bc³

BASQUE CENTRE
FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

ACTIVITY REPORT 2016

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1. INTRODUCTION

After the farewell in December 2015 of the worldwide leading expert, Prof. Anil Markandya, who led the center since our creation in 2008, Prof. María José Sanz was appointed new Scientific Director of BC3. Her mission, to lead our scientific contribution during this very crucial "post-COP21 era". In reference to the important agreements reached at the United Nations Climate Summit held in Paris in December 2015, her appointment was an outstanding boost to the capabilities of the BC3, thanks to her career and prior experience at the highest tier in academia, as well as to her involvement in the guidance of political decisions.

We also changed BC3's headquarters for this new stage, and in June 2016 we moved to our current location, the Science Park of the University of the Basque Country in Leioa. This new location is key to consolidate our relation with the University of the Basque Country (UPV/EHU) and other members of the Science and Innovation panorama, as it made possible to take greater advantage of the synergies between research teams at a crucial moment for climate change science.

Climate change represents one of the greatest environmental, social and economic threats humanity has ever faced, as recognized by the long-term goal of the Paris Agreement. Its long term nature, the high uncertainty about future impacts, and the ethical responsibilities connected with causes and capacities make it very difficult to address effectively. Private and public sectors, including, governments, corporations and civil society, must choose between many, but often conflicting, priorities and objectives. So far, research has played a decisive warning role, raising climate change and the related global environmental issues. **Now, the issue is no longer raising the alarm but to innovate, proposing and testing urgent solutions, and evaluating their impact and effectiveness**. Experience on the ground so far clearly indicates that local values and contexts matter, and that top-down solutions need to be matched with a diversity of bottom-up approaches across sectors. This implies that all levels of governance (local, regional national and international) need to be involved in the design and implementation of future climate policy.

A key rationale for the creation of BC3 in 2008 was the idea that the science-policy interface on climate change required stronger integration between physical studies and socio-economic analysis. This is now widely accepted, thus the Intergovernmental Panel on Climate Change Fifth Assessment Report, put greater emphasis on assessing the socio-economic aspects of climate change and their implications for sustainable development. Furthermore, the IPCC's sixth cycle of assessment becomes an opportunity for the scientific community to provide inputs and insights into the new era of climate action opened by COP21 in Paris.

At this crucial juncture, scientist must supply the right information to support decision-makers and other stakeholders across sectors and scales for designing effective, efficient and equitable policies to adopt synergetic mitigation and adaptation options. This requires the integration of different understandings, visions and languages, and thus scientific disciplines, from the start.

BC3 will further develop its mission, emphasizing the **bridging of scales and scientific languages to support policy- and decision-making in economically efficient and socially equitable ways**. In order to do so, the center will continue to engage with highly recognized scientific **multidisciplinary** teams and institutions at global, national and regional level with an increased emphasis on effectively conveying policy messages to public and private decision makers.

We were first established in 2008 to study the causes and consequences of climate change and the best ways of addressing it. Given the vast range of the topic, we focused on the socio-economic aspects of climate change, within an interdisciplinary framework that includes the natural as well as social sciences, and we are nowadays one of the few centres in Europe with this specialization. Since its inception, the centre has grown rapidly and we are now a team of 43. Our areas of work cover; Low Carbon, Climate and Natural Environment, Health and Climate and Climate Policy.

At BC3 we believe that we can only be successful if we are fully integrated into the network of research centres working on the same topic. To this end, we have developed collaborative agreements with institutions all over the world.

As excellent research centre the external funding is one of the key indicators to value, as it represents the capacity to compete in a Science Environment with such a challenging economic situation BC3 has been increasingly successful in obtaining funds from different calls and agreements, so that in 2016 nearly % 62 of the funds came from such sources. The number of H2020 projects (European Commission) atracted by the center deserves a special mention. This Activity Report compiles numerous contributions that illustrate the wide impact of BC3´s work.

Prof. Maria Jose Sanz, new Scientific Director of BC3 to develop the Post-Paris (COP21) era.

A centre of excellence is evaluated primarily in terms of its scientific output and in this regard BC3 is making a name for itself. As the staff has increased, so has the volume of publications, principally in scientific journals, but also in books and monographs. In 2016 we produced 72 articles as well as 3 books and 15 chapters. At the same time we are mindful of the fact that a research centre working in the socio-economic domain of a problem such as climate change has a responsibility to be relevant. Hence we have participated in major fora where this subject is discussed, including the annual Conference of Parties to the Framework Convention on Climate Change, and we are contributing to the important Intergovernmental Panel for Climate Change (IPCC), and IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) which brings together the state of knowledge on research on climate and makes it accessible to policymakers. Last but not least, we have prepared policy briefs and technical reports for various governments.

2. THE CENTRE

2.1 PRESENTATION OF THE CENTRE

BC3 (Basque Centre for Climate Change) is an excellence research centre that contributes to long-term research on the causes and consequences of climate change. Our main goal is to foster the creation of knowledge in this multidisciplinary science, as well as to engage a highly-qualified team of researchers with the primary objective of achieving excellence in research, training and dissemination.

Our Centre was created in 2008 jointly by the Basque Government and the Basque University, under the so-called BERC programme (Basque Excellence Research Centres), with the aim of focusing on the socio-economic aspects of climate change, within an interdisciplinary framework that includes both natural and social sciences.

We are currently among the few centres in Europe specialized in this field, where we already count with a strong reputation. Therefore, as a world-class climate change research centre, we address the socio-economic implications of global climate change, contributing to decision-making at Basque, Spanish, and International level from an integrated perspective.

The centre also highlights the importance that the Basque Government, through both the Basque Environmental Strategy for Sustainable Development 2002-2020, and Environmental Framework Programme 2020 of the Basque Country, gives to the creation of knowledge and strategies to reconcile the improvement of the population's quality of life with the preservation of the environment and its resources.

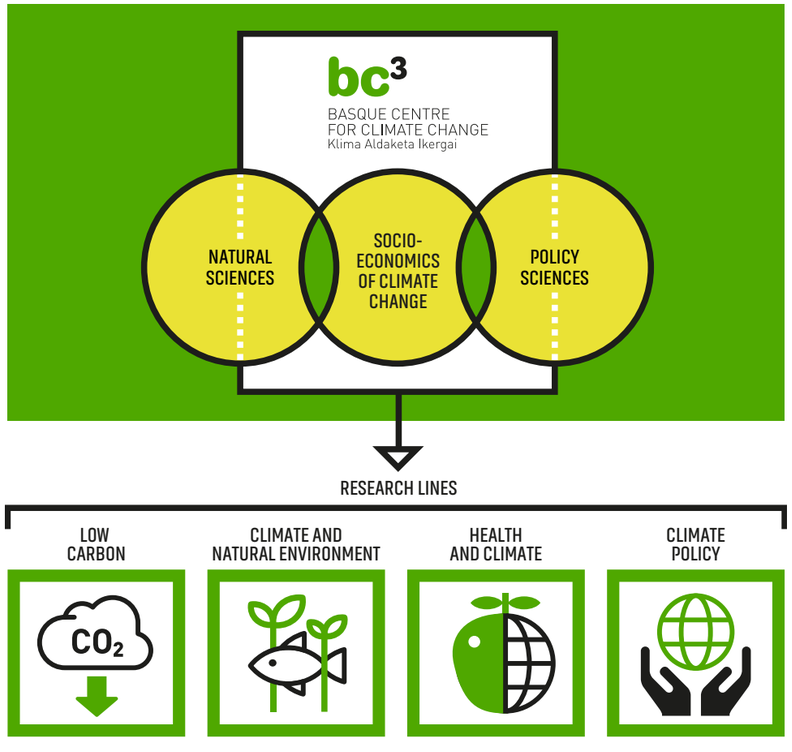
Our research lines fall broadly into the following groups:

- **LOW CARBON**
- **CLIMATE AND NATURAL ENVIRONMENT**
- **HEALTH AND CLIMATE**
- **CLIMATE POLICY**

The Strategic objectives that underlie the BC3 strategic plan, support the centre's vision and focus on its aspiration: To be a world-class climate change research centre aimed at informing decision-making at the Basque, Spanish, and international level by integrating natural and social sciences to address the socio-economic implications of global climate change.

BC3 STRATEGIC OBJETIVES:

- **SO1.** To develop an excellence–based, innovative and multidisciplinary Climate Change research programme.
- **SO2.** To participate and develop high-level training programmes on Climate Change.
- **SO3.** To contribute to increase local/national/international development and citizens standard of living by Climate Change knowledge transfer to society.
- **SO4.** To promote collaboration and cooperation with Governments, universities, research centres, technology centres, social agents and companies at local, national and international level.
- **SO5.** To implement an excellence-based Financial and People Management in order to attract funding and top-ranking talents.



2.2 PARTNERS

We are a non-profit association formed by the following associate members:

ikerbasque
Basque Foundation for Science

eman ta zabal zazu
Universidad del País Vasco
Euskal Herriko Unibertsitatea

ihobe

2.3 MISSION - VISION

MISSION

The BC3 is a Research Centre based in the Basque Country, which aims to contribute to long-term research on the causes and consequences of climate change, in order to foster the creation of knowledge in this multidisciplinary science.

We seek to prepare a highly qualified team of researchers with the primary objective of achieving excellence in research, training and dissemination.

It is our goal that our methods and analytical tools allow to widen the frontiers of human scientific knowledge, making our organisation a worldwide benchmark on climate change research.

VISION

To be a world-class climate change research centre aimed at informing decision-making at the Basque, Spanish, and international level by integrating natural and social sciences to address the socio-economic implications of global climate change.

This synergy is realized through our research on low carbon transitions, natural environment and ecosystem services, health, economics and policy.

2.4 INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

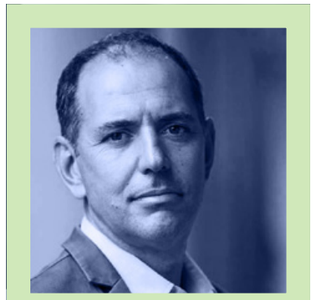
The International Scientific Advisory Committee (ISAC) is a consultative body of independent experts created to provide advisory opinions and analysis on science to our centre. Its remit includes matters concerning research program and general strategy.

Members are appointed for four years, as independent scientific experts on the basis of their specific skills, abilities, experience and knowledge.

In 2014, our International Scientific Advisory Board was updated, and five of its six members were newly appointed. The following members compose the current committee:

ISAC MEMBERS:

Neil Adger
PROFESSOR OF HUMAN GEOGRAPHY
—
University of Exeter

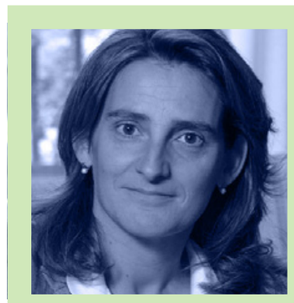


Xavier Labandeira
PROFESSOR OF APPLIED ECONOMICS
—
University of Vigo

Reinhard Mechler
DEPUTY DIRECTOR OF "RISK, POLICY, VULNERABILITY"
—
International Institute for Applied Systems Analysis (IIASA)

Pete Smith
PROFESSOR OF SOILS & GLOBAL CHANGE
—
University of Aberdeen

Valentina Bosetti
ASSOCIATE PROFESSOR OF ECONOMICS
—
Bocconi University



Teresa Ribera
DIRECTOR
—
Institute for Sustainable Development and International Relations (IDDRI)

2.5 BC3 TEAM | 2.5.1 Statistics

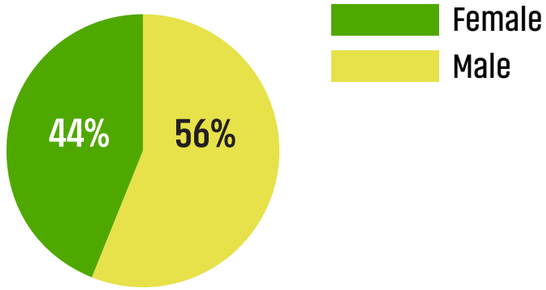
BC3 TEAM DISTRIBUTION BY POSITION

TOTAL BC3 TEAM	**43**
SCIENTIFIC DIRECTOR	**1**
RESEARCHERS	**37**
Research Professors	11
Research Fellows	2
Post Doc Researchers	13
PhD Student	11
ADMINISTRATION TEAM	**5**
Operation Manager	1
Project Manager Outreach	1
Project Officer	2
Management Assistant	1

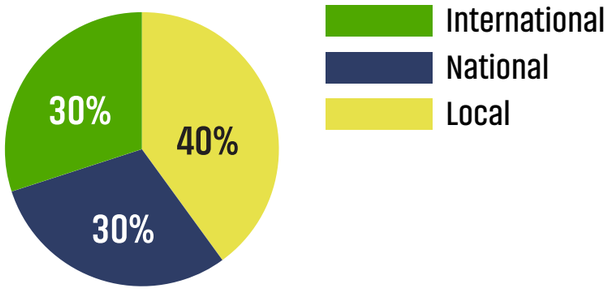
* BC3 team members at 31st of December 2016.
** 7 of the BC3 researchers were IKERBASQUE researchers (5 Ikerbasque Professors, 1 Ikerbasque Distinguised Professor and 1 Ikerbasque Research Fellow).
*** 2 of the Ikerbasque Researchers were also *Ramon y Cajal* researchers.

BC3 TEAM DISTRIBUTION BY GENDER AND NATIONALITY

Distribution by gender



Distribution by nationality



As mentioned before, another key aspect for our consolidation as a research center of international relevance is the talent retention. Such process pivots on the following axes of action:

- EFFECTIVE AND INNOVATIVE PROCESSES AND ORGANIZATION
- EXCELLENT INFRASTRUCTURE AND LOCATION
- LINKS TO LEADING CLIMATE CHANGE CENTERS WORLDWIDE
- TRAINING
- STAFF SATISFACTION PROGRAM

As mentioned in the Introduction of this Activity Report, the most relevant event in 2016 in terms of staff was the incorporation of Prof. Maria José Sanz Sanchez as Scientific Director of BC3 on the first of January. This was meant to support our strategic thinking process.

Moreover, throughout 2016, 12 calls linked to research projects were published for the recruitment of staff in open calls. In total, 146 applications were received.

Within 2016, we also hosted 16 guest-researchers that stayed in the centre a time frame inferior to 6 months. The guest-researchers stays enabled the institution to identify new collaborators.

2.5 BC3 TEAM | 2.5.2 BC3 Team

RESEARCHERS - I

For more information, visit our website.

RESEARCH LINES:

LOW CARBON · NATURAL ENVIRONMENT · HEALTH AND CLIMATE · CLIMATE POLICY

María José Sanz
SCIENTIFIC DIRECTOR.
IKERBASQUE PROFESSOR

Anil Markandya
IKERBASQUE DISTINGUISHED PROFESSOR AND FORMER SCIENTIFIC DIRECTOR

Ferdinando Villa
IKERBASQUE
RESEARCH PROFESSOR

Unai Pascual
IKERBASQUE
RESEARCH PROFESSOR

Sérgio H. Faria
IKERBASQUE
RESEARCH PROFESSOR

Marc Neumann
IKERBASQUE
RESEARCH PROFESSOR

Aline Chiabai
RESEARCH
PROFESSOR

Ibon Galarraga
RESEARCH
PROFESSOR

Mikel González-Eguino
RESEARCH
PROFESSOR

Luis Maria Abadie
RESEARCH
PROFESSOR

Agustin Del Prado
RESEARCH
PROFESSOR

Iñaki Arto
RESEARCH
PROFESSOR

David Moreno
IKERBASQUE
RESEARCH FELLOW

Stefano Balbi
RESEARCH
PROFESSOR

Sebastien Foudi
POSTDOCTORAL
RESEARCHER

Marta Pascual
POST DOCTORAL RESEARCHER OF IKERBASQUE – DKR IN AUSTRALIA

RESEARCHERS - II

For more information, visit our website.

RESEARCH LINES:

LOW CARBON | NATURAL ENVIRONMENT | HEALTH AND CLIMATE | CLIMATE POLICY

Marta Olazabal
POSTDOCTORAL RESEARCHER

Amaia de Ayala
POST DOCTORAL RESEARCHER

Josue Polanco
POST DOCTORAL RESEARCHER

Ignacio Palomo
POST DOCTORAL RESEARCHER

Federico Cardona
POST OCTORAL RESEARCHER

Ignacio Cazcarro
POST DOCTORAL RESEARCHER

Elena Galan
POST DOCTORAL RESEARCHER

Leif Vogel
POST DOCTORAL RESEARCHER + MARIE CURIE

Javier Martinez
POST DOCTORAL RESEARCHER

Elisa Sainz de Murieta
POST DOCTORAL RESEARCHER

Guillermo Pardo
POST DOCTORAL RESEARCHER

Cristina Pizarro
POST DOCTORAL RESEARCHER

Mª Victoria Román de Lara
JUNIOR RESEARCHER - PHD STUDENT

Xoaquin Garcia
JUNIOR RESEARCHER - PHD STUDENT

Alina Tepes
JUNIOR RESEARCHER - PHD STUDENT

Laetitia Pettinotti
JUNIOR RESEARCHER - PHD STUDENT

RESEARCH LINES:

LOW CARBON | NATURAL ENVIRONMENT | HEALTH AND CLIMATE | CLIMATE POLICY

RESEARCHERS - III

For more information, visit our website.

Jon Sampedro
JUNIOR RESEARCHER - PHD STUDENT

Dirk Jan Van de Ven
JUNIOR RESEARCHER - PHD STUDENT

Ambika Markanday
JUNIOR RESEARCHER - PHD STUDENT

Bosco Lliso
JUNIOR RESEARCHER - PHD STUDENT

Asun Rodriguez
JUNIOR RESEARCHER - PHD STUDENT

Iratxe Rubio
JUNIOR RESEARCHER - PHD STUDENT

June Hidalgo
JUNIOR RESEARCHER - Research Assistant

ADMINISTRATION STAFF

Nerea Ortiz
OPERATION MANAGER

Susana Pérez
MANAGEMENT ASSISTANT

Ainhoa Azkarate
OUTREACH MANAGER

Silvia de Luis
PROJECT OFFICER

Irune Vegas
PROJECT OFFICER

2.5 BC3 TEAM | 2.5.3 HR Excellence in Research

HR EXCELLENCE IN RESEARCH

In April 2015, after a thorough analysis of our human resources policies, the European Commission awarded BC3 with the HR EXCELLENCE IN RESEARCH, in recognition to our commitment with the 40 principles defined in the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers.

More specifically, the "European Charter for Researchers" outlines the roles, responsibilities and rights of researchers and their employers. The aim is to ensure that the relationship between these parties contributes to the successful achievement of the generation, dissemination and exchange of knowledge, as well as to the professional development of researchers from the early stages of their careers.

The implementation of the Charter & Code was meant to improve our performance in talent attraction, making of us an even more attractive destination for researchers in the coming years, as it ensures, among others, that our selection procedures are fair and transparent. The Charter & Code also provides information about our working environment and development possibilities, as we not only evaluate researcher's performance based on publication production criteria but also based on other evaluation criteria such as education and training, supervision, teamwork, knowledge transfer and public awareness and management activities.

The European Commission adopted the European Charter for Researchers and the Code for their Recruitment, drafting two documents directed to researchers, employers and providers of public and private sector funding. Both documents have become key elements of the European Union's policy, making research an attractive career and stimulating economic growth and employment in the continent.

3. RESEARCH

3.1 RESEARCH LINES | 3.1.1 Low Carbon

OBJECTIVES OF THE RESEARCH LINE

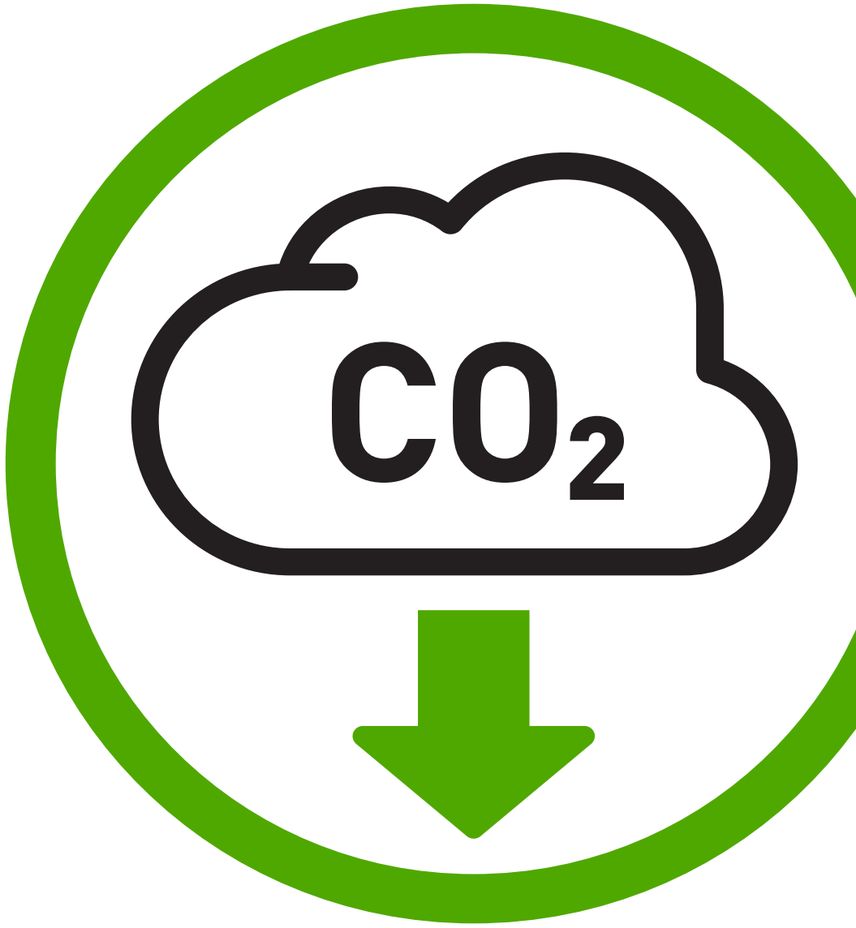
The "Low Carbon" (LC) research line deals with the implications of the transition to a low carbon economy. The major source of carbon emissions is the production and consumption of energy and a great deal of our effort at BC3 is devoted to understand how to reduce emissions without unduly affecting economic and social wellbeing, especially among the most vulnerable people.

This line has been very active over the last years, contributing to many different areas. As an overview, our research covers the transition to a low carbon economy from the micro level (for example, the decision of a firm or consumer to invest in energy efficiency or not) to the global level (such as the implications of different climate agreements). We analyse the economic implications of climate policies (including distributional impacts) and their impact on households, economic sectors and regions. The interrelations and interactions of climate policies with energy, economy, the environment, land use, trade and health policies are also explored, building strong links between our work and our other research lines.

The methodologies applied are very diverse:

- Real option theory and models: used to analyse optimal investments by considering the existing uncertainty in the price of commodities.
- Energy-system models: used to understand in a better way the implications of the transition to a low-carbon economy in some key sectors, such as power.
- Input-Output and CGE models: used to analyse the energy-economy-environment (E3) implications of policies that have economy-wide effects at regional, national and global levels.

Finally, we also explore the interrelations between the economy and the climate system, using Integrated Assessment models (DICER and GCAM-BC3) to analyse different issues related to climate policy, such as the implications of different climate agreements for the energy system and the optimal climate policy considering different estimations for damage functions. Other applications include the consequences of climate policies and scenarios in terms of costs, global temperature change and sea level rise. All these tools are in constant development, enabling us to quantitatively explore the full implications of a low-carbon transition and effectively support decision-making processes.



3.1 RESEARCH LINES | 3.1.1 Low Carbon

2016 RESEARCH IN ACTION: TOPICS

Co-benefits of low carbon transitions: looks at the health and other co-benefits of transition to low carbon in selected cities in Europe, India and China.

The economics of fuel industries in a carbon constrained world: deepens in energy economics and climate change research to help deliver a low carbon future.

Forward-looking methodologies to analyse societal challenges in the area of energy: reviews the performance of forward-looking models to assess grand societal challenges related to energy and develop methods to improve their applicability.

New modelling tools for managing step-change dynamics by working across a wide range of spatio-temporal scales, and integrating the knowledge of many stakeholder communities: develops complex systems in which causal relations are variant over time (as opposed to simple systems where causality is fixed). The approach is used to create tools that are more applicable to decision-making the changing social and technological structures that emerge as we move to a different economic structure.

