, flood, forest fire, volcanic and avalanche risk assessment.** Understanding of processes leading to earthquakes. Technologies and methods to observe, analyse and monitor earthquake related phenomena. Volcanic risk assessment considering the operationalisation, cost of implementation of techniques developed to the benefit of end users. Research approaches for flood risk, hazard and vulnerability assessment⁸. Mechanisms provoking avalanches. Modelling and propagation studies of forest fires. Co-operation with US (NSF) through co-ordinated calls; co-operation with Japan, China and India through co-ordinating actions is considered important for the areas of seismic and landslide risk due to their vulnerability for earthquakes. Co-operation with US and Canada is foreseen for the areas of forest fires and floods through co-ordinated calls.

⁴ Integrated information systems on risk management will be developed in Priority 1.1.4.

⁵ Priority 1.1.2 will cover the IT developments

⁶ Idem

⁷ Priority 1.1.2 will cover the IT developments

⁸ Emphasis should be placed on prevention and mitigation of flood disasters. For integrated research activities, see topic II.1.2.a.

V.Strategies for sustainable land management, including coastal zones, agricultural land and forests

The objective is to contribute to the development of strategies and tools for sustainable use of land, with emphasis on the coastal zones, agricultural lands and forests, including integrated concepts for the multipurpose utilisation of agricultural and forest resources, and the integrated forestry/wood chain in order to ensure sustainable development at economic, social, and at environmental levels. Qualitative and quantitative aspects of multifunctionality of agriculture and forestry will be addressed.

Two parts will be addressed in this area, the first one dedicated to the sustainable land-use and the second one addressing the qualitative and quantitative aspects of multifunctionality of agriculture and forest/wood chain.

Topics

V.1. Sustainable use of land

V.1.1) Land-use and landscapes in sensitive regions

Concepts and strategies for sustainable land-use and landscape development in sensitive regions such as mountains, coastal zones, islands and industrialised zones will have to be defined, taking into account the existing knowledge on this matter. Modelling approaches for integrated land-management highlighting regional issues will be developed or improved if already existing. A European-wide knowledge and data-base on rural development practices, policies and other data usable for modelling and future land-use management decisions will be built. Sustainable regional development for sensitive areas will also be addressed.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

V.1.1.a) **Methods for sustainable regional development assessment:** development of tools for definition and monitoring of strategies of regional sustainable development in Europe (EU and accession countries), including sensitive areas such as mountains, coastal zones, islands, industrialised zones and taking into account the effects of rural development, land-use, agriculture and forestry

Indicative topics for STREPs and Co-ordination Actions to implement in 2004

V.1.1.b) **Development of new concepts, strategies and tools** for sustainable land-use and landscape management through a multi-functional approach. Integrated framework for decision-support in land-use, including the identification of thresholds of sustainability, cost-effectiveness and cost benefit analysis and other economic methods or policy tools.

V.1.1.c) **Land-use modelling** and creation of relevant databases taking into account the management of materials, energy and land-use; development of tools for integrated assessment, indicators, multi-level strategies and instruments.

V.1.2) Integrated Coastal Zone Management (ICZM) considering spatial and temporal integration and stakeholders involvement for Sustainable Development

This activity will address in an harmonised and synthetic way the assessment of the causes for environmental degradation and their socio-economic impacts in the coastal zone at a regional and global scale. It will generate option development and decision making tools: methodologies, models and tools for integrating interrelated processes, including socio-economic driving forces and feed-backs, for integrated management; it will provide in a

consistent way socio-economic impact from short-term events and long-term changes, involvement of stakeholders and co-ordination of different players.

Indicative topic for Network of Excellence to implement in 2004

V.1.2.a) **Establishment of a long-lasting network** of all research partners working at international, national and regional levels on ICZM in Europe to: stimulate co-ordination and coastal research including by integrating existing or emerging national networks and stimulate emergence of such networks when they do not exist, promote interdisciplinary approaches and using the scientific knowledge generated by the research on ecosystems, develop decision-making tools for integrated management including socio-economic parameters, involve stakeholders in the management of multiple/conflicting use of natural resources, promote communication and dissemination of knowledge.

