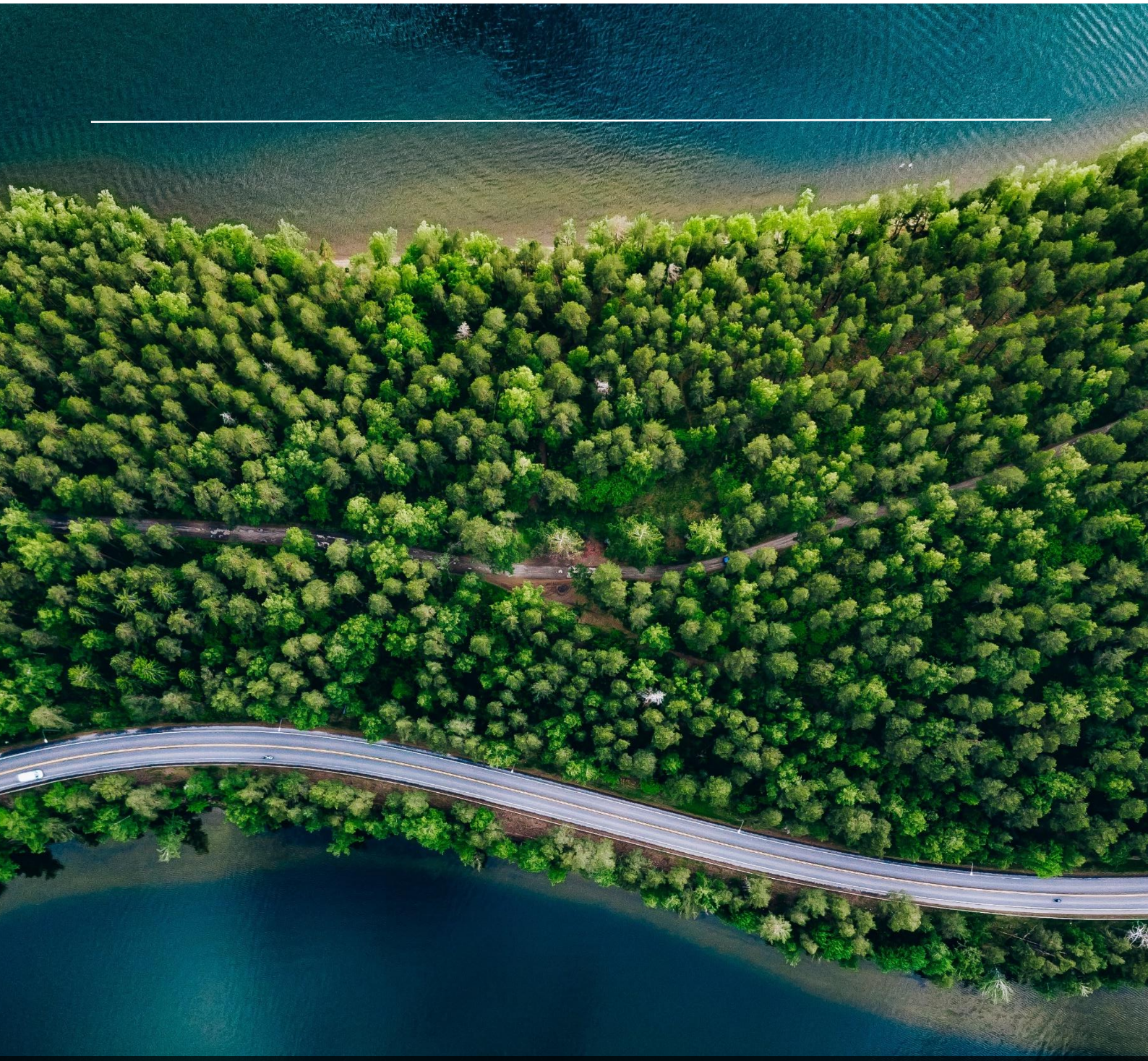

CLIMATE CHANGE MODELLING INFORMATION

Quarterly report – Q4 2021 report

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A report submitted by ICF S.A.
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Contents

High-level executive summary

This report under the **"Climate change modelling information"** series presents recent developments reported by key international climate modelling institutions. This issue sets an emphasis on **land use, land use changes, and forestry**, in addition to the regular sections on the implementation of **Nationally Determined Contributions** and **mid-century strategies**.

