COUN-91-X-1-c

CATALOGUE OF MODELS, TOOLS & SOFTWARE CURRENTLY IN USE

Compiled by the Open Access to Data Task Force, October 2017

1. GAINS

Program: AIR

Format: Model

Contact Person: Wolfgang Schoepp (schoepp@iiasa.ac.at)

Description: The GAINS model explores cost-effective emission control strategies that simultaneously tackle local air quality and greenhouse gases so as to maximize benefits at all scales. The GAINS holds scenarios on emissions and abatement costs from the AIR team. Users are welcomed to enter their own scenarios. These data are connected to Source Receptor Matrix to calculate acid depositions and air pollutant. These is then further used to calculate impacts. A complete scenario can be exported to the optimizing module to fins cost effected solution with GAMS.

Europe and East and South Asia

Documentation: on request

Availability: Link from IIASA website

How to access: http://gains.iiasa.ac.at/models/gains_models3.html\

Asia and local models

Documentation: Tutorial

Availability: Link from IIASA website

How to access: http://gains.iiasa.ac.at/models/gains_models3.html

NMO versions - special password, no public registration

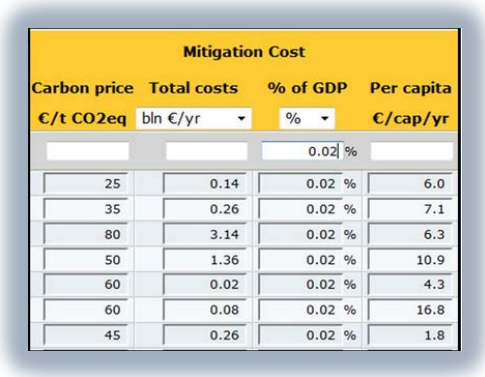
GAINS - CITY DELHI:

http://gains.iiasa.ac.at/gains/DLH/index.login?logout=1

GAINS – Korea (using 16 regions of south Korea and Korean CTM):

http://gains.iiasa.ac.at/gains/KOR/index.login?logout=1

2. Mitigation Efforts Calculator (MEC)



Mitigation Cost			
Carbon price	Total costs	% of GDP	Per capita
€/t CO2eq	bln €/yr	%	€/cap/yr
		0.02 %	
25	0.14	0.02 %	6.0
35	0.26	0.02 %	7.1
80	3.14	0.02 %	6.3
50	1.36	0.02 %	10.9
60	0.02	0.02 %	4.3
60	0.08	0.02 %	16.8
45	0.26	0.02 %	1.8

Program: AIR

Format: Tool

Contact Person: Binh Nguyen (nguyenb@iiasa.ac.at)

Documentation: Video Tutorial

Availability: Link from IIASA website

How to access: http://gains.iiasa.ac.at/MEC/index.html

Description: The Mitigation Efforts Calculator (MEC) has been developed by the International Institute for Applied Systems Analysis (IIASA) as an online tool to compare greenhouse gas (GHG) mitigation proposals by various countries for the year 2020. In this paper, first we introduce the MEC conceptual model, i.e. the methodology and system architecture. Hereafter, the optimization process and its output results, namely cost curves are presented. We then discuss the abstract formulation of four different international greenhouse gas trading regimes that are conceivable. Finally, we illustrate the MEC as a tool for interactively evaluating complex cost curve information in the context of GHG mitigation targets as currently discussed in international climate policy circles.

References:

Amann M, Cofala J, Rafaj P, & Wagner F (2009). GAINS: The impact of economic crisis on GHG mitigation potentials and costs in Annex I Countries. IIASA, Laxenburg, Austria

Amann M, Rafaj P, & Hoehne N (2009). GHG Mitigation Potentials in Annex I Countries. Comparison of Model Estimates for 2020. IIASA Interim Report. IIASA, Laxenburg, Austria: IR-09-034

Amann M, Kejun J, Jiming H, Wang S, Xing Z, Xiang DY, Hong L, Jia X, et al. (2008). GAINS Asia. Scenarios for cost-effective control of air pollution and greenhouse gases in China. IIASA, Laxenburg, Austria

Related links:

A Tool for Comparing Countries' Efforts to Reduce Greenhouse Gas Emissions
(IIASA Policy Brief)

3. Reconciling information from alternative sources

Program: ASA

Format: Software

Contact Person: Anna Shchiptsova (shchipts@iiasa.ac.at)

Documentation: PDF-Manual

Availability: Download from IIASA website

How to access:
http://www.iiasa.ac.at/web/home/research/researchPrograms/AdvancedSystemsAnalysis/modelIntegration-package.html

Description: This software provides means to aggregate several probability distributions into a single integrated one. Suppose that, several independent methods are used to observe a deterministic element and each method represents the latter as a probability distribution. Thus, we deal with a family of probability distributions providing alternative descriptions to the same object. The problem is how to combine information from the prior estimates. This package implements the posterior integration method (Kryazhimskiy, 2013), which is based on the assumption that model outcomes are mutually compatible, i.e., we should observe identical outcomes after the use of model ensemble. For comparison, an implementation of simple averaging of the input distributions is added.

References:

Kryazhimskiy A (2016). A Posteriori Integration of Probabilities. Elementary Theory. Theory of Probability & Its Applications 60 (1): 62-87. DOI:10.1137/S0040585X97T987466.

Rovenskaya E, Shchiptsova A, & Kovalevsky D (2016). Reconciling Information From Climate-Economic Model Ensembles. Geoinformatics Research Papers 4: BS4002. DOI:10.2205/2016BS01Sochi.

Shchiptsova A, Kovalevsky D, & Rovenskaya E (2015). Reconciling Information from Alternative Climate-economic Models: A Posterior Integration Approach. In: Systems Analysis 2015 - A Conference in Celebration of Howard Raiffa, 11 -13 November, 2015, Laxenburg, Austria.

Kryazhimskiy AV (2013). Posterior Integration of Independent Stochastic Estimates. IIASA Interim Report. IIASA, Laxenburg, Austria: IR-13-006

Related links:
COMPLEX project

4. Statistical analysis for spatial land use data

Program: ASA

Format: Software

Contact Person: Anna Shchiptsova (shchipts@iiasa.ac.at)

Documentation: PDF-Manual

Availability: under development

How to access:
http://www.iiasa.ac.at/web/home/research/researchPrograms/AdvancedSystemsAnalysis/land-use-spatial-analysis.html

Description: This software provides means to perform exploratory statistical analysis for the non- temporal spatial data. The goal is to deduce conditions associated with the level of the response in different areas of the studied region. The data should be compiled for the census areas, defined by the regional administrative division. Additionally, the tool allows estimating accuracy of the approximation by a statistical model to the higher resolution data, defined on the GIS lattice. Software is supplied in several packages.

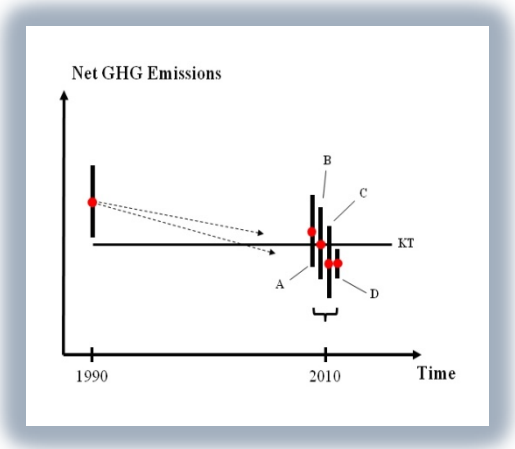
References:

Shchiptsova A, Hewitt R, & Rovenskaya E (2016). Exploratory Spatial Analysis of Regional Urbanization Patterns in the Province of Seville, Spain. IIASA Working Paper. IIASA, Laxenburg, Austria: WP-16-016

Related links:

COMPLEX project

5. Impact of Uncertainty on Compliance



Program: ASA

Format: Model

Contact Person: Matthias Jonas (jonas@iiasa.ac.at)