V.2. Qualitative and quantitative aspects of multi-functionality of agriculture and forest/wood chain

The research for the agriculture and forest/wood chain will take into account the global-local scale, and will use an integrated, multifunctional approach covering environmental, economic, and social levels. Furthermore, the link and complementarity between EU internal and external dimensions of the Sustainable Development are fundamental components of the multi-functionality concept; a particular effort is requested for the integration and participation of Developing Countries (e.g. African Countries).

V.2.1) Agriculture for Sustainable Development

(topics may be subject of a later call)

V.2.2) Forestry/wood chain for Sustainable Development.

Topic for up to one Network of Excellence or Integrated Project to implement in 2003

V.2.2.a) Development and application of integrated approach and tools for long-term **sustainability of forest health and productivity**. Role and impact of the complete forest/wood chain in the context of the EU sustainable development strategy, including the regional and international dimensions and the societal needs; The necessary integration and sustainability of the different stages of the complete forestry/wood chain and the targets for the environmental, economic and social benefits at local, regional and global levels should be included in the technological and industrial processes analysis.

VI. Operational forecasting and modelling including global climatic change observation systems

The objective is to make systematic observations of atmospheric, terrestrial and oceanic parameters, including those of climate, so as to improve forecasting of the marine, terrestrial and atmospheric environment, consolidate long-term observations for the modelling and in particular prediction, establish common European data bases and contribute to international programmes.

The research will focus on development of observing and forecasting systems such as GCOS (Global Climate Observing System), GTOS (Global Terrestrial Observing System) and GOOS (Global Ocean Observing System).

Topics

VI.1. Development of observing and forecasting systems

Research will focus on the scientific and technological development and implementation of systems to make long-term systematic observations of marine, terrestrial and atmospheric parameters necessary for global change research and management strategies, and of extreme events. Such large observing / monitoring / surveying / operational forecasting⁹ / modelling networks are required to support the activities carried out within the research priority "Global Change and Ecosystems"¹⁰. Research under this heading should also take into account the development of a European capacity for Global Monitoring of Environment and Security¹¹ (GMES), with emphasis on contributing to the establishment of GMES by 2008. Research activities should take due account of the results obtained by the end of the initial period of the GMES Action Plan, i.e. the end of 2003. They will be complemented by the action of Priority 1.1.4 and Priority 1.1.2.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

VI.1.a) **Earth system observations.** Contribution to the development of terrestrial, marine and atmospheric observation and forecasting systems, including systems for climate research. Development and implementation of observing and forecasting systems, quality, resolution and spatial coverage, the capacity of the systems to adapt to technological progress over the medium and long-term. The optimum use of both in-situ and remote sensing instruments and data¹². The evaluation of the socio-economic benefits obtained from such observing systems.

VII. Complementary research

The objective is to focus on the development of advanced methodologies for risk assessment of processes, technologies, measures and policies, the appraisal of environmental quality, including reliable indicators of population health and environmental conditions and risk evaluation in relation to outdoor and indoor exposure. Relevant pre-normative research on measurements and testing for these purposes will also be necessary.

The research will focus on the development of advanced methodologies for risk assessment, and the appraisal of environmental quality, population health and monitoring tools.

Topics

VII.1. Development of advanced methodologies for risk assessment

Chemicals and pathogenic agents in the environment put tremendous pressure on natural environmental resources and environmental health in the different regions of Europe. The overall aim is to strengthen and advance risk assessment knowledge and practices for integrated risk assessment of environmental stressors. The transfer of knowledge between experts in human and environmental health is essential. The approach should also include risk evaluation in relation to outdoor and indoor exposure and take into account implication of the European diversity e.g. the geographical, ecological, social and cultural differences. The research will focus on the establishment of an integrated risk assessment scheme, covering both the development of risk assessment methodologies and more specific methods

⁹ Operational forecasting studies will not comprise meteorological or weather forecasting.