The role of Migration as an Adaptation and its policy implications: the purpose of the research is to assess the economic impacts of climate change in Delta areas. Impacts of flexibility on biofuels policy: assess the impacts of giving more flexibility to EU´S biofuels policy.

Impacts of flexibility on biofuels policy: assess the impacts of giving more flexibility to EU´S biofuels policy.

SOME ACCOMPLISHMENTS:

Additionally, the team continued improving the capacities in quantitative and qualitative tools and models for carrying out state-of-the-art research on the implications (climatic, macroeconomic, distributive and microeconomic) of different policies (energy, climate, soil, Health) at different levels (global, regional, national and sub-national).

MAIN COLLABORATORS

- UPV/EHU
- Technical University of Berlin
- University of Oldenburg
- University of Rome – Roma Tre
- Irena
- Universidad de Castilla la Mancha
- University of Oulu
- LSE
- World Bank
- University of Southampton

MAIN RESEARCH PROJECTS

- TRANSRISK (EU H2020)
- CONSEED (EU H2020)
- DECCMA (CARIAA)
- ENABLE (EU H2020)
- COMPLEX (EU FP7)
- CECILIA 2050 (EU FP7)

SOME HIGHLIGHTED OUTPUTS

- **González-Eguino, M. and Neumann, M.B. 2016. Significant implications of permafrost thawing for climate change control. Climatic Change. DOI 10.1007/s10584-016-1666-5**. This was a relevant output on the use of Integrated Assessment Models to analyse climate feedbacks. Much of the current evidence on permafrost emissions has been published following the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) and has not yet been considered. This new study shows significant consequences when integrating the permafrost carbon feedback into the assessment of the climate change scenarios and mitigation options. According to our simulations, global fossil fuel and industrial CO2 emissions need to peak 5–10 years earlier and the carbon budget needs to be reduced by 6–17 % to offset this additional source of warming.

- **Capellán-Pérez, I., Arto, I., Polanco-Martínez, J.M., González-Eguino, M., and Neumann, M.B. 2016. Likelihood of climate change pathways under uncertainty on fossil fuel resource availability. Energy & Environmental Science 9, 2482-2496.** Future energy transitions are often modelled as demand-driven transformations. This study showed that the consideration of robust and transparent estimates of fossil fuel resources reduces the expected climate response in relation to current IPCC baseline scenarios (i.e. scenarios without additional climate policies). Still, the need for an urgent action against climate change was confirmed. It was also found that the depletion of fossil fuels, which is likely to occur during the second half of the century, would imply an acceleration of the transition to renewable energy sources in baseline scenarios. And that, by the end of the century, the two highest emission pathways from the IPCC, the Representative Concentration Pathways RCP6 and RCP8.5, where the baseline scenarios currently lie, have probabilities of only 42% and 12% of being surpassed. Hence, the integrated analysis of resource availability and climate change emerges as an essential feature to obtain internally consistent climate pathways. This work should be considered in the context of implementing the Paris Agreement.

- **García-Muros, X., Markandya, A., Romero-Jordán,D., González-Eguino, M. 2016 (Forthcoming). The distributional effects of carbon-based food taxes. Journal of Cleaner Production. DOI 10.1016/j.jclepro.2016.05.171.** In this remarkable output of interdisciplinary work in this research line, our team expanded the options of mitigation policies that have focused so far, mainly on the energy and transport sectors to the food sector. This study assessed the implications of levying consumption taxes on food products based on their carbon footprint. This paper analyses also for the first time, the distributional implications of these emerging policies. The results show that carbon-based food taxation tends to be slightly regressive and can have more effect on specific social groups. However, that effect can be ameliorated if exemptions on some basic food products are introduced and can also improve the diet towards the WHO recommendations.

RESEARCH APPLICATION IN THE BASQUE COUNTRY

BC3 often uses the Basque Country as a case study to offer Basque policy-makers state-of-the-art knowledge in its progress towards a low carbon economy. In this vein, we work in different areas such as the improvement of the design of the market-based instruments for energy efficiency promotion, comparisons of different schemes of taxes and subsidies or combinations of both, and evaluation of policies with standard economic tools, as well as with new approaches from behavioural and experimental economics.

3.1 RESEARCH LINES | 3.1.2 Climate and Natural Environment

OBJECTIVES OF THE RESEARCH LINE

Climate change has complex impacts on human well-being. In this research line BC3 is concerned with the scientific study of the interplay between climate change and the environment. We address the interlinkages between climate change, natural capital (natural resources and ecosystems), and the benefits that derive from them in terms of human well-being. The Natural Environment Research Line focuses on both, the role of natural capital assets (stocks of natural resources) and the flows of the benefits that derive through their management (ecosystem services), and the ways they interact with climate change. It therefore includes two related areas of research:

- **Natural Resources** (NR)
- **Ecosystem Services** (ES).

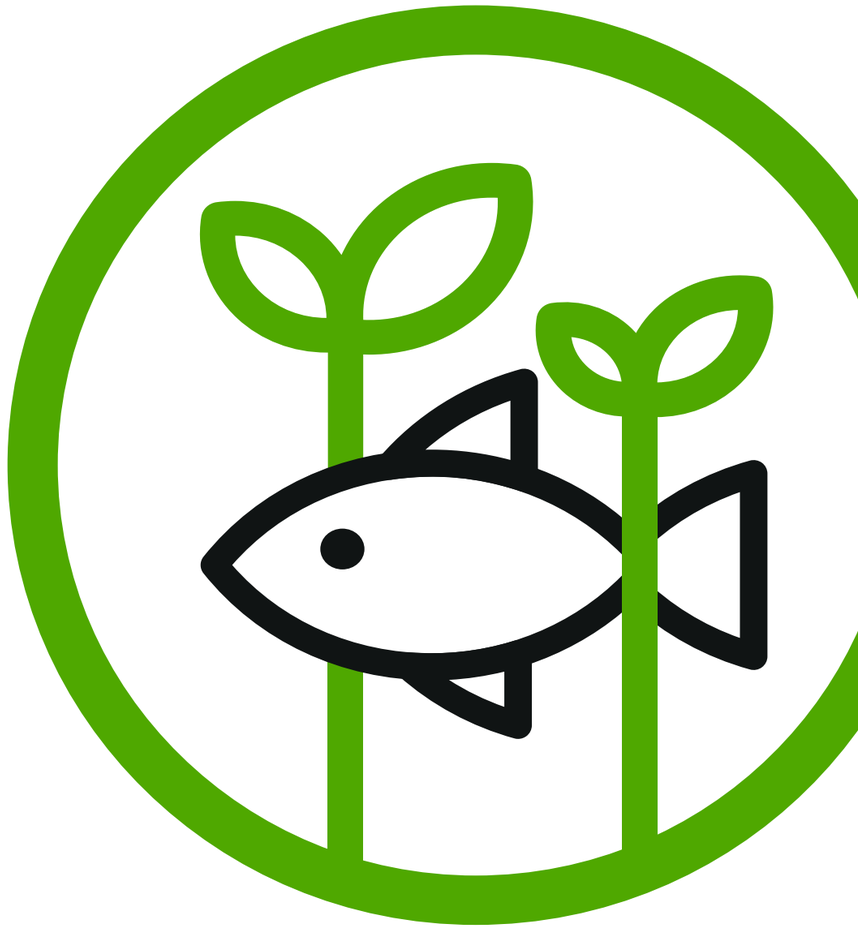
The general objective of Natural Resources (NR) is to investigate the links between climate change and the formation, depletion and exploitation of natural systems and reserves of biotic and abiotic resources. Physical, ecological, social, and economic aspects are considered, all of which are of great relevance for local, national, and international decision-making.

Ecosystem services (ES) are the benefits that societies obtain from NR. These include the direct provision of material goods, such as food, fuel and fibre, as well as the regulation of undesired events, such as climate change and flooding. Many non-material benefits, such as spiritual or aesthetic enjoyment, are also obtained from nature.

Our scientific work at BC3 on NR can be best communicated by mastering the discourse on ecosystem services. This is a key mission of the Natural Environment (NE) Research Line. NE uses the ES as a language that has gained momentum in science and policy after the publication of the Millennium Ecosystem Assessment. As a science-policy interface, using an ecosystem services framework, allows NE to focus on connecting climate change with human well-being through the management of NR and ecosystems. The language of ES is unique for being both rooted in science and understood by policy makers. By focusing directly on benefits to humans through ES, form BC3 we can bridge climate change science and decision-making, allowing the consequences of action to be understood by all actors.

The physical, biological, economic and political ecology strands of the NE Research Line necessitate integrative research methodologies. Further, research in NE inherently requires an effort to gather and organize field data for detailed multi-scale analyses and modelling applications. It should be emphasized that our studies are not constrained by the use of existing models and tools. Rather, we also develop our own new mathematical, empirical, and computational models and tools, which are best suited to investigate particular issues out of the many dimensions of Climate Change (spatial, temporal, social, cultural, economic, etc.).

To this aim, we use a variety of methods, ranging from multiscale modelling and renormalization to artificial intelligence and network flow analysis. For example, the NE Research Line is at the forefront of this innovation through the development of novel physical models (e.g. continuous diversity) and methodologies such as ARIES (www.ariesonline.org), one of a few methodologies to quantify physical flows of benefits and model the way they translate into economic value and well-being. Other research methods at the core of NE are based on the use of spatially explicit databases, life-cycle analysis, inventories and socio-economic approaches (e.g. cost benefit analysis, multicriteria analysis, behavioural economics, bio-economic modelling), hydro-economic modelling, and stakeholder participatory analyses. The range of methods and focus on integrating them is one of the core scientific values of the NE.



3.1 RESEARCH LINES | 3.1.2 Climate and Natural Environment

2016 RESEARCH IN ACTION: TOPICS

Development and testing of integrated models to assess the potential of green/natural infrastructure to build climate resilient sustainable development policies: Test and demonstrate approaches to using portfolios of built and natural water infrastructure development to achieve more optimal outcomes for the multiple goals of poverty reduction, water-food-energy security, biodiversity conservation and climate resilience.

Systems-based approaches for integrated mitigation and adaptation strategies in agriculture at different spatial and temporal scales: Modelling the effect of new low-protein cow diets on overall GHG emissions; Review of grassland-based EU farm-level modelling approaches for research on integration of GHG mitigation and adaptation strategies; Modelling N2O emissions from most common cropping systems in Spain using the DNDC model; Modelling GHG emissions from bioenergy cropping systems in the Basque Country; Simulating the effect of climatic and management conditions on the main interactions between carbon and nitrogen and sustainability of dairy farms in the Basque Country; Simulation of livestock housing climate for region-specific barn concepts and climate boundary conditions; Strategies for adapting ruminant livestock systems to climate change in different regions of Europe Potential EU network on mitigation of GHG emissions from agricultural systems; Risk analysis and natural resources to identify optimal adaptation strategies to climate change: Adaptation strategies to environmental risks (drought) in agriculture.

Developing theoretical frameworks, and methods to assess the role of biodiversity for ES delivery and its impact on the adaptive capacity of the poor to climate change stressors.

Development of scientific research on ES that supports climate policy in the Basque Country: specific sectorial levels addressed (e.g. agriculture, forest, water and natural protected areas). This includes integrated strategies on: **(I)** drought and flooding, **(II)** forest and agricultural management, **(III)** soil management, **(IV)** sea level rise, **(V)** freshwater provision and **(VI)** biodiversity conservation.

Integrating bioeconomic models across temporal and spatial scales that link biodiversity, ecological processes, ecosystem services and social well-being: Connecting biodiversity to ecosystem services with regard to the role of soil biodiversity in agricultural soils.

Marine ecosystem services and adaptation strategies.

Sea-level rise scenarios for the Basque coast and related economic impacts.

Climate Change in Extreme Environments: The Cryosphere: We investigate how the cryosphere (ice sheets, glaciers, sea ice, icebergs, snow, and permafrost) records, affects, and responds to climate change on diverse size and time scales.

Climate Change in Extreme Environments: Natural Hazards.

Ecosystem Dynamics in a Changing Climate: Biodiversity Change.

Ecosystem Dynamics in a Changing Climate: Populations with Continuous Diversity.

SOME ACCOMPLISHMENTS:

- During 2016, the CNE line has been very active in international science and policy, particularly through the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES). We were represented by Prof. Unai Pascual in the Multidisciplinary Expert Panel and by Dr. Ignacio Palomo as fellow in the Global Assessment report (Chapter 4). Prof. Pascual has been the chair of the group 'Values Group of IPBES', leading the development of the conceptual framework of values called 'nature's contributions to people' and has also been a member of the Management Committee of the Global Assessment.

- ARIES team, led by Prof. Ferdinando Villa, disseminated the methods of analysis of ecosystem services globally, among others, in a workshop was held in ICIMOD (Kathmandu) in November 2016. In addition, within the group and through a project financed by the MINECO "Retos program" and by the Basque Government, the group is analyzing the Ecosystem Services Payments (PRS) to contribute to environmental and social objectives (equity) with cases of Study in Latin America. This work will result in a doctoral thesis.

- The senior researcher, Dr. David Moreno is researching, funded by MINECO "Retos Programme" empirically, how the effects of anthropogenic alterations on ecosystems evolve over centuries-old time scales and how biodiversity and ecosystem functionalities are compromised in long periods of time.

- Within this multidisciplinary line, conceptual models for adapting to climate change are also being studied, incorporating and improving the capacity to capture inter sectoral perspectives through cognitive maps that allow, for example, to understand how heat waves affect different sectors and how these impacts Interact with each other. This analysis conducted by Dr. Marta Olazabal has resulted in a study that addresses complexity and unintended consequences.

- The role of thresholds and non-linearity in the delivery of ecosystem services by green infrastructures, has been researched, as well as the economic analysis of adaptation strategies with variable time thresholds.

- Dr. Agustín del Prado's group focused its research on the development and use of scenarios in mitigation and adaptation models for different agricultural systems (greenhouse gas emissions, pollution, carbon sequestration in the agricultural and livestock industry, and climate-smart solutions to relieve heat stress in European dairies).

- BC3 was granted with the ERC Starting Grant CLOCK "Climate Adaptation to Shifting Stocks" research project lead by Dr. Elena Ojea.

3.1 RESEARCH LINES | 3.1.2 Climate and Natural Environment

MAIN COLLABORATORS

- UPV/EHU
- BCAM
- NEIKER
- CIEMAT
- Univ. Miguel Hernández de Elche
- CSIC
- Greenwich University
- McGill University
- ETH Zurich
- University of Bordeaux
- University of Leicester
- Osnabrueck University
- ICIMOD
- CIFOR
- Université Laval
- Colorado State University
- NIPR
- Nagaoka University of Technology

among others.

MAIN RESEARCH PROJECTS

- CLOCK (ERC Starting Grant)
- AQUACROSS (EU H2020)
- ISAGE (EU H2020)
- ECONADAPT (EU FP7)
- OPTIBARN (ERA-NET)
- ESPERA (MINECO RETOS)
- REBECOM (MINECO RETOS)
- SEES (Basque Government - Proyectos investigación)
- DEFRA (UK Department for Environment, Food & Rural Affairs)
- ATLANTIC ACTION PLAN (EU DG-MARE Contract)
- TObeWELL (Cost Action)

among others.

SOME HIGHLIGHTED OUTPUTS

1. Ganzedo, U., J.M. Polanco-Martínez, A.M. Caballero-Alfonso, S.H. Faria and J.J. Castro-Hernández (2016). Climate effects on historic bluefin tuna captures in the Gibraltar Strait and Western Mediterranean. Journal of Marine Systems 158: 84–92.

2. An unprecedented integrated assessment of the potential of different management practices for mitigating 46 specific components of the total GHG budget (N2O and CH4 emissions and C sequestration) of Mediterranean agro-systems was accepted in Agriculture, Ecosystems and Environment by Sanz-Cobena et al. (3 authors from BC3: A. Del Prado, G. Pardo and M.J. Sanz).

3. A comprehensive assessment of the transparency and robustness of GHGs fluxes from forest, and reasons of discrepancies from top down scientific estimated fluxes and bottom up was done to shape the near future support to research and action in this filed. The conclusions are critical to move towards the reconciliation of conflicting GHGs estimates emerging for the latest top scientific papers on the issue and the national GHGs inventories that follow the IPCC methodological guidance and Paris Agreement transparency discussions. Publication for a high impact scientific journal is under preparation.

4. Weikusat, I., Jansen, D., Binder, T., Eichler, J., Faria, S.H., Wilhelms, F., Kipfstuhl, S., Sheldon, S., Miller, H., Dahl-Jensen, D., Kleiner, T. 2016. Physical analysis of an Antarctic ice core—towards an integration of micro- and macrodynamics of polar ice. Philosophical Transactions of The Royal Society A-Mathematical Physical And Engineering Sciences. 375. (2086) DOI (10.1098/rsta.2015.0347).

5. Zabala, A., Pascual, U. 2016. Bootstrapping Q Methodology to Improve the Understanding of Human Perspectives. PLoS One. 11. (2) e0148087. DOI (10.1371/journal.pone.0148087).

6. Chan, K., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., Gould, R.K., Hannahs, N., Jax, K., Klain, S.C., Luck, G., Martín-López, B., Muraca, B., Norton, B., Ott, K., Pascual, U., Satterfield, S., Tadaki, M., Taggart, J., Turner. 2016. Why Protect Nature? Rethinking Values and the Environment. Proceedings of the National Academy Of Sciences of the United States of America. 113. (6) 1462–1465. DOI (10.1073/pnas.1525002113).

APPLICATION IN THE BASQUE COUNTRY

The Basque Country is an ideal region to analyse the interlinkage between climate change and human well-being through the impacts on the natural environment. The multi-tiered institutional structure of the Basque Country creates a fertile ground for applying the research conducted under the CNE research line in order to understand how its institutional structures can be optimized in the face of climate change through an integrated management of natural capital assets and the flow of ecosystem services at multiple social and ecological scales.

At BC3, through the NE Research Line, we are committed to developing new tools to support policy in the Basque Country with an ecosystem services-centric decision making prism to achieve environmentally sustainable, economically efficient and socially acceptable management of natural habitats, as well as the definition of new incentives and mechanisms for an integrated management of ecosystems services.

3.1 RESEARCH LINES | 3.1.3 Health and Climate

OBJECTIVES OF THE RESEARCH LINE

Climate change addresses not only environmental and development issues, but it also represents a big threat to human health, and in the public mind, this impact gives rise to great concern. Health assessment in BC3 focuses on these threats, and analyses in this context the social, economic and behavioural factors that influence vulnerability of people, communities and social systems. This social dimension is however not fully integrated in the decision policy yet, and BC3 research line on health attempts to contribute in filling this gap.

Climate affects health through direct and indirect pathways. The expected increase in temperature will have a direct impact on both the incidence and the geographic distribution of climate-sensitive health outcomes, such as those related to heat waves, floods and infectious diseases. Human health will also be indirectly impacted by increased pressure via other pathways affecting natural and socio-economic systems, such as air pollution, ecosystem services, water, agriculture and food. On all these pathways, there are still considerable uncertainties. Yet the need for policy action is strong, in the form of capacity building, drawing up appropriate adaptation plans, and ensuring that health is appropriately considered in decision making related to other sectors, such as energy, transportation and agriculture.

In addition to the above, another important link between climate policy and health is in the area of co-benefits. Measures taken to reduce emissions of GHGs (e.g. sustainable policies on household energy, agriculture, transport) can often also reduce local pollutants such as particulate matter that have a detrimental effect on the health of the population. This means that the cost of a shift to sources of energy that have low GHG emissions is lower than would be the case of such benefits were not taken into account. At the same time, these benefits can provide strong political motivation.

The Health Research Line can be seen as a seed area that is developing along with all the other related research lines (Low Carbon, Natural Environment and Climate Policy). We are working with some of the leading research groups in the world on these issues in well-defined areas that address some important questions. The methodologies employed are diverse, including epidemiological and socio-economic models in the frames of health economics, environmental economics, health impact assessment, environmental impact assessment, environmental fate analysis, and uncertainty analysis.

3.1 RESEARCH LINES | 3.1.3 Health and Climate

2016 RESEARCH IN ACTION: TOPICS

Health impacts and costs/benefits of adaptation and mitigation strategies

Health vulnerability indicator

Human health and ecosystems

Application to national and local contexts

MAIN COLLABORATORS

- UPV/EHU
- Universidad of Alcalá (Spain)
- Universidad de Valencia (Spain)
- UPM (Spain)
- Aarhus University (Denmark)
- Centro Euro-Mediterráneo per i Cambiamenti Climatici (Italy)
- London School of Hygiene and Tropical Medicine (United Kingdom)
- Charles University (Czech Republic)
- Queen's University (Ireland)
- University of Leicester (United Kingdom)
- Amherst College (USA)
- University of Massachusetts (USA)
- University of Texas (USA)
- National Taiwan University (Taiwan)
- Université de Bordeaux (France)
- Universidad de las Palmas de Gran Canaria (Spain).

MAIN RESEARCH PROJECTS

- INHERIT (EU H2020)
- BASE (EU FP7)
- GLANCE (MARIE SKLODOWSKA CURIE (NSC-H2020))
- OSATU (IHOBE - KLIMATEK)
- TOBEWELL (COST ACTION)

SOME HIGHLIGHTED OUTPUTS

The team strengthened its network of collaborators in 2016, especially with environmental and scientific economists with experience in health economics, environmental economics, health and environmental impact analysis, citizen participation measures and uncertainty analysis.

An innovative research on ways in which diet change can help to attain health improvements as well as to reduce greenhouse gases.

- A. Markandya, I. Galarraga, L.M. Abadie, J.Lucas-Rueda and J. Spadaro. 2016. **What Role Can Taxes and Subsidies Play in Changing Diets? An Application from Spain.**, FinanzArchiv/Public Finance Analysis, 72, 1, 175-201.

3.1 RESEARCH LINES | 3.1.4 Climate Policy

OBJECTIVES OF THE RESEARCH LINE

The research line "Regional, National and International Climate Policy" focuses, as the title suggests, on the policy-side of climate research. Sound policy of course is based on the results of work done under the other research lines (Low Carbon, Natural Environment, and Health), but it also involves some further lines of investigation. This research line therefore involves drawing out the policy implications of the research undertaken under the other lines as well as undertaking research on issues directly related to the formulation of policy.

The methodologies employed are diverse and include – amongst others – micro-simulation models, CGE-modelling, multi-criteria analysis, cost-benefit analysis, game theory, and integrated assessment modelling.

Both adaptation and mitigation policies are topics of the research in this research line and much of it is aligned with energy aspects (e.g., using economic instruments to influence energy use in a sustainable way, vulnerability of the electricity sector). With respect to international policy, thematic foci of the mid-term research strategy are international environmental agreements and international climate finance. These involve aspects such as ancillary benefits, green bonds and private financing, instruments to ensure fairness and sustainable development while pursuing climate goals. Concerning national policy, the mid-term strategy is concerned with market-based instruments (e.g. environmental tax reform), technology and innovation policy and adaptation to climate change.

The role of regional and local governments in climate protection plays also an important role in the research line with special emphasis in supporting the Basque Climate Policy.

One of the most relevant activities of this group is related to the participation of BC3 researchers as scientific experts in the most important international scientific organization that deals with climate change: the IPCC (Intergovernmental Panel of Climate Change) of the United Nations. We have actively contributed to its 5th Assessment Report (AR5), released in 2014 and we are also contributing to the next (6th) Assessment Report. This is the main report that this organization produces every 6 years and has deep global policy implications.

At BC3 we also help to define with the policy makers the strategic positioning of regional and national bodies in climate negotiations (such as the Conference of the Parties or COP or the EU). We closely follows and attend all COP meetings and have actively participated in the drafting of the Climate Change Plan for the Basque Government.

See Section POLICY RELEVANT KNOWLEDGE TRANSFER.

3.1 RESEARCH LINES | 3.1.4 Climate Policy

2016 RESEARCH IN ACTION: TOPICS

Exploiting the full potential of economic instruments to contribute to achieving the EU's greenhouse gas emissions reduction objectives for 2050.

Economic valuation of climate change adaptation in Spain: the case of water.

Design and evaluation of Energy Efficiency Programmes.

Exploring the potential for Environmental Fiscal Reform in Spain.

Better measurement of emissions from land use and policies to improve IPCC/ GHG inventories for agriculture and land use methodologies.

Support in the elaboration of plans and programs linked with climate change.