The first section of the report is dedicated to modelling developments linked to **land use, land use change, and forestry.** Land use plays an important role in global cycles of greenhouse gases (GHG) and can result in emissions or removal of GHG from the atmosphere, therefore land use changes can either help or hinder mitigation and adaptation efforts. Recent studies highlight the importance of taking into account land use change when developing new policies. Researchers from **Iran** have modelled the impacts of both climate and land use change on water security in a semi-arid forested watershed in northern Iran. A study from **Pakistan** highlights the importance of considering the combined effect of land use and climate change together, focusing on the impact of the two on biodiversity, considering eight different land use and land cover scenarios. A research team from **Germany** studies the driving forces of the dynamics of land use and land cover on the past to predict future ones to support rational use of agricultural land and to well manage forest conversion needs. Another research paper from Germany quantifies the effects of land use and model scale on water partitioning and water edges, using tracer-aided ecohydrological models. The International Institute for Applied Systems Analysis in **Austria** carried out a study that focuses on the relations between land-based climate change mitigation and its potential to achieve SDGs. Researchers find that achieving SDGs delivers synergies with GHG abatement and may even, without additional mitigation policies, allow to realise up to 25% of the expected GHG abatement from land use required to stay on track with the 1.5 °C target until 2050.

The second section focuses on research linked to the development and implementation of **Nationally Determined Contributions (NDCs)**. A study assesses the impacts of different carbon tax policies in **China** using eight different models, showing that the 2030 NDC target for China is easily met in all models but the 2060 carbon neutrality goal is hard to be achieved even with highest carbon tax rates. Another study in **Costa Rica**, uses a tailored TIMES model, to assesses climate mitigation pathways to reach the goal set in Costa Rica's NDC. The study is unique in that it involved local experts in the development. A study from **Germany** assesses the potential gains of inter-regional cooperation in CO2 markets and finds that such cooperation lowers the global costs incurred from achieving NDCs.

In the third section, the report features research linked to **mid-century strategies**. Many studies analyse the NDCs and net zero emission targets alignment with the Paris Agreement. In the **European Union,** the Global Energy and Climate Outlook 2021 report finds that while current policies may lead to climate change exceeding 3°C, the implied temperature change from announced targets would amount to about 1.8°C by 2100. A similar study was done by The New Climate Institute for the 30 major economies finds that GHG emissions trends are far from the Paris Agreement goal; emissions in the 30 economies as a group will increase on average by approximately 0.4% in the period 2020 – 2030. Another study published in *Nature*, finds that current pledges, if fully implemented, could reduce the temperature by around 0.8–0.9 °C by 2100. And finally, a study in **Zimbabwe**, conceives a sustainable development scenario and a rapid growth pathway, that include adaptation strategies, and successfully engages stakeholders.