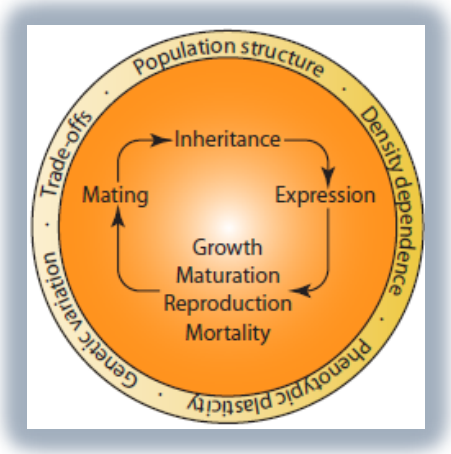
Documentation: See access link

Availability: Access to compliance and monitoring mode (Track I and II) from IIASA website

How to access:
http://webarchive.iiasa.ac.at/Research/FOR/models/IUCET/index.html

Description: This exercise allows a user to get a grip on the uncertainty in the emissions of greenhouse gases and understand its impact at the scale of countries on compliance (Track I: compliance mode) and the amount of emission permits that can be traded (Track II: monitoring mode) under the Kyoto Protoco

6. Framework for Eco-Genetic Modeling



Program: EEP

Format: Model

Contact person: Ulf Dieckmann (dieckmann@iiasa.ac.at)

Documentation: See Dunlop et al. (2009)

Availability: On request

How to access: Get in touch with contact person

Description: The framework for eco-genetic modeling offers flexible tools for exploring the course and rates of multi-trait life-history evolution in natural populations. This framework builds on existing modeling approaches by combining features that facilitate studying the ecological and evolutionary dynamics of realistically structured populations. In particular, the joint consideration of age and size structure enables the analysis of phenotypically plastic populations with more than a single growth trajectory, and ecological feedback is readily included in the form of density dependence and frequency dependence. Stochasticity and life-history trade-offs can also be implemented. Critically, eco-genetic models permit the incorporation of salient genetic detail such as a population's genetic variances and covariances and the corresponding heritabilities, as well as the probabilistic inheritance and phenotypic expression of quantitative traits. These inclusions are crucial for predicting rates of evolutionary change on both contemporary and longer timescales. An eco-genetic model can be tightly coupled with empirical data and therefore may have considerable practical relevance, in terms of generating testable predictions and evaluating alternative management measures.

Reference:

Dunlop ES, Heino M, & Dieckmann U (2009). Eco-genetic modeling of contemporary life-history evolution. Ecological Applications 19: 1815-1834.

Related references:

Dunlop ES, Baskett ML, Heino M, & Dieckmann U (2009). Propensity of marine reserves to reduce the evolutionary effects of fishing in a migratory species. Evolutionary Applications 2: 371-393.

Dunlop ES, Shuter BJ, & Dieckmann U (2007). The demographic and evolutionary consequences of selective mortality: Predictions from an eco-genetic model of the smallmouth bass. Transactions of the American Fisheries Society 136: 749-765.

Eikeset AM, Dunlop ES, Heino M, Storvik G, Stenseth NC, & Dieckmann U (2016). Roles of density-dependent growth and life history evolution in accounting for fisheries-induced trait changes. Proceedings of the National Academy of Sciences of the USA 113: 15030-15035.

Eikeset AM, Richter A, Dunlop ES, Dieckmann U, & Stenseth NC (2013). Economic repercussions of fisheries-induced evolution. Proceedings of the National Academy of Sciences of the USA 110: 12259-12264.

Enberg K, Dunlop ES, Jørgensen C, Heino M, & Dieckmann U (2009). Implications of fisheries-induced evolution for stock rebuilding and recovery. Evolutionary Applications 2: 394-414.

Mollet FM, Dieckmann U, & Rijnsdorp AD (2016). Reconstructing the effects of fishing on life history evolution in North Sea plaice (Pleuronectes platessa). Marine Ecology Progress Series 542: 195-208.

Mollet FM, Poos JJ, Dieckmann U, & Rijnsdorp AD (2016). Evolutionary impact assessment of the North Sea plaice fishery. Canadian Journal of Fisheries and Aquatic Sciences 73: 1126-1137.

Okamoto KW, Whitlock R, Magnan P, & Dieckmann U (2009). Mitigating fisheries-induced evolution in lacustrine brook charr (Salvelinus fontinalis) in southern Quebec, Canada. Evolutionary Applications 2: 415-437.

Thériault V, Dunlop ES, Dieckmann U, Bernatchez L, & Dodson JJ (2008). The impact of fishing-induced mortality on the evolution of alternative life-history tactics in brook charr. Evolutionary Applications 1: 409-423.

7. R Library for Estimating Fisheries-Induced Selection Pressures

Program: EEP

Format: Software

Contact person: Ulf Dieckmann (dieckmann@iiasa.ac.at) on behalf of the Working Group on Fisheries-Induced Evolution (WGEVO) of the International Council for the Exploration of the Sea (ICES)

Documentation: See Laugen et al. (2014)

Availability: On request

How to access: Get in touch with contact person

Description: The Working Group on Fisheries-Induced Evolution (WGEVO) of the International Council for the Exploration of the Sea (ICES) has developed a general framework for investigating eco-evolutionary changes in fish stocks and their utilities in terms of ecosystem services and for assessing the management implications of fisheries-induced evolution through Evolutionary Impact Assessments (EvoIAs). On this basis, WGEVO is currently developing an R library for estimating fisheries-induced selection pressures, which is expected to be released in 2018.

References:

Laugen AT, Engelhard GH, Whitlock R, Arlinghaus R, Dankel DJ, Dunlop ES, Eikeset AM, Enberg K, Jørgensen C, Matsumura S, Nusslé S, Urbach D, Baulier L, Boukal DS, Ernande B, Johnston FD, Mollet F, Pardoe H, Therkildsen NO, Uusi-Heikkilä S, Vainikka A, Heino M, Rijnsdorp AD & Dieckmann U (2014). Evolutionary impact assessment: Accounting for evolutionary consequences of fishing in an ecosystem approach to fisheries management. Fish and Fisheries 15: 65-96.

2017 Report of the Working Group on Fisheries-Induced Evolution (WGEVO) of the International Council for the Exploration of the Sea (ICES).

8. Trait Ecology and Evolution Model (PLANT)

Program: EEP

Format: Software

Contact person: Ulf Dieckmann (dieckmann@iiasa.ac.at)

Documentation: See link below

Availability: Download from GitHub

How to access: https://github.com/traitecoevo/plant

Description: Responding to the need among vegetation researchers for a flexible toolbox for investigating the eco-evolutionary dynamics of vegetation, EEP co-developed the PLANT model, a comprehensive software package for studying the ecology and evolution of plant communities. The PLANT model shows how community evolution in two functional traits can give rise to species-rich communities matching empirical observations. The PLANT model also shows, for the first time, the emergence of neutral fitness ridges in niche models of plant communities, thereby demonstrating an assumption previously used a priori by the neutral theory of biodiversity.

References:

Falster DS, FitzJohn RG, Brännström Å, Dieckmann U, & Westoby M (2016). PLANT: A package for modelling forest trait ecology and evolution. Methods in Ecology and Evolution 7 (2): 136-146. DOI:10.1111/2041-210X.12525.

Falster DS, Brännström Å, Westoby M, & Dieckmann U (2017). Multi-trait successional forest dynamics enable diverse competitive coexistence. Proceedings of the National Academy of Sciences of the USA 114 (13): E2719-E2728. DOI:10.1073/pnas.1610206114.

9. Large Community-Evolution Models (LCEMs)

Program: EEP

Format: Models

Contact person: Ulf Dieckmann (dieckmann@iiasa.ac.at)

Documentation: See references,
in particular Brännström et al. (2012)

Availability: On request

How to access: Get in touch with contact person

Description: The complexity and dynamical nature of community interactions make modelling a useful tool for understanding how biodiversity patterns in communities develop over time and how they respond to external perturbations. Large community-evolution models (LCEMs) are particularly promising, since they can address both ecological and evolutionary questions, and can give rise to richly structured and diverse model communities. LCEMs encompass a variety of modelled traits and interactions, demographic dynamics, and evolutionary dynamics. LCEMs are able to reproduce empirical community structures. LCEMs have already generated new insights, such as the dual role of competition, which limits diversity through competitive exclusion yet facilitates diversity through speciation. Other critical factors determining eventual community structure are the shape of trade-off functions, inclusion of adaptive foraging, and energy availability. A particularly interesting feature of LCEMs is that these models not only help to contrast outcomes of community formation via species assembly with those of community formation via gradual evolution and speciation, but that they can furthermore unify the underlying invasion processes and evolutionary processes into a single framework.

