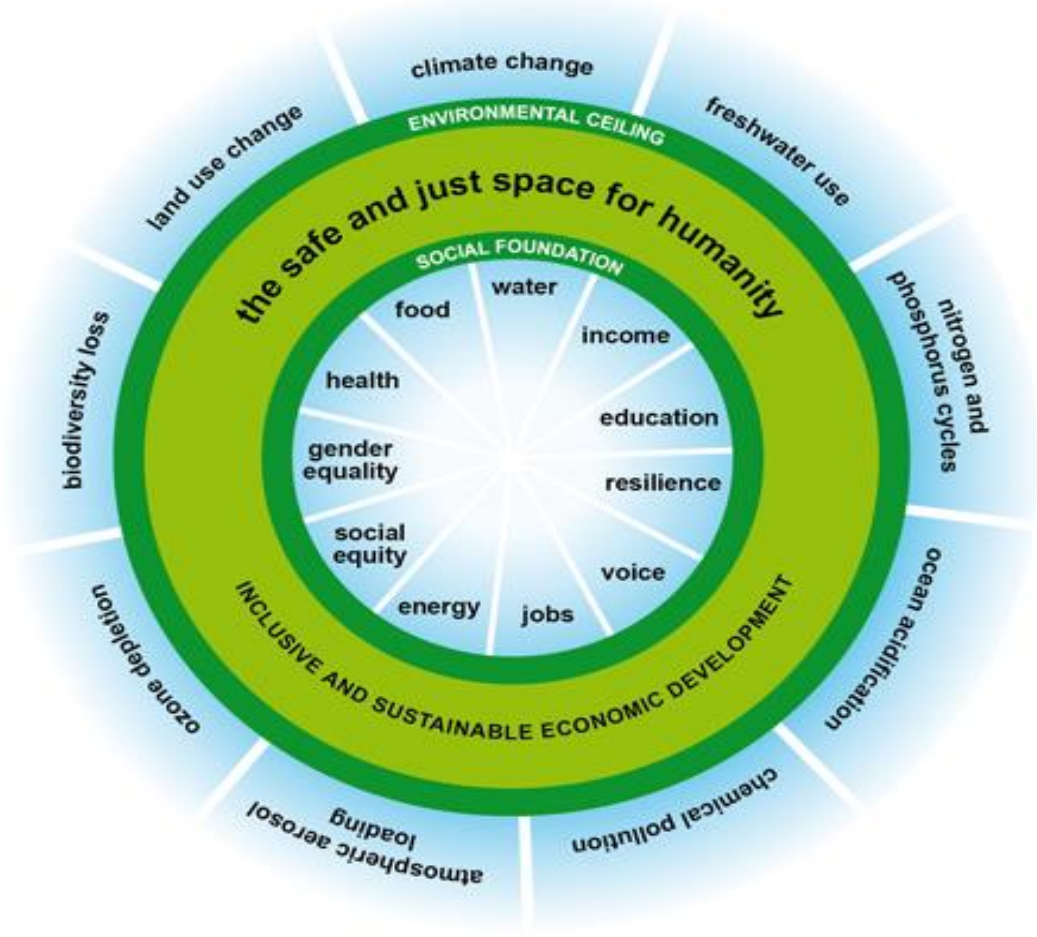


MOSES - Modeling of Sustainable Economic Systems



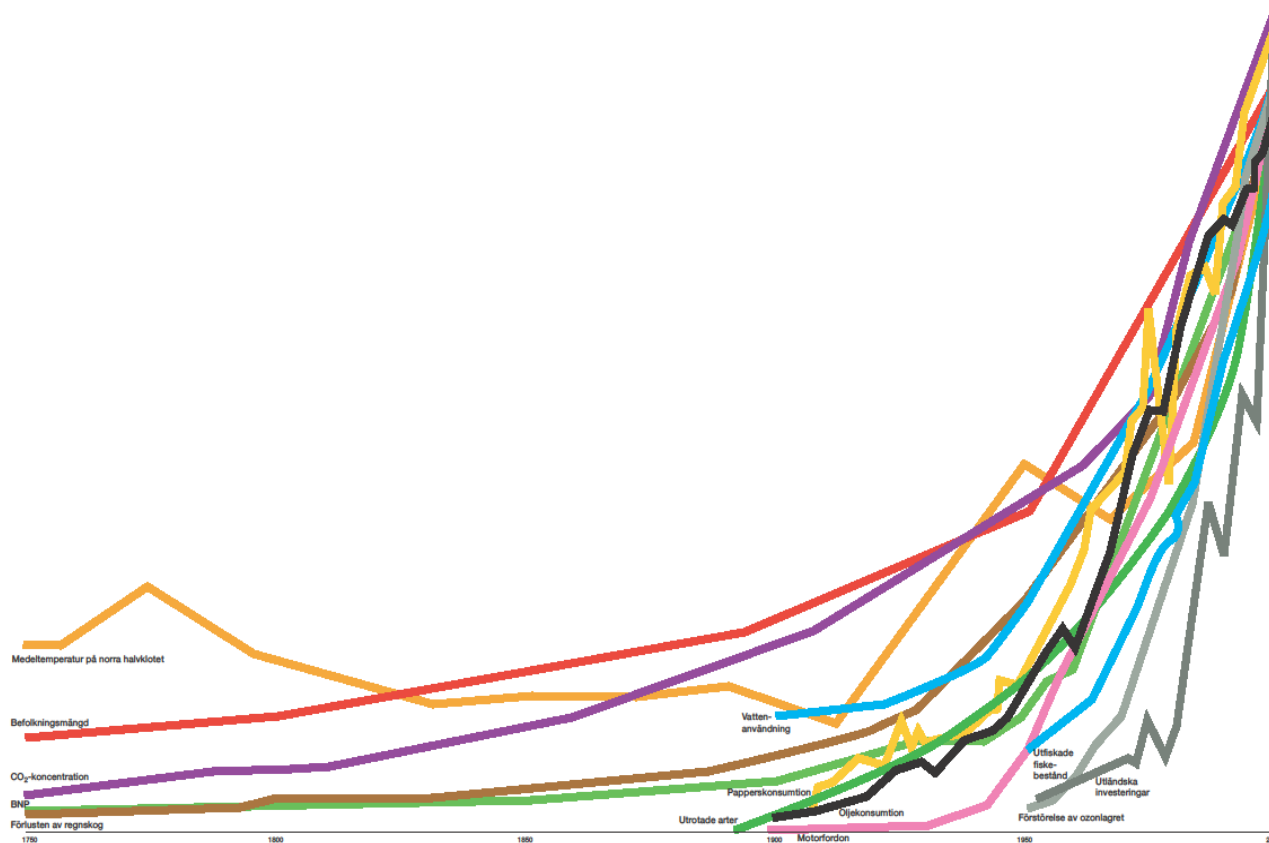
Welcome!

MOSES-2016 Workshop May 6-20, 2016

Linköping University, Sweden

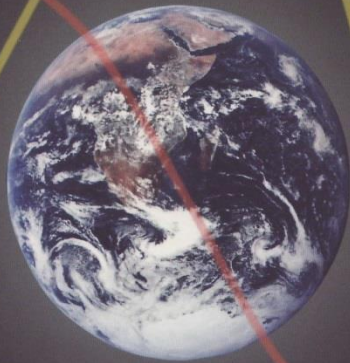
A Unique Point in History – Exponential Trends Approach Planet Earth Boundaries

Year 1750-2000:



- Mean temperature north hemisphere,
- Population,
- CO₂-concentration,
- BNP,
- Loss av rain forest,
- Water usage
- Paper consumption,
- Exterminated species
- Oil consumption,
- Motor vehicles
- Destroyed fish populations
- Destruction of ozon layer
- Foreign investments