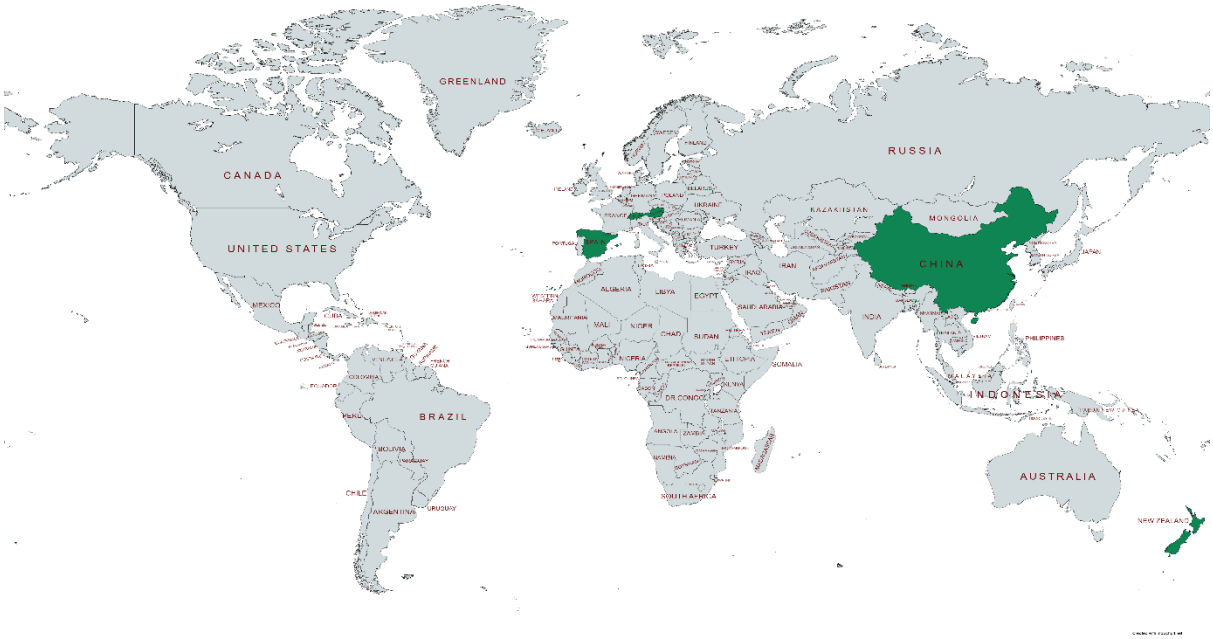
Introduction

This report is the fourth quarterly report of 2021 under the series 'Climate Change Modelling Information' financed by the European Commission. This project aims to provide the EU and global climate change modelling community and interested policy makers with up-to-date information about ongoing modelling developments and projected results. The project focusses on economic assessments of policies to mitigate climate change, ways to combine climate action with other global priorities, and assessments of the impacts of climate change and how to adapt to it. The data presented in this report were collected through an open survey sent to more than 200 modelling teams worldwide and more than 450 subscribers to the CCMI newsletter (there is some overlap between the two lists). The survey was open from 6 October-26 November 2021.

The survey asked modellers to report relevant developments with a focus on land change, the implementation of Nationally Determined Contributions (NDCs), and mid-century strategies. Although the objective of this report is to present an extensive list of recent developments, it cannot be considered as exhaustive. For this quarterly report, responses came from five countries (see Figure 2.1), five organisations and covered five different modelling developments and projects.

Additional research was undertaken to complement the survey results.

1 Geographical coverage of climate change modelling developments reported through the online survey (n = 5)



Source: ICF, 2021. Climate change modelling information Q4 2021 survey.

The modelling developments discussed in this report are summarised below and further described in the coming chapters.

Modelling developments linked to land use, land use change, and forestry

- Modelling the impacts of climate and land use change on water security in a semi-arid forested watershed using InVEST (Iran)

- Land use and climate change interaction triggers contrasting trajectories of biological invasion (Pakistan)
- Modeling and prediction of land use land cover change dynamics based on Land Change Modeler (LCM) in Nashe Watershed, Upper Blue Nile Basin, Ethiopia (Germany)
- Quantifying the effects of land use and model scale on water partitioning and water ages using tracer-aided ecohydrological models (Germany)
- Land-based climate change mitigation potentials within the agenda for sustainable development (Austria)

Modelling developments linked to Nationally Determined Contributions:

- The general equilibrium impacts of carbon tax policy in China: A multi-model comparison (China)
- Costa Rica - Assessing climate mitigation pathways to support NDC implementation (USA)
- Economic gains from global cooperation in fulfilling climate pledges (Germany)

Modelling developments linked to mid-century strategies:

- Tracking climate mitigation efforts in 30 major emitters (Germany)
- The Global Energy and Climate Outlook 2021 (GECO 2021) (Spain)
- Wave of net zero emission targets opens window to meeting the Paris Agreement (Germany)
- Climate change impacts and adaptation for dryland farming systems in Zimbabwe: a stakeholder-driven integrated multi-model assessment (Zimbabwe)

Results of the 2021 IAMC annual meeting

Modelling developments linked to land use change

- Researchers from universities based in Iran, Canada, the Netherlands and Sweden have published a paper on modelling the impacts of both climate and land use change on water security in a semi-arid forested watershed in northern Iran, near the Caspian Sea. The study's main innovation is the use the water yield model in the Integrated Valuation of Environmental Service and Tradeoffs (InVEST) tool to model the impacts of both climate change and land use change on water security. The study also translates results of the models into a water stress indicator and estimates the associated economic costs of future reduced water supply.