References:

Brännström Å, Johansson J, Loeuille N, Kristensen N, Troost T, HilleRisLambers R, & Dieckmann U (2012). Modeling the ecology and evolution of communities: A review of past achievements, current efforts, and future promises. Evolutionary Ecology Research 14: 601-625.

Brännström Å, Loeuille N, Loreau M, & Dieckmann U (2011). Emergence and maintenance of biodiversity in an evolutionary food-web model. Theoretical Ecology 4: 467-478.

Takahashi D, Brännström Å, Mazzucco R, Yamauchi A, & Dieckmann U (2013). Abrupt community transitions and cyclic evolutionary dynamics in complex food webs. Journal of Theoretical Biology 337: 181-189.

Takahashi D, Brännström Å, Mazzucco R, Yamauchi A, & Dieckmann U (2011). Cyclic transitions in simulated food-web evolution. Journal of Plant Interactions 6: 181-182.

Zhang L, Andersen KH, Dieckmann U, & Brännström Å (2015). Four types of interference competition and their impacts on the ecology and evolution of size-structured populations and communities. Journal of Theoretical Biology 380: 280-290.

10. Tools for Assessing Incentive Mechanisms

Program: EEP

Format: Models

Contact person: Ulf Dieckmann (dieckmann@iiasa.ac.at)

Documentation: See references

Availability: On request

How to access: Get in touch with contact person

Description: Ensuring that common goods and open-access resources—everything from clean air and the global climate to the internet and civil security—are equitably and fairly available to everyone requires incentive mechanisms. This is also true for living resources with shared ownership, such as stocks of fish and game. In a limited world, common goods and open-access resources that are used without incentives promoting cooperation often suffer from over-exploitation and may collapse through a "tragedy of the commons." Incentives to prevent these problems can emerge bottom-up, through interactions of and agreements among stakeholders, or be imposed top-down by governing agencies. Social institutions and individual agents thus often use negative incentives (rewards) and positive incentives (penalties) to promote cooperation. Since providing incentives tends to be costly, models are required to identify policies for their effective and efficient use. Several models are available as tools for this purpose.

References:

Chen X, Gross T, & Dieckmann U (2013). Shared rewarding overcomes defection traps in generalized volunteer's dilemmas. Journal of Theoretical Biology 335: 13-21.

Chen X, Sasaki T, Brännström Å, & Dieckmann U (2015). First carrot, then stick: How the adaptive hybridization of incentives promotes cooperation. Journal of the Royal Society Interface 12: 20140935.

Kun Á & Dieckmann U (2013). Resource heterogeneity can facilitate cooperation. Nature Communications 4: 2453.

Nakamaru M & Dieckmann U (2009). Runaway selection for cooperation and strict-and-severe punishment. Journal of Theoretical Biology 257: 1-8.

Sasaki T, Brännström Å, Dieckmann U &, Sigmund K (2012). The take-it-or-leave-it option allows small penalties to overcome social dilemmas. Proceedings of the National Academy of Sciences of the USA 109: 1165-1169.

11. Disease-Eradication Model

Program: EEP

Format: Model

Contact person: Ulf Dieckmann (dieckmann@iiasa.ac.at)

Documentation: See Mazzucco et al. (2016)

Availability: On request

How to access: Get in touch with contact person

Description: Despite modern medical interventions, infectious diseases continue to generate huge socio-economic losses. Whereas the benefits of eradicating a disease are therefore high, eradications require huge and costly efforts, which can be sustained only if sufficient progress can be achieved. While initial successes are usually obtained more easily, progress often becomes harder as a disease becomes rare in the eradication endgame. A long eradication tail of slowly decreasing incidence levels can frustrate eradication efforts, as it becomes unclear whether progress toward eradication is still being made and how much more needs to be invested to push the targeted disease beyond its extinction threshold. Realistic disease dynamics are complicated by evolutionary responses to interventions and by interactions among different temporal and spatial scales. Our model accounts for these complexities and allows predicting how hard or costly disease eradication will be.

References:

Mazzucco R, Dieckmann U, & Metz JAJ (2016). Epidemiological, evolutionary, and economic determinants of eradication tails. Journal of Theoretical Biology 405: 58-65.

12. MESSAGE

Program: ENE

Format: Model

Contact Person: Keywan Riahi (riahi@iiasa.ac.at), Volker Krey (krey@iiasa.ac.at)

Documentation: Yes (not yet released, previous version: http://data.ene.iiasa.ac.at/message-globiom/)

Availability: Private repository, not yet released

How to access: get in touch with contact person

Description: MESSAGE is a linear programming (LP) energy-engineering model that is used for energy system planning and policy analysis, and future scenario development. MESSAGE is linked to the land-use model GLOBIOM, the macro-economic model MACRO, the air quality model GAINS and the simple climate model MAGICC.

References:

Fricko O, Havlik P, Rogelj J, Klimont Z, Gusti M, Johnson N, Kolp P, Strubegger M, et al. (2017). The marker quantification of the Shared Socioeconomic Pathway 2: A middle-of-the-road scenario for the 21st century. Global Environmental Change 42: 251-267. DOI:10.1016/j.gloenvcha.2016.06.004.

Rogner ML & Riahi K (2013). Future nuclear perspectives based on MESSAGE integrated assessment modeling. Energy Strategy Reviews 1 (4): 223-232. DOI:10.1016/j.esr.2013.02.006.

Sullivan P, Krey V, & Riahi K (2013). Impacts of considering electric sector variability and reliability in the MESSAGE model. Energy Strategy Reviews 1 (3): 157-183. DOI:10.1016/j.esr.2013.01.001.

Rao S, Riahi K, Stehfest E, van Vuuren DP, Cho C, Elzen MGJ den, Isaac M, & van Vliet J (2008). IMAGE and MESSAGE Scenarios Limiting GHG Concentration to Low Levels. IIASA Interim Report. IIASA, Laxenburg, Austria: IR-08-020

Related links (modeling framework):

Energy system representation

MESSAGE-MAGICC

MESSAGE-MACRO

13. MESSAGE-Access

Program: ENE

Format: Model

Contact Person: Shonali Pachauri (pachauri@iiasa.ac.at), Narasimha Rao (nrao@iiasa.ac.at)

Documentation: Publication (Cameron et al., 2016)

Availability: Link on IIASA website

How to access: http://www.iiasa.ac.at/web/home/research/researchPrograms/Energy/MESSAGE-Access.en.html

Description: "MESSAGE-Access" is a residential energy and technology choice model, which interacts with the global energy system model, MESSAGE. It is used to assess pathways to achieve universal access to modern energy by 2030 by accelerating the transition to clean cooking fuels and electrification. MESSAGE-Access is implemented for the regions of South Asia, Pacific Asia, Central America, and sub-Saharan Africa. The model is the first to take into account the heterogeneity in energy choices by grouping people according to their income level and separately for urban and rural areas. Model results show the need for both credit access (micro-financing) and fuel price support (subsidies) to achieve universal access to modern forms of energy by 2030.

References:

Cameron C, Pachauri S, Rao N, McCollum D, Rogelj J, & Riahi K (2016). Policy trade-offs between climate mitigation and clean cook-stove access in South Asia. Nature Energy 1: e15010. DOI:10.1038/nenergy.2015.10.

14. Energy Access Interactive Tool

Program: ENE

Format: Tool

Contact Person: Shonali Pachauri (pachauri@iiasa.ac.at)
Documentation: User Manual
Availability: Link from IIASA website

How to access: http://www.iiasa.ac.at/web-apps/ene/ENACT

Description:

The Energy Access Interactive Tool (ENACT) is designed to assist national and regional policymakers and analysts in their strategic policy planning processes to improve energy access for the rural poor in developing countries. It allows the assessment of different policies for achieving universal access to modern energy by 2030.