LIMITS TO GROWTH



The 30-Year Update

DONELLA MEADOWS | JORGEN RANDERS | DENNIS MEADOWS

THE NEW YORK TIMES BESTSELLER

COLLAPSE

HOW SOCIETIES CHOOSE

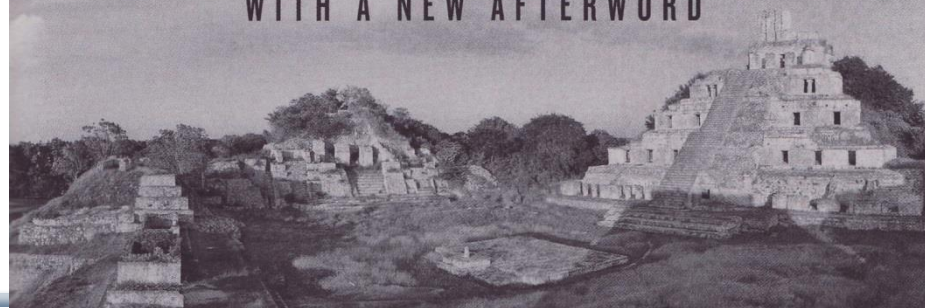
TO FAIL OR SUCCEED

JARED DIAMOND

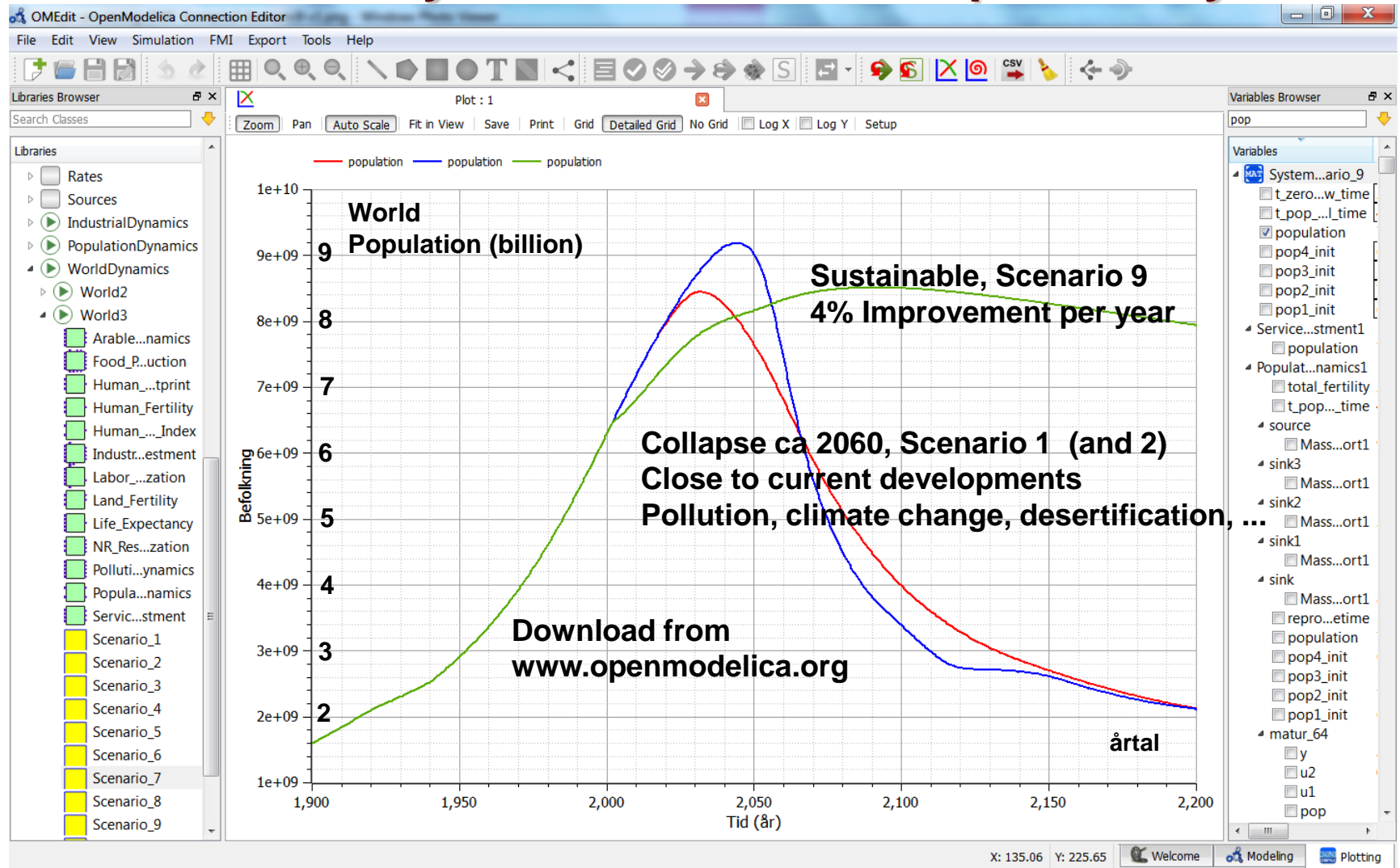
author of the Pulitzer Prize-winning

GUNS, GERMS, and STEEL

WITH A NEW AFTERWORD



The Biggest Challenge of All – Sustainable Society Circular Economy – Avoid Global Collapse in 50 years