SOME ACCOMPLISHMENTS:

- During the year 2016 the application of the theory of "real options" and stochastic modeling was investigated for the analysis of energy problems and also of the measures of adaptation.
- Other applications investigated were "ancillary" benefits, Green bond and private finance or the instruments to ensure justice and sustainable development in pursuit of climate objectives.
- With regard to the investigation of national policies, the medium-term strategy was oriented towards the study of market instruments, and policies for innovation and adaptation to climate change.
- The role of local and regional governments in protecting the environment also played an important role in the strategic research objectives of this line during the year .
- One of the most relevant activities of this group was related to the participation of BC3 researcher as scientific experts in the most important international scientific organization that deals with climate change: the IPCC (Intergovernmental Panel of Climate Change) of the United Nations. BC3 actively contributed to its 5th Assessment Report (AR5), released in 2014 and is also contributing to the next (6th) Assessment Report. This is the main report that this organization produces every 6 years and has deep global policy implications. It is worth highlighting the active participation of BC3 in the COP 22 climate change summit held in Marrakesh in November-December 2016.
- During 2016, this line also contributed to the setting up of the "INCCCETT 4CB - International Climate Change Centers of Excellence and Think Tanks for Capacity Building" launched at the COP 22 summit, of which we are founder member.
- And finally, we also helped to define with the policy makers the strategic positioning of regional and national bodies in climate negotiations (such as the Conference of the Parties or COP or the EU). The BC3 closely follows and attends all COP meetings and has continued collaborating with national and regional policy-makers to support their decisions.

MAIN COLLABORATORS

- UPV/EHU
- City Council of Bilbao
- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – CIEMAT
- Fondazione Eni Enrico Mattei
- TNO - Netherlands Organisation for Applied Scientific Research
- Economics for Energy
- World Bank
- IHOBE
- CICERO
- Danish Board of Technology
- University of Bath
- European Environmental Agency
- Nagaoka University of Technology.

MAIN RESEARCH PROJECTS

- RESIN (EU H2020)
- CICEP (Collaboration Agreement)
- ENABLE (EU H2020)
- REMEDISOST (IHOBE)
- ECONADAPT (EU FP7)
- BRODISE (EU H2020)
- CONSEED (EU H2020)

SOME HIGHLIGHTED OUTPUTS

- Sanz, M.J. and Penman, J. (2016). **An overview of REDD+.** Unasylva 246 (67): 21-30; and Sanz, M.J. (2016). UN-REDD, the United Nations programme to reduce emissions from deforestation and forest degradation (2008–2015). Ibid. 31-36.
- Markandya, A. (2016), **"Cost benefit analysis and the environment: How to best cover impacts on biodiversity and ecosystem services"**, OECD Environment Working Papers, No. 101, OECD Publishing, Paris. DOI 10.1787/5jm2f6w8b25l-en.

RESEARCH APPLICATION IN THE BASQUE COUNTRY

The Basque Country counts on with a high level of self-government, including taxation. In terms of specific policies, the region has been recognized by EU institutions and the United Nations as one of the most active regions in climate change policy during the last years. Hence, it can be stated that the Basque Country has not only the capacity and the legal framework to deal with climate change policy, but also the willingness to do so. Specifically, the research activities applicable to the context of the area are the following:

- Mitigation Policy related issues: Design of instruments to reduce greenhouse gases at regional, national and global levels; Policies to promote low-carbon economies; Uncertainty and climate policy: diverse tools to design bestpolicies to address climate change in the face of huge uncertainties and the long time periods involved.
- Adaptation Policy related issues: Biophysical and socioeconomic impact assessment: health, agroforestry, ecosystems, water and infrastructure related; Costs and benefits of adaptation measures; Design of optimal adaptation strategies.
- Support and dissemination.

See Section POLICY RELEVANT KNOWLEDGE TRANSFER.

3.2 RESEARCH PROJECTS

ONGOING RESEARCH PROJECTS

European Commission or other international funding programs

CONSEED - "CONsumer Energy Efficiency Decision Making"	H2020-EE-2016-RIA-IA
ENABLE "Enabling the Energy Union through understanding the drivers of individual and collective energy choices in Europe"	H2020-LCE-2016-2017 submitted for H2020-LCE-2016-RES-CCS-RIA
ALICE "AcceLerate Innovation in urban wastewater management for Climate changE"	H2020-MSCARISE-2016
ISAGE "Innovation for Sustainable Sheep and Goat Production in Europe"	H2020-SFS-2015-2
INHERIT "INter-sectoral Health Environment Research for InnovaTions"	H2020-PHC-4-2015
CLOCK "Climate Adaptation To Shifting Stocks"	H2020 - ERC-StG-2015
BRODISE - BROWNFIELD Decontamination In Southern Europe	H2020-SC5-2014
TRANSRISK - Transitions pathways and risk analysis for climate change mitigation and adaption strategies	H2020-SC5-3-2014
RESIN_Climate Resilient Cities and Infrastructures	H2020-DRS-9-2014
AQUACROSS - Knowledge, Assessment, and Management for AQUAtic Biodiversity and Ecosystem Services aCROSS EU policies	H2020-SC5-6-2014
GLANCE - calculatinG heaLth impActs of atmospheric pollutioN in a Changing climatE	H2020-MSCA-IF-2014-EF - Marie Sklodowska-Curie Individual Fellowships (IF-EF)

BASE "Bottom-up Climate Adaptation Strategies towards a Sustainable Europe"	EC FP7-ENV-2012-two-stage (European Commission)
COMPLEX "Knowledge Based Climate Mitigation Systems for a Low Carbon Economy"	FP7-ENV-2012-two-stage (European Commission)
ECONADAPT "Economics of climate change adaptation in Europe"	EC FP7-ENV.2013.6.1-6
CECILIA 2050 "Choosing Efficient Combinations of Policy Instruments for Low-carbon development and Innovation to Achieve Europe's 2050 climate targets"	EC-FP7-ENV-2012
ASSETS "Attaining Sustainable Services from Ecosystems"	NERC-ESPA Programme (Ecosystem Services for Poverty Alleviation)
WISER "Which Ecosystem Service Models Best Capture the Needs of the Rural Poor?"	NERC-ESPA Programme (Ecosystem Services for Poverty Alleviation)
"Optimising the efficiency of dietary nitrogen use to reduce emissions and waste in dairy systems"	UK Department for Environment, Food & Rural Affairs
WISE-UP "Water Infrastructure Solutions from Ecosystem Services Underpinning Climate Resilient Policies and Programmes"	International Climate Initiative 2012 (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)
DECCMA "DEltas, vulnerability and Climate Change; Migration as an Adaptation"	Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA)
FRONTIERS "Landscapes in transition: synthesising knowledge on trade-offs between land use changes, ecosystem services and wellbeing"	NERC-ESPA 2016 Grants

3.2 RESEARCH PROJECTS

ONGOING RESEARCH PROJECTS

MINECO or Spanish Institutions

CAUSE "Comparative Assessment and Valuation of Ecosystem Services in Agro-Forest systems: a methodology for Land Use Policy prioritization"	MINECO – Spanish Ministry for Economy and Competitiveness (Plan Nacional de Proyectos de investigación fundamental no orientada 2012)
REBECOM "Estimación del tiempo de recuperación de bosques templados tras impactos antropogénicos históricos a lo largo de un gradiente de complejidad"	MINECO – Spanish Ministry for Economy and Competitiveness (Programa Estatal de I+D+i Orientada a los Retos de la Sociedad 2015)
CLIMAECON "Políticas climáticas y transición a una economía baja en carbono"	MINECO – Spanish Ministry for Economy and Competitiveness (Programa Estatal de I+D+i Orientada a los Retos de la Sociedad 2015)
ESPERA "La Equidad Social en los Pagos por Servicios Ambientales (PSA): Una Perspectiva Socio- Ecológica"	MINECO – Spanish Ministry for Economy and Competitiveness (Programa Estatal de I+D+i Orientada a los Retos de la Sociedad 2015)
OPTIBARN "Optimised animal specific barn climatisation facing temperature rise and increased climate variability"	MINECO – National Institute for Agricultural and Food Research and Technology (INIA) (FACCE ERA-NET Plus Initiative Climate Smart Agriculture)

Basque Government or Basque Institutions

"The role of Social Equity in the Governance of Nature: A Social-Ecological approach"	Basque Government
OSATU "Olas Dde Calor y Salud: Impactos y Adaptación en EUSKADI" (Heatwaves and Health: Impacts and Adaptation at the Basque Country)	Klimatek I+B+G 2016 "Proyectos I+D, Innovación y demostración en adaptación al cambio climático"
REMEDISOST "Diseño de una Metodología para la Evaluación de la Sostenibilidad De Planes de Remediación de Suelos Contaminados" (Design of a Methodology for the Evaluation of the Sustainability of Contaminated Soil Remediation Plans)	Proyectos de Ecoinnovación durante el ejercicio 2016. IHOBE

Other Funding Agencies

CICERO - BC3 agreement	Centre for International Climate and Energy Policy (CICEP)
Collaboration agreement	Osnabruck University
Analysis and Assessment On Determining Drivers of Global Land Use Change	The Food and Agriculture Organization of the United Nations (FAO)
The Potential of Sustainable Land Management Practices to Create Synergies Between Addressing Desertification, Land Degradation and Drought, and Climate Change Mitigation and Adaptation	United Nations Convention to Combat Desertification (UNCCD)
Forecasting Sustainability of Productive Landscapes Across Environmental, Social, Political, Climatic and Economic Dimensions in San Martín, Peru	Conservation International

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

European Commission or other international funding programs

H2020_CONSEED

GRANT AGREEMENT:	GA 723741
NAME OF THE PROJECT:	CONSEED - "CONsumer Energy Efficiency Decision Making"
FUNDING AGENCY:	The European Union Horizon 2020 research and innovations programme
TYPE:	H2020-EE-2016-RIA-IA
TIME FRAME:	2016-2019
FUNDING:	359.635 €
PARTNERS:	**The Provost, Fellows, Foundation Scholars & The Other Members of Board of The College Of The Holy & Undivided Trinity Of Queen Elizabeth Near Dublin (Tcd) –** Coordinator **Cicero Senter Klimaforskning Stiftelse (Cicero)** **Asociacion Bc3 Basque Centre For Climate Change - Klima Aldaketa Ikergai (BcC3)** **Univerza V Ljubljani (Ul)** **Agricultural University of Athens (AUA)**

Project Description

Consumers do not minimize the total costs of their energy-consuming investments due to a range of market and non-market based failures. This is known as the 'Energy Efficiency Gap'. To reduce the gap and provide customers with energy consumption information, the EU has mandated that electrical appliances, cars and buildings carry information to indicate their energy consumption.There is a large knowledge gap in terms of understanding which factors are salient in consumers' decisions, the relative importance of these factors and how these factors change by consumer group and product type. The key idea behind CONSEED is to understand how consumers make decisions which involve an energy component, and to make (energy) operating costs more salient to consumers at the point of purchase to increase efficient behaviour.CONSEED will involve four key steps: Step **1)** Develop a theoretical framework to base our work on the best available knowledge in the field and Step **2)** Collect empirical data on consumer behaviour through a range of different methods. Our project will involve 27 focus groups, eleven large consumer surveys, three field experiments, and three discrete choice experiments, with tailored treatments to generate a novel database consisting of empirical evidence on the salient factors impacting on the consumer decision making process. Step **3)** will validate the theoretical models using our empirical data. Step **4)** will deliver evidence-based research on consumer decisions involving an energy component that will enable better, more efficient and effective energy policy. Many of the challenges relating to energy efficiency policy derive from the large number of factors which potentially play a role in influencing ultimate consumer decisions. CONSEED research will directly investigate the relative importance of these factors and isolate the aspects which are likely to provide the greatest impact in terms of future energy efficiency policy.

Key BC3 researchers involved

Prof. Anil Markandya
Mari Mar Solá
Dr. Ibon Galarraga
Dr. Amaia de Ayala
Dr. Luis Mª Abadie

Link with BC3 Research Line

Low Carbon
Climate Policy

Acknowledgement

CONSEED has received funding from the European Union's Horizon 2020 Programme for Research, Technological Development and Demonstration under Grant Agreement no. 723741.

URL Address

http://www.conseedproject.eu/

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

European Commission or other international funding programs

H2020_ENABLE

GRANT AGREEMENT:	GA 727524
NAME OF THE PROJECT:	ENABLE "Enabling the Energy Union through understanding the drivers of individual and collective energy choices in Europe"
FUNDING AGENCY:	The European Union Horizon 2020 research and innovations programme
TYPE:	H2020-LCE-2016-2017 submitted for H2020-LCE-2016-RES-CCS-RIA
TIME FRAME:	2016-2019
FUNDING:	344.563 €
PARTNERS:	**Istituto Di Studi Per L'integrazione Dei Sistemi Sc (Isinnova)** – Coordinator **Notre Europe - Institut Jacques Delors Association (JDI)** **Center for The Study Of Democracy (CSD)** **Cicero Senter Klimaforskning Stiftelse (Cicero)** **BC3 Basque Centre For Climate Change - Klima Aldaketa Ikergai** **Cambridge Econometrics Limited (CE)** **Rekk Energiapiaci Tanacsado Kft (Rekk)** **Ekonomski Institut Ad Beograd (EI)** **Westfaelische Wilhelms-Universitaet Muenster (WWU)** **Centre For Global Studies Strategy Xxi (Cgs21)** **Polski Instytut Spraw Miedzynarodowych (PISM)** **London School Of Economics And Political Science (Gri-Lse)**

Project Description

The Energy Union Framework Strategy laid out on 25 February 2015 has embraced a citizens-oriented energy transition based on a low-carbon transformation of the energy system. The success of the energy transition pillar in the Energy Union will hinge upon the social acceptability of the necessary reforms and on the public engagement in conceptualizing, planning, and implementing low carbon energy transitions. The ENABLE.EU project will aim to define the key determinants of individual and collective energy choices in three key consumption areas - transportation, heating & cooling, and electricity – and in the shift to presumption (users-led initiatives of decentralised energy production and trade). The project will also investigate the interrelations between individual and collective energy choices and their impact on regulatory, technological and investment decisions. The analysis will be based on national household and business surveys in 11 countries, as well as research-area-based comparative case studies. ENABLE.EU aims to also strengthen the knowledge base for energy transition patterns by analysing existing public participation mechanisms, energy cultures, social mobilisation, scientists' engagement with citizens. Gender issues and concerns regarding energy vulnerability and affluence will be given particular attention. The project will also develop participatory-driven scenarios for the development of energy choices until 2050 by including the findings from the comparative sociological research in the E3ME model created by Cambridge Econometrics and used extensively by DG Energy. The findings from the modelling exercise will feed into the formulation of strategic and policy recommendations for overcoming the gaps in the social acceptability of the energy transition and the Energy Union plan. Results will be disseminated to relevant national and EU-level actors as well as to the general public.

Key BC3 researchers involved

Prof. Anil Markandya
Alessandro Silvestri
Dr. Ibon Galarraga
Dr. Amaia de Ayala
Dr. Luis Mª Abadie

Link with BC3 Research Line

Low Carbon
Climate Policy

Acknowledgement

ENABLE.EU has received funding from the European Union's Horizon 2020 Programme for Research, Technological Development and Demonstration under Grant Agreement no. 727524.

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

European Commission or other international funding programs

H2020_ALICE

GRANT AGREEMENT:	GA 734560
NAME OF THE PROJECT:	ALICE "AcceLerate Innovation in urban wastewater management for Climate changE"
FUNDING AGENCY:	The European Union Horizon 2020 research and innovations programme
TYPE:	HORIZON 2020-MSCA-RISE-2016
TIME FRAME:	2016-2020
FUNDING:	36.000 €
PARTNERS:	**University of Ulster** – Coordinator **Northern Ireland Water Ltd** **The Queen's University of Belfast** **Dublin City University** **Dionergy Ltd** **BC3 Basque Centre For Climate Change - Klima Aldaketa Ikergai** **Centro De Investigaciones Energeticas, Medioambientales Y Tecnologicas-CIEMAT** **Región De Murcia** **Universita Degli Studi Di Macerata** **Redinn Srl** **Aset** **University of Cyprus** **Militos Symvouleutiki A.E.**

Project Description

The challenges facing society in urban wastewater management cannot be solved by any one sector alone. ALICE (AcceLerate Innovation in urban wastewater management for Climate changE) will accelerate innovation by bringing together and exchanging knowledge between the key players who can, together, address the future techno-economic, governance and societal challenges arising from climate change. It will boost international and interdisciplinary skills, as well as careers perspective of Experienced Researchers, Early Stage Researchers, and the workforce of industry, water utilities and public organizations. The results will **1)** benefit water utilities, **2)** support political and managerial decisions in wastewater, **3)** benefit wastewater equipment manufacturers, identifying new market opportunities in the EU, **4)** benefit EU citizens from the improved wastewater infrastructure, the environment and job creations. Higher precipitation and more frequent storms will require change in sewer water management. Moreover, higher risks of water scarcity and droughts require increased wastewater reuse, currently at 20% of its potential in the EU. These changes will lead to increased energy demand in a sector that is already a major contributor of carbon emissions. ALICE will promote effective solutions based on innovative technologies, green infrastructures, climate vulnerability assessments, governance and economic models, embracing stakeholders' and citizens' views to overcome barriers to the acceptance and uptake of new technologies. The excellence of the project lies in the joined-up thinking of different perspectives and disciplines. Academic and non-academic partners along the wastewater value-chain will exchange knowledge, develop training, research and innovation activities. ALICE will build lasting knowledge and cooperation networks and will provide the non-academic sector with practical solutions to respond in innovative ways to the challenges posed by climate change.

BC3's contribution to the project

Develop a general framework for the vulnerability assessment which includes **(I)** compiling of climate and socioeconomic information; **(II)** evaluating the climate sensitivity and **(III)** determining the adaptive capacity. The framework will be applied to Belfast and Murcia.

Key BC3 researchers involved

Dr. Marc Neumann
Dr. Sebastien Foudi
Dr. Elisa Sainz de Murieta
Dr. Josue Polanco
Dr. Marta Olazabal
Alina Tepes

Link with BC3 Research Line

Climate and Natural Environment

Acknowledgement

ALICE has received funding from the European Union's Horizon 2020 Programme for Research, Technological Development and Demonstration under the Marie Sklodowska-Curie Grant Agreement no. 734560

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

European Commission or other international funding programs

H2020_ISAGE

GRANT AGREEMENT:	GA 679302
NAME OF THE PROJECT:	ISAGE "Innovation for Sustainable Sheep and Goat Production in Europe"
FUNDING AGENCY:	The European Union Horizon 2020 research and innovations programme
TYPE:	H2020-SFS-2015-2
TIME FRAME:	2016-2020
FUNDING:	474.259 €
PARTNERS:	Aristotle University of Thessaloniki - Coordinator ● Kentro Genetikis Beltiosis Zoon Neas Mesimvrias ● LEVER S.A. Development Consultants LEVER ● Agricultural Cooperative of Pieria Sheep and Goat Farmers ● Agricultural Livestock Cooperative of Western Greece ● Luke- National Resource Institute Finland ● ProAgria Association of Rural Advisory Centers ● Institut National de la Recherche Agronomique L'Institut de l'Elevage ● Capgenes ● Comite National Brebis Laitieres ● European Federation of Animal Science ● Universita Politecnica delle MarcheIstituto per la Certificazione Etica ed Ambientale ● Mediterranean Agronomic Institute of Zaragoza /International Centre for Advanced Mediterranean Agronomic ● Instituto Nacional de Investigacion y Tecnologia Agraria y Alimentaria Agencia Estatal Consejo Superior de Investigaciones Científicas ● BC3 Basque Centre for Climate Change – Klima ● Carnes Oviarogon SCL ● CABRANDALUCIA Federacion Andaluza de Asociaciones de Ganado Caprino de Raza Pura ● ASSAFE (ES); ARDIEKIN SL ● Asociación Nacional de Criadores de Ganado Ovino Selecto de Raza Manchega ● Asociacion Espanola de Criadores de Ovino Selecto de Raza Lacaune ● Nigde University ● Ataturk University ● Pan Hayvancilik Gida Sanayi Tic LTD ● Red Rock Agricultural Pastoral Tarim Limited Sirketi ● Gaziantep Ili Damizlik Koyun Keçi Yetistiricileri Birligi ● Scotland's Rural College ● Organic Research Centre ● National Sheep Association ● The Agriculture and Horticulture Development Board ● Yorkshire Dairy Goats

Project Description

iSAGE will enhance the sustainability, competitiveness and resilience of the European Sheep and Goat sectors through collaboration between industry and research. iSAGE have a powerful consortium with 18 industry representatives from various EU production systems and socio-economic contexts. The sheep and goat sector will be investigated because it is sensitive to general socio-economic, demographic, and ecological and market challenges; nevertheless, the project's approach and results will be made available and disseminated to other EU livestock industries. Therefore, at the core of iSAGE is a participatory approach centered on a multi-actor internal and external communication (WP) to build the project from the farmer level. This approach will ensure relevant issues are addressed and the project outcomes are applicable in practice and create a farm-level observatory and knowledge exchange network on the sustainability of livestock. This WP will also assist three assessment work packages that will deal with the sustainability assessment of sheep and goat farm systems and related supply chains, with socio-economic demographic and consumer trend analyses, and with the impacts of climate change. Assessment WPs will inform action WPs that will: (1) redesign holistic farming systems to best reconcile the various demands concerning productivity, sustainability and societal values. (2) identify industry solutions that aim to improve sustainability and productivity of sheep and goat systems through breeding, including new phenotypes linked to sustainable animal productivity. iSAGE, together with stakeholders and end-users, will draft a roadmap for further research and policy making. The stakeholder groups will be the key players in disseminating project outputs through case studies and demonstrations to act as a blueprint to other producers across Europe and create networks to assist wider implementation of iSAGE outputs. iSAGE will enhance the sustainability, competitiveness and resilience of the European Sheep and Goat sectors through collaboration between industry and research. iSAGE have a powerful consortium with 18 industry representatives from various EU production systems and socio-economic contexts. The sheep and goat sector will be investigated because it is sensitive to general socio-economic, demographic, and ecological and market challenges; nevertheless, the project's approach and results will be made available and disseminated to other EU livestock industries. Therefore, at the core of iSAGE is a participatory approach centered on a multi-actor internal and external communication (WP) to build the project from the farmer level. This approach will ensure relevant issues are addressed and the project outcomes are applicable in practice and create a farm-level observatory and knowledge exchange network on the sustainability of livestock. This WP will also assist three assessment work packages that will deal with the sustainability assessment of sheep and goat farm systems and related supply chains, with socio-economic demographic and consumer trend analyses, and with the impacts of climate change. Assessment WPs will inform action WPs that will: (1) redesign holistic farming systems to best reconcile the various demands concerning productivity, sustainability and societal values. (2) identify industry solutions that aim to improve sustainability and productivity of sheep and goat systems through breeding, including new phenotypes linked to sustainable animal productivity. iSAGE, together with stakeholders and end-users, will draft a roadmap for further research and policy making. The stakeholder groups will be the key players in disseminating project outputs through case studies and demonstrations to act as a blueprint to other producers across Europe and create networks to assist wider implementation of iSAGE outputs.

BC3's contribution to the project

BC3 is partner of a consortium led by Aristotle University of Thessaloniki with 33 partners. "Innovation for Sustainable Sheep and Goat Production in Europe". Pl_ Agustin Del Prado

Key BC3 researchers involved

Dr. Agustín del Prado
Guillermo Pardo

Link with BC3 Research Line

Climate and Natural Environment

Acknowledgement

This project has received funding from the European Union Horizon 2020 research and innovations programme under grant agreement Nº 679302

URL Address

www.isage.eu

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

European Commission or other international funding programs

H2020_INHERIT

GRANT AGREEMENT:	GA 667364
NAME OF THE PROJECT:	INHERIT "INter-sectoral Health Environment Research for InnovaTions"
FUNDING AGENCY:	The European Union Horizon 2020 research and innovations programme
TYPE:	Horizon 2020-H2020-PHC-4-2015
TIME FRAME:	2016-2018
FUNDING:	288.175 €
PARTNERS:	EuroHealthNet – European Partnership for Improving Health, Equity and Wellbeing (EHNet) - Coordinator National Institute for Public Health and the Environment (RIVM) University College London (UCL) Health Equity Institute Institute of Preventive Medicine Environmental and Occupational Health (Prolepsis) University of Exeter Medical School, European Centre for Environment and Human Health (UNEXE) Norwegian University of Science and Technology, Faculty of Social Sciences and Technology Management (NTNU) Riga City Council, Housing, Environment and Welfare Department (RIGA) Collaborating Centre on Sustainable Consumption and Production (CSCP) Swedish Public Health Agency (FoHM) National Institute of Public Health (IJZRM) Basque Research Centre for Climate Change (BC3) Lisbon University Institute (ISCTE-IUL) Univerzita Karlova v Praze (CUNI), Environment University of Alcala (UAH) Revolve Media (REVOLVE) Philips Electronics Nederland (PHILIPS) Flemish Institute for Health Promotion and Disease Prevention (VIGeZ) Federal Centre for Health Education (BZgA)

Project Description

The overarching aim of INHERIT is to define effective inter-sectoral policies and interventions that promote health and well-being across the social gradient by tackling key environmental stressors and related inequalities in the areas of living, consuming and moving. INHERIT will bring together relevant stakeholders from different sectors, including the private sector.