References:

Pachauri S, Nagai Y, Kolp P, Riahi K, & Schreck B (2012). The IIASA Energy Access Tool (Energy-ENACT). IIASA, Laxenburg, Austria
Pachauri S, Rao ND, Nagai Y, & Riahi K (2012). Access to Modern Energy: Assessment and Outlook for Developing and Emerging Regions. IIASA, Laxenburg, Austria

Related links (GEA):
Report and software tool were jointly developed by the Energy program at IIASA, partly within the context of Chapter 19 of the Global Energy Assessment:

Riahi, K., F. Dentener, D. Gielen, A. Grubler, J. Jewell, Z. Klimont, V. Krey, D. McCollum, S. Pachauri, S. Rao, B. van Ruijven, D. P. van Vuuren, and C. Wilson (2012). Energy Pathways for Sustainable Development. In GEA (2012): Global Energy Assessment – Toward a Sustainable Future. Cambridge University Press, Cambridge, UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg, Austria

15. Energy Multi-Criteria Analysis Tool

Program: ENE

Format: Tool

Contact Person: David McCallum (mccollum@iiasa.ac.at)

Documentation: User Manual

Availability: Link from IIASA website

How to access: http://www.iiasa.ac.at/web-apps/ene/GeaMCA/McaTool.html

Description: The Energy Multi-Criteria Analysis (MCA) tool allows energy decision makers and planners to conduct a comprehensive and integrated assessment of the major energy challenges of the 21st century and, in so doing, to make more informed choices about the sustainable energy development pathways on which they will embark in the future.

References:

McCollum DL, Krey V, & Riahi K (2011). An integrated approach to energy sustainability. Nature Climate Change 1 (9): 428-429. DOI:10.1038/nclimate1297.

McCollum DL, Krey V, Riahi K, Kolp P, Grubler A, Makowski M, & Nakicenovic N (2013). Climate policies can help resolve energy security and air pollution challenges. Climatic Change 119 (2): 479-494. DOI:10.1007/s10584-013-0710-y.

McCollum DL, Krey V, Riahi K, Kolp P, Makowski M, & Schreck B (2012). The IIASA Energy-Multi Criteria Analysis Tool (ENE-MCA). IIASA, Laxenburg, Austria

Riahi K, McCollum DL, & Krey V (2012). The Next Energy Transition: Transformative Pathways, Choices and Opportunities. IIASA, Laxenburg, Austria

Related links (GEA):
Report and software tool were jointly developed by the Energy program at the IIASA partly within the context of Chapter 17 of the Global Energy Assessment:

Riahi, K., F. Dentener, D. Gielen, A. Grubler, J. Jewell, Z. Klimont, V. Krey, D. McCollum, S. Pachauri, S. Rao, B. van Ruijven, D. P. van Vuuren, and C. Wilson (2012). Energy Pathways for Sustainable Development. In GEA (2012): Global Energy Assessment – Toward a Sustainable Future. Cambridge University Press, Cambridge, UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg, Austria

16. Agricultural Production Planning and Allocation (APPA) Model

Program: ESM

Format: Model

Contact Person: Tatiana Ermolieva (ermol@iiasa.ac.at)

Documentation: No

Availability: on request

How to access: Get in touch with contact person

Description: APPA is an integrated model for long term and geographically detailed planning of agricultural activities. Physical production potentials of land are incorporated in the model together with demographic and socio-economic variables and behavioral drivers to reflect spatial distribution of demands and production intensification levels. The model permits to study in a systemic way robust pathways increasing resource use efficiency in national, subnational and regional agricultural systems to fulfill food security goals, reduce pollution (e.g., non-point source pollution) and stress on natural non- renewable resources (e.g., water, soil), which may significantly depend on the climatic conditions and weather variability.

References:

Borodina O, Borodina E, Ermolieva T, Ermoliev Y, Fischer G, Makowski M, & van Velthuizen HT (2010). Integrated modeling approach to the analysis of food security and sustainable rural developments: Ukrainian case study. IIASA Interim Report. IIASA, Laxenburg, Austria: IR-10-017

Kyryzyuk S, Ermolieva T, & Ermoliev Y (2011). Planning sustainable agroproduction for food security under risks (Моделювання сталого агровиробництва в умовах зовнішніх викликів для забезпечення продовольчої безпеки). Economics of Agriculture (Економіка АПК) 9: 145-151.

Frayer O (2011). Agricultural Production Intensification in Ukraine: Decision Support of Agricultural Policies Based On the Assessment of Ecological and Social Impacts in Rural Areas. IIASA Interim Report. IIASA, Laxenburg, Austria: IR-11-037

17. BeWhere

Program: ESM

Format: Model

Contact Person: Sylvain Leduc (leduc@iiasa.ac.at)

Documentation: Technical Overview

Availability: Visualization of preselected results through link from IIASA website

How to access: Get in touch with contact person

Description: BeWhere is a techno-economic engineering model for renewable energy systems optimization. It identifies the localization, size and technology of the renewable energy system that should be applied in in a specific region. The economy of the supply chain is calculated with respect to the economy of scale of the corresponding renewable energy system.

References:

Mesfun S, Sanchez DL, Leduc S, Wetterlund E, Lundgren J, Biberracher M, & Kraxner F (2017). Power-to-gas and power-to-liquid for managing renewable electricity intermittency in the Alpine Region. Renewable Energy 107: 361-372. DOI:10.1016/j.renene.2017.02.020.

Xylia M, Leduc S, Patrizio P, Kraxner F, & Silveira S (2017). Locating charging infrastructure for electric buses in Stockholm. Transportation Research Part C: Emerging Technologies 78: 183-200. DOI:10.1016/j.trc.2017.03.005.

Patrizio P, Leduc S, Chinese D, & Kraxner F (2017). Internalizing the external costs of biogas supply chains in the Italian energy sector. Energy 125: 85-96. DOI:10.1016/j.energy.2017.01.033.

Campana PE, Leduc S, Kim M, Olsson A, Zhang J, Liu J, Kraxner F, McCallum I, et al. (2017). Suitable and optimal locations for implementing photovoltaic water pumping systems for grassland irrigation in China. Applied Energy 185 (Part 2): 1879-1889. DOI:10.1016/j.apenergy.2016.01.004.

… more publications

Related links:

recharge.green – balancing Alpine energy and nature

Supplying Non-food Biomass in Europe (S2Biom)

18. BioGeoChemistry Management Model (BGC-MAN)

Program: ESM

Format: Model

Contact Person: Stephan Pietsch (pietsch@iiasa.ac.at)

Documentation: Yes

Availability: on request

How to access:
http://www.iiasa.ac.at/web/home/research/researchPrograms/EcosystemsServicesandManagement/BioGeoChemistry_Management_Model_(BGC-MAN)1.html

Description: BGC-MAN simulates the cycles of carbon, water, nutrients and energy within a given ecosystem. It provides estimates on productivity, carbon sequestration, livestock feed and fodder potential, coarse woody debris and litter stocks, etc. to the IIASA/ ESM GLOBIOM-EPIC-G4M-FLAM modelling cluster. In addition, BGC-MAN provides estimates of the stability and resilience of a given management type or land use form under current and changing environmental conditions.

References:

Pietsch S & Bednar JE (2015). Ergodic to Non-ergodic Behavior Transitions and Hysteresis in Ecosystem Models. In: Systems Analysis 2015 - A Conference in Celebration of Howard Raiffa, 11 -13 November, 2015, Laxenburg, Austria.

Pietsch S, Bednar JE, Mosnier A, & Obersteiner M (2015). Probabilistic Spatial and Temporal Resilience Landscapes for the Congo Basin. In: Systems Analysis 2015 - A Conference in Celebration of Howard Raiffa, 11 -13 November, 2015, Laxenburg, Austria.

Related links:
CoForTips project

19. Integrated Emission Trading and Abatement (ETA) Model

Program: ESM

Format: Model

Contact Person: Tatiana Ermolieva (ermol@iiasa.ac.at)

Documentation: No

Availability: on request

How to access: Get in touch with contact person

Description: ETA model is an exploratory market environment for carbon emissions trading. It allows trading parties (countries or emitting entities) to investigate the conditions of their cost-efficient trades and emissions abatements. The model suggests cost efficient and environmentally safe equilibrium solution that can be implemented in reality. Functioning of the robust market is illustrated with numerical results involving such countries as US, Australia, Canada, Japan, EU27, Russia, Ukraine.