  Results show the emergence of new water stressed sub-watersheds in Iran due to substantial negative impacts of climate change on water yields (because of reduced precipitation levels) and growing water demand (expected to double in the future) due to land use changes. Under the most severe climate change scenario, for example, almost one third of the ten sub-areas are unable to meet water demand, not only in the South, where precipitations levels are currently already low, but also in the North and North-eastern part, where current precipitations level are high. Under this scenario, more than half of the area is under severe stress. These areas will not be able to supply the water needed for residential and agricultural uses. Taking into account climate change and land use change may lead to increased water security concerns in Iran, further increasing the pressure on its inhabitants, their economic activities, and ecological values.

  Policy implications: Analyses of integrated impacts of climate and land use change on water resources have been lacking in Iran, which has experienced repeated water crises over the last decades due to changing climate conditions and strong distortions of its water cycles due to deforestation, urban sprawl, and the conversion of rangelands and rainfed agricultural lands. The estimation of the economic costs of increased water insecurity provides information for policy and decision-makers about future investments in climate adaptation and mitigation. The water stress index allows policy and decision-makers to spatially prioritize conservation efforts to ensure water security, as an example, limiting the conversion of specific land cover such as (semi-)dense forested watersheds into agricultural crop land or limiting the cultivation of high water demand crops such as cotton.

- A study conducted by researchers from Pakistan, the UK and Czechia focused on the effects of the interaction of land use and climate change on biodiversity, since the two affect the introduction, colonisation and spread of invasive species by affecting niche availability and dispersal potential. The study uses a MaxEnt-based ecological niche model to assess the effects of climate and land use change on current and future habitat suitability of *Rhododendron ponticum* in Wales, UK. Eight different Land Use Land Cover and Climate (LULCC) scenarios for the year 2030 were created by using two policy-driven land use change projections combined with two Representative Concentration Pathways, RCP 2.6 and RCP 8.6. The land use and land cover projections were derived using a Multi-Layer-Perceptron and Markov Chain ensemble algorithms to create a "Business-as-Usual" scenario and "Ecosystem Conservation" scenario.

  The results of the models show that in seven out of eight scenarios, the habitat suitability for *Rhododendron ponticum* is likely to reduce by 2030. In one scenario, however, representing an extreme case where land use change and GHG emissions both accelerate, an increase of habitat suitability of the species is predicted.

Policy implications: The study highlights the importance of considering the combined effects of land use and climate change. It also highlights the importance of including policy-driven land use change projections to test the potential of an invasive species to expand or retreat in future.

- Researchers from the University of Rostock and Jimma University have conducted a study on *sustainability,* to assess the temporal and spatial Land Use and Land Cover (LULC) dynamics of the past and to predict the future, for the years 2035 and 2050, by considering the drivers in LULC dynamics. The study has been conducted in the Nashe watershed, in Ethiopia, which is the main tributary of the Upper Blue Nile basin. The prediction was created considering the historical trends in LULC changes, and in particular, Landsat images from 2019, 2005 and 1990. The monitoring, assessment of changes and future predictions were performed using LCM (Land Change Modeler), integrated in TerrSet Geospatial Monitoring and Modeling System assimilated with MLP and CA-Markov chain. Validation of the predicted LULC map was conducted with the actual LULC map.

  Results show that the forest land, range land, and grass land declined annually in the area of study in Ethiopia with rates of 48.38%, 19.58%, and 26.23%, respectively from 2019. The predicted LULC map shows that the forest cover will further degrade from 16.94% in 2019 to 8.07% in 2050, while agricultural land would be expanded to 69,021.20 ha and 69,264.44 ha in 2035 and 2050 from 57,868.95 ha in 2019.

  Policy implications: Providing empirical evidence on patterns and rates and identifying major driving forces of LULC dynamics can improve policies in land use within the framework of sustainable land use planning and sustainable water resources in relation to future changes or development. This study can support new measures to achieve a rational use of agricultural land and to well manage forest conversion needs.