It will support inter-sectoral cooperation between environment, climate and health by: **a)** Analysing existing scientific knowledge on key environmental stressors to health and approaches to address these; **b)** Identifying existing promising inter-sector policies and interventions that enable conditions for more healthy and environmentally sustainable behaviours, in three main areas: living, consuming and moving; **c)** Developing a Common Analytical Framework using impact assessment tools and quantitative and qualitative indicators to assess the social, environmental and health benefits and the economic value in promising inter-sectoral interventions; **d)** Developing targets and future visions while considering overall economic and politics contexts and global trends (i.e. participatory back-casting, stakeholder and citizen consultations and household surveys); **e)** Implementing, testing and evaluating pilot interventions in different European contexts; **f)** Enhancing the leadership skills of public health professionals in inter-sectoral work to address key environmental stressors to health and promote healthy and environmentally sustainable lifestyles; **g)** Translating evaluation findings into models of good practice for effective inter-sectoral work and evidence based tools for policy development to contribute to the global and European environment, health and sustainable development policy agenda. The novelty of INHERIT lies in its support for health, environment and climate sectors to jointly pursue the inter-related goals of improving health and well-being of the population while preserving the environment.

BC3's contribution to the project

BC3 is co-leader of WP5 for the quantitative evaluation of the identified best practices and is leading the cost-benefit analysis for 3 case studies (living environment, moving and nutrition). BC3 is also contributing to the literature review and to the scenario building.

Key BC3 researchers involved

Prof. Anil Markandya
Dr. Amaia de Ayala
Dr. Aline Chiabai (PI)

Link with BC3 Research Line

Health and Climate

Acknowledgement

The INHERIT project (www.inherit.eu), coordinated by EuroHealthNet, has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 667364.

URL Address

http://inherit.eu/

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

European Commission or other international funding programs

European Research Council
Established by the European Commission
Supporting top researchers from anywhere in the world

H2020_ERC:Stg_CLOCK

GRANT AGREEMENT:	GA 679812
NAME OF THE PROJECT:	CLOCK "Climate Adaptation To Shifting Stocks"
FUNDING AGENCY:	The European Union Horizon 2020 research and innovations programme
TYPE:	Horizon 2020 ERC-Starting Grant 2015
TIME FRAME:	2016-2021
FUNDING:	135.364 €
PARTNERS:	University of Vigo - Coordinator BC3 Basque Centre for Climate Change (BC3)

Project Description

Management of marine fisheries is still far from incorporating adaptation to climate change, even though global stocks are heavily overexploited and climate change is adding additional pressure to the resource. In fact, there is growing evidence that current fisheries management systems may no longer be effective under climate change, and this will translate into both ecological and socioeconomic impacts. This research project argues that the combination of fisheries management science and socio-ecological systems thinking is necessary in order to advance in fisheries adaptation to climate change. To this end, the main objectives are set to: **1)** Identify and understand the new challenges raised by climate change for current sustainable fisheries management; **2)** Develop a novel approach to fisheries adaptation within a socio-ecological framework; **3)** Provide empirical evidence on potential solutions for the adaptation of fisheries management systems; and **4)** Help introduce fisheries adaptation at the top of the regional and international adaptation policy agendas. To do this, CLOCK will combine model and simulation approaches to fisheries with specific case studies where both biophysical and economic variables will be studied an modelled, but also individuals will be given the opportunity to participate in an active way, learning from participatory methods their preferences towards adaptation and the consequences of the new scenarios climate change poses. Three potential case studies are identified for property rights over stocks, property rights over space, and Marine Reserves in two European and one international case study areas. As a result, CLOCK expect to develop a new Adaptation Framework for fisheries management that can be scalable, transferable and easily operationalized, and a set of case study examples on how to integrate theory and participatory processes with the aim of increasing social, ecological and institutional resilience to climate change.

Key BC3 researchers involved

Dr. Elena Ojea
Iratxe Rubio

Link with BC3 Research Line

Climate and Natural Environment

Acknowledgement

CLOCK has received funding from the European Research Council Horizon 2020 Programme 2015 for Starting Grants under Grant Agreement no. 679812.

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

European Commission or other international funding programs

NERC ESPA_FRONTIERS

GRANT AGREEMENT:	NE/P008356/1
NAME OF THE PROJECT:	"FRONTIERS "Landscapes in transition: synthesising knowledge on trade-offs between land use changes, ecosystem services and wellbeing"
FUNDING AGENCY:	UK Natural Environment Research Council
TYPE:	NERC-ESPA 2016 Grants
TIME FRAME:	2016-2017
FUNDING:	5133,25€
PARTNERS:	University of East Anglia University of Edinburgh University of Copenhagen University of Barcelona BC3-Basque Centre for Climate Change

Project Description

Agricultural intensification is a dominant environment and development policy intervention in landscapes characterised by shifting cultivation and/or by a mosaic of farm and forest lands. And yet recent studies from ESPA and beyond are beginning to show that the outcomes of such interventions can frequently fail in their intentions to alleviate poverty and reduce losses of forests and biodiversity. The main objective of this research is to improve our understanding of the effects of agricultural intensification, with a view to better understanding how agricultural policy and interventions can be more sustainable and pro-poor.The specific objectives of the project are:

1. To generate insight into the evolving trade-offs between land use changes, ecosystem services, associated values and well-being in transitional landscapes at the forest-agriculture frontier in the global south, more specifically to generate: **a.** Evidence of the effects of agricultural intensification on ecosystem services. **b.** Evidence of the effects of agricultural intensification on human wellbeing. **c.** Evidence of how cultural, institutional and governance contexts shape the evolving nexus of trade-offs between land use change, ecosystem services and well-being. **d.** Evidence of how trade-offs between land use changes, ecosystem services and well-being are negotiated and managed by communities and authorities. **e.** Evidence of how agricultural intensification affects ecosystem service values across key stakeholders and associated facets of wellbeing.
2. To bring about academic impact through advancing conceptual insights into relationships between agricultural intensification, ecosystem services and human wellbeing.
3. To bring about poverty alleviation impact through knowledge exchange with key policymaking and practitioner communities.
4. To produce a working paper and co-produced knowledge products (Policy brief, film) and to aim at publishing at least one academic article in a high impact journal such as PNAS or Global Environmental Change.
5. To disseminate new knowledge through workshops, conferences, online survey, and science-policy platforms.

BC3's contribution to the project

BC3 is a partner of ESPA Research Consortium.

Key BC3 researchers involved

Dr. Unai Pascual

Link with BC3 Research Line

Climate and Natural Environment

Acknowledgement

CLOCK has received funding from the European Research Council Horizon 2020 Programme 2015 for Starting Grants under Grant Agreement no. 679812.

URL Address

http://www.espa.ac.uk/

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

MINECO or Spanish Institutions

GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

REBECOM

MINECO_RETOS 15_REBECOM

GRANT AGREEMENT:	CGL2015-70452-R
NAME OF THE PROJECT:	REBECOM "Estimation of the recovery time of temperate forests after historical anthropogenic impacts along a complexity gradient"
FUNDING AGENCY:	MINECO – Spanish Ministry for Economy and Competitiveness
TYPE:	Programa Estatal de I+D+i Orientada a los Retos de la Sociedad 2015
TIME FRAME:	2016-2018
FUNDING:	141.000 €
PARTNERS:	University of the Basque Country (UPV-EHU)

Project Description

In order to reduce the accelerated loss of ecosystem diversity, functions and services, a multitude of restoration strategies and programs have been launched around the world driven by the initiatives of the Convention on Biological Diversity or the European Commission. However, it has been found in wetlands, rivers and other habitats that restored ecosystems are less functional and less diverse than those preserved (relatively undisturbed) for long periods of time (> 100 years). This may be due to many factors, but it is related to the time it takes ecosystems to fully recover and the parameters used to measure the success of the restoration. In this project, we measure the evolution of some interactions along a chronosequence of 500 years to understand the process of recovery of the deep structure of ecosystems. In this study we consider a recovered ecosystem as one that reaches stability from a multidimensional perspective, including biogeochemical means (carbon and nitrogen in the soil), community structure (fungivorous insects and ectomycorrhizas) and architecture of interaction networks (Among ectomycorrhizae, trees and insects) all related to essential functions of the ecosystem, such as the production and cycling of nutrients in the system. To know these recovery times, we will measure these parameters in a chronosequence in two mining areas of the massif of Peña del Aia and surroundings in the provinces of Navarra and Guipuzcoa. This will also allow us to study the temporal evolution of interactions in the ecological networks studied and to identify possible groups of species with a key role in the recovery and functioning of the system. This will have applications in the regulation of the restoration of ecosystems, within the mitigation policies, as it will allow to know the true magnitude of the degradation that must be compensated and will also have application for the practice of the restoration and the forest management for Conservation, since it will guide efforts towards key elements that regulate the recovery and functionality of temperate forests after cessation of human impacts.

BC3's contribution to the project

This research project is led by Dr. David Moreno.

Key BC3 researchers involved

Dr. David Moreno
Asun Rodríguez
June Hidalgo

Link with BC3 Research Line

Climate and Natural Environment

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

MINECO or Spanish Institutions

MINECO_RETOS 15_CLIMAECOM

GRANT AGREEMENT:	ECO2015-68023-C2-1-R
NAME OF THE PROJECT:	CLIMAECOM "Climate policies and transition to a low carbon economy"
FUNDING AGENCY:	MINECO – Spanish Ministry for Economy and Competitiveness
TYPE:	Programa Estatal de I+D+i Orientada a los Retos de la Sociedad 2015
TIME FRAME:	2016-2018
FUNDING:	6.700 €
PARTNERS:	University of the Basque Country (UPV-EHU)

Project Description

The main objective of this research project is to contribute to the advancement of scientific knowledge to promote the reduction of carbon emissions and to promote the transition to a low carbon economy. This project is specifically aimed at acquiring new knowledge to advance the resolution of Challenge 5 ("Action on climate change and efficiency in the use of resources and raw materials") identified in the Spanish Strategy for Science and Technology and Innovation. There is a growing scientific consensus that, if we are to avoid the potential adverse effects of climate change, carbon emission levels should be reduced globally by 50% by 2050. Achieving this objective without the economic and social well-being of each country, especially for the most vulnerable, is disadvantaged is not an easy task. In fact, this international and intergenerational dimension of climate change explains the difficulties encountered in the negotiations in the context of the United Nations. Framework Convention on Climate Change. There is, therefore, a need to investigate different national and / or international strategies for reducing CO2 emissions. In this project we will analyze different key dimensions related to the design of climate policies to favor the transition towards a low carbon economy. For example, the importance of financial mechanisms for climate policy, the interaction between climate policy and international trade, or how to design climate policies that incorporate the risk and uncertainty inherent in climate change will be analyzed. We will also explore alternative ways to achieve mitigation objectives through changes at the macroeconomic level, technological changes and changes in consumption patterns, to foster the decoupling of economic growth and CO2 emissions. In addition, the economic impact (in terms of efficiency and equity) of different policies and instruments such as different types of fiscal reform, as well as the additional benefits in terms of local pollution and public health associated with some climate policies will be studied.

BC3's contribution to the project

This project is led by Dr. Mikel González-Eguino.

Key BC3 researchers involved

Prof. Anil Markandya
Dr. Iñaki Arto
Dr. Mikel Gonzalez
Dr. Luis Mª Abadie
Dr. Ignacio Cazcarro
Dr. Kishore Dhavala

Link with BC3 Research Line

Low Carbon

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

MINECO or Spanish Institutions

MINECO_RETOS 15_ESPERA

GRANT AGREEMENT:	CSO2015-71243-R
NAME OF THE PROJECT:	ESPERA "Social Equity in Payments for Environmental Services: A Socio-Ecological Perspective"
FUNDING AGENCY:	MINECO – Spanish Ministry for Economy and Competitiveness
TYPE:	Programa Estatal de I+D+i Orientada a los Retos de la Sociedad 2015 MINECO
TIME FRAME:	2016-2018
FUNDING:	15.000 €

Project Description

The main objective of ESPERA is to contribute to the knowledge of the impact of PESs (Payment for Ecosystem Services) on social equity and its trade-offs with environmental effectiveness and economic efficiency, from the socio-ecological perspective of Ecosystem services. ESPERA will advance in the development of a conceptual framework by introducing power relations among PES actors, a variable usually overlooked in the literature on PES. The governance of nature conservation is evolving towards the use of voluntary economic incentives, and within these, towards the so-called Payments for Environmental or Ecosystem Services (PES). The PES are now at the center of the international conservation agenda promoted by various actors such as intergovernmental institutions (eg World Bank, UNEP, etc.), national governments (eg, Costa Rica, Colombia, Mexico, etc.) and the private sector (eg Vitell-Danone). PSAs are justified for reasons of economic efficiency and for the ability to achieve public-private financing. However, there is a weak integration of aspects of social equity in the PES. Social equity is understood in a multidimensional manner including aspects of **(I)** distribution of the benefits of payments and conservation responsibilities among stakeholders; **(II)** recognition of values from the ethical point of view on the relationship between society and nature; And **(III)** participation in the design and implementation of PES by the main actors. The main objective of ESPERA is to contribute to the knowledge of the impact of PES on social equity and its trade-offs with environmental effectiveness and economic efficiency from the socio-ecological perspective of ecosystem services. To study empirically the social equity in PES already established PES programs, through meta-analysis and two case studies in depth in Latin America; One in Costa Rica, a pioneer country in the implementation of PES programs, and another in Colombia.

BC3's contribution to the project

This research project is led by Dr. Unai Pascual.

Key BC3 researchers involved

Prof. Maria Jose Sanz (PI)
Dr. Unai Pascual Ikerbasque Professor (PI)
Dr. Sebastien Foudi
Dr. Ignacio Palomo
Dr. Eneko Garmendia

Link with BC3 Research Line

Climate and Natural Environment

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

Basque Government and Basque Institutions

IHOBE_OSATU

NAME OF THE PROJECT:	**"OSATU "Heatwaves and Health: Impacts and Adaptation at the Basque Country"**
FUNDING AGENCY:	**IHOBE**
TYPE:	**Klimatek I+B+G 2016 "Proyectos I+D, Innovación y demostración en adaptación al cambio climático**
TIME FRAME:	**15/03/2016-31/12/2016**
FUNDING:	**49.000 €**

Project Description

The main objective of the OSATU project is to develop a methodology with key elements to help decision making in the prevention of the effects of heat waves on health in the Basque Country in a context of climate change. In addition, it is hoped to be able to obtain results that are relevant to adapt the early warning plans to the expected changes in the future. The overall objective will be developed through 5 specific objectives, which are listed below:

- Analyze data on projections of maximum temperature and the potential incidence of heat waves in the Basque Country.
- Determine the potential impact of temperature on people's health, specifically on the risk of mortality.
- Carry out an economic assessment of the impacts on mortality risk.
- Compare the costs and benefits of heat wave alert systems (SAOCs).
- Propose recommendations, which can contribute to improve the efficiency of SAOCs.

Key BC3 researchers involved

Dr. Aline Chiabai
Dr. Amaia de Ayala
Dr. Elisa Sainz de Murieta

Link with BC3 Research Line

Health and Climate

URL Address

http://www.bc3research.org/research_projects/health_and_climate_completed_projects/osatu.html

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

Basque Government and Basque Institutions

IHOBE_REMEDISOST

NAME OF THE PROJECT:	**REMEDISOST "Design of a Methodology for the Evaluation of the Sustainability of Contaminated Soil Remediation Plans"**
FUNDING AGENCY:	**IHOBE**
TYPE:	**Proyectos de Ecoinnovación durante el ejercicio 2016. IHOBE**
TIME FRAME:	**11/07/2016-26/05/2017**
FUNDING:	**23.209 €**
PARTNERS:	**Gaiker IK4** - Coordinator **Neiker Tecnalia** **AFESA Medioambiente S.A.** **BC3 Basque Centre for Climate Change (BC3)**

Project Description

The REMEDISOST project aims to develop a rigorous, reliable and robust methodology that can carry out an analysis and evaluation of the sustainability of the different remediation plans of contaminated soils that, from the technical point of view, allow to recover a soil from an initial contamination situation to a final situation according to the intended use of the soil. The methodology to be developed will be based on the life cycle analysis and will take into account the environmental, social and economic impacts produced throughout the life of the remediation process, which will be able to control and avoid the transfer of impacts between stages Of the life cycle and reduce the impacts generated. Likewise, considering that the soil forms a fundamental part of the ecosystem and supports many of the services that other ecosystems offer us, an analysis of these services and the impacts that the remediation plans will have on them will be carried out with In order to include these results in the evaluation of their impacts, mainly with respect to social and economic impacts.

Key BC3 researchers involved

Dr. Ibon Galarraga
Dr. Ignacio Palomo
Dr. Elisa Sainz de Murieta

Link with BC3 Research Line

Climate Policy

URL Address

http://www.bc3research.org/research_projects/climate_policy_completed_projects/remedisost_2.html

3.2 RESEARCH PROJECTS

RESEARCH PROJECTS: HIGHLIGHTS

Other Funding agencies or collaboration agreements

Food and Agriculture Organization of the United Nations

FAO

NAME OF THE PROJECT:	**"Analysis and Assessment On Determining Drivers of Global Land Use Change"**
FUNDING AGENCY:	**The Food and Agriculture Organization of the United Nations**
TYPE:	**Agreement**
TIME FRAME:	**15/12/2016-30/11/2017**
FUNDING:	**91.488 €**

Project Description

It is well known that in the last decades the use of land worldwide has changed dramatically. For example, between the years 1990 and 2013, agriculture area and planted forest area worldwide have increased, while primary and natural forest area has decreased (FAOSTAT, 2016). However, the factors driving these land use changes are lesser known. The objective of this agreement is to carry out an analysis which will provide information which is essential in order to better understand the social, economic and technological processes underlying land use change, to explore future scenarios of land demand and to design measures aimed at promoting a more sustainable use of land.

The aim is to identify and quantify the main drivers of land use change for food purposes (182 crops and 123 food products) , bioenergy and forestry related purposes (76 categories), at the global and country level (all countries covered by FAOSTAT) from 1961 to 2013 (or most recent year).

These factors include land productivity, bilateral trade structure, diet composition and waste (in the case of food), affluence (i.e. GDP per capita) and population. Taking the FAOSTAT database (production, trade and food balances, forestry statistics) as starting point, the work will develop an Index Decomposition Analysis to quantify the contribution of each of these factors to global land use changes at country level... Ultimately, this study will, based on different statistical operations of the Statistics Division of FAO and other available information, support at country and global level the design and improve the understanding of better options in the future for mitigation in the land use sector as well as highlight the importance of the data provided by FAO.

Key BC3 researchers involved

Prof. María Jose Sanz
Dr. Iñaki Arto
Dr. Ignacio Cazcarro
Dr. Mikel Gonzalez-Eguino
Dr. Joaquin García
Dr. Mikel Gonzalez
Itxaso Ruiz

3.3 Collaborators

In BC3, we operate under the philosophy that effective research can only be conducted in collaboration with other research groups. As a result, BC3 researchers were directly involved in collaborative research projects, dissemination and training activities both locally and worldwide. Besides, our international collaboration programs have enabled us to establish collaborations and own networks that span five continents.

This networking involves:

- THE DEVELOPMENT OF SHARED RESEARCH PROJECTS.
- THE EXCHANGE OF RESEARCHERS.
- THE EXCHANGE OF PHD STUDENTS.
- THE TRANSFER OF BEST PRACTICES.
- THE COOPERATION AND PARTICIPATION IN DISSEMINATION AND TRAINING ACTIVITIES.

At BC3 we were actively involved in attracting external funds from international funding bodies, with a special focus on the European Union Research projects (H2020), which also were an interesting way of creating scientific networks, collaboratively with the consortium partners.

On top of that, the research lines maintained their collaboration with the most prestigious universities and research centers at international level among which we stand out the following during 2016: Nagaoka University. Technology (Japan), University of Belfast (Ireland), University of Leicester (United Kingdom), among others.

Several contracts and agreements were also obtained with scientific prestigious institutions at local and international level allowing us to widen our collaborator's net.

- **Ararteko**. Elaboration of the report "The Basque Country's energy transition towards a more sustainable and low carbon model".
- **Conservation International Foundation**. "Forecasting sustainability of productive landscapes across environmental, social, political, climatic and economic dimensions in San Martín, Peru".
- **UNCCD - United Nations Convention on Combat Desertification**. Preparation of the report "The Basque Country's energy transition towards a more sustainable and low carbon model".
- **FAO - Food and Agriculture Organization of United Nations**. Research project "Analysis and Assessment of drivers of global land use change".
- **UNESCO - The United Nations Educational, Scientific and Cultural Organization**. IPBES Workshop "Classification of values of biodiversity and ecosystem services".

Our **visiting programme** was another important way to attract international and national climate change experts to the Basque Country, as well as to begin new relationships with other institutions.

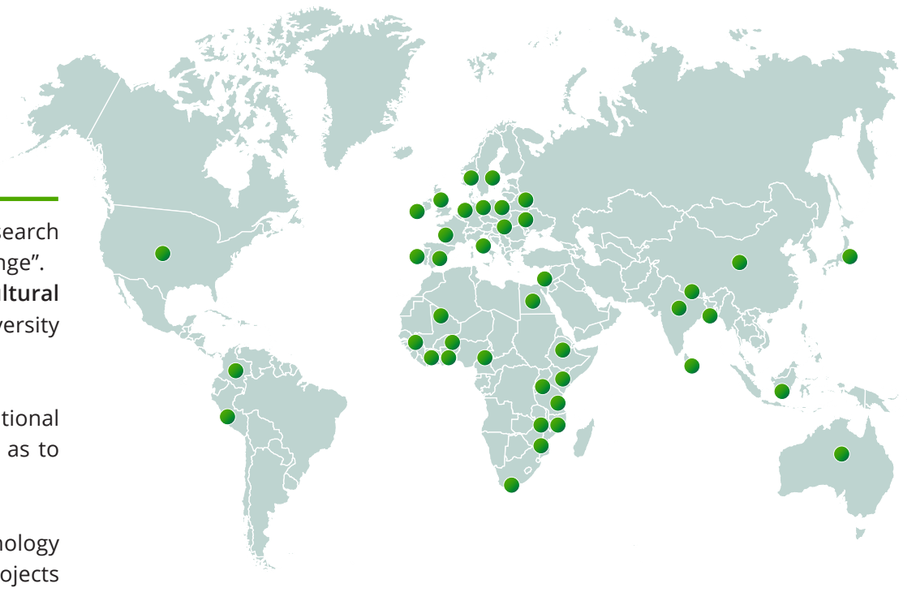
Besides, BC3 was dynamic and active part of the Basque Science, Technology and Innovation Network, promoting and collaborating in Research projects with the different members of the network.

The University of the Basque Country (UPV / EHU) is our academic partner and therefore the joint work carried out covered different areas such as research, training and scientific dissemination. Since our centre was created in 2008, we have kept a close relationship with UPV/EHU and, over the years, we have consolidated different programs: joint seminars, the Klimagune Workshop, our participation in the "EUSKAMPUS" initiative, collaboration in various proposals and research projects or in masters and doctoral programs, among others.

REINFORCING COLLABORATIONS THROUGH NETWORK:

REMEDIA network

In 2011, we fostered the establishment of REMEDIA network (Scientific Network on the Mitigation of GHG Emissions from Agroforestry Activities) to promote exchanges among the researches working the mitigation of GHG emissions from agriculture and forestry sectors, as well as to exchange dissemination of scientific and strategic information with both public institutions and private sector in Spain. At an international level, this network fosters a closer research collaboration with other international networks. Spanish Ministry of Agriculture and Fisheries, Food and Environment (MAPAMA), acknowledged the importance of this initiative –nowadays made of around a hundred and fifty of researchers, spread through very



diverse geographic regions and academic fields- for its contributions to the improvement of the scientific basis of the estimated GHG inventory for the Spanish agroforestry industry.