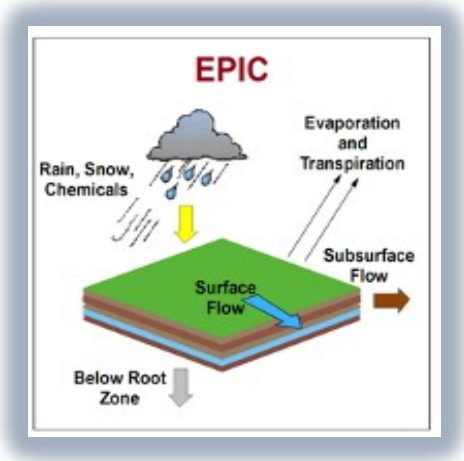
References:

Ermolieva T, Ermoliev Y, Fischer G, Jonas M, Makowski M, & Wagner F (2010). Carbon emission trading and carbon taxes under uncertainties. Climatic Change 103 (1): 277-289. DOI:10.1007/s10584-010-9910-x.

Godal O, Ermoliev Y, Klaassen G, & Obersteiner M (2003). Carbon trading with imperfectly observable emissions. Environmental and Resource Economics 25 (2): 151-169. DOI:10.1023/A:1023914324084.

Ermoliev YM, Klaassen G, & Nentjes A (1996). The design of cost effective ambient charges under incomplete information and risk. In: Economics of Atmospheric Pollution. Eds. Ierland, E. van & Gorka, K., Heidelberg: Springer-Verlag. ISBN 3-540-61671-3

20. The Environmental Policy Integrated Model (EPIC)



Program: ESM

Format: Model

Contact Person: Juraj Balkovic (balkovic@iiasa.ac.at)

Documentation: No

Availability: on request

How to access: Get in touch with contact person

Description: At IIASA, EPIC is used to compare land and forest management systems and their effects on environmental indicators like water availability, nitrogen and phosphorous levels in soil, and greenhouse gas emissions. EPIC can analyze several crop types and their management under different weather, topographical, and soil conditions. It investigates the trade-offs between plant growth and yield on the one hand, and environmental impacts and sustainability on the other.

For example, EPIC can estimate—based on soil type and prevailing climatic conditions—the extent to which nutrients from fertilizer, such as Nitrogen (N) are leaching into nearby river and stream networks. This problem is of growing concern as globally, two-fifths of N used in agriculture is lost to ecosystems, with harmful environmental effects.

References:

van der Velde M, Tubiello FN, Vrieling A, & Bouraoui F (2012). Impacts of extreme weather on wheat and maize in France: Evaluating regional crop simulations against observed data. Climatic Change 113 (3): 751-765. DOI:10.1007/s10584-011-0368-2.

Related projects:

LC-IMPACT

Carbo-Extreme

ISAC

21. FeliX Model

Program: ESM

Format: Model

Contact Person: Felicjan Rydzak (rydzak@iiasa.ac.at)

Documentation: PDF model report and technical documentation

Availability: Link from IIASA website

How to access: http://www.felixmodel.com/

Description: The FeliX model (www.felixmodel.org) is encoded with Vensim software and represents a full system dynamics perspective on the social, economic, and environmental sub-components of the Earth system. Critical interdependencies among these systems are incorporated to recreate the complex dynamic behavior which characterizes the Anthropocene.

The model consists of over 1300 elements including 91 stocks. Its outcomes are determined by many interacting feedback loops encompassing 8 model sectors: Economy, Energy, Carbon Cycle, Climate, Biodiversity, Water, Population and Land Use. Wherever possible, elements and stocks are calibrated to historical data available from the FAO, IEA, and UNIHP.

After calibration, FeliX scenario outcomes project on a global scale major stock changes (e.g., depletion of natural resources, accrual of carbon dioxide in the atmosphere) as well as the aggregate consequences of policies and technologies (e.g., afforestation, emissions reduction) over time.

References:

Walsh B, Ciais P, Janssens IA, Penuelas J, Riahi K, Rydzak F, van Vuuren DP, & Obersteiner M (2017). Pathways for balancing CO2 emissions and sinks. Nature Communications 8: e14856. DOI:10.1038/ncomms14856.

Walsh BJ, Rydzak F, Palazzo A, Kraxner F, Herrero M, Schenk P, Ciais P, Janssens IA, et al. (2015). New feed sources key to ambitious climate targets. Carbon Balance and Management 10 (1): 1-8. DOI:10.1186/s13021-015-0040-7.

Related links:
GEO-BENE project

22. FLAM

Program: ESM

Format: Model

Contact Person: Nikolay Khabarov (khabarov@iiasa.ac.at), Andrey Krasovskii (krasov@iiasa.ac.at)

Documentation: No

Availability: on request

How to access: http://www.iiasa.ac.at/flam

Description: The wildFire cLimate impacts and Adaptation Model (FLAM) is able to capture the complex impact of climate, population, and fuel availability on burned areas. FLAM uses a process-based fire parameterization algorithm that was originally developed to link a fire model with dynamic global vegetation models. The key features implemented in FLAM include fuel moisture computation based on the Canadian Fine Fuel Moisture Code (FFMC) index, and a procedure to calibrate regional fire suppression efficiency.

References:

Krasovskii A, Khabarov N, Migliavacca M, Kraxner F, & Obersteiner M (2016). Regional aspects of modelling burned areas in Europe. International Journal of Wildland Fire 25 (8): 811-818. DOI:10.1071/WF15012.

Khabarov N, Krasovskii AA, Obersteiner M, Swart R, Dosio A, San-Miguel-Ayanz J, Durrant T, Camia A, et al. (2016). Forest fires and adaptation options in Europe. Regional Environmental Change 16 (1): 21-30. DOI:10.1007/s10113-014-0621-0.

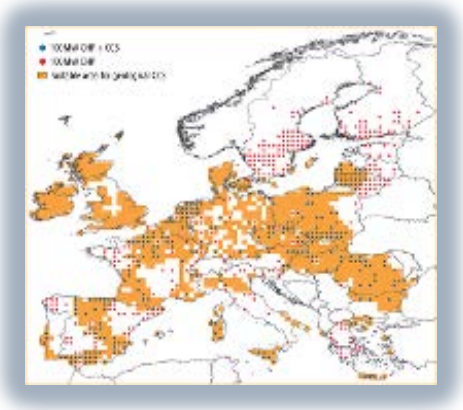
Related links (FLAM projects):

Options Market and Risk-Reduction Tools for REDD+ (NORAD OMRRT REDD+)

Economics of Climate Change Adaptation in Europe (ECONADAPT)

MEDIATION - Methodology for Effective Decision-making on Impacts and AdaptaTION

23. The Global Forest Model (G4M)



Program: ESM

Format: Model

Contact Person: Georg Kindermann (kinder@iiasa.ac.at), Mykola Gusti (gusti@iiasa.ac.at)

Documentation: No

Availability: on request

How to access:
http://www.iiasa.ac.at/web/home/research/researchPrograms/EcosystemsServicesandManagement/G4M.en.html

Description: IIASA's G4M model compares the income derived from forests with the income that could be derived from an alternative use of the same land, for example, to grow grain for food or biofuel. To do this, G4M estimates the amount of net income currently being derived from forests by calculating the amount and value of wood produced minus the harvesting costs (i.e., logging and timber extraction). It also assesses the potential income represented by carbon storage in forests (sequestration). Taking these values into account, G4M demonstrates whether it would be more profitable to grow agricultural crops or bio-fuels at the location, or whether forestry is the best option for the land.

References:

Kindermann G, Obersteiner M, Rametsteiner E, & McCallum I (2006). Predicting the deforestation-trend under different carbon-prices. Carbon Balance and Management 1 (15): 1-17. DOI:10.1186/1750-0680-1-15.

Kindermann G, Obersteiner M, Sohngen B, Sathaye J, Andrasko K, Rametsteiner E, Schlamadinger B, Wunder S, et al. (2008). Global cost estimates of reducing carbon emissions through avoided deforestation. Proceedings of the National Academy of Sciences 105 (30): 10302-10307. DOI:10.1073/pnas.0710616105.