- Researcher from Germany, the UK and the USA conducted a study to quantify the effects of vegetation on water partitioning at different spatial and temporal scales in complex, managed catchments. Researchers used the tracer-aided ecohydrological model EcH2O-iso in an intensively monitored 66 km^2 mixed land use catchment in north-eastern Germany to quantify water flux–storage–age interactions at four model grid resolutions (250, 500, 750, and 1000 m). Field data, including precipitation, soil water, groundwater, and stream isotopes as well as remote sensing data was used in the calibration.

  The study finds that tracers provide effective calibration constraints on larger resolution ecohydrological modelling. It shows that, in the model, larger grids were unable to replicate observed streamflow and distributed isotope dynamics in the way smaller grids could. However, using isotope data in the calibration, helps constrain the estimation of fluxes, storage, and water ages at coarser resolutions. **The study also contributes** to understanding the influence of grid resolution on the simulation of vegetation–soil interactions, with coarse models (i.e., smaller resolution) simulating higher evapotranspiration, lower relative transpiration, increased overland flow, and slower groundwater movement.

  Policy implications: This study increases the knowledge needed to assess water availability for a range of ecosystem services and evaluate how these might change under increasing extreme events, such as droughts. Also, it increases knowledge in estimating land use influence on large-scale “blue” and "green" fluxes, particularly for future environmental changes. Better understanding and quantification of how vegetation mediates water partitioning at different spatial and temporal scales through

ecohydrological models is a prerequisite for using these models in decision support. This is fundamental for long-term sustainable land and water management.

- A research paper published in early 2021, led by the International Institute for Applied Systems Analysis, in Austria, assesses the capacity of the Agriculture, Forestry and Other Land Use (AFOLU) sector to contribute to ambitious climate change mitigation within the Sustainable Development Goals (SDGs) agenda. The considered indicators of SDGs are related to Zero Hunger, Clean Water and Sanitation, Responsible Consumption and Production, and Life on Land. Researchers apply the economic land use model GLOBIOM together with the forest model to represent biophysical and (socio-) economic aspects across scales and across the land-uses in a consistent bottom-up approach. They develop a quantified scenario matrix, a rich dataset, taking into account the SDGs implications. This dataset can be used by Integrated Assessment Models (IAMs) and other models, which used a similar matrix in the past, however, without considering the SDGs. This approach allows to develop SDG compliant climate stabilisation pathways for land use.

  The research finds that achieving SDGs delivers synergies with GHG abatement and may even, in the absence of additional mitigation policies, allow the realisation of up to 25%, 45 $GtCO_2$ eq, of the expected GHG abatement from land use required to stay on track with the 1.5 °C target until 2050. Results show that SDGs allow for more rapid and deeper emissions cuts as compared to the scenarios without consideration of SDGs. AFOLU emissions could drop to 2 $GtCO_2eq$ per year in 2050 thereby delivering emission savings of around 8.7 $GtCO_2eq$ per year as compared to a baseline without mitigation efforts in 2050

  Policy implications: The study provides evidence that synergies across SDGs should be used and considered for future land use mitigation policies, since the achievement of SDGs alone already allows the abatement of the relevant amount of GHG. In the absence of targeted mitigation efforts in the land sector, achieving SDGs could drive emissions reductions from land use of 2.1 $GtCO_2eq$ per year in 2050 related to reduced consumption of ruminant products and food waste (1.4 $GtCO_2eq$ per year) as well as biodiversity protection and related decline in land use change emissions (0.7 $GtCO_2eq$ per year).

Modelling developments linked to Nationally Determined Contributions (NDCs)

- Researchers from China and the United States have conducted a study to compare the impacts of a carbon tax policy in China using different models, in both near-term (2020), medium-term (2030), and distant future (2050). Researchers have compared eight computable general equilibrium (CGE) models, to examine the effects of a reasonable range of carbon tax scenarios, including low, medium, and high carbon taxes in China. The models used are made comparable by having the same population growth, GDP growth path and world energy price shocks. This study also analyses the results of the model comparison, including differences in the model structure, substitution parameters, baseline renewable penetration and methods of revenue recycling.

  Results show that the 2030 NDC targets for China are easily met in all eight models, but this is not the case for the 2060 carbon neutrality goal, which cannot be achieved even with the highest carbon tax scenario. Moreover, the study finds that all eight CGE models differ substantially in terms of impacts on the macroeconomy, aggregate prices, energy use and carbon reductions, as well as industry level output and price effects. The

eight models have different structures, use different assumptions on revenue recycling and make different assumptions about expected policies, and thus project different paths of energy use and emissions in the no-policy baseline.