NUT_Global University Network

BC3 will coordinate the innovative project for a worldwide campus of excellence, led by the Nagaoka Technological University of Japan, which in 10 years will make possible the creation of a "Global University", which will facilitate the international mobility of students and researchers, and will strengthen the international presence of SMEs in the field of sustainable technologies. This exchange model is a strategic initiative of the Japanese government to generate a global campus of excellence, with permanent connections in countries such as Germany, South Africa, Vietnam and Mexico. According to their estimates, the project will be fully deployed in a decade, and will count on with an average of 900 participants annually. The program is entirely financed by the Japanese government, through endowments intended for this purpose.

The agreement was made possible by the work done by the BC3 team, led by Professor Ikerbasque and researcher Ramón y Cajal, Sérgio Henrique Faria, with the collaboration of BIZKAIA: TALENT, the association promoted by the Provincial Council of Bizkaia to attract, retain and link highly qualified people to Bizkaia (Basque Country), in the scientific, technological and business fields.

3.3 Collaborators

Some of our collaborators in 2016

Aarhus University (Denmark)

Amherst College (USA)

Basque Center for Applied Mathematics BCAM (Spain)

CEAM - Centro de Estudios del Mediterráneo (Spain)

CEEW -Council on Energy, Environment and Water (India)

Center for International Forestry Research (CIFOR) (Indonesia)

Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – CIEMAT (Spain)

Centro Euro-Mediterraneo per i Cambiamenti Climatici (CMCC)(Italy)

Charles University Environment Centre (Czech Republic)

CICERO (Norway)

City of Bilbao (Spain)

Colorado State University (USA)

Conservation International (USA)

CSIC (Spain)

Danish Board of Technology (Denmark)

Economics for Energy - University of Vigo (Spain)

ETH Zurich (Switzerland)

European Environmental Agency (Europe)

FAO – Food and Agriculture Organization of the United Nations (International)

Fondazione Eni Enrico Mattei (FEEM) (Italy)

Greenwich University (UK)

ICRA - Catalan Institute for Water Research (Spain)

IH Cantabria (Spain)

IHOBE (Spain)

Instituto Carlos III (Spain)

International Centre for Integrated Mountain Development (ICIMOD), (Nepal)

Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB) (Germany)

London School Of Economics And Political Science (Gri-Lse)

London School of Hygiene and Tropical Medicine (UK)

McGill University (Canada)

National Taiwan University (Taiwan)

Neiker Tecnalia (Spain)

NIPR - National Institute of Polar Research (Japan)

NUT – Nagaoka University of Technology (Japan)

Osnabrueck University (Germany)

Queen's University Belfast (UK)

Rothamsted Research Centre (UK)

Technical University of Berlin (Germany)

The International Renewable Energy Agency - IRENA), (Germany)

UNCCD - United Nations Convention to Combat Desertification (International)

Universidad de Alcalá (Spain)

Universidad de Cadiz (Spain)

Universidad de Castilla la Mancha (Spain)

Universidad de las Palmas de Gran Canaria (Spain)

Universidad de Valencia (Spain)

Universidad Miguel Hernández de Elche (UMH) (Spain)

Universidad of Alcalá (España),

Université de Bordeaux (France)

Université Laval (Canada)

University of Alcala (UAH) (Spain)

University of Bath (UK)

University of Exeter (UK)

University of Leicester (UK)

University of Massachusetts (USA)

University of Oldenburg (Germany)

University of Oulu (Finlandia)

University of Rome – Roma Tre (Italy),

University of Southampton (UK)

University of Texas(USA)

University of the Basque Country (UPV/EHU) (Spain)

University of Vigo (Spain)

UPM (Spain)

Wageningen University (Netherlands)

World Bank (International)

3.4 Publications

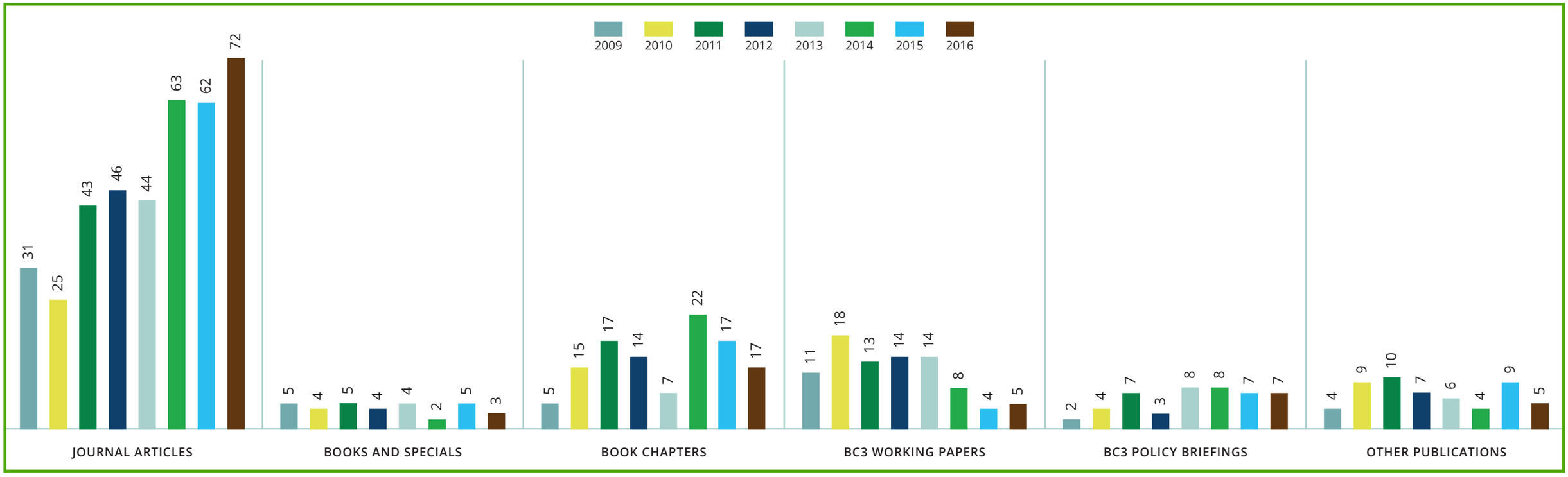
Since our creation in 2008, we have been aimed at publishing in the first-class international peer-reviewed journals and with the world-class most influential leading academic publishers. As a result, our volume of publications has increased, and so has their quality and impact.

Prove of this, is that during 2016, 86% of the BC3 articles indexed in Scopus were published in first quartile (Q1) journals. These outstanding metrics, have taken BC3 to be ranked among the top ten climate change research institutions worldwide (based on standardized ranking of ICCG (International Centre for Climate Governance) in the latest 4 years. All the research lines of the centre contributed to these results through inter and multidisciplinary work in the area of climate and global change. Many of the publications demonstrate the multidisciplinary nature of the centre.

Following BC3´s classification system, the scientific production of the centre in 2016 was as follows:

During 2016, we published:

72 JOURNAL ARTICLES
3 BOOKS
15 BOOK CHAPTERS
5 BC3 WORKING PAPERS
7 BC3 POLICY BRIEFING and
5 TECHNICAL REPORTS.



3.4 Publications | 3.4.1 List of Publications

Journal Articles (published on-line in 2016)

1. Abadie, L.M. and Chamorro, J.M. 2016. **Revenue Risk of U.S. Tight-Oil Firms**. Energies. 9. (10) 848-. DOI (10.3390/en9100848).
2. Abadie, L.M., Sainz de Murieta, E., Galarraga, I. 2016. **Climate Risk Assessment under Uncertainty: An Application to Main European Coastal Cities**. Frontiers in Marine Science. 3. (265) DOI (10.3389/fmars.2016.00265).
3. Agnoli, L., Capitello, R., De Salvo, M., Longo, A., Boeri, M. 2016. **Food fraud and consumers' choices in the wake of the horsemeat scandal.** British Food Journal. 118. (8) 1878-1893. DOI (10.1108/BFJ-04-2016-0176).
4. Almagro, M.;Martinez-Lopez, J.; Maestre, F.T.;Rey, A. 2016. **The Contribution of Photodegradation to Litter Decomposition in Semiarid Mediterranean Grasslands Depends on its Interaction with Local Humidity Conditions, Litter Quality and Position**. Ecosystems. 1-16. DOI (10.1007/s10021-016-0036-5).
5. Amelung,B., Student,J., Nicholls,S., Lamers,M., Baggio,R., Boavida-Portugal,I., Johnson,P., de Jong,E., Hofstede,G.J., Pons,M., Steiger,R., Balbi, S. 2016. **The value of agent-based modelling for assessing tourism–environment interactions in the Anthropocene**. Current Opinion in Environmental Sustainability. 23. 46-53. DOI (10.1016/j.cosust.2016.11.015).
6. Aronson, J., Clewell, A., Moreno-Mateos, D. 2016. **Ecological restoration and ecological engineering: Complementary or indivisible?**. Ecological Engineering. 91. 392-395. DOI (10.1016/j.ecoleng.2016.02.043).
7. Arto, I., Andreoni, V., Rueda-Cantuche, J.M. 2016. **Global use of water resources: A multiregional analysis of water use, water footprint and water trade balance**. Water Resources and Economics. DOI (10.1016/j.wre.2016.04.002).
8. Arto, I., Capellán-Pérez, I., Lago, R., Bueno, G., Bermejo, R. 2016. **The energy requirements of a developed world**. Energy for Sustainable Development. 33. 1-13. DOI (10.1016/j.esd.2016.04.001).
9. Baró, F., Palomo, I., Zulian, G., Vizcaino, P., Haase, D., Gómez-Baggethun, E. 2016. **Mapping ecosystem service capacity, flow and demand for landscape and urban planning: A case study in the Barcelona metropolitan region**. Land Use Policy. 57. 405-417. DOI (10.1016/j.landusepol.2016.06.006).
10. Berbés-Blázquez, M. González, J., Pascual, U. 2016. **Towards an ecosystem services approach that addresses social power relations**. Current Opinion in Environmental Sustainability. 19. 134-143. DOI (10.1016/j.cosust.2016.02.003).
11. Bohan, D.A., Landuyt, D., Ma, A., Macfadyen, S., Marinet, V., Massol, F., McInerny, G., Montoya, J.M., Mulder, C., Pascual, U., et al. 2016. **Networking our way to better ecosystem service provision**. Trends in Ecology and Evolution. 31. 112-121. DOI (10.1016/j.tree.2015.12.003).
12. Bonzanigoa, L., Giupponi, C. and Balbi, S. 2016. **Sustainable tourism planning and climate change adaptation in the Alps: a case study of winter tourism in mountain communities in the Dolomites**. Journal of Sustainable Tourism. 0. (0) 1-16. DOI (10.1080/09669582.2015.1122013).
13. Brink, Andreas B., Martínez-López, Javier, Szantoi, Zoltan, Moreno-Atencia, Pablo, Lupi, Andrea, Bastin, Lucy, Dubois, Grégoire. 2016. **Indicators for Assessing Habitat Values and Pressures for Protected Areas—An Integrated Habitat and Land Cover Change Approach for the Udzungwa Mountains National Park in Tanzania**. Remote Sensing. 8. (10) 862. DOI (10.3390/rs8100862).
14. Capellán-Pérez, I., Arto, I., Polanco-Martínez, J.M., González-Eguino, M., Neumann, M.B. 2016. **Likelihood of climate change pathways under uncertainty on fossil fuel resources availability**. Energy & Environmental Science. DOI (10.1039/C6EE01008C).
15. Cazcarro, I., Lopez-Morales, CA., Duchin, F. 2016. **The global economic costs of the need to treat polluted water**. Economic Systems Research. 28. (3) 295-314. DOI (10.1080/09535314.2016.1161600).
16. Cazcarro, I.; Duarte, R. and Sánchez Chóliz, J. 2016. **Downscaling the grey water footprints of production and consumption**. Journal of Cleaner Production. DOI (10.1016/j.jclepro.2015.07.113).
17. Cazcarro, I., Duarte, R. and Sánchez Chóliz, J. 2016. **Tracking Water Footprints at the Micro and Meso Scale: An Application to Spanish Tourism by Regions and Municipalities**. Journal Of Industrial Ecology. DOI (10.1111/jiec.12414).
18. Chan, K., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., Gould, R.K., Hannahs, N., Jax, K., Klain, S.C., Luck, G., Martín-López, B., Muraca, B., Norton, B., Ott, K., Pascual, U., Satterfield, S., Tadaki, M., Taggart, J., Turner. 2016. **Why Protect Nature? Rethinking Values and the Environment**. Proceedings of the National Academy Of Sciences of the United States of America. 113. (6) 1462–1465. DOI (10.1073/pnas.1525002113).
19. Cortés_Avizanda, A., Blanco, G., DeVault, T.R.,Markandya, A., Virani,M.Z.,Brandt, J., Donázar, J.A. 2016. **Supplementary feeding and endangered avian scavengers: benefits, caveats, and controversies**. Frontiers in Ecology and the Environment. 14. (4) 191-199. DOI (10.1002/fee.1257).
20. de Ayala, A., Galarraga, I. and Spadaro, J.V. 2016. **The price of energy efficiency in the Spanish housing market**. Energy Policy. 94. 16-24. DOI (10.1016/j.enpol.2016.03.032).
21. Del Prado, A. and Sanz, M.J. 2016. **Implicaciones del Acuerdo de París en los sectores relacionados con los usos de la tierra cambios de uso de la tierra y la silvicultura**. Ambienta. 114. 84-114.
22. Ding, H., Chiabai, A., Silvestri, S., and Nunes, Paulo A. L. D. 2016. **Valuing climate change impacts on European forest ecosystems**. Ecosystem Services. 18. 141-153. DOI (10.1016/j.ecoser.2016.02.039).
23. Francesconi, W., Srinivasan, R., Pérez-Miñana, E., Willcock, S., Quintero,M. 2016. **Using the Soil and Water Assessment Tool (SWAT) to model ecosystem services: A systematic review**. Journal of Hydrology. 535. 625-636. DOI (10.1016/j.jhydrol.2016.01.034).
24. Galan, E. 2016. **Power to the people: energy in Europe over the last five centuries**. Historia Agraria. 68. 218- 221.
25. Galán, E., Padró, R., Marco, I., Tello, E., Cunfer, G., Guzmán, G.I., González de Molina, M.,Krausmann, F., Gingrich, S., Sacristán, V., Moreno-Delgado, D. 2016. **Widening the analysis of Energy Return on Investment (EROI) in agro-ecosystems: Socio-ecological transitions to industrialized farm systems (the Vallès County, Catalonia, c.1860 and 1999)**. Ecological Modelling. 336. 13-25. DOI (10.1016/j.ecolmodel.2016.05.012).
26. Galán, E.; Sanchis, E., Estellés, F.; Calvet, S., del Prado, A. 2016. **Heat stress effects in milk yield and milk traits at farm scale**. Advances in Animal Biosciences. 7. (3) 238-239. DOI (10.1017/S2040470016000261).
27. Galarraga, I., Abadie, L.M. and Kallbekken, S. 2016. **Designing incentive schemes for promoting energy-efficient appliances: A new methodology and a case study for Spain**. Energy Policy. DOI (10.1016/j.enpol.2015.12.010).
28. Ganzedo,U., Polanco-Martínez, J. M., Caballero-Alfonso, A. M., Faria, S.H. ,Jianke, L. and Castro-Hernández, J.J. 2016. **Climate effects on historic bluefin tuna captures in the Gibraltar Strait and Western Mediterranean**. Journal of Marine Systems. 158. 84-92. DOI (10.1016/j.jmarsys.2016.02.002).
29. García-Llorente, M ., Harrison,P.A., Berry, P., Palomo, I., Gómez-Baggethun, E., Iniesta-Arandia, I., Montes, C., García del Amo, D., Martín-López,B. 2016. **What can conservation strategies learn from the ecosystem services approach? Insights from ecosystem assessments in two Spanish protected areas**. Biodiversity and Conservation. 1-23. DOI (10.1007/s10531-016-1152-4).
30. García-Muros, X., Burguillo, M.,González-Eguino,M., Romero-Jordán, D. 2016. **Local air pollution and global climate change taxes: a distributional analysis for the case of Spain**. Journal of Environmental Planning and Management. DOI (10.1080/09640568.2016.1159951).
31. García-Muros, X., Markandya, A., Romero-Jordán,D., González-Eguino, M. 2016. **The distributional effects of carbon-based food taxes**. Journal of Cleaner Production. DOI (10.1016/j.jclepro.2016.05.171).
32. Garmendia, E., Apostolopoulou, E., Adams,W.M., Bormpoudakis, D. 2016. **Biodiversity and Green Infrastructure in Europe: boundary object or ecological trap?**. Land Use Policy. DOI (10.1016/j.landusepol.2016.04.003).
33. Garmendia, E., Urkidi, L., Arto, I. Barcena, I., Bermejo, R., Hoyos, D., Lago, R. 2016. T**racing the impacts of a northern open economy on the global environment**. Ecological Economics. 169-181. DOI (10.1016/j.ecolecon.2016.02.011).
34. González-Eguino, M., Capellán-Pérez, I., Arto, I., Ansuategi, A., Markandya, A. 2016. **Industrial and Terrestrial Carbon Leakage under Policy Fragmentation. Climate Policy**. DOI (10.1080/14693062.2016.1227955).
35. González-Eguino, M., Neumann, M.B. 2016. **Significant implications of permafrost thawing for climate change control**. Climatic Change. DOI (10.1007/s10584-016-1666-5).
36. Johnson,P., Nicholls, S., Student,J., Amelung, B., Baggio, R., Balbi,S., Boavida-Portugal, I., Jong,E., Hofstede,G.J., Lamers,M., Pons, M., Steigerm, R. 2016. **Easing the adoption of agent-based modelling (ABM) in tourism research**. Current Issues in Tourism. DOI (10.1080/13683500.2016.1209165).
37. Lucas, J., Escapa, M. and Galarraga, I. 2016. ADAPTECC: **Un juego de Rol sobre la Adaptación al Cambio Climático**. e-Pública: revista electrónica sobre la enseñanza de la economía pública. 19.
38. Lübcke, P., Lampel, J., Arellano, S., Bobrowski, N., Dinger, F., Galle, B., Garzón, G., Hidalgo, S., Chacón Ortiz, Z., Vogel, L., Warnach, S., Platt, U. 2016. **Retrieval of absolute SO2 column amounts from scattered-light spectra: implications for the evaluation of data from automated DOAS networks**. Atmospheric Measurement Techniques. 9. (12) 5677-5698. DOI (10.5194/amt-9-5677-2016).
39. Markandya, A., Arto, I., González-Eguino, M., Román, M.V. 2016. **Towards a green energy economy? Tracking the employment effects of low-carbon technologies in the European Union**. Applied Energy. 179. 1321–1330. DOI (10.1016/j.apenergy.2016.02.122).
40. Markandya, A., Galarraga, I., Abadie, L.M., Lucas, L. and Spadaro, J. V . 2016. **What Role Can Taxes and Subsidies Play in Changing Diets? An Application from Spain**. FinanzArchiv. DOI (10.1628/001522116X14581329755499).
41. Martínez-López, J., Bertzky, B.; Bonet-García, F.J.; Bastin, L., Dubois, G. 2016. **Biophysical Characterization of Protected Areas Globally through Optimized Image Segmentation and Classification**. Remote Sensing. 8. (9) 780. DOI (10.3390/rs8090780).
42. McCrackin, M.L., Jones, H.P., Jones, P.C., Moreno-Mateos, D. 2016. **Recovery of lakes and coastal marine ecosystems from eutrophication: A global meta?analysis**. Limnology and Oceanography. DOI (10.1002/lno.1044110.1002/lno.10441).
43. Medina-Elizalde, M., Polanco-Martínez, J.M., Lases-Hernández, F., Bradley, R., Burns, S. 2016. **Testing the "tropical storm" hypothesis of Yucatan Peninsula climate variability during the Maya Terminal Classic Period**. Quaternary Research. DOI (10.1016/j.yqres.2016.05.006).
44. Mundaca, L. and Markandya, A. 2016. **Assessing regional progress towards a 'Green Energy Economy'**. Applied Energy. 179. 1372-1394. DOI (10.1016/j.apenergy.2015.10.098).

3.4 Publications | 3.4.1 List of Publications

Journal Articles (published on-line in 2016)

45. Mundaca, Luis; Neij, Lena; Markandya, Anil; Hennicke, Peter; Yan, Jinyue. 2016. **Towards a Green Energy Economy? Assessing policy choices, strategies and transitional pathways**. Applied Energy. 179. 1283-1292. DOI (10.1016/j.apenergy.2016.08.086).

46. O. Heidrich, D. Reckien, M. Olazabal, A. Foley, M. Salvia, S. De Gregorio Hurtado, H. Orru, J. Flacke, D. Geneletti, F. Pietrapertosa, J.J.-P. Hamann, A. Tiwary, E. Feliu and R.J. Dawson. 2016. **National climate policies across Europe and their impacts on cities strategies**. Journal of Environmental Management. DOI (10.1016/j.jenvman.2015.11.043).

47. Palomo, I., Felipe-Lucía, M., Bennett, E., Martín-López, B. and Pascual, U. 2016. **Disentangling the Pathways and Effects of Ecosystem Service Co-Production**. Advances in Ecological Research. 53. DOI (10.1016/bs.aecr.2015.09.003).

48. Pardo, G., Martin-Garcia, I., Arco, B.A., Yañez-Ruiz, D.R., Moral, R. and del Prado, A. 2016. **Greenhouse-gas mitigation potential of agro-industrial by-products in the diet of dairy goats in Spain: a life-cycle perspective**. Animal Production Science. 56. (3) 646-654. DOI (10.1071/AN15620).

49. Pascual, M., Pérez-Miñana, E. and Giacomello, E. 2016. **Integrating knowledge on biodiversity and ecosystem services: Mind-mapping and Bayesian Network modelling** . Ecosystem Services. 17. 112-122. DOI (10.1016/j.ecoser.2015.12.004).

50. Pascual, M., Rossetto, M., Ojea, E., Milchakova, N., Kark, S.,Korolesova, D., Melià, P. 2016. **Socioeconomic impacts of marine protected areas in the Mediterranean and Black Seas**. Ocean & Coastal Management. DOI (10.1016/j.ocecoaman.2016.09.001)

51. Pérez-Miñana, E. 2016. **Improving Ecosystem Services Modelling**. Environmental Modelling & Software. 85. (C) 184–201. DOI (10.1016/j.envsoft.2016.07.007).

52. Polanco Martínez, J.M. 2016. **El papel del análisis por componentes principales en la evaluación de redes de control de la calidad del aire**. Comunicaciones en Estadistica. 9. (2) 271-294.

53. Polanco-Martínez, J.M., Abadie, L.M. 2016. **Analyzing Crude Oil Spot Price Dynamics versus Long Term Future Prices: A Wavelet Analysis Approach**. Energies. 9. (12) 1089. DOI (10.3390/en9121089).

54. Polanco-Martínez, J.M., Faria, S. H. 2016. **(Forthcoming). Estimation of the significance of the Foster's wavelet spectrum by means of the permutation test, and applications to paleoclimate records**. Boletin Geologico y Minero.

55. Rabl, A. and Spadaro, J.V. 2016. **External Costs of Energy: How Much Is Clean Energy Worth?**. Journal of Solar Energy Engineering-Transactions of the Asme. 138. (4) 040801. DOI (10.1115/1.4033596).

56. Ravera F., Martín-López, Pascual U. and Drucker A. 2016. **The diversity of gendered adaptation strategies to climate change of Indian farmers: A feminist intersectional approach**. AMBIO. 45. (3) 335-351. DOI (10.1007/s13280-016-0833-2).

57. Ravera, F., Iniesta-Arandia, I., Martín-López, B., Pascual, U., Bose, P. 2016. **Gender perspectives in resilience, vulnerability and adaptation to global environmental change**. AMBIO. 45. (3) 235-247. DOI (10.1007/s13280-016-0842-1).

58. Roman De Lara, M.V. and Galarraga, I. 2016. **The Paris Summit: The Beginning of the End of The Carbon Economy**. Dyna Energía y Sostenibilidad. 5. (1) 41-44. DOI (10.6036/ES7954).

59. Roman De Lara, M.V. and Galarraga, I. 2016. **The summit in Paris, a historic result?**. DYNA Ingeniería e Industria. 91. (2) 131. DOI (10.6036/7958).

