

Domain 1: Optimal behavior of systems



Major themes:

- ❑ Size-structured population dynamics and tradeoffs between economic and ecological objectives
- ❑ Drivers and impacts of economic growth
- ❑ Food-energy-water nexus: Robust solutions

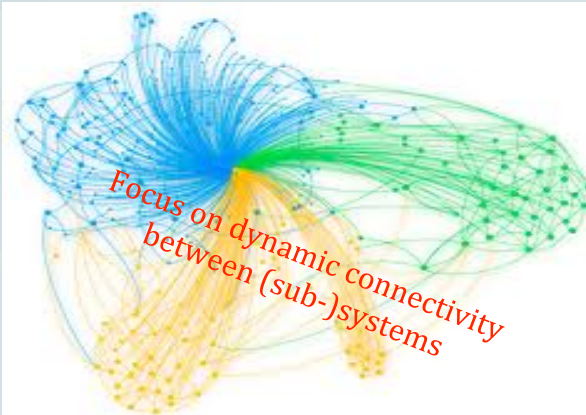
Key recent publications:

- Aseev and Veliov (2015): *Maximum principle for infinite-horizon optimal control problems under weak regularity assumptions*. Proc. Steklov Inst. Math. 291(1):22-39
- Ermolieva et al. (2016): *Integrated management of land use systems under systemic risks and security targets: A stochastic Global Biosphere Management model*. J. Agric. Econ. 67(3): 584-601
- Belyakov et al. (2015): *Optimal cyclic exploitation of renewable resources*. J. Dyn. Contr. Syst. 21(3):475-494

Key projects:

- Energy Efficiency and Risk Management in Public Buildings (EnRiMa) – supported by EC FP7
- Optimal Research and Extraction Policy towards a Backstop Technology – supported by the Russian Ministry of Education and Science

Domain 2: Interactions within systems



Major themes:

- ❑ Systemic risk in financial systems
- ❑ Role of indirect effects in ecological and economic systems
- ❑ Game-theoretic approach for social interactions

Key recent publications:

- Poledna and Thurner (2016): *Elimination of systemic risk in financial networks by means of a systemic risk transaction tax*. Quant. Fin. 1-15
- Kharrazi et al. (2017): *Network structure impacts global commodity trade growth and resilience*. PLoS ONE 12(2): e0171184
- Manzoor et al. (2016): *Game-theoretic insights into the role of environmentalism and social-ecological relevance: A cognitive model of resource consumption*. Ecol. Mod. 240:74-85

Key projects:

- Systemic Risk and Network Dynamics – supported by IIASA's cross-cutting fund
- Resilience, Social Networks and Austrian Security – supported by the Austrian Security Research Programme

Domain 3: Systems transitions and resilience of systems



Major themes:

- ❑ Agent-based modeling for regional economic development
- ❑ Role of uncertainty in climate science and meeting sustainability constraints
- ❑ Reconciling uncertainty of multiple-model ensembles

Key recent publications:

- Smith et al. (2016): *Biophysical and economic limits to negative CO2 emissions*. Nature Climate Change 6(1):42-50
- Ilmola-Sheppard and Strelkovskii (2016): *Soft social systems and shocks: an experiment with an agent-based model*. In: Masys (ed.), Appl. Syst. Think. Soft Oper. Res. Man. Complex., Springer, 269-290
- Kryazhimskiy et al. (2015): *Towards harmonizing competing models: Russian forests' net primary production case study*. Tech. For. Soc. Change, 98:245-254

Key projects:

- Platform Value Now – supported by Finnish Research Council
- Knowledge-based Climate Mitigation Systems for a Low Carbon Economy (COMPLEX) – funded by EC FP7
- Structural Change of the Finnish Economy – a Systems Approach – supported by Finnish Ministry of Employment and Economy

ASA's mission

IIASA's research programs:



Since 2011, ASA **produces, practices** and **prototypes** novel system-analytical interdisciplinary **approaches, methods** and **tools**, which allow solving problems that cannot be addressed by the existing tools, or which enable addressing the problems more efficiently

Uniqueness:
agile cross-fertilization
between methods and
applications using systems
of systems approach



ASA's team



Our interdisciplinary team

24 researchers
(+ up to 10 visiting researchers per year)
10 nationalities
different career stages
different backgrounds
strives to explore how
mathematics can help address
contemporary challenges
of systems analysis

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More information:

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*"How can it be that
mathematics, being after
all a product of human
thought, which is
independent of experience,
is so admirably appropriate to the
objects of reality?"* Albert Einstein 1921