Policy Implications: The study shows that existing models, used to assess emission reduction, energy use and economy-wide general equilibrium outcomes in China, are very different and make it challenging to derive policies. This study responds to this challenge by using different but comparable models, and thus provides a better understanding of the impacts of carbon tax scenarios. It provides the basis for future policy-makers decisions.

- A study funded by the World Bank and with the support of the Partnership for Market Readiness (PMR), assesses climate mitigation pathways to reach the goal set in Costa Rica's NDC, using a TIMES-CostaRica model. The model and scenario development involved the active participation and contributions of local experts as they were being trained in its use. Three groups of different scenarios were developed with the TIMES model[1] to assess alternative energy and decarbonisation pathways for the country. The business-as-usual scenario was set as the benchmark in the absence of any mitigation policies. Additional scenarios were created to reflect the already planned policies and programmes in Costa Rica, and an enhanced mitigation scenarios that lead the country towards its NDC at least-cost was also developed.

  As a result of this study, over 75 mitigation measures were defined and addressed, covering all the sectors within the energy economy. A set of tools for processing model outputs and graphical comparison of scenarios was also used to facilitate the communication of results to stakeholders.

  Policy implications: developing models and scenario involving local experts can be of great added-value as well facilitating the communication of results through an ad-hoc set of tools. The TIMES tool can be used and tailored at national level to support decision makers in setting targets and new policies to decarbonize their economies and show the better pathway to take to reach country-based NDCs.

- A study conducted by the Kiel Institute for World Economy calculates the global costs and their regional distribution for achieving the NDC targets, under different assumptions about the cooperation between regions. The study considers cooperative versus non-cooperative CO_2 markets and different CO_2 permit allocation rules. It disaggregates the mitigation costs into direct and indirect shares. A global computable general equilibrium model based on the GTAP-9 database and the add-on GTAP-Power database is used to perform the study.

  Results show that in 2030, global costs are lowered by 60% when regions cooperate compared to when they act unilaterally. This means that there could be gains of up to USD 106 billion from global cooperation in CO_2 markets. Considerable monetary transfers from high per capita emission regions to low per capita emission regions are expected as a result of a cooperative CO_2 permit market, with equal per capita allowances. Results also show that for the energy-exporting regions, the largest cost component is unambiguously the indirect mitigation costs.

  Policy implications: pursuing voluntary cooperation in the implementation of countries' NDCs, as established in Article 6 of the Paris Agreement, could play a key role in lowering the global costs of fulfilling the NDCs. If countries undertake cooperative

[1] The TIMES modeling platform is available from the International Energy Agency Energy Technology Systems Analysis Program (IEA-ETSAP). The TIMES-CostaRica model is the property of the Ministry of Environment and Energy, Costa Rica.

action, the cost savings from the coordinated effort could be redirected and invested in enhanced mitigation action by boosting the revised NDC pledges, and thereby providing economic and environmental gains.

Modelling developments linked to Mid-century strategies

- Experts from the NewClimate Institute, IIASA and FTSE Russell, have published a report to document near-term climate policies and measures and the resulting GHG emissions trajectories in the 30 major economies. The study takes into account NDC commitments and net-zero pledges until October 2021. IIASA developed projections for the LULUCF sector, using two complementary models, the land use model GLOBIOM, and G4M, a detailed forestry model that also estimates the impact of forestry activities on biomass and carbon stocks. For the remaining sectors, the NewClimate Institute analysis follows the calculations steps used in the Climate Action Tracker. The combined projections cover all relevant sectors and include the effect of COVID-19.

  The report finds that emissions trends are far from the Paris Agreement goal in the post-2020 period. To get on track to meet the goals of the Paris Agreement, global emissions should fall by 7.6% each year up until 2030. According to the report's projections, emissions in the 30 economies as a group will increase on average by approximately 0.4% per year between 2021 and 2030.

  Policy implications: this report can support new decisions on NDCs and net-zero commitment for countries to help them align with the Paris Agreement.