Bottcher H, Verkerk PJ, Gusti M, Havlik P, & Grassi G (2012). Projection of the future EU forest CO2 sink as affected by recent bioenergy policies using two advanced forest management models. GCB Bioenergy 4 (6): 773-783. DOI:10.1111/j.1757-1707.2011.01152.x.

Related links (G4M projects):

recharge.green – balancing Alpine energy and nature

Supplying Non-food Biomass in Europe (S2Biom)

EUCLIMIT

24. GEO-WIKI

Program: ESM

Format: Tools and dataset

Contact Person: Steffen Fritz (fritz@iiasa.ac.at)

Documentation: Technical Background

Availability: Access from IIASA website

How to access:
http://www.iiasa.ac.at/web/home/research/researchPrograms/EcosystemsServicesandManagement/Geo_wiki_Data_Sets.en.html ; http://www.geo-wiki.org

Description: Geo-Wiki is an online tool that provides users with access to global environmental spatial datasets, including those related to land cover, forest, agriculture, biomass, and many more, organized in different Geo-Wiki branches. Geo-Wiki allows users to compare different products, and to provide feedback and local expertise. Users can display maps of the spatial disagreement between pairs of land cover maps, along with the overall disagreement in the forest and cropland domains. It is also possible to view a hybrid land cover map, created from existing land cover products and crowdsourced data. Such a portal helps to identify the most suitable datasets and aids in building data products of higher accuracy with users in a participatory fashion. Furthermore, Geo-Wiki can be used to collect reference data sets for validation and calibration activities as well as statistical data about land use information such as extent of forest cover, cropland, etc. Data are compiled via trained experts or volunteers. Gamification and other techniques are used to incentivize volunteers (more Geo-Wiki research).

References:

Laso Bayas JC, Lesiv M, Waldner F, Schucknecht A, Duerauer M, See L, Fritz S, Fraisl D, et al. (2017). A global reference database of crowdsourced cropland data collected using the Geo-Wiki platform. Scientific Data 4: e170136. DOI:10.1038/sdata.2017.136.

Baklanov A, Fritz S, Khachay M, Nurmukhametov O, Salk C, See L, & Shchepashchenko D (2016). Improved Vote Aggregation Techniques for the Geo-Wiki Cropland Capture Crowdsourcing Game. In: European Geosciences Union (EGU) General Assembly 2016, 17–22 April 2016, Vienna, Austria.

See L, Fritz S, Perger C, Schill C, McCallum I, Schepaschenko D, Dürauer M, Sturn T, et al. (2015). Harnessing the power of volunteers, the internet and Google Earth to collect and validate global spatial information using Geo-Wiki. Technological Forecasting and Social Change 98: 324-335. DOI:10.1016/j.techfore.2015.03.002.

Perger C, LeDrew E, See L, & Fritz S (2014). Geography Geo-Wiki in the classroom: Using crowdsourcing to enhance geographical teaching. Future Internet 6 (4): 597-611. DOI:10.3390/fi6040597.

25. Geo-Wiki Mobile Apps and Games

Program: ESM

Format: Tools

Contact Person: Steffen Fritz (fritz@iiasa.ac.at)

Documentation: See website

Availability: Information about where to download the apps is available from the Geo-Wiki website

How to access: http://www.geo-wiki.org/

Description: The Geo-Wiki project has developed a number of mobile apps and games as follows:

Geo-Wiki Pictures: This mobile app is used to collect information outdoors on any subject of interest, e.g. land cover classes, crop types, tree species, etc. The app asks volunteers to take a picture of a location, which is geo-tagged, and other information such as the compass direction and tilt are automatically recorded. The volunteer then tags the photograph from a customizable legend. The photographs can be viewed, shared and managed in the Geo-Wiki Pictures branch found in the main Geo-Wiki application.

FotoQuest Europe: This mobile app is played outdoors and sends volunteers to capture land cover and land use information at specific locations marked on a map. Each location is worth points, and players compete for small prizes to collect as much field-based information as possible. The resulting data are useful for the calibration and validation data of land cover and land use products.

Picture Pile: This mobile and browser-based game involves the rapid classification of satellite imagery and geotagged photographs. Each pile of pictures consists of a different theme, e.g. identification of deforestation, rapid building damage assessment following a natural disaster, among others. The data collected from the game are used to validate existing land cover maps or aid organizations such as Humanitarian OpenStreetMap in creating damage maps for disaster response.

References:

Laso-Bayas JC, See L, Fritz S, Sturn T, Karner M, Perger C, Dürauer M, Mondel T, et al. (2016). Assessing the quality of crowdsourced in-situ land-use and land cover data from FotoQuest Austria application. In: European Geosciences Union (EGU) General Assembly 2016, 17–22 April 2016, Vienna, Austria

26. GLOBIOM

Program: ESM

Format: Model

Contact Person: Petr Havlik (havlik@iiasa.ac.at)

Documentation: on request

Availability: on request

How to access: The model is hosted at IIASA on an SVN version control server, accessible via the server for partners.

Description: GLOBIOM is a partial equilibrium model of the agricultural and forestry sectors covering not only economic but also environmental parameters. It is being used for agricultural and forest markets foresight, policy impact assessments and sustainable land use pathways development.

References:

Havlik P, Valin H, Herrero M, Obersteiner M, Schmid E, Rufino MC, Mosnier A, Thornton PK, et al. (2014). Climate change mitigation through livestock system transitions. Proceedings of the National Academy of Sciences 111 (10): 3709-3714. DOI:10.1073/pnas.1308044111.

Related links (current GLOBIOM projects):

REDD-PAC

IMPACT2C

GLOBAL IQ

GHG-Europe

EUCLIMIT

EnerGEO

AnimalChange

27. LACO-WIKI (currently in a beta stage)

Program: ESM

Format: Tool

Contact Person: Linda See (see@iiasa.ac.at), Christoph Perger (pergerch@iiasa.ac.at)

Documentation: PDF Manual
Availability: Access from IIASA website

How to access: http://www.laco-wiki.net

Description: LACO-Wiki is an online land cover validation tool that simplifies the process of validating a land cover map. In LACO-Wiki, land cover validation is broken down into four simple steps as follows: (i) upload a raster or vector map for validation; (ii) create a validation sample, which can be random, stratified random or systematic; (iii) carry out the validation session by interpreting the samples using Google Earth, Bing imagery, OpenStreetMap, Sentinel-2 or images supplied by the user via a Web Map Service; and (iv) calculate the confusion matrix and accuracy statistics, presented as a report and/or raw data for downloading. The tool is aimed at a variety of users from researchers and students to map producers and industry. In addition to land cover validation, the vision behind LACO-Wiki is to become an open access repository for calibration and validation data that can be used by the land monitoring community to improve future land cover products.

References:

Laso Bayas JC, Lesiv M, Waldner F, Schucknecht A, Duerauer M, See L, Fritz S, Fraisl D, et al. (2017). A global reference database of crowdsourced cropland data collected using the Geo-Wiki platform. Scientific Data 4: e170136. DOI:10.1038/sdata.2017.136.

See L, Laso Bayas JC, Schepaschenko D, Perger C, Dresel C, Maus V, Salk C, Weichselgartner J, et al. (2017). LACO-Wiki: A New Online Land Cover Validation Tool Demonstrated Using GlobeLand30 for Kenya. Remote Sensing 9 (7): e754. DOI:10.3390/rs9070754.

Schepaschenko D, See L, Perger C, Hofer M, Weichselbaum J, Dresel C, & Fritz S (2016). LACO-WIKI-A new open access online portal for land cover validation with high resolution imagery. In: Aerospace Methods and GIS Technologies in Forestry, Forest Management and Ecology: Proceedings of the VI All-Russian Conference. Eds. Ershov, D.V., Zhirin, V.M., Knyazeva, S.V., Eidlina, S.P., Korolyeva, N.V. & Gavrilyuk, E.A., pp. 74-79 Moscow: M. CEPF RAS. ISBN 978-5-9901791-7-2

See L, Perger C, Dresel C, Hofer M, Weichselbaum J, Mondel T, & Fritz S (2016). LACO-Wiki: A land cover validation tool and a new, innovative teaching resource for remote sensing and the geosciences. In: European Geosciences Union (EGU) General Assembly 2016, 17–22 April 2016, Vienna, Austria.