¹⁰ The development of environmental models for predictive purposes is addressed under other research areas of Priority 1.1.6.3.

¹¹ COM (609)2001

¹² Research on satellite-based systems is also dealt with under Priority 1.1.4 "Aeronautics and Space"

for the risk assessment of pharmaceuticals in the environment and on the development of methodologies for assessing the life cycle of products.

VII.1.1) Integrated Risk Assessment

Indicative topic for Network of Excellence or Integrated Projects to implement in 2004

VII.1.1.a) **Development of risk assessment methodologies** and particularly those requiring conceptual changes and/or developments, such as sound exposure prediction and assessment tools, assessing the effects of combined exposures to several stressors including chemical cocktails and physical/biological agents.

Indicative topic for STREPs and Co-ordination Actions to implement in 2004

VII.1.1.b) **Methods for risk assessment of pharmaceuticals in the environment.** The aim is to advance the scientific knowledge and practise for evaluation of the risks associated with the presence of pharmaceuticals in the environment. The action should stimulate the co-ordination and collaboration for information exchange among stakeholders, authorities, industry and expertise in the exposure assessment, human health and ecological effects assessment.

VII.1.2) Assessment of product life cycle

(topics may be subject of a later call)

VII.2. Appraisal of environmental quality, population health and monitoring tools

Climate change, the contamination of soil and water resources, the pollution of air and other forms of environmental damages have consequences not only on the ecosystems but also directly or indirectly on human health. Research should address the climate change driven environmental changes likely to affect human population health. Moreover, research should tackle broad aspects of environmental quality, damage assessment and environmental liability considering the related policy aspects in the Community. The actions should provide improved environmental monitoring and early warning tools, integrated measurement systems and validated common standardised methods. The research will focus on the development of methods for appraising environmental quality and health, and on environmental monitoring tools (standards measurement and testing).

VII.2.1) Methods for appraising environmental quality and health

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

VII 2.1.a) **Assessment of global change-driven environmental factors linked to the risk of introducing or spreading emerging diseases in Europe.** The aim is to identify, evaluate and catalogue European ecosystems and environmental conditions linked to global change, which can influence the spatial and temporal distribution and dynamics of pathogenic agents.

VII.2.2) Environmental monitoring tools (standards, measurement and testing)

(topics may be subject of a later call)

VIII. Cross-cutting issue: Sustainable Development concepts and tools

The objective is to develop concepts and tools for facing the complex challenges expressed in the EU Strategy on Sustainable Development and the Johannesburg Summit and to characterise the sustainability dimension of the relevant policies. The desired tools, including potential positive and negative externalities, will support the Sustainability Impact Assessment instrument, the assessment of the interrelations of environmental, economic and social impacts of policies and measures in qualitative and quantitative terms. The

precautionary principle and the regional aspects to sustainable development will be key elements to be taken into account.

The research will focus on the estimation of thresholds of sustainability and externalities and on the development of tools for integrated sustainability assessment and for the incorporation of sustainability in decision making processes.

Topics

VIII.1. Estimating thresholds of sustainability and externalities

The definition and estimation of scientifically based thresholds of sustainability and points of no-return as a tool for the sustainable management and the characterisation of the state of the environment will have to be addressed; this implies an equal balance between the necessary ecological, social and economic dimensions. This activity will cover: the estimation of cumulative, interactive effects over time caused by current and foreseeable actions; the coupling of data with policy judgements reflecting costs; the identification of time and scale of potential damages; the use of thresholds in policy making. Developing and harmonising methods for evaluating environmental and health impacts are also required.