- The Joint Research Center of the European Commission has recently published The Global Energy and Climate Outlook 2021 (GECO 2021), that presents energy, emission, and temperature consequences of NDCs and long-term emission pledges (LTS), including net-zero targets. The analysis includes NDCs made until early November 2021 and compares future scenarios against the 1.5°C scenario. The study uses several JRC models including the world energy system model, POLES-JRC, which is used for energy sector and GHG emissions forecasting, and JRC-GEM-E3, which is used for assessing the economic impacts of the scenarios developed. The study shows mitigation options to bridge the implementation gap, the difference between the current policy and NDC/LTS scenario, as well as the ambition gap, that is the difference between NDC/LTS scenario and 1.5°C scenario. A regional view, with detailed results, is presented for the G20 countries.

  The study finds that while current policies may lead to climate change exceeding 3°C, the implied temperature change from announced targets would amount to about 1.8°C by 2100. The study concludes that achieving short-term (2030) and long-term (2050) targets will require additional policy measures, as current policies are only sufficient to stabilise global emissions by 2035-2040. Also, to limit global warming to 1.5°C, more ambitious targets are needed, both in the short term and in the long term, as some major emitters have not yet embraced a net zero target.

  Policy implications: this study provides an overview of the state-of-the art of current pledges and future scenarios. It can support countries in setting new targets and fill the implementation and ambition gap of countries.

- A brief communication recently published in *Nature Climate Change*, analyses the net zero emission targets alignment with the Paris agreement. The study takes into account

131 countries that have been discussing, announced or adopted net zero targets, covering 72% of global emissions. Two approaches are used to assess future temperature increase level, one is the approach used in the UNEP Emission GAP report, the other is the approach used by the Climate Action Tracker.

Results show that if fully implemented, the national net zero emission targets, could substantially lower projected warming to 2.0–2.4 °C by 2100, compared to currently implemented policies, that would otherwise take to 2.9–3.2 °C, or pledges submitted to the Paris Agreement, which will bring an increase to 2.4–2.9 °C. The two estimates largely agree on temperature reductions for individual country targets. Consistent across both estimates is the relative magnitude of the overall effect of net zero targets (that is, reducing temperature by around 0.8–0.9 °C).

Policy implications: there is considerable momentum in target setting towards net zero GHG emissions which could bring the temperature limit of the Paris Agreement within reach. These good intentions must now propagate into short-term action immediately to put countries on a path towards meeting their net zero emission ambitions and to keep the goals of the Paris Agreement within reach. Existing policies and targets driving short-term action are currently not at all consistent with the announced net zero targets.

- A research project conducted in Zimbabwe describes a stakeholder-driven, science-based multimodel approach developed and used by the Agricultural Model Intercomparison and Improvement Project (AgMIP) to generate actionable information for adaptation planning processes. For a range of mid-century climate projections—likely to be hotter, drier, and more variable—contrasting future socio-economic scenarios (Representative Agricultural Pathways, RAPs) were co-developed with stakeholders to portray a sustainable development scenario and a rapid economic growth pathway. Distribution of outcomes were simulated with climate, crop, livestock, and economic impact assessment models for smallholder crop livestock farmers in a typical dryland agro-ecological zone in Zimbabwe, characterized by low and erratic rainfall and nutrient depleted soils.

  Results showed that in Nkayi District, Western Zimbabwe, climate change would threaten most of the farms, and, in particular, those with large cattle herds due to feed shortages. Most successful adaptation strategies included diversification using legume production, soil fertility improvement, and investment in conducive market environments. The sustainable development scenario consistently addressed institutional failures and motivated productivity-enhancing, environmentally sound technologies and inclusive development approaches.

  Policy implications: The research highlights the successful and unique approach in the integration of multi-modeling with stakeholder engagement to co-develop scenarios and adaptation strategies.

Results of the 2021 IAMC annual meeting

The 14th annual meeting of the Integrated Assessment Modelling Consortium was held online between 29 November – 3 December 2021. There were 4 keynote plenary presentations, 105 papers presented in 24 oral parallel sessions, , and 73 papers presented in 6 poster sessions. The conference was attended by 421 participants from 34 countries.