60. Sánchez Goñi, M.F., Rodrigues, T., Hodell, D.A., Polanco-Martínez, J.M., Alonso-García,M.,Hernández-Almeida, I.,Desprat, S and Ferretti, P. 2016. **Tropically-driven climate shifts in southwestern Europe during MIS19, alow eccentricity interglacial.** Earth And Planetary Science Letters. 448. 81-93. DOI (10.1016/j.epsl.2016.05.018).

61. Sanz, M.J. 2016. **UN-REDD, the United Nations programme to reduce emissions from deforestation and forest degradation (2008–2015)**. Unasylva. 246. (67) 20-25.

62. Sanz, M.J. & Penman, J. 2016. **An overview of REDD+**. Unasylva. 246. (67) 10-19.

63. Sun, Zhanli; Lorscheid, Iris; Millington, James D.; Lauf, Steffen; Magliocca, Nicholas R.; Groeneveld, Jürgen; Balbi, Stefano; Nolzen, Henning; Müller, Birgit; Schulze, Jule; Buchmann, Carsten M. 2016. **Simple or complicated agent-based models? A complicated issue**. Environmental Modelling & Software. 86. 56-67. DOI (10.1016/j.envsoft.2016.09.006).

64. Tagliafierro, C., Boeri, M., Longo, A., Hutchinson, WG. 2016. **Stated preference methods and landscape ecology indicators: An example of transdisciplinarity in landscape economic valuation**. Ecological Economics. 127. (11) 22. DOI (10.1016/j.ecolecon.2016.03.022).

65. Taheripour, F., Hertel, T.W., Narayanan,B., Narayanan, S., Markandya, A., Mitra, B.K. 2016. **Economic and Land Use Impacts of Improving Water Use Efficiency in Irrigation in South Asia**. Journal of Environmental Protection. 7. (11) 1571-1591. DOI (10.4236/jep.2016.711130).

66. Tello, E., Galán, E., Sacristán, V., Cunfer, G. , Guzmán,G.I., González de Molina,M.,Krausmann, F., Gingrich,S., Padró, R., Marco, I., Moreno-Delgado, D. 2016. **Opening the black box of energy throughputs in farm systems: A decomposition analysis between the energy returns to external inputs, internal biomass reuses and total inputs consumed (the Vallès County, Catalonia, c.1860 and 1999)**. Ecological Economics. 121. 160-174. DOI (10.1016/j.ecolecon.2015.11.012).

67. Thompson-Hall, M., Carr, E.R., Pascual, U. 2016. **Enhancing and expanding intersectional research for climate change adaptation in agrarian settings**. AMBIO. 45. (3) 373-382. DOI (10.1007/s13280-016-0827-0).

68. Weikusat, I., Jansen, D., Binder, T., Eichler, J., Faria, S.H., Wilhelms, F., Kipfstuhl, S., Sheldon, S., Miller, H., Dahl-Jensen, D., Kleiner, T. 2016. **Physical analysis of an Antarctic ice core—towards an integration of micro- and macrodynamics of polar ice**. Philosophical Transactions of The Royal Society A-Mathematical Physical And Engineering Sciences. 375. (2086) DOI (10.1098/rsta.2015.0347).

69. Zabala, A., Pascual, U. 2016. **Bootstrapping Q Methodology to Improve the Understanding of Human Perspectives**. PLoS One. 11. (2) e0148087. DOI (10.1371/journal.pone.0148087).

70. Zank, B., Bagstad, K.J., Voigt, B., Villa. F. 2016. **Modeling the effects of urban expansion on natural capital stocks and ecosystem service flows: A case study in the Puget Sound, Washington, USA.** Landscape and Urban Planning. 149. 31-42. DOI (10.1016/j.landurbplan.2016.01.004).

71. Zubizarreta-Gerendiain, A., Garcia-Gonzalo, J., Strandman, H., Jylha, K., Peltola, H . 2016. **Regional effects of alternative climate change and management scenarios on timber production, economic profitability, and carbon stocks in Norway spruce forests in Finland**. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere. 46. (2) 274-283. DOI (10.1139/cjfr-2015-0218).

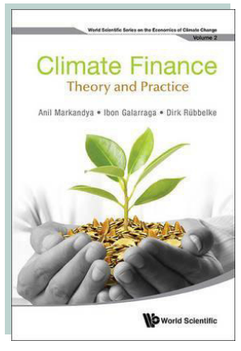
72. Zubizarreta-Gerendiain, A., Pukkala, T., Peltola, H. 2016. **Effects of wood harvesting and utilisation policies on the carbon balance of forestry under changing climate: a Finnish case study**. Forest Policy and Economics. 62. 168-176. DOI (10.1016/j.forpol.2015.08.007).

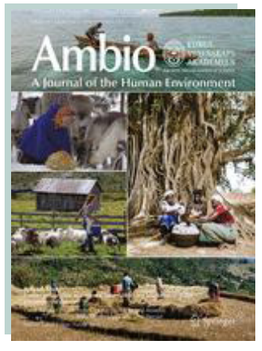
Books

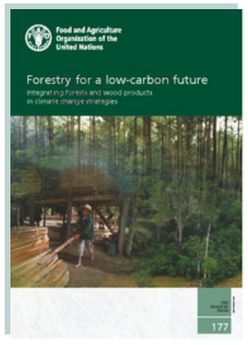
1. Markandya, A., Galarraga, I. and Rübbelke, D. 2016. **Climate Finance: Theory and Practice**. Singapore. World Scientific Series on the Economics of Climate Change. 300. ISBN 978-981-4641-80-7.

2. Ravera, F., I. Iniesta-Arandia, B. Martín-López, U. Pascual, and P. Bose. 2016. **Gender perspectives in resilience, vulnerability and adaptation to global environmental change**. Special Issue AMBIO. Netherlands. Springer. ISBN 10.1007/s13280-016-0842-1.

3. Sanz, M.J. et all. 2016. **Forestry for a low-carbon future. Integrating forest and Wood products in climate change strategies**. Rome. FAO. 180. ISBN 978-92-5-109312-2.







3.4 Publications | 3.4.1 List of Publications

Book Chapters

1. **Climate Investments**. Climate Finance: Theory and Practice. Singapore. World Scientific Series on the Economics of Climate Change. 300. ISBN 978-981-4641-80-7.
2. Abadie, L.M., Spadaro, J.V. 2016. **Role of Uncertainty in Energy Investments and Regulation. Delivering Energy Law and Policy in the EU and the US**. Edinburgh. Edinburgh University Press. 768. ISBN 9780748696789.
3. Arto, I., Capellán-Pérez, I., Filatova, T., González-Eguino, M., Hasselmann, K., Kovalevsky, D., Markandya, A., Moghayer, S.M., Tariku, M.B. 2016. **Definitions. Non-linearities and system-flips**. Sigtuna, Sweden. Sigtunastifelsen. ISBN 978-91-976048-2-6.
4. Arto, I., Capellán-Pérez, I., Filatova, T., González-Eguino, M., Hasselmann, K., Kovalevsky, D., Markandya, A., Moghayer, S.M., Tariku, M.B. 2016. **The climate system. Non-linearities and system-flips**. Sigtuna, Sweden. Sigtunastifelsen. ISBN 978-91-976048-2-6.
5. Arto, I., Capellán-Pérez, I., Filatova, T., González-Eguino, M., Hasselmann, K., Kovalevsky, D., Markandya, A., Moghayer, S.M., Tariku, M.B. 2016. **Socio-ecological systems. Non-linearities and system-flips**. Sigtuna, Sweden. Sigtunastifelsen. ISBN 978-91-976048-2-6.
6. Arto, I., Capellán-Pérez, I., Filatova, T., González-Eguino, M., Hasselmann, K., Kovalevsky, D., Markandya, A., Moghayer, S.M., Tariku, M.B. 2016. **Lake systems. Non-linearities and system-flips**. Sigtuna, Sweden. Sigtunastifelsen. ISBN 978-91-976048-2-6.
7. Arto, I., Capellán-Pérez, I., Filatova, T., González-Eguino, M., Hasselmann, K., Kovalevsky, D., Markandya, A., Moghayer, S.M., Tariku, M.B. 2016. **Climate mitigation policies. Non-linearities and system-flips**. Sigtuna, Sweden. Sigtunastifelsen. ISBN 978-91-976048-2-6.
8. Arto, I., Capellán-Pérez, I., Filatova, T., González-Eguino, M., Hasselmann, K., Kovalevsky, D., Markandya, A., Moghayer, S.M., Tariku, M.B. 2016. **Coupled environment-ecology modelling. Non-linearities and system-flips**. Sigtuna, Sweden. Sigtunastifelsen. ISBN 978-91-976048-2-6.
9. Capellán-Pérez, I., Arto, I., Polanco-Martínez, J. M., González-Eguino, M., Neumann, M. B. 2016. **Climate Change Pathways and Uncertainty on Recoverable Energy Resources**. **Establishing Policy-Relevance: Developing and Evaluating Policy Options**. Sigtunastifelsen. ISBN 978-91-976048-3-3.
10. de Ayala, A. Hoyos, D. and Mariel, P. 2016. **Valoración económica de los paisajes de la Llanada Alavesa. Catálogo de paisaje de la Llanada Alavesa**. Editorial Service from the University of the Basque Country. ISBN 978-84-9082-370-5.
11. Galarraga, I., Markandya A. and Rübbelke, D. 2016. **Challenges in International Climate Finance**. Climate Finance: Theory and Practice. World Scientific Series on the Economics of Climate Change.
12. Gonzalez Eguino, M., Markandya, A. and Rey, L. 2016. **Climate Policy Instrumentation in Spain. Delivering Energy Policy in the EU and US**. Edinburgh. Edinburgh University Press. 768. ISBN 978-0-7486-9678-9.
13. Mani, M., Markandya, A., Sagar, A., Strukova, E. and Joshi, G. 2016. **Estimating Cost of Environmental Degradation in India**. Environment and Development : Essays in Honour of Dr U. Sankar. Sage. ISBN 978-93-5150-649-2.
14. Moreno-Mateos, D. and Palmer, M.A. 2016. **Watershed Processes as Drivers for Aquatic Ecosystem Restoration. Foundations of Restoration Ecology**. 2nd ed. Washington, DC. Island Press. ISBN 9781610916974.
15. Ruhi, Q., Fairchild, G.W., Spieles, D.J., Becerra-Jurado, G., Moreno-Mateos, D. 2016. **Constructed and restored wetlands. Invertebrates in Freshwater Wetlands**: An international perspective on their ecology. Switzerland. Springer. 525-564. ISBN 978-3-319-24976-6.

Other Publications

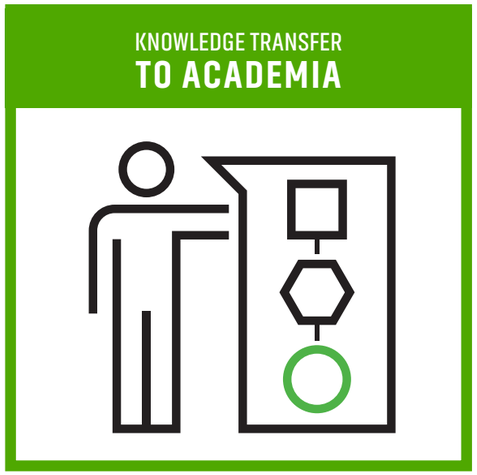
1. Anil Markandya, Deger Saygin, Asami Miketa, Dolf Gielen and Nicholas Wagner. 2016. **The True Cost of Fossil Fuels: Saving On the Externalities of Air Pollution and Climate Change**. (IRENA).
2. Federici, S., Grassi, G., Harris, N., Lee, D., Neeff, T., Penman, J., Sanz, M.J. and Wollosin, M. 2016. **GHG fluxes from forests: An assessment of national reporting and independent science in the context of the Paris Agreement**. GFOI (Climate and Land Use Alliance).
3. Markandya, A. 2016. **Cost benefit analysis and the environment: How to best cover impacts on biodiversity and ecosystem services**. OECD, Organisation for Economic Co-operation and Development. 101. 41. DOI (10.1787/5jm2f6w8b25l-en).
4. Sanz, M.J. et all. 2016. **Integration of remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative**. Food and Agriculture Organization.
5. Sophie Aubin, Elizabeth Arnaud, Thomas Baker, Patricia Bertin, Christopher Brewster, Caterina Caracciolo, Fabrizio Celli,Michael Devlin,Christine Geith, Odile Hologne, Ilkay Holt, Johannes Keizer, Devika Madalli, Nikos Manouselis,Laura Meggiolaro, Graham Mullier, Valeria Pesce, Rob Lokers, Martin Parr, Philip Roberts, Armando Stellato, Giannis Stoitsis, Imma Subirats,Ferdinando Villa. 2016. **The Chania Declaration**.

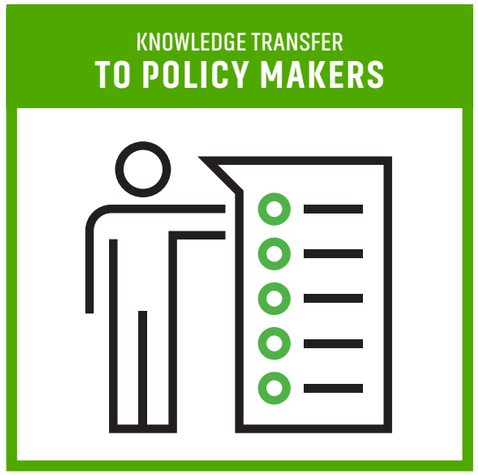
4. KNOWLEDGE TRANSFER

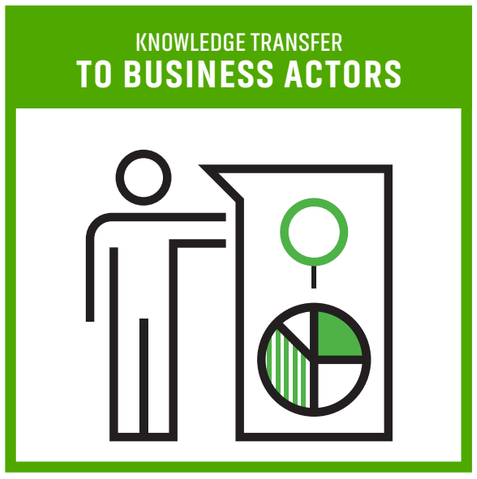
The role of science in shaping climate policies, building capabilities and raising awareness has become increasingly important, since climate change is nowadays at the top of political agendas. In fact, it is a fundamental part of our work is to contribute, through science, to the climate policy making process.

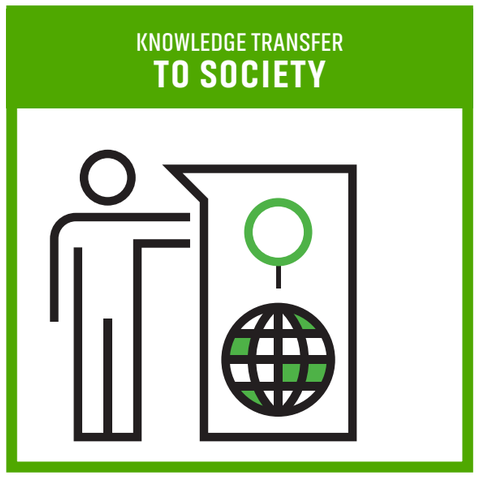
The BC3 Knowledge Transfer deployment is brought into action through the centre´s Dissemination and Strategic Communication Plan (SCP) 2014-2017, which was designed in 2013 and it is being implemented since then. This plan pursues excellence in research, training and dissemination making the knowledge generated in our centre broadly available to the following target audiences:

- SCIENTIFIC COMMUNITY (ACADEMIA)
- POLICY MAKERS
- BUSINESS ACTORS
- SOCIETY









BC3's Dissemination, Training & Capacity Building and Science Outreach permanent initiatives

DRIVING ACTIONS

designed to disseminate and disclose rigorous information on climate change.

Dissemination:
of research findings in Key Scientific Meetings.

Dissemination:
BC3 Seminar Programme.

Dissemination:
BC3 Visiting Programme.

Dissemination:
BC3 Working Papers Serie.

TRAINING AND CAPACITY BUILDING

activities to "bridge knowledge" in terms of scientific advancements.

Training:
Supervised Phd and Master Students.

Training:
Classes given in Post graduate Courses.

Capacity building:
Workshops: Klimagune and ad-hoc organized events

Training & Capacity Building:
BC3 - UPV/EHU Summer School.

Training & Capacity Building:
Spring University on Ecosystem Services Modeling.

Capacity building:
Policy Briefing Series.

Capacity building:
Contribution to UNFCCC COPs.

SCIENCE EDUCATION AND PUBLIC AWARENESS

Raising awareness of Climate Change at Basque Country Scale

Science Education:
Training Caravan (Researchers at Classroom).

Public awareness in the media.

4.1 TO ACADEMIA | 4.1.1 Dissemination in Scientific Meetings

During 2016, BC3 researchers participated in major science conferences and congresses related to their specialties all around the world. Following a selected contributions are listed.

NAME OF THE CONFERENCE/CONGRESS	CITY	HOST INSTITUTION	TITLE OF THE CONTRIBUTION
13th European IAEE Conference	Düsseldorf	International Association for Energy Economics	Is green energy expensive? Empirical evidence from the Spanish electricity market
35th International Energy Workshop 2016	Cork	University College Cork	The price of energy efficiency in the Spanish housing market
3rd International Conference on Biodiversity and Food Security – From Trade-offs to Synergies	Aix en Provence	Universitiy of Aix en Provence	Can we save agrobiodiversity by paying farmers? Insights from a field experiment in the Andes?
8th International Congress on Environmental Modelling and Software	Toulouse	The International Environmental Modelling & Software Society	Integrating human agency and ecosystem services: an ABM perspective on food
9th International Ecosystem Services Partnership Conference	Antwerp	Ecosystem Services Partnership	Disentangling the Pathways and Effects of Ecosystem Service Co-Production
Annual Conference of the European Association of Environmental and Resource Economics	Zurich	Swiss Federal Institute of Technology in Zurich (ETHZ)	Rain or Shine? Understanding climate variability and poverty reduction in the Indian context
Annual meeting Finnish Forest Mensurationist's club on REDD+ History and Present status in the context of the UNFCCC	Helsinki	World Bank	Implications of the COP21 on countries reporting needs and responsibilities: What is the future of NFMS and MRV?"
ASABE 1st Climate Change Symposium	Chicago, IL	American Society of Agricultural and Biological Engineers	Linking Ecosystem Services to Food Security in a Changing Planet: assessing Peruvian Amazon deforestation using the Artificial Intelligence for Ecosystem Services (ARIES) framework
Food and Agriculture Organization of the United Nation's 23rd Session of the Committee on Forestry (COFO) and the 5th World Forest Week	Rome	FAO	Climate change mitigation options in the forest sector: Economics, opportunities and way forward
International Conference on Policy Mixes in Environmental and Conservation Policies	Leipzig	Helmholtz Centre for Environmental Research – UFZ	Mitigation – Adaptation tradeoffs in climate policy
Towards quantifying the links between environment and economic growth	Paris	OECD	Natural Capital and Economic Growth: Past Evidence and Future Prospects
VII Conference of the Spanish-Portuguese Association of Resources and Environmental Economics (AERNA)	Aveiro	Universidade de Aveiro, Portugal	Climate change implication for soil biodiversity conservation: A bio-economic modelling approach

4.1 TO ACADEMIA | 4.1.2 Supervised post-graduate students

As one of the BC3 training key activities, during 2016 the following PhD and Master students were supervised by BC3 Knowledge body

PhD Students

TITLE	PhD STUDENT	SUPERVISOR
Economics of Climate Finance	Maria Victoria Román	Dirk Rübbelke Iñaki Arto
Combined application of cost–benefit analysis and multi-criteria analysis for decision support in air quality management policy: a case study in the metropolitan area of Lima and El Callao, Peru	Gerardo Sánchez	Aline Chiabai
Coupling models and life cycle assessment to evaluate agricultural mitigation strategies involving organic resources management	Guillermo Pardo	Agustin del Prado
Political Ecology of soil management	Amaia Albizua	Unai Pascual
Distributional implications of environmental policies	Xaquín García	Mikel González Ruiz de Eguino
Energy and climate policy interactions: an Integrated Assessment modelling approach	Iñigo Capellán	Mikel González Ruiz de Eguino
Statistical analysis of climate and paleoclimate records	Gonzalo Morcillo	Sérgio H Faria
Modelling of public opinion and awareness of climate change	Itxaso Ruiz	Sérgio H Faria
Implications of uncertainties for adaptation decision making in the agriculture sector	Alina Tepes	Ibon Galarraga
On economics of adaptation	Ambika Markanday	Ibon Galarraga
Integrated Assessment and behavioural options for mitigation	Dirk Jan Van de Ven	Mikel González Ruiz de Eguino Iñaki Arto
Economics of ecosystem services	Laetitia Pettinotti	Anil Markandya
Integrated Assessment and the co-benefits of mitigation	Jon Sampedro	Mikel González Ruiz de Eguino Iñaki Arto
A socio-institutional analysis of wildlife conservation in Africa	Giulia Wegner	Unai Pascual
Multicriteria evaluation of sustainable tourism development projects	Juan Luis Eugenio Martin	Unai Pascual

PhD Students

TITLE	PhD STUDENT	SUPERVISOR
Recuperación de la estabilidad de las redes de interacción en bosques templados tras impactos causados por la minería desde la edad media	Asun Rodriguez	David Moreno
Incorporating complexity into ecosystem services governance	Javier Moreno	Ignacio Palomo
Tradeoffs between effectiveness and equity in Payments for Ecosystem Services	Bosco Lliso	Unai Pascual
Desarrollo de herramientas para evaluar los efectos de las medidas de adaptación al cambio climático	Pablo Martinez	Aline Chiabai
Territorialidad, resiliencia tradicional/ancestral y cambio climático: pueblos y nacionalidades indígenas de la Amazonía ecuatoriana del Cantón Mera de la Provincia de Pastaza 2016-2018	Freddy Eliseo Michel Portugal	Sérgio H Faria

Master students

TITLE	MASTER STUDENT	SUPERVISOR
Integrated sustainability assessment of livestock grazing in mountain areas: the case of Aralar.	Aitor Andonegi	Eneko Garmendia
Tesis de Máster: Estimación de los cambios en los stocks de carbono del suelo a escala regional: Impacto de los usos del suelo y del manejo en la Comunidad Autónoma de Aragón	Asma Jebari	Agustin del Prado Santeodoro
An analysis of the socio-economic activities in the low Oka Estuary	Beñat Iglesias	Elisa Sainz de Murieta
Impactos de los cambios de usos del suelo en el suministro y demanda de servicios en Madrid	Alberto Gonzalez	Ignacio Palomo
Servicios de los ecosistemas generados por el viñedo tradicional de secano de Doñana	Sergio Baraibar	Ignacio Palomo
Is renewable energy a cost-effective mitigation resource against climate change? An analysis of the Spanish electricity market beyond the merit-order effect	Gabriel Peto	Cristina Pizarro
Monitoring, Evaluation and Reporting (MER) mechanisms for local climate change adaptation planning	Lies Huitema	Marta Olazabal

4.1 TO ACADEMIA | 4.1.3 Classes given in post-graduate courses

Among our training activity drivers, we may also find the classes offered by our researchers' body in post-graduate and advanced courses in different international universities during the year.

TYPE OF COURSE	TITLE OF COURSE	UNIVERSITY
Advanced course	ARIES training for urban watershed management.	Metro Vancouver, Canada
Advanced course	I Curso de economía ecológica	University of the Basque Country UPV/EHU
Master course	Climate Change Policy / European Master of Science in Marine Environment and Resources. Joint European Postgraduate Studies MO2006-00744	University of the Basque Country UPV/EHU
Master course	Cambio Climático, el gran reto social de nuestro tiempo	Universidad Camilo José Cela, Universidad de Salamanca, FLACSO España, Ecologistas en Acción, Greenpeace, WWF, Seo/ BirdLife, FUHEM
Master course	Herramientas de análisis económico ante conflictos ambientales/ Master de "Democracia participativa y desarrollo Comunitario"	University of the Basque Country UPV/EHU
Master course	Metabolismo social y Deuda ecológica/ Master de "Economíia Ecolóogica: Hacia una economía circular en materiales"	University of the Basque Country UPV/EHU
Master course	Planificación y gestión socio-ecológica del territorio aplicada a los espacios naturales/ Master en Espacios Naturales Protegidos	Universidad Autónoma de Madrid
Master course	Stakeholder based mapping/ Master on Ecosystem Services Mapping for Landscape planning	Instituto Agronómico de Zaragoza
Master course	An Introductory course on environmental & economic data with (quantum) / Máster Universitario en Economía "Medio ambiente, crecimiento y ecología industrial"	Universidad de Zaragoza

4.1 TO ACADEMIA | 4.1.4 Seminars given

From BC3 we organized in 2016 a series of interdisciplinary lectures that contributed to climate change knowledge transfer. Focused on key theoretical and methodological issues on climate change, these lectures brought together professors, researchers and PhD students. Some of these seminar series were jointly organized with the University of the Basque Country.