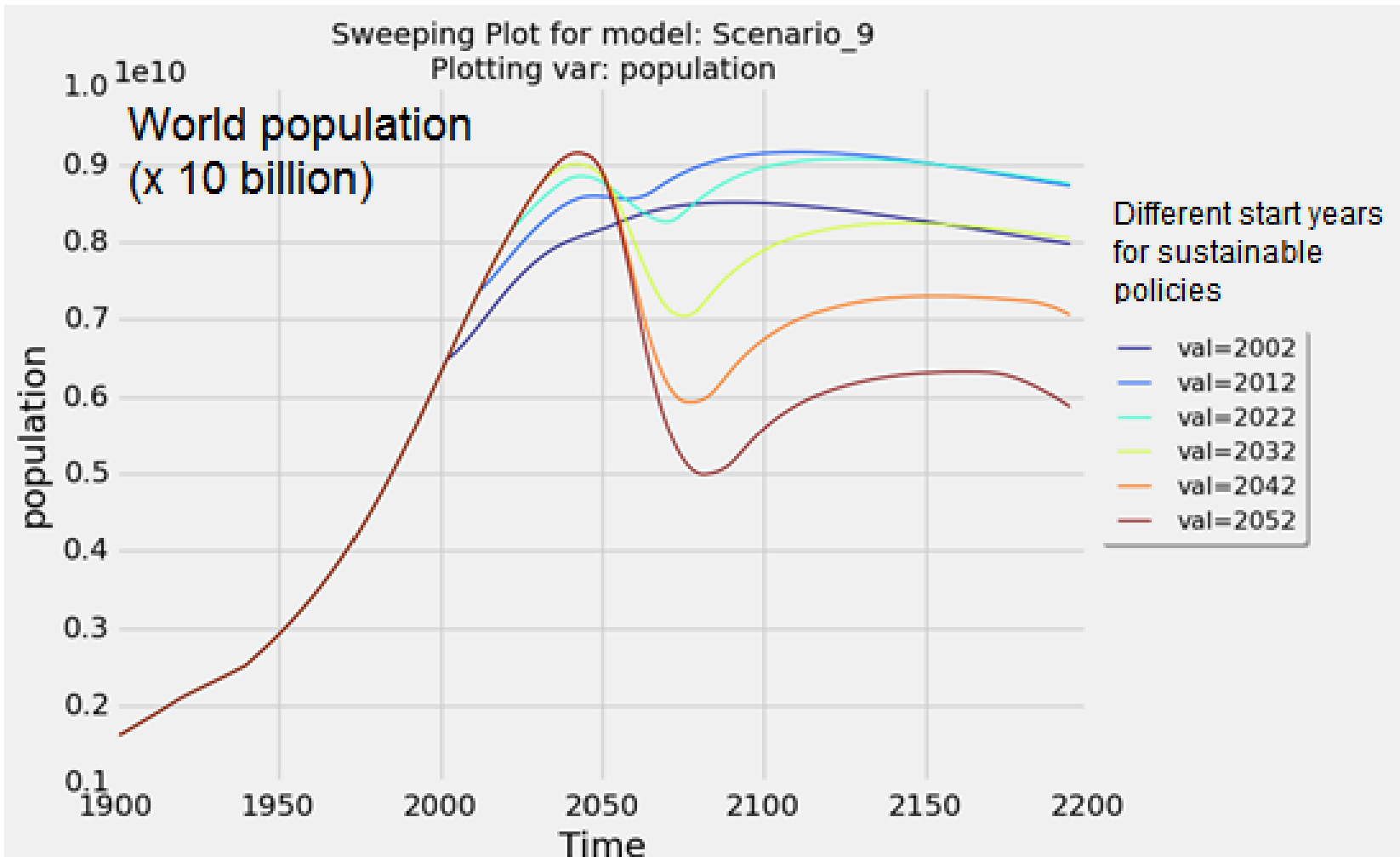


System Dynamics Simulation with OpenModelica – World3 Model, Meadows et al

Transition to Sustainable Economy is Urgent!

Starting 2022 gives partial collapse of half a billion, population decrease

Starting 2032 gives partial collapse of two billion, population decrease



System Dynamics Simulation with OpenModelica – World3 Model, Meadows et al

Is the World3 Model, Valid?

- Complicated issue
- Scenario 1 follows developments so far
- Comprehensive: Includes many different areas:
- Somewhat optimistic:
 - Assumes proportional pollution effect, i.e., no modeling of sudden ecosystem flip (e.g. from rainforest or arable land to desert)
 - Assumes no waste of resources on wars and weapons
 - Assumes population control (2 children per woman)

MOSES – A Unique Inter-Disciplinary Initiative addressing the Sustainable Society challenge

- Economics, finance and business
- Systems approach and Modelica technology
- Ecology with world planetary boundaries

- Financial World model (FWORLD) toolbox for investigating scenarios towards a sustainable society