The first plenary session discussed the need for an update of the Shared Socio-economic Pathways (SSP), which are widely used for the integrated research on climate change across disciplinary boundaries and based on comparable harmonised assumptions. The second plenary session focused on how to incorporate climate impacts into mitigation scenarios. So far, the modelling community examining climate stabilisation pathways has mostly disregarded climate impacts. This has limited the capacity to assess the net benefits of climate policies, and to incorporate the consequences of climate risks for the climate transition. The third plenary session discussed how to better connect social sciences and integrated assessment modelling. And the fourth plenary session focused on the implications of COP26 for IAM research. Some of the issues discussed were: deepening the scope of research by looking into single theme/sectoral initiatives discussed in Glasgow; widening the scope by focusing on distributional impacts, just transitions, financial contributions within and between countries; the need to further understand adaptation and impacts along with mitigation.

The papers presented at the meeting were divided into 15 research topics, including the assessment of deep mitigation scenarios; assessment of national mitigation strategies and the 2023 Global Stocktake; economic assessment of climate policy and integration of mitigation, adaptation and (residual) impacts; feasibility of socio-technical energy/land transitions; further elaboration of the SSP; just transition; and a variety of methodological issues. All posters presented at the meeting are available online.

Events

Event	Location, Date	Objectives	Topics covered / relevance to climate change modelling	Deadlines
Fourteenth IAMC Annual Meeting 2021	29 November – 3 December 2021, online	The IAMC annual meeting is a scientific meeting intended for peer sharing and vetting.	Results of the conference can be found online.	
The International Society for Ecological Modelling Global Conference 2022: Ecological Models for Tomorrow's Solutions	Postponed to 2023, University of Toronto, Canada	ISEM 2022 aims to provide insights into the current state of the field of ecological modelling, and highlight the major challenges in supporting adaptive management implementation.	• Dynamic ecosystem models • Uncertainty analysis • Ensemble modelling • Data assimilation and optimization techniques • Machine learning and (big) data • Model integration, metamodels • Individual-based modelling • Software and tools • Bioenergetics: Dynamic energy budget models • Network modelling • Models of socio-ecological systems • Models of global, climate and land-use change • Sustainability and resilience • Ecosystem services • Biodiversity and conservation • Community models • Marine ecology and fisheries • Forests • Freshwaters (lakes and rivers) • Models of epidemics	Call for symposium proposals
2nd International Conference on Negative CO2 emissions	14-17 June 2022, Chalmers University of Technology, Gothenburg, Sweden	The purpose of this conference series is to bring together a wide range of scientists, experts and stakeholders, in order to engage in various aspects of research relating to negative CO2 emissions	Various negative emission technologies, climate modelling, climate policies and incentives will be discussed. The main topics of the conference, around which the sessions will be built, include: • BECCS • Biospheric storage • Cross-cutting sessions • Direct air capture • Enhanced weathering	Call for abstracts Deadline for paper submission closed on December 1, 2021

			• Modeling Ocean alkalisation	
25th Annual Conference on Global Economic Analysis	8-10 June 2022, Kigali, Rwanda	The conference is coordinated by the Global Trade Analysis Project (GTAP), Purdue University, with the support of national and international agencies. The purpose of the conference is to promote the exchange of ideas between economists conducting quantitative analysis of global economic issues. Emphasis will be placed on applied general equilibrium methods, data and application.	The theme of the conference is 'Accelerating Economic Transformation, Diversification and Job Creation', with sub-themes including: • Achieving sustainable development goals • Tackling challenges related to climate change, environment and natural resources management • Filling data gaps	Call for abstracts is open. Deadline is 15 January 2022.
Energy Modelling Forum Snowmass Workshop	Date not announced, Snowmass, CO	A two-week annual workshop that brings together climate change experts to discuss the state of the art in climate policy analysis. The workshop has been organised in Snowmass, Colorado since 1995.	The workshop covers the latest developments in energy and environment modelling, with specific topics changing annually.	
Conference on Econometric Models of Climate Change	2022	The Conference on Econometric Models of Climate Change aims to promote an interdisciplinary approach to the detection and attribution of climate change, knowledge exchange between climate science, economics and econometrics, and econometric estimates of climate impacts and policy evaluation.		
Annual Conference of the European Association of Environmental and Resource Economists	2022	The aim of the conference is to create opportunities for meeting, exchanging and debating current topics in environmental and resource economics.	Details are not yet published on the conference website.	Call for papers is open. Deadline is 31 January 2022.