BC3 Seminars

DATE	LECTURER	INSTITUTION	SEMINAR TITLE
2016/12/14	**Dr. Sami Domisch**	Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany.	Species distribution modelling of freshwater organisms
2016/12/14	**Dr. Simone Langhans**	Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany.	How decision analysis theory can be used for river management
2016/12/13	**Dr. Virgilio Hermoso.** **Dr. Simone Langhans**	Centre Tecnològic Forestal de Catalunya. Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany	Catchment zoning to enhance co-benefits and minimise trade-offs between ecosystem services and biodiversity conservation
2016/11/29	**Isabel Casas**	BCAM - Basque Center for Applied Mathematics	Exploring option pricing via volatility asymmetry
2016/09/05	**Makoto Oba** **Prof. Kiichiro Hayashi**	National Institute for Environmental Studies, Japan Institute of Materials and Systems for Sustainability Division of Systems Research,Nagoya University, Japan	Demand and supply assessment of ecosystem services in the case of Japan
2016/07/27	**Prof. Anders Skonhoft**	Norwegian University of Science and Technology	The Norwegian electric car policy; environmental friendly or an economic disaster?

BC3 Seminars

DATE	LECTURER	INSTITUTION	SEMINAR TITLE
2016/06/28	**Hanna Brauers**	Technische Universität Berlin and Research assistant at German Institute for Economic Research	Diverging coal phase-out strategies and their implications for eu climate & energy policies
2016/06/22	**Alina Averchenkova**	Grantham Research Institute	Beyond the targets: Assessing the political credibility of the NDCs under the Paris agreement
2016/06/21	**Christopher Costello**	Bren School of Environmental Science & Management	Global fishery futures under contrasting management regimes and climate change
2016/06/14	**Lorenzo Chelleri**	Gran Sasso Science Institute (GSSI), L'Aquila, Italy	City Resilience: just do it?
2016/06/07	**Carlo Giupponi**	Venice Centre of Climate Studies	Spatial and temporal variabilities of land uses as affected by global change: a focus on Mediterranean agriculture.
2016/04/14	**Maria Joao Ferreira Dos Santos**	Copernicus Institute of Sustainable Development, Utrecht University	Understanding ecosystem responses under a mosaic of land sparing and sharing
2016/01/27	**Prof. Dr. Reinhard Mechler**	IIASA and Vienna University of Economics and Business	Climate risk management for the Loss & Damage Debate: Acting on principles of distributional and compensatory justice

4.1 TO ACADEMIA | 4.1.5 Visiting Programme

The aim of our Visiting Programme is to promote research and dialogue between BC3 and other institutions by supporting and hosting local and international researchers wishing to establish a link with us. Additionally, this programme allows our institution to contribute to climate change knowledge at the Basque Country by inviting visitors to participate in the BC3 Seminar Programme. Our Visiting Programme may be considered therefore an additional source for talent attraction, as well as a chance to join international research initiatives.

List of 2016 visitors

VISIT DATE	VISITOR	INSTITUTION	POSITION	LINK WITH BC3 RESEARCH LINE
April	**Maria Joao Ferreira Dos Santos**	Copernicus Institute of Sustainable Development, Utrecht University	Assistant Professor	Climate and Natural Environment
June	**Michael Carbajales-Dale**	Clemson University (USA)	Associate Professor	Low Carbon
June	**Carlo Giupponi**	Venice Centre of Climate Studies	Tenure Professor at Ca' Foscari University	Climate and Natural Environment
June	**Lorenzo Chelleri**	Gran Sasso Science Institute (GSSI), L'Aquila, Italy	Postdoctoral Research Fellow	Climate Policy
June	**Christopher Costello**	Bren School of Environmental Science & Management	Professor	Climate Policy
June	**Alina Averchenkova**	Grantham Research Institute	Co-Head Climate Policy	Climate Policy

4.1 TO ACADEMIA & POLICY MAKERS | 4.1.6 Organization of Scientific Events

BC3 plays an active role organizing international Climate Change scientific events and workshops involving the most influential researchers in the field. During 2016, we organized with this objective a series of different dissemination activities, such as workshops, directed to nurture ongoing research, support decision-making processes and enhance the engagement of key players (stakeholders) by establishing a dialogue with them.

SOME HIGHLIGHTED WORKSHOPS

UNESCO (IPBES) Workshop

"RELATIONAL VALUES AND NATURE: IMPLICATIONS FOR SCIENCE AND POLICY". 30TH MAY – 1ST JUNE 2016.

On 30th May – 1st June we co-organized the workshop "Relational Values and Nature: Implications for Science and Policy" in the city of San Sebastian. Focused on the classification of values of Biodiversity and Ecosystem, it was led by Prof. Unai Pascual and Prof. Kai Chan, under the supervision of the Senior Programme Specialist for Scientific Assessments including IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services). This is the intergovernmental body which assesses the state of biodiversity and of the ecosystem services it provides to society, in response to requests from decision makers, and it is placed under the auspices of four United Nations entities: UNEP, UNESCO, FAO and UNDP and administered by UNEP), all in the framework of UNESCO.
This 3-day meeting convened 20 leading experts with interdisciplinary expertise on values and valuation, including experts engaged with IPBES, with the purpose of producing a draft to be be considered for the IPBES plenary in 2017.

+ Info: http://unescows2016.bc3research.org/

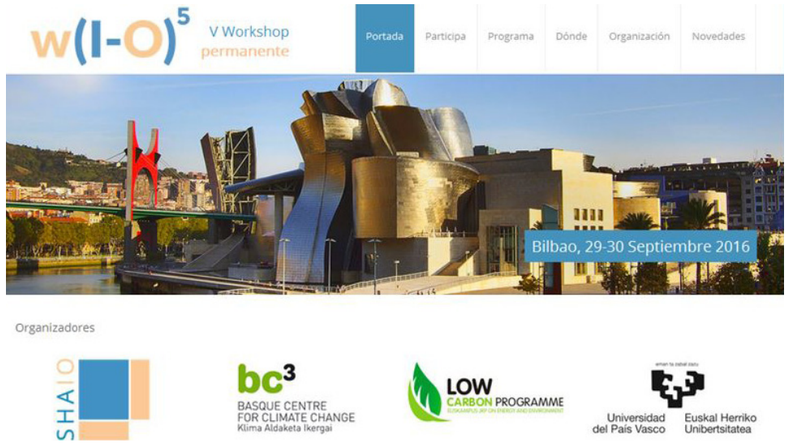
5th Spanish Workshop on Input-Output Analysis Workshop

29TH-30TH SEPTEMBER 2016, FACULTY OF SARRIKO, BILBAO.

This workshop was organized by BC3, led by BC3 Researcher Dr. Iñaki Arto, jointly with the Hispano-American Society of Input-Output Analysis with the collaboration of the University of the Basque Country and the Low Carbon Programme.

The Hispano-American Society for Input-Output Analysis (SHAIO), established in 2007, intends to contribute to the promotion, dissemination and research of input-output analysis and other related scientific-economic topics, as well as to develop scientific projects for the development and application of these techniques of economic analysis. The Society was born from a group of researchers from different countries called the Input-Output Group (IOG), founded in 2003, faced with the need to undertake new challenges, several members of the group encouraged the transformation of the group into association. SHAIO brings together over 100 researchers from several countries.

The keynote speaker was lectured by Prof. Geoffrey J.D. Hewings (Director of REAL at University of Illinois (US).



4.1 TO ACADEMIA | 4.1.7 BC3 Working Papers — 4.1.8 Open Access

4.1.7 BC3 WORKING PAPERS

BC3 produces also its own Working Paper Series, which serves to illustrate and disseminate the scientific work developed by our researchers and collaborators, as well as triggers the scientific debate on hot topics. They are accessible via several media channels, including our website, Research Papers on Economics (RePEc) and the public repository of the University of the Basque Country (ADDI).

- [2016/05] **The geographic distribution of the economic impact of climate finance.**
  María Victoria Román, Iñaki Arto and Alberto Ansuategi.
- [2016-04] **Beyond Ecosystem Services: A Food Security Perspective (Draft).**
  Stefano Balbi and Ferdinando Villa.
- [2016-03] **The role of flexible biofuel policies in meeting biofuel mandates.**
  Anil Markandya, Kishore Dhavala and Alessandro Palma.
- [2016-02] **Industrial and terrestrial carbon leakage under climate policy fragmentation.**
  Mikel González-Eguino, Iñigo Capellán-Pérez, Iñaki Arto,
  Alberto Ansuategi and Anil Markandya.
- [2016-01] **What determines the magnitude of the economic impact of climate finance in recipient countries? A structural decomposition of value-added creation between countries.**
  María Victoria Román, Iñaki Arto and Alberto Ansuategi.

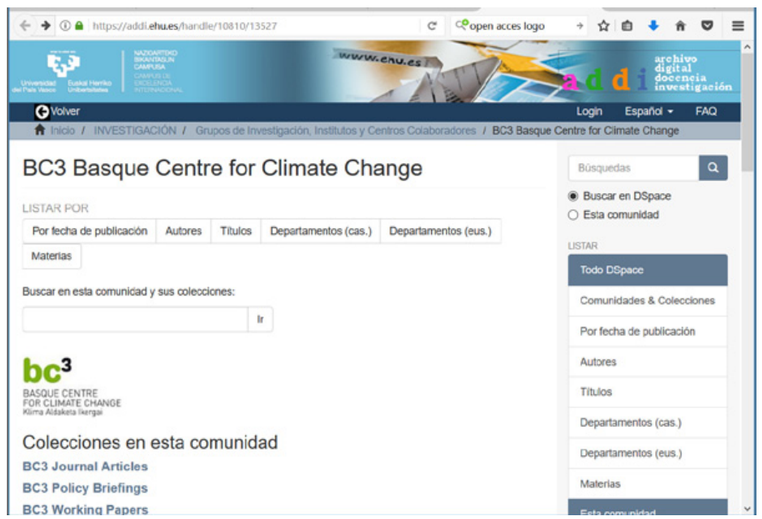
4.1.8 OPEN ACCESS

In 2014, we reached a collaboration agreement with the ADDI platform (public repository of publications of the University of the Basque Country) for the delegated archive of our Working Papers series of publications and Policy Briefings in a public repository. During 2016, we continued making available throug ADDI all its publications series at ADDI platform and scientific journal publications.

ADDI public repository platform, is interconnected with OPENAIRE in a way that optimizes the visibility of open access BC3 publications series.

The publications are available at:

- **https://addi.ehu.es/handle/10810/13527**



4.2 TO POLICY-MAKERS | 4.2.1 Policy relevant contributions: Highlights

Climate change is nowadays at the top of political agendas and it is a fundamental part of our work to contribute to the design of related policies, as well as to facilitate, through science, their application in a regulatory framework, consistent with the protection of the planet.

Hence, our involvement in the most relevant organizations, such as IPCC (Intergovernmental Panel on Climate Change), IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) and the UNFCCC (United Nations Framework Convention on Climate Change) is strategic for us, as it shows our ability to play an active role among the most authoritative actors in the field of climate change and climate policy. Such involvement is also a sign of international recognition, and a demonstration of our capacity to build relevant links and connections, addressing policy-makers at the highest levels.

One of our relevant contributions to the EU policy making process is taking part in the UNFCCC Side Events. These were established as a platform for observer organizations to highlight diverse climate change issues at UNFCCC conferences, and are a vital component of the UNFCCC sessions, as they provide opportunities for information dissemination, capacity building, policy discussions and a way to legitimize global governance.

BC3 is recognized by the United Nations Framework Convention on Climate Change (UNFCCC) as a Non-Governmental Organization and in 2016, we contributed to several official side events at the Conferences of the Parties at COP22 in Marrakesh jointly with other leading Climate Change scientific and policy institutions

Sustainable development priorities of highly sensitive regions to Climate Change in Latin America: Appropriate orchestration of Adaptation and Mitigation actions.

14th of November, Marrakesh.

The event was held in Marrakesh and was jointly organized by BC3 and the government of El Salvador. It attracted representatives of regional authorities and expert scientists in the study of climate change who shared successful experiences that can be transferred to other regions.

Creation of the International Network of Centers of Excellence and Climate Change Think-Tanks For Capacity Development (INCCCETT 4CB)

14th of November, Marrakesh.

BC3, jointly with other 11 international reference research centers, announced on the 14 November at the COP 22 its participation in the creation of a pioneering network of research centers of excellence (INCCCETT 4CB) “International Network on Climate Change Centres of Excellence and Think Tanks”.

This network, whose technical secretary is in charge of the recently created Center of Compétences Changement Climatique du Maroc (4C Maroc), is participated by first level centers such as the International Institute for Climate and Society of Columbia (IRI), the Stockholm Environment Institute (SEI), the International Institute for Global Change Research (IAI) and the International Institute for Climate Change For Sustainable Development (IISD), and its purpose is:

1. To achieve climate action in the climate contributions of all countries through better South-South-North collaboration between Think-Tanks and centers of excellence, thus responding to the needs of policy makers at all levels of government (local, regional, national).
2. To increase the impact of capacity development by improving outreach and focusing on practices that have a sustainable impact.

Our Scientific Director, Prof. Maria Jose Sanz, participated in the launch of the network with Nizar Baraka, President of the Scientific Committee of COP22, Carlos Gentille, Deputy Minister for Climate Change and Sustainable Development of the Government of Argentina and Daniele Violetti, representative of the secretariat of the United Nations Framework Convention on Climate Change.

In addition to these contributions, we were also invited to participate as keynote speakers and moderators in other Official Side Events organized during the climate Change Summit COP22.

- **GREEN CLIMATE FUND DIALOGUE ON REDD+**
- **WORKSHOP TO THE SIDE-EVENT ON THE INCCCETT INITIATIVE 4 CB**

Moreover, we took part and addressed the Fourth Plenary of the Intergovernmental Platform of Biodiversity and Ecosystem Services (IPBES) celebrated in February 2016.

4.2 TO POLICY-MAKERS | 4.2.1 Policy relevant contributions: Highlights

Basque Parliament Reporting

On February 17, 2016, Prof. Unai Pascual, Ikerbasque researcher at BC3, made a presentation in the Basque Parliament.

The hearing was organized at the request of the "Committee on Environment and Territorial Policy of the Basque Parliament" to assess the agreement reached at the summit on climate change held in Paris.

KLIMA 2050 BASQUE COUNTRY

Climate Change Strategy of the Basque Country to 2050

Climate Change Strategy of the Basque Country, KLIMA 2050

The Basque Climate Change Strategy, Klima 2050, started in 2014 when a strategic focus document was produced. BC3 was involved from the outset in this above mention strategy, as climate change expert.

During 2016, we continued our collaboration in different actions and activities implemented in the framework of the Klima 2050. Osatu Research Project was one example of the contributions done.

4.2 TO POLICY-MAKERS | 4.2.2 Policy making supporting methodology tools

ECOSYSTEM SERVICES

BC3 has also developed decision making suporting tools in the context of ecosystem services, such as ARIES (Artificial Intelligence for Ecosystem Services), a web-based free modelling technology offered to users such as practitioners, scientists and decision-makers including members of NGOs, academic, or governmental institutions worldwide, to assist rapid ecosystem service assessment and valuation (ESAV).

BC3, with ARIES has developed some of the most advanced methodologies (assembling deterministic or probabilistic models) to quantify and value flows of ecosystem services at the appropriate spatial scale, ecological and socio-economic context. ARIES maps concrete, spatially explicit beneficiaries of ecosystem services, and quantifies their demand for each service. Conceptualizing ecosystem services as a concrete list of benefits for concrete beneficiary groups avoids the problem of "double counting" of benefits that has plagued past ecosystem service valuation efforts.

LOW CARBON TRANSITION PATHWAYS

Regarding low carbon transition pathways, BC3 has developed different tools and methodologies that can capture the interlinkages between the socio-economic, energy, environmental and the climate systems to better understand the measures to control GHG emissions at national and global level. These tool/models are very diverse and include different types of CGE/input-output models, integrated assessment models and micro-simulation models.

DERIO

(Dynamic Econometric input-output Model for the Basque Country)

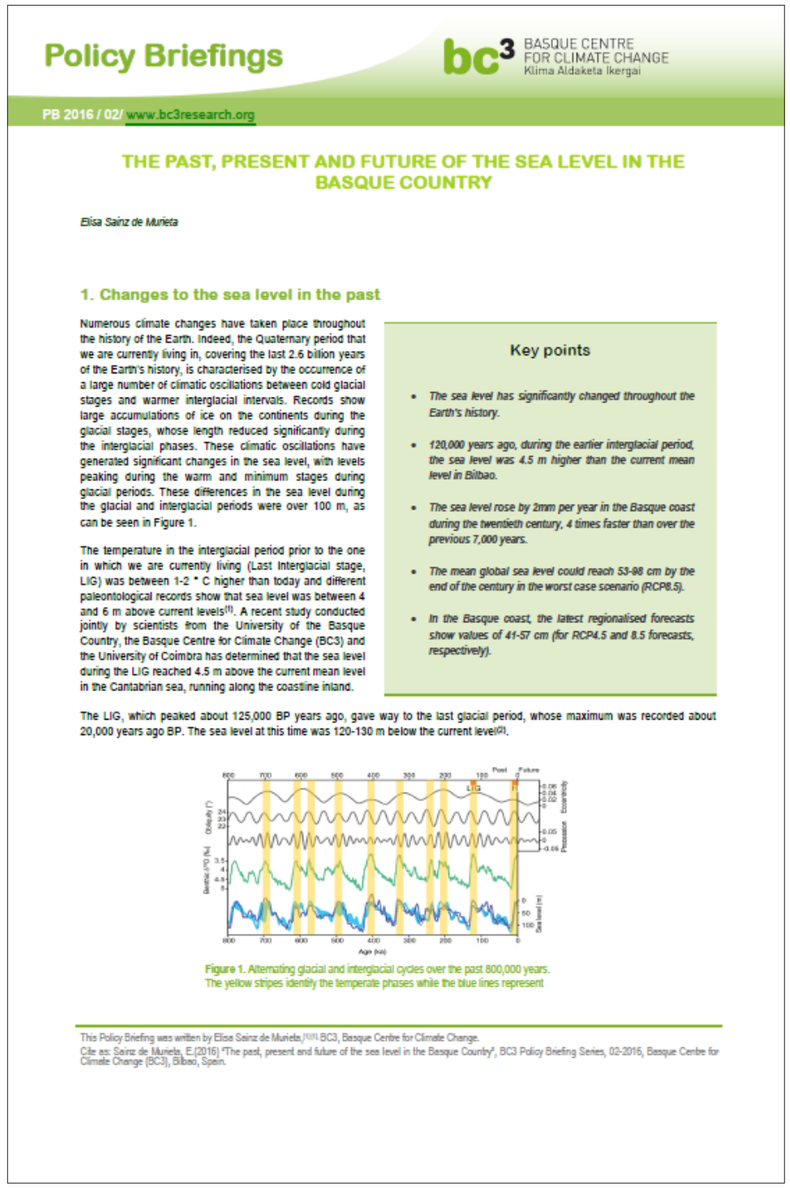
A team of researchers from the Basque Centre for Climate Change (BC3) led by Iñaki Arto, in collaboration with Professor Kurt Kratena (Center for Economic Scenario Analysis and Research, CESAR and Austrian Institute of Economic Research, WIFO) developed an economic- energy-environment model for the Basque Country oriented the analysis of scenarios and policies in different areas of decision. The model was successfully used for the analysis of the economic impact of the Basque Country's 2050 Climate Change Strategy.

The DERIO model, developed under the Bizkaia: Talent program, follows the philosophy of the FIDELIO (Fully Interregional Dynamic Econometric Long-term Input- Output) created by Professor Kurt Kratena together with Iñaki Arto for the Joint Research Centre of the European Commission. This model has recently contributed to the analysis of the impact of the Clean Air Package of the European Union.

DERIO is characterized by a detailed description of the Basque economy in terms of sectors (88 sectors), products (105 products), consumers (5 groups of consumers differentiated by income level), categories of final consumption (16 categories), energy system (processing industry, exchanges, final consumption, etc.) and environmental extensions (energy, CO2 emissions and other pollutants). For the development of the model, different official statistical sources such as economic accounts (EUSTAT), family budget survey (INE), energy balances (EVE) or emission inventories (IHOBE) were been used.

One of the main characteristics of the model is that the user can adapt it according to his needs. This feature, together with its multi-dimensional character, makes it especially useful for the analysis of scenarios and policies in different areas of decision. In addition, its flexibility and versatility make it suitable for the analysis of specific policies such as the promotion of energy efficiency (households, industry or transport), Renove plans, tax reforms, etc.

4.2 TO POLICY-MAKERS | 4.2.3 Policy making supporting information: Policy Briefing Series



Policy Briefings

bc3 BASQUE CENTRE FOR CLIMATE CHANGE Klima Aldaketa Ikergai

PB 2016 / 02/ www.bc3research.org

THE PAST, PRESENT AND FUTURE OF THE SEA LEVEL IN THE BASQUE COUNTRY

Elisa Sainz de Murieta

1. Changes to the sea level in the past

Numerous climate changes have taken place throughout the history of the Earth. Indeed, the Quaternary period that we are currently living in, covering the last 2.6 billion years of the Earth's history, is characterised by the occurrence of a large number of climatic oscillations between cold glacial stages and warmer interglacial intervals. Records show large accumulations of ice on the continents during the glacial stages, whose length reduced significantly during the interglacial phases. These climatic oscillations have generated significant changes in the sea level, with levels peaking during the warm and minimum stages during glacial periods. These differences in the sea level during the glacial and interglacial periods were over 100 m, as can be seen in Figure 1.

The temperature in the interglacial period prior to the one in which we are currently living (Last Interglacial stage, LIG) was between 1-2 ° C higher than today and different paleontological records show that sea level was between 4 and 6 m above current levels[1]. A recent study conducted jointly by scientists from the University of the Basque Country, the Basque Centre for Climate Change (BC3) and the University of Coimbra has determined that the sea level during the LIG reached 4.5 m above the current mean level in the Cantabrian sea, running along the coastline inland.

Key points

- *The sea level has significantly changed throughout the Earth's history.*
- *120,000 years ago, during the earlier interglacial period, the sea level was 4.5 m higher than the current mean level in Bilbao.*
- *The sea level rose by 2mm per year in the Basque coast during the twentieth century, 4 times faster than over the previous 7,000 years.*
- *The mean global sea level could reach 53-98 cm by the end of the century in the worst case scenario (RCP8.5).*
- *In the Basque coast, the latest regionalised forecasts show values of 41-57 cm (for RCP4.5 and 8.5 forecasts, respectively).*

The LIG, which peaked about 125,000 BP years ago, gave way to the last glacial period, whose maximum was recorded about 20,000 years ago BP. The sea level at this time was 120-130 m below the current level[2].

Figure 1. Alternating glacial and interglacial cycles over the past 800,000 years. The yellow stripes identify the temperate phases while the blue lines represent

This Policy Briefing was written by Elisa Sainz de Murieta,[1][2] BC3, Basque Centre for Climate Change.

Cite as: Sainz de Murieta, E.(2016) "The past, present and future of the sea level in the Basque Country", BC3 Policy Briefing Series, 02-2016, Basque Centre for Climate Change (BC3), Bilbao, Spain.

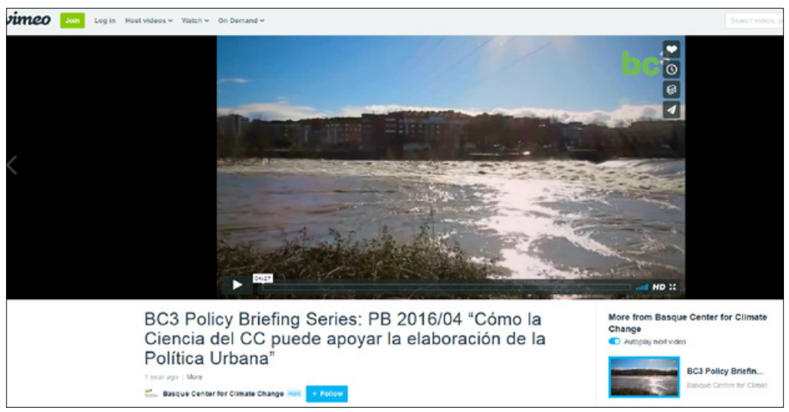
With the objective of being relevant to policy makers, BC3 continued to produce highly accessible Policy Briefings aimed to offer first-hand information to policy makers. During 2016, BC3 produced 7 Policy Briefings altogether.