MOSES-2016 Workshop

- Economics, finance and business
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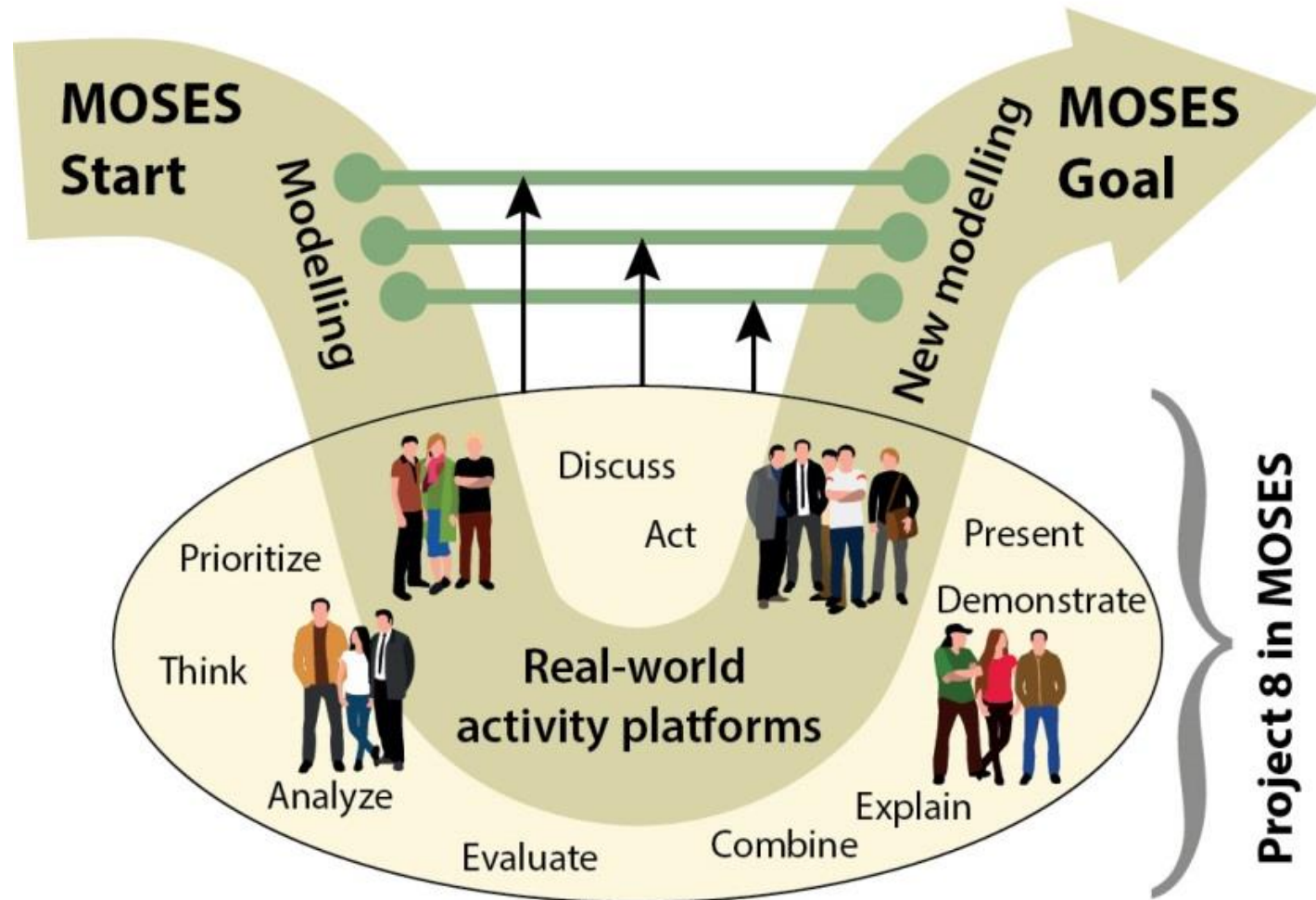
- Financial World model (FWORLD) toolbox for investigating scenarios towards a sustainable society

Presenting Ourselves

Peter Fritzson	Linköping University	Professor in computer science; Modeling & Simulation; Modelica language, OpenModelica tool
Bernhard Thiele	Linköping University	Post.doc computer science and systems modeling
Ola Leifler	Linköping University	Associate prof. In computer science with sustainability interest
Lars Olert	Linköping	Engineer with economics interests
Rodrigo Castro	University of Buenos Aires	Associate prof. In modeling and engineering
Sarah Cornell	Stockholm Resilience Center	Associate prof. Planetary boundaries researcher
David Collste	Stockholm Resilience Center	MSc; PhD student, World modeling
Jennifer Hinton	Stockholm Resilience Center	MSc; PhD student, non-profit sustainability in world modeling
Stephen Hinton	Swedish Sust Economy Found	MSC; sustainable economics
Steve Keen	Kingston University London	Professor in economics with sustainability focus
Ulrich Goluke	Germany, (Passau neighborhood)	World modeler in collaboration with Jörgen Randers
Jonas Lagander	Motala municipality	Local sustainability developer
Deniz Koca	Lund university	Assistant Professor, world modeling, resource aspects
Stefan Anderberg	Linköping University	Professor in industrial ecology
Ilaria Perissi	University of Florence	PhD student; world modeling, resources
Sara Falsini	University of