28. Decentralized Water Pricing and Water Pollution Taxation Model in the Presence of Uncertainties, Incomplete and Asymmetric Information (WAP)

Program: ESM

Format: Model & Data

Contact Person: Tatiana Ermolieva (ermol@iiasa.ac.at), Yurii Yermoliev (ermoliev@iiasa.a.at)

Documentation: No

Availability: Get in touch with contact person

Description: The decentralized water pricing methodology addresses main challenges of sharing a common resource – water - among the competing users in an efficient and fair way and a problem of preserving the water quality. The model has been applied to the agricultural region around the Aral Sea to determine how water policies may affect agricultural production and improve environmental conditions. Then, the model has been advanced and applied for the analysis of pollution abatement strategies and later, the methodology of decentralized pricing under uncertainties, incomplete and asymmetric information has been used for the development of a prototype emission trading model in the framework of a joint GGI project at IIASA.

References:

Ermolieva T, Ermoliev Y, Fischer G, Jonas M, Makowski M, & Wagner F (2010). Carbon emission trading and carbon taxes under uncertainties. Climatic Change 103 (1): 277-289. DOI:10.1007/s10584-010-9910-x.

Godal O, Ermoliev Y, Klaassen G, & Obersteiner M (2003). Carbon trading with imperfectly observable emissions. Environmental and Resource Economics 25 (2): 151-169. DOI:10.1023/A:1023914324084.

Ermoliev YM, Michalevich M, & Nentjes A (2000). Markets for tradeable emission and ambient permits: A dynamic approach. Environmental and Resource Economics 15 (1): 39-56. DOI:10.1023/A:100836961137

29. CATSIM

Program: RISK

Format: Model

Contact Person: Reinhard Mechler (mechler@iiasa.ac.at)

Documentation: User Manual

Availability: get in touch with contact person

Description: The CATSIM model was designed by IIASA researchers to help policymakers, particularly in developing countries, devise public financing strategies to be implemented in both the pre- and post-disaster context. National data can be input into CATSIM allowing policy advisers to pose "what if" questions. The model will then show the best combination of financial strategies to suit current national circumstances.

CATSIM played a founding role in the "Caribbean Catastrophe Risk Insurance facility" in 2006, being distributed to 10 Caribbean countries and two regional banks, the CDB and the IADB. CATSIM was used by Mexico to assess earthquake risks in 2007; this led to the first-ever government-issued catastrophe bond against natural disasters.

This is the only model available worldwide which can assess the financial vulnerability of governments to disaster risk and possible risk management strategies to decrease it. It iscomplicated but the standalone version is equipped with a user interface to make it easier to understand, however, training is always needed - in the past usually NMOs through their YSSP were using this model.

References:

Hochrainer-Stigler S, Mechler R, & Pflug GC (2013). Modeling macro scale disaster risk: The CATSIM model. In: Integrated Catastrophe Risk Modeling: Supporting Policy Processes. Eds. Amendola, A, Ermolieva, T, Linnerooth-Bayer, J & Mechler, R, Dordrecht: Springer. DOI:10.1007/978-94-007-2226-2_8.

Hochrainer-Stigler S, Timonina AV, Williges K, Pflug GC, & Mechler R (2013). Modelling the economic and fiscal risks from natural disasters: Insights based on the CatSim model. Background paper prepared for the Global Assessment Report on Disaster Risk Reduction 2013, UNISDR, Geneva, Switzerland

Hochrainer-Stigler S (2014). User Interface of the CatSim Model and Practical Guidelines. IIASA Laxenburg, Austria

Related projects:

MEDIATION

30. CATSIM - Inter-industry Impact Assessment

Program: RISK

Format: Model

Contact Person: Junko Mochizuki (mochizuk@iiasa.ac.at)

Documentation: see references below

Availability: Get in touch with contact person

Description: A CATSIM economic module which estimates the time-dependent higher order impact of natural disasters in different sectors. It can be used to quantify the benefit of better fiscal preparedness and faster recovery and reconstruction processes (used in countries such as Nepal and Cambodia). IIASA's Risk and Resilience team has built a CATSIM module which quantifies the inter-industry impact of natural disasters. The model estimates the economic costs of natural disasters across sectors and takes into account the economy's existing production structures and estimated disaster recovery time. The model may be calibrated using commonly available datasets such as input-output tables and users may see the economic benefit of better fiscal preparedness (faster disaster recovery). This software module has been built as part of the CATSIM framework, and may be used in policy assessment and capacity building activates. Further software development which includes interface and other visualization tools is being planned.

References:

Mochizuki J, Vitoontus S, Wickramarachchi B, Hochrainer-Stigler S, Williges K, Mechler R, & Sovann R (2015). Operationalizing iterative risk management under limited information: fiscal and economic risks due to natural disasters in Cambodia. International Journal of Disaster Risk Science 6 (4): 321-334. DOI:10.1007/s13753-015-0069-y.

Williges K, Hochrainer-Stigler S, Mochizuki J, & Mechler R (2015). Modeling the indirect and fiscal risks from natural disasters for informing options for enhancing resilience and building back better. UNISDR , Geneva, Switzerland.

Related links:

Cambodia CATSIM

Workshop on Fiscal and Economic Disaster Risks in Cambodia

31. CATSIM - Stochastic Debt Analysis Module

Program: RISK

Format: Model

Contact Person: Junko Mochizuki (mochizuk@iiasa.ac.at)

Documentation: see references below

Availability: Get in touch with contact person

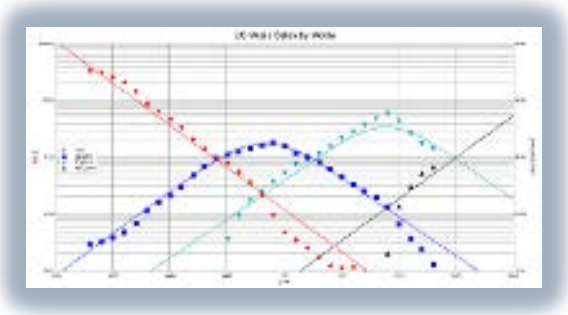
Description: A CATSIM economic module which estimates the impact of stochastic shocks to country's longer-term debt level and sustainability. It is currently calibrated to EU 28 countries and estimates debt sustainability indicators (e.g. S1, S2) used by the EU commission, taking into account of public liability rising from climate extreme events (used in EU 28 countries to assess fiscal risk of climate extreme events by 2050). Building on IIASA's expertise in longer-term scenario-based integrated assessments, the CATSIM Stochastic Debt Assessment estimates the fiscal risk under alternative Shared Socioeconomic Pathways (SSPs) and Representative Concentration Pathways (RCPs). This software module has been built as part of the CATSIM framework, and may be used in policy assessment and capacity building activities. Further software development including interfacing and other visualization tools is being planned. The model is currently being applied in Austria to assess flood and drought risk under climate change.

References:

Mochizuki J, Mechler R, Hochrainer-Stigler S, & Schinko T (2016). Pan-European Assessment of Fiscal Consequence of Climate Extremes. ECONADAPT Deliverable 5.2.

Related projects:
ECONADAPT

32. LSM2



Program: TNT

Format: Software

Contact Person: Arnulf Grubler (gruebler@iiasa.ac.at), Peter Kolp (kolp@iiasa.ac.at)

Documentation: User Guide

Availability: Download + Link from IIASA website

How to access:
http://www.iiasa.ac.at/web/home/research/researchPrograms/TransitionstoNewTechnologies/LSM2.en.html

Description: A software tool to estimate the parameters of technological growth and substitution processes. LSM2 is a software tool developed at IIASA that allows to analyze the dynamics of how a technology (product, technique, process, practice) grows and interacts (competes) with other technologies. The tool uses empirical data to analyze the technology substitution process over time, computes the market shares of several competing technologies across multiple time frames, and analyzes not only absolute production/sales amounts per technology but also the total market volume growth of all technologies taken together. Simple model parameters approximate the growth and substitution dynamics, making it useful for comparative research.