Topic for STREPs and Co-ordination Actions to implement in 2003

VIII.1.a) **Harmonising and sharing of methods and data** in environmental and health externalities evaluation; extraction of operational estimates from existing studies (excluding energy and transport).

Indicative topics for Network of Excellence or Integrated Project to implement in 2004

VIII.1.b) **Thresholds:** Scientifically based thresholds of environmental sustainability and points of no-return need to be defined and estimated as a tool for the sustainable management and the characterisation of the state of the environment. An equal balance of the ecological, social and economic dimensions should be taken into account. The ecological quality aspects together with valuation of externalities will be used to define and estimate thresholds of sustainability, aiming also at their use in policy-making.

VIII.1.c) **Elaborating new accounting frameworks of externalities:** positive and negative externalities of policies, instruments, production activities and technologies playing a significant role for the Sustainable Development strategy implementation.

VIII.2. Developing tools for integrated sustainability assessment and for the incorporation of sustainability in decision making processes

Sustainability assessment and Sustainable Development strategy definition need integrated modelling at the macro and sectoral level at the world, EU, national and regional dimensions for policy appraisal, including simulation, scenario building, risk analysis and forecasting. In this respect, the development of quantitative tools and analysis will combine economic with ecological modelling, integrating horizontal and sectoral topics such as technology, land-use, agriculture, forestry, energy, transport, biodiversity and social issues; these tools and analysis must integrate the externalities of policies and technologies. Measuring progress towards Sustainable Development for policy purposes needs also to be strengthened. Education programmes should ensure the dissemination of knowledge and practices relative to this socio-economic research.

Topics for STREPs and Co-ordination Actions to implement in 2003

VIII.2.a) **High level scientific** validation of methodologies, tools and appraisals developed for the Sustainable Development assessment and strategy definition.

VIII.2.b) **Indicators:** sharing and harmonising databases and statistics and building consensus on combined ecological, environmental and social indicators to be used to monitor progress towards Sustainable Development at different geographical levels, in particular the regional one.

Indicative topic for Network of Excellence or Integrated Project to implement in 2004

VIII.2.c) **Innovative methods and tools** for integrated assessment of environmental, economic and social components of Sustainable Development; benchmarking of existing tools and development of new ones; shared analysis on foresight practices for Sustainable Development analysis. Qualitative and participatory tools should also be included, with a view to increasing public participation and involvement in the process.

Indicative topics for STREPs and Co-ordination Actions to implement in 2004

VIII.2.d) **Integrated modelling and quantitative tools development and application** for sustainability scenarios building and specific assessments (macro- and micro-levels; economic, environmental and social dimension, global, regional, local scales); these tools should allow for public involvement in the process.

VIII.2.e) **Education programmes** on social and economic and environmental tools for the implementation of the EU Strategy on Sustainable Development at both EU and international levels (addressed in particular to stakeholders and decision-makers).

Specific Support Actions

Specific Support Actions are projects aiming to actively contribute to the implementation of the work programme, the analysis and dissemination of results or the preparation of future activities, with a view to enabling the Community to achieve or define its RTD strategic objectives.

The following topics should be considered for **Specific Support Actions in 2003:**

- ü **Actions such as the European Network for Research in Global Change (ENRICH)** to build and strengthen co-operation with partners in the developing world on issues such as climate change, biodiversity, ecosystems, natural risks and hazards. The objective of ENRICH is to promote co-operation by training and by integrating critical masses of resources and capabilities of industrialised and developing countries. These activities are complementing other initiatives like the Asian-Pacific Network or the Inter American Institute in Latin America. ENRICH would also be an indicative topic for Specific Support Actions in 2004.
- ü **Consolidating knowledge on the role of wetlands in the water cycle.** There is a need to synthesise the results of concluded and on-going research activities, both at European and national level, for giving guidance on the hydrological, ecological and socio-economic role of wetlands.
- ü **European contribution to international observation systems.** Actions toward international co-operation are envisaged with a view to providing a European contribution to the setting-up of observation systems (in particular, in the developing countries) together with non-EU countries such as US (e.g. NASA, NOAA) and Japan. This is needed in order to sustain the role of EU on the international stage and to exploit the technological capacity and methodologies in the area of global change observations.
- ü **Capitalisation of results from the past research on sustainable agriculture** and perspectives for future research actions. Contribution of the agro-ecological systems to the different land uses. Comparison of existing externalities calculation in agricultural and forest production.
- ü **Lessons from past research on sustainable production and utilisation of forests.** Characterisation of the multi-functionality aspects of forest/wood chain with regard to

their capacity of natural resource conservation, landscape creation and land-use according to different types of regions (mountains, coastal zones, cultivated areas and urban forests) including their industrial utilisation in the forest/wood chain and taking into account the role of the actors, institutions and legislation.

An indicative topic would also be considered for a **call for tender** in 2004.

ü **Providing support for the activities and further development of the European Platform for Biodiversity Research Strategy (EPBRS).**

4. LINKS TO OTHER RESEARCH TOPICS

The main links between some topics of "Global Change and Ecosystems" and the other priorities which will be subject of co-ordination are indicated below; the differentiation between the priorities is indicated in the description of the topics presented in section 3.

- Priority 1.1.6.3. will contribute to Global Monitoring for Environment and Security (GMES) although the main research contribution will come from the Priority 1.1.4 "Aeronautics and Space".
- Natural disasters, Coastal management, Water management systems will be co-ordinated with Priority 1.1.2 "Information Society Technologies".
- Sustainable Development and foresight of the "cross-cutting issue" activity will be subject of co-ordination with Priority 1.1.7 "Citizens and Governance in a Knowledge-based Society". It will also be co-ordinated with the similar activity of the sub-priority 1.1.6.1. "Sustainable Energy".
- Forest/wood chain will be co-ordinated with the Priority 1.1.3 "Nano-technology and Nano-sciences, Knowledge-based Multifunctional Materials, New Production Processes and Devices".
- Agricultural research for Sustainable Development will be co-ordinated with the Priority 1.1.5 "Food Quality and Safety".
- A general co-ordination for all areas is expected with "Specific activities covering a wider field or research", including activities related to the EU Water Initiative which will be co-ordinated with the "Specific Measures in support of International Co-operation".

5. IMPLEMENTATION PLAN AND RELATED ISSUES

Networks of Excellence, Integrated Projects, Strategic Targeted Research Projects and Co-ordination Actions will be implemented by means of three periodic calls with the first deadline in year 2003. The proposals submitted to the first deadline will follow a single stage proposal submission procedure.

Specific Support Actions will be subject of one call continuously open until 2005 with cut-off-dates similar to the deadlines of periodic calls.

Budget allocation, participants and type of instruments for the first call (2003)

Type of Instruments	Participants	Indicative budget 1st call 2003
Networks of Excellence	See general Rules for Participation	140 M€
Integrated Projects	See general Rules for Participation	
STREPs	See general Rules for Participation	25 M€
Co-ordination Actions	See general Rules for Participation	
Specific Support Actions	See general Rules for Participation	5 M€

6. CALL INFORMATION

1. **Specific Programme:** Integrating and Strengthening the European Research Area
2. **Activity:** Sub-Priority "Global Change and Ecosystems"
3. **Identifying number for call:** XXXX
4. **Envisaged publication:** 17/12/2002
5. **Envisaged deadline:** 31/03/2003
6. **Total indicative budget for the first call:** 170 M€ of which 140 M€ (82%) for the New Instruments and 25 M€ (15%) for the STREPs and Co-ordination Actions and 5 M€ for the Specific Support Actions.
7. **Restrictions to participation:** Standard rules for participation for the instruments. No additional restrictions are foreseen.
8. **Criteria A:** Evaluation and selection of proposals for indirect actions.