These documents provide policy recommendations based on our expertise and results from research carried at the centre. The briefings also offer information and training to policy makers and public interest organisations, in order to help them address and respond to the environmental policy related issues.

The documents are accessible through our website and through the public repository of the University of the Basque Country (ADDI), which is interconnected to the "Openaire" repository.

Only at our website, these publications received a large amount of hits in the reference period, and the Basque Parliament called BC3 researchers to present some of their key findings before the political representatives at the Commission for Environment of the Basque Government.

During 2016, we also produced several short videos, targeted at policy makers and society as a whole, to optimize the knowledge transfer and supporting information. Policy briefings Videos are available at our Vimeo Channel.



List of 2016 BC3 Policy Briefings:

- [2016-07] **COP22 in Marrakech confirms worldwide commitment to fighting climate change.** Maria Victoria Román, María José Sanz Sanchez and Ibon Galarraga.
- [2016-06] **Engaging the Public with Science in the Basque Country: On scientists' experiences and perspectives.** María Loroño and Ibon Galarraga.
- [2016-05] **Climate Change in the Basque Country: Impact on Health and Adaptation measures.** Pablo Martínez-Juárez, Amaia de Ayala, Sonia Quiroga and Aline Chiabai.
- [2016-04] **Urban research at BC3: How climate change science can support urban policy making,** Elisa Sainz de Murieta, Sébastien Foudi, Aline Chiabai, Ibon Galarraga, Stefano Balbi, Leif Vogel, María Victoria Román and Anil Markandya.
- [2016-03] **Bridging Science and Policy to Mitigate and Adapt Cities to Climate Change: Challenges and Opportunities in the Context of the Basque Declaration.** Marta Olazabal and Elisa Sainz de Murieta.
- [2016-02] **The past, present and future of the sea level in the Basque Country.** Elisa Sainz de Murieta.
- [2016-01] **The Paris Summit: the beginning of the end of the carbon economy.** María Victoria Román and Ibon Galarraga.

4.2 TO POLICY MAKERS & ACADEMIA | 4.2.4 Training & Capacity Building

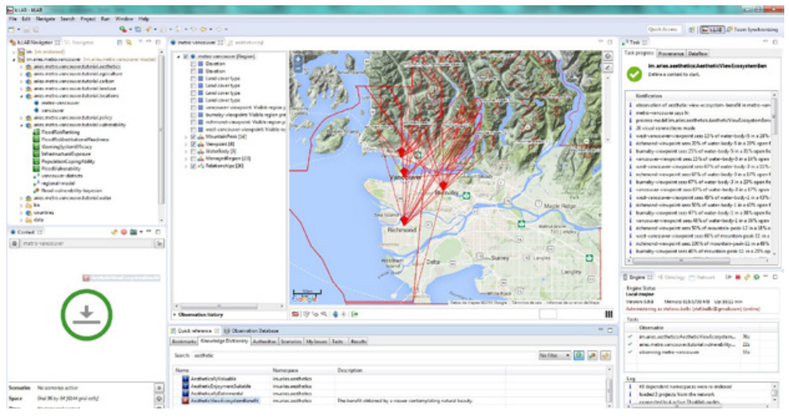
International Spring University on Ecosystem Services Modelling

BC3 launched in 2013 a very successful training programme, "International Spring University on Ecosystem Services Modelling", in collaboration with Conservation International (USA) and the University of Vermont (USA) and during 2016, the programme was consolidated with a new edition.

This initiative, an annual two week intensive advanced course, enables simple use of complex models through artificial intelligence. The course is meant to build a new generation of scientists and policy analysts, capable of using coupled human-environmental models in research, and policy, to address and solve complex sustainability problems. The training plan covers the theory and practice of collaborative, integrated modelling on networked repositories, applied to concrete ecological and social issues of interest of the participants and of the larger community built around the ARIES project.

The 2016 edition of the Spring University, took place from May 2-13 in Bilbao and counted with 25 participants from governmental, non-profit and academic institutions. Participants brought a problem statement and some data to describe it, and left with a developed framework tailored to their case study, together with the knowledge required to build a working solution.

This 4th edition emphasized the theory and practice of collaborative, integrated modelling on networked repositories, applied to concrete ecological and social issues of interest to the participants and to the larger community built around the ARIES project. Using the latest advances of ecoinformatics research, including a high-level modeling language (k.IM) and an infrastructure (k.LAB) that supports the integration of data and models with different modeling paradigms.



BC3- UPV/EHU Summer School 2016: "Climate Change Challenges after Paris Agreement"

Another relevant course for BC3, is the annual Summer School on Climate Change, launched in 2010 with the collaboration of the University of the Basque Country. The objective of this 3-day school, is to offer an updated and recent view of the ongoing trends in climate change issues, gathering leading experts in the field and students from top universities and research centres worldwide.

Its 7th edition took place in San Sebastian, from the 11th- 13th of July 2016, was entitled "Climate Change Challenges after Paris agreement", and led by Dr. Marta Escapa (UPV / EHU) and Dr. Ibon Galarraga (BC3).

After two weeks of hard negotiations, the Paris Agreement was finally adopted on Saturday, 12 December 2015. Thanks to it, a very important milestone in global climate policy has been achieved because it is the basis for greater, transparent and coordinated action of all countries in the coming years. Paris's achievements have surpassed the expectations of many analysts who were already familiar with the slow and rocky progress of climate negotiations. Some observers believe that the key to Paris's success was the extraordinary transparency and trust that prevailed throughout the process. Evidence on the effect that Climate Change has on the sustainability of the world is leading governments around the world to take political, economic and social measures to anticipate and reverse the damage generated and to establish protection and recovery actions.

4.2 TO POLICY MAKERS & ACADEMIA | 4.2.4 Training & Capacity Building

ARIES event for capacity building: "Understanding multiscale linkages in Ecosystem services assessment using ARIES Platform" ICIMOD (Kathmandu), 8th-10th November 2016

In 2016 we organized a regional workshop at ICIMOD (Kathmandu) **for in-house professionals and partner organizations about the ARIES platform**. The objective of this event was to build their capacity on using this platform for assessment of ecosystem services in their country, and to discuss the strategies for mainstreaming the framework for assessment and valuation of ecosystem services for upscaling to HKH level.

Quantifying and mapping ecosystem services (ES) that reach beneficiaries provide a key to distinguishing between the potential for benefit provision and the benefits actually accrued by society. Such a spatially explicit information framework can improve the accuracy of ES valuation and expand the value of ES assessments to decision makers. Beneficiary-based maps of ES provision are crucial in resource management scenarios for influencing management decisions that appropriately address distributional equities among "winners" and "losers". Modeling approaches that map and quantify service-specific sources (ecosystem capacity to provide a service), sinks (biophysical or anthropogenic features that deplete or alter service flows), beneficiaries (user locations and level of demand), and spatial flows only can provide a more complete understanding of ecosystem services leading to decision making at different scales. Researchers have long recognized that the ecosystems that provide benefits to people and the beneficiaries of these services are not always located in the same region. ARIES (Artificial Intelligence for Ecosystem Services) is the first modeling tool that explicitly accounts for this spatial disconnect.

ARIES accomplishes this by first using deterministic or probabilistic models to map provision, use, and sinks of ecosystem services. It then uses agent based models to move a carrier for each service across the landscape according to service specific flow paths. While most ecosystem services mapping tools and projects have simply mapped the potential provision of ecosystem services in the past, ARIES maps actual provision, use, and flows of services by accounting for flow paths and rival use or "sink" regions that deplete or transform the carrier of a service as it moves across the landscape.

At ICIMOD, under transboundary landscapes regional program various initiatives are working on assessment and quantification of ecosystem services, thus it will be crucial to monitor the status of these services under changing climatic and anthropogenic scenarios. For example, a framework on assessment and valuation of non-monitory cultural ecosystem services is already been prepared for Kailash Sacred Landscape, which defines methods and formats for collection of data on cultural services. Geospatial Solutions theme and KSLCDI are currently utilizing ARIES modelling platform to assess the sacredness potential of the Kailash landscape based on the data on cultural sites from India, China, and Nepal, which could prove to be an important input while nominating the landscape as an UNESCO world heritage site. Similarly, quantification and assessment based on the geospatial framework in ARIES could help in understanding the current source-sink-beneficiaries scenario in other ecosystem services from other transboundary landscapes as well.

4.2 TO POLICY MAKERS & ACADEMIA | 4.2.5 Other highlighted contributions

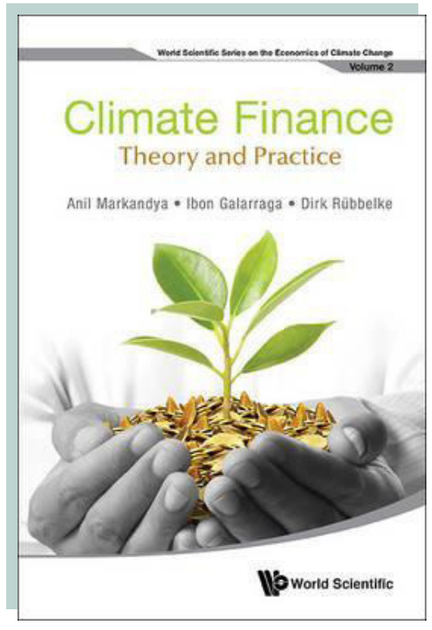
Contribution to the OECD (Organisation for Economic Co-operation and Development)

"Cost benefit analysis and the environment: How to best cover impacts on biodiversity and ecosystem services (2016)" carried out for the Organization for Economic Co-operation and Development.
Markandya, A. (2016), OECD Environment Working Papers No. 101, OECD Publishing, Paris. (DOI 10.1787/5jm2f6w8b25l-en)

Climate Finance: Theory and Practice

This book book edited in 2016 by BC3 researchers Anil Markandya and Ibon Galarraga in collaboration with Dirk Rübbelke (Technische Universität Bergakademie Freiberg, Germany) in World Scientific Series on the Economics of Climate Change), gives an overview of the key debates that have emerged in the field of climate finance, including those concerned with efficiency, equity, justice, and contribution to the public good between developed and developing countries.

With the collaboration of internationally renowned experts in the field of climate finance, the authors highlight the importance of climate finance, showing the theoretical aspects that influence it, and some practices that are currently being implemented or have been proposed to finance mitigation and adaptation policies in the developed and developing world.



4.3 TO SOCIETY. Science Education and Public Awareness

The role of science in shaping climate policies and raising awareness among the general public has become increasingly important. "Bridging knowledge" is a crucial issue, as we understand at BC3.

Thus, we organize events and activities, which enable us to reach and attract all the sectors of society, making the science produced at the institution available to a broad public. This way, we raise awareness on specific subjects and scientific advancements among the people who will eventually play an important role in demanding policy-makers to reshape their policy agendas or to plan concrete actions.

The central message of this first year of the post-Paris era, 2016, was a unanimous call to action, both political and social. So far, science has played a decisive role of warning about climate change and issues related to global environmental issues. From now on, the issue is not to continue to alert, but to innovate, to seek and test urgent solutions, and to evaluate its impact and effectiveness.

Providing tools for training and developing innovative ways to connect climate change science with society will help make science more attractive to citizens and open up new research and innovation activities. In this sense, we promoted our communication activity to citizens and the implementation of different knowledge transfer actions, contributing to the awareness of society about what the European Commission describes as one of the of the greatest European social challenges. These actions included the Training Caravan program, the knowledge transfer program to the teachers of the Basque Country in joint collaboration with Ingurugela (Basque Government Environmental Science Education platform) and the knowledge transfer program target at general public through the media.

Our activities pursue an impact of the research findings on policy, managerial and professional practices, and social behavior, and they were directed to:

- BUILDING CAPACITIES AND DEVELOPING INNOVATIVE WAYS OF CONNECTING CLIMATE CHANGE SCIENCE TO SOCIETY (SCIENCE EDUCATION).
- TAKING THE "CLIMATE CHANGE CHALLENGE" CLOSER TO THE SOCIETY.
- BUILDING A MORE SCIENTIFICALLY LITERATE SOCIETY ABLE TO ACTIVELY PARTICIPATE IN AND SUPPORT DEMOCRATIC PROCESSES.

4.3 TO SOCIETY. Science Education and Public Awareness | 4.3.1 Training Caravan

TRAINING CARAVAN.
Climate Change Researchers at Classrooms

Under BC3's Responsible Research Programme Framework (Sub-area of Science Education), and together with the Basque Ministry of Education and the BERC (Basque Excellence Research Centre), we jointly organize the Training initiative since 2010.

The main objective of this activity targeted at Basque student's aged 16-17, is to provide science-based answers to some central questions about climate change, drawing on the best current scientific understanding and at the same time, making science education and careers attractive for young people. With this purpose, a selection of BC3 researchers feature the Climate Change Science at the classrooms and present the research career. Firmly committed with Climate Change Science Education, our philosophy tries to anticipate and assesses potential implications and societal expectations with regard to climate change research in order to foster the design of inclusive and sustainable research.

In the past years, we have reached over 5.550 students of the Basque Country Autonomous Community through 74 Training Caravan Speeches altogether. For more info, check our http://trainingcaravan.bc3research.org/ or their social network activity (#trainingcaravan).

DATE	SCHOOL	LOCATION	SPEAKER
25-Feb	**IES Bidebieta BHI**	Donostia	Marta Pascual
25-Feb	**SUMMA Aldapeta**	Donostia	Marta Pascual
2-Mar	**Colegio Bizkaia**	Zamudio	Ignacio Palomo
4-Mar	**Nazaret zentroa**	Donostia	Stefano Balbi
7-Apr	**San Viator Ikastetxea**	Vitoria Gasteiz	Elisa Sainz de Murieta
7-Apr	**IES Zaraobe BHI**	Amurrio	Elisa Sainz de Murieta
14-Apr	**IES Bengoetxe BHI**	Galdakao	Marta Olazabal
20-Apr	**Oianguren BHI**	Ordizia	Elena Galán
20-Apr	**San Benito Ikastola**	Lazkao	Elena Galán
12-May	**Elorrio BHI**	Elorrio	María José Sanz
12-May	**Urritxe BHI**	Amorebieta	David Moreno

COLLABORATION WITH INGURUGELA
Science Education initiative focus on High School Teachers and members of local municipalities

The objetive of this iniciative, is the Knowledge Transfer on Climate Change to the Basque teachers of the CAV. This collaboration emerged from the organization of the initiative Training Caravan (researchers at Classrooms) initiative. We found that high school teachers demanded a training in climate change that could be transferred to the classroom after having many of them participated in the TC initiative. Through a close collaboration with Ingurugela and having as its axis of action the School Agenda21, a selection of BC3 senior researchers developed training activities to the teaching and technical staff of different Basque Country´s local governments on climate change, for its later implementation in the classrooms and in the municipal organs.

4.3 TO SOCIETY. Science Education and Public Awareness | 4.3.2 BC3 in the media

Besides the publication of our research results in leading scientific journals, at BC3 we make a special effort to build an institutional reputation in order to be a benchmark at the local, national or international level. In 2013, we designed the Strategic Communication Plan with this aim, which settled the different channels and tools to be used in the 2014-2017 period. Thus, our outreach activities are based on a comprehensive stakeholder analysis.

In 2014, we added to our webpage and blog, our social media channels (Twitter, LinkedIn, Vimeo, Slideshare, Facebook, among others) with the objective of reaching targeted stakeholders. Furthermore, we worked on the reinforcement of relations with media, both at national and regional levels, and we agreed different permanent collaborations with the local television and with several radio programmes.

BC3 is regularly consulted by different media as an expert adviser in climate change. In this regards, we had significant presence in national and international communication media. Besides, we developed a permanent monthly collaboration with two programas on the Basque TV channel, EITB, (Azpimarra and Ahoz aho) with the objective to transfer knowledge about climate change.

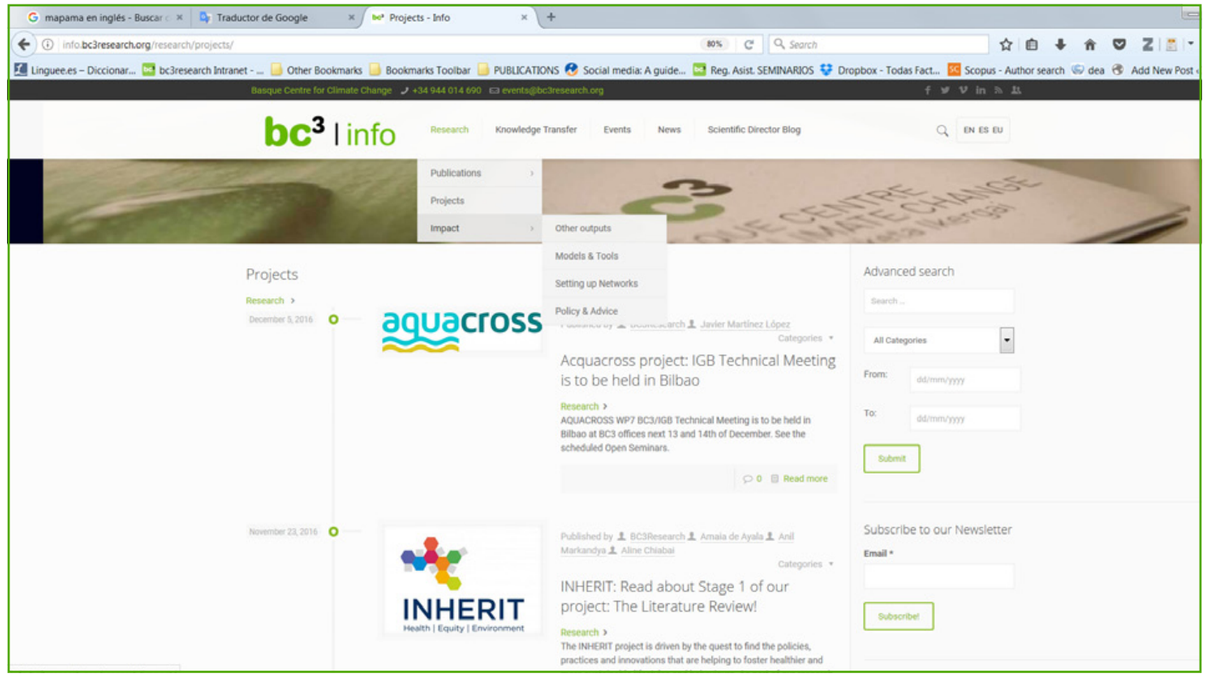
As regards to the media, the impact obtained in different media channels during 2016 was: 14 interviews were done in TV Programmes, 34 interview in Newspaper/ Magazines, 15 appearences in Digital media, 22 Radio Interviews were offered and 5 Press Releases organized. Our web page and social platforms received 47.106 visits along the year.

During 2016, we also launched our blog; a new communication channel to bring our stakeholders the opportunity to share in social media all our news and events. This blog aimed to become the platform to disseminate our research results (scientific publications with edits of authors, research projects in which BC3 is involved, activities organized within the scientific research process, the ongoing scientific findings and outputs, as well as "capacity building" activities organized and focused on the decision-making processes (Policy) and scientific networks creation and any other science dissemination initiative).

Its final objective is therefore to bridge science with policy-making and to gather enterprises and society as a whole, and it is aligned with our Strategic Goal of promoting the transition towards Trans-disciplinary Science. Science with and for society.

IMPACT IN MEDIA DURING 2016:

TV — **14**
Newspaper/ Magazines — **34**
Digital media — **15**
Radio — **22**
Press Releases — **5**
Tweets — **232**
Google Analytics (Visits) — **47.106**



5. FUNDING

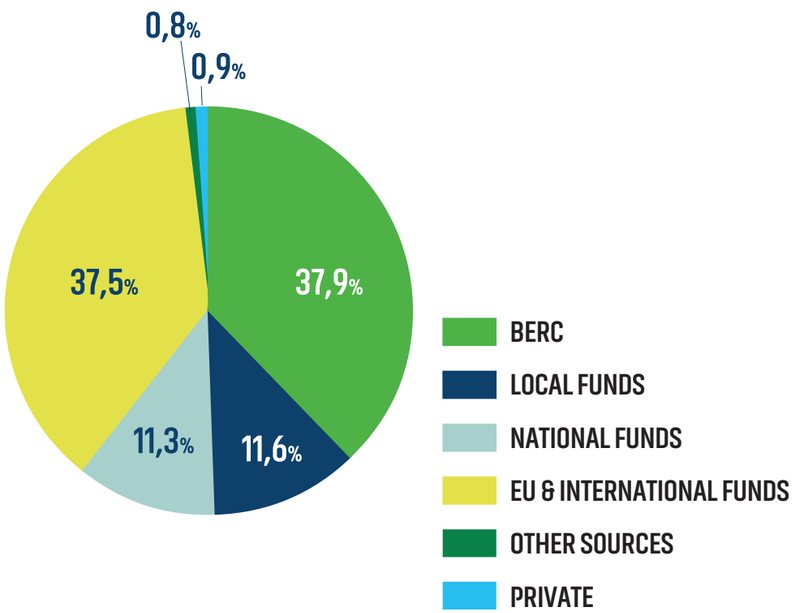
5.1 FUNDING SOURCES

If we consider the attraction of external funds, not BERC, as an indicator of excellence, we can conclude that BC3 has reached exceptional levels in this regard.

The year 2016, with a budget executed very similar to that of 2015, has been exceptional in terms of external resources attracted. The non-BERC percentage of the 2016 annuity has reached 62%.

The following chart shows the external financing structure of BC3 in the 2016 annuity,

DISTRIBUTION OF BC3 FUNDS



6. SET OF INDICATORS

PUBLICATIONS (Production)

Total number of publications published in the given year (* Published on line)	107
Number of articles published in the given year (* Published on line)	72
Number of Books and Chapters published in the given year	18
Other publications published in the given year	5
BC3 Policy Briefings published in the given year	7
BC3 Working papers published in the given year	5

PUBLICATIONS (Impact Factor)

% of Indexed articles in Quartile 1	86%
Citation number per year	1300
H index	25

TRAINING

PhD - Defended thesis	4
PhD - Supervised students	20
Master - Supervised students	7

EXCELLENCE

ERC (Requested)	1
Ikerbasque Researchers	7

FUNDING

% of Funding (non BERC)	62

PEOPLE

Total BC3 Team	43
Number of researchers	38
Number of administration staff	5

* number of people at 31 of December of the given year.

Fig. 1: Quartile distribution of the articles indexed in SCOPUS:

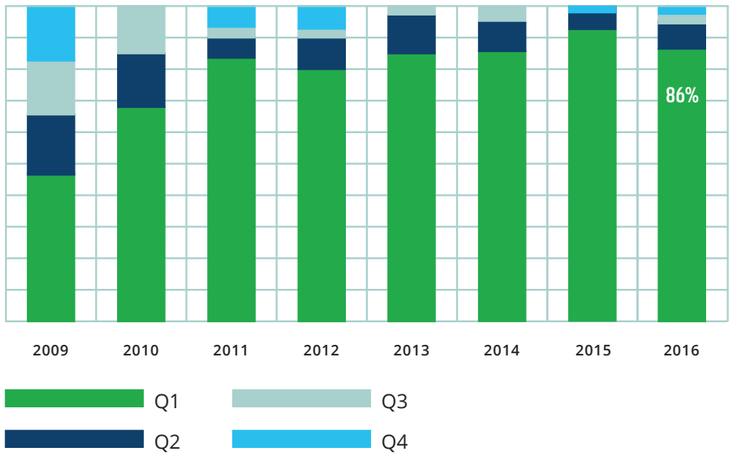
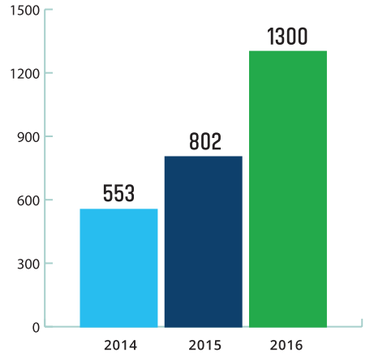


Fig. 2: Evolution of the Citation number per year:



bc³

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