Related links:

Webstart LSM2

Download LSM2

33. The LANDFLOW Model

Program: WAT

Format: Model and global database

Contact Person: Guenther Fischer (fisher@iiasa.ac.at)

Documentation: No

Availability: get in touch with contact person

Description: A model that traces land and water use embodied in production, trade and consumption of agricultural commodities. LANDFLOW is a powerful tool for estimating how many hectares of land are directly or indirectly associated with different consumption patterns. A first version was developed during the project, "Modeling Opportunities and Limits for Restructuring Europe towards Sustainability" (MOSUS) to trace embedded land in agriculture and forest sector commodities. LANDFLOW traces commodity flows from primary production, via intermediate products and trade, to final use. LANDFLOW generates a database for 1990 to 2009, which provides a detailed account of the agricultural and forestry products produced and traded by individual countries. The agricultural products included in the database are: crops, livestock, and fisheries, both primary and processed products; forestry commodities including primary roundwood, manufactured wood, and wood products, pulp and paper (but excluding some secondary manufactured products like furniture).

References:

Cuypers D, Geerken T, Gorissen L, Lust A, Peters G, Karstensen J, Prieler S, Fischer G, et al. (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation. European Commission, DG ENV

Devriendt N, Lust A, Lemeire C, Cuypers D, Prieler S, Fischer G, Hizsnyik E, De Smet L, et al. (2013). The impact of EU consumption on deforestation: Proposal of specific Community policy, legislative measures and other initiatives for further consideration by the Commission. European Commission, DG ENV

Devriendt N, Lust A, Lemeire C, Cuypers D, Prieler S, Fischer G, Hizsnyik E, de Smet L, et al. (2013). The impact of EU consumption on deforestation: dentification of critical areas where Community policies and legislation could be reviewed. European Commission, DG ENV

Related projects:

The impact of EU consumption on deforestation

34. World Food System model (WFS)

Program: WAT

Format: Model

Contact Person: Guenther Fischer (fisher@iiasa.ac.at)

Documentation: on request

Availability: get in touch with contact person

Description: The world food system model comprises a series of national and regional agricultural economic models. It provides a framework for analyzing the world food system, viewing national food and agricultural components as embedded in national economies, which in turn interact with each other at the international trade level. The IIASA World Food System (WFS) provides a framework for analyzing—in annual steps—how much food will be produced and consumed in the world, where it will be produced and consumed, and the trade and financial flows related to such activities. For the purpose of international linkages, the production, consumption, and trade of goods and services of a country are aggregated into nine main agricultural sectors and one non-agricultural sector.

References:

Fischer G, Hizsnyik E, Prieler S, Shah M, & van Velthuizen HT (2009). Biofuels and Food Security. Final Report to Sponsor: The OPEC Fund for International Development (OFID), Vienna, Austria

Related research:

GAEZ

Land Use Systems

35. Community Water Model

Program: WAT

Format: Model

Contact Person: Peter Burek (burek@iiasa.ac.at), Yoshihide Wada (wada@iiasa.ac.at)

Documentation: See link below

Availability: Link from IIASA website

How to access: https://cwatm.github.io/

Description: Open source model to examine how future water demand will evolve in response to socioeconomic change and how water availability will change in response to climate. The Community Water Model allows the assessment of water supply and human and environmental water demands at both global and regional levels.

The Community Water Model allows the assessment of water supply and human and environmental water demands at both global and regional levels. The model is the first step towards developing a next-generation global hydro-economic modeling framework, that can explore the economic trade-offs among different water management options, encompassing both water supply infrastructure and demand management.

The integrated modeling framework will consider water demand from agriculture, domestic, energy, industry, and the environment. It will also take into account the investment needed to alleviate future water scarcity, and provide a portfolio of economically optimal solutions. In addition, it will be able to track the energy requirements associated with the water supply system; for example, pumping, desalination, and inter-basin transfer.

References:

Burek P, Satoh Y, Greve P, Kahil T, & Wada Y (2017). The CommunityWater Model (CWATM) / Development of a community driven global water model. In: European Geosciences Union (EGU) General Assembly 2017, 23–28 April 2017, Vienna, Austria.

Burek P, Satoh Y, Fischer G, Kahil MT, Scherzer A, Tramberend S, Nava LF, Wada Y, et al. (2016). Water Futures and Solution - Fast Track Initiative (Final Report). IIASA Working Paper. IIASA, Laxenburg, Austria: WP-16-006

Wada Y, Flörke M, Hanasaki N, Eisner S, Fischer G, Tramberend S, Satoh Y, van Vliet M, et al. (2016). Modeling global water use for the 21st century: Water Futures and Solutions (WFaS) initiative and its approaches. Geoscientific Model Development 9: 175-222. DOI:10.5194/gmd-9-175-2016.

Satoh Y, Kahil T, Byers E, Burek P, Fischer G, Tramberend S, Greve P, Flörke M, et al. (2017). Multi-model and multi-scenario assessments of Asian water futures: the Water Futures and Solutions (WFaS) initiative. Earth's Future 5 (7): 823-852. DOI:10.1002/2016EF000503.

Related models:

Global Hydro-Economic

MESSAGE

GLOBIOM

EPIC

36. Global Hydro-economic Model

Program: WAT

Format: Model

Contact Person: Peter Burek (burek@iiasa.ac.at), Taher Kahil (kahil@iiasa.ac.at)

Documentation: under development

Availability: under development

Description: The Global Hydro-economic Model uses optimization to balance global water demand and supply at the level of large-scale river basins. The technique allows the model to minimize the total costs of meeting the water demands from the agricultural, industrial (energy and manufacturing), and domestic sectors, while also taking into account various resource, institutional, and environmental constraints, such as retaining enough water for healthy aquatic ecosystems. Monthly variation will be included so the model can align with existing IIASA integrated assessment models. The model can be used to simulate a variety of basin management decisions including resource extractions, interbasin transfers, reservoir storage, and water infrastructure investment (i.e., the choice of the size and location of new water projects). The model uses information on water demand and availability provided by existing global integrated assessment models at IIASA and provides information on water resources development and allocation to those models.

References:

Wada Y, Flörke M, Hanasaki N, Eisner S, Fischer G, Tramberend S, Satoh Y, van Vliet M, et al. (2016). Modeling global water use for the 21st century: Water Futures and Solutions (WFaS) initiative and its approaches. Geoscientific Model Development 9: 175-222.

Kahil MT, Ward F A, Albiac J, Eggleston J, & Sanz D (2016). Hydro-economic modeling with aquifer-river interactions to guide sustainable basin management. Journal of Hydrology 539: 510-524.

Kahil TM, Ward FA, Albiac J, Eggleston J, & Sanz D (2016). Hydro-economic modeling of conjunctive ground and surface water use to guide sustainable basin management. In: European Geosciences Union (EGU) General Assembly 2016, 17–22 April 2016, Vienna, Austria.

Related research:

Integrated Solutions for Water, Energy, and Land project

Community Water Model

37. CHINAGRO-II MODEL

Program: WAT

Format: Model

Contact Person: Laixiang Sun (sun@iiasa.ac.at), Guenther Fischer (fisher@iiasa.ac.at)

Documentation: User Manual

Availability: Get in touch with contact person

Description: CHINAGRO is a general equilibrium model of Policy Decision Support for Sustainable Adaptation of China's Agriculture to Globalization. It is featured by 17-commodities, 8-region with 6 income groups per region, and agricultural supply from 2844 counties. In every county several land use types in cropping and livestock production are distinguished, with in total 28 aggregate outputs. Apart from the 17 tradable commodities, local commodities such as manure, household waste and crop residuals are accounted for. Data are collected from various basic sources, reclassified into Chinagro taxonomy and made consistent for the Chinagro-I's base-year 1997 and Chinagro-II's base-year 2005. An effort to update the base year to 2015 (CHINAGRO-III) is on the way. The construction of the model and its supporting dataset is programmed in GAMS, with a modular set-up that shows the steps from source data to final data and facilitates revisions of specific components. Base-year tabulations are also available in ASCII format.

References:

Fischer G, Huang J, Keyzer MA, Qiu H, Sun L, & van Veen VCM (2007). China's agricultural prospects and challenges. Report on scenario simulations until 2030 with the Chinagro welfare model covering national, regional and county level. Centre for World Food Studies, VU University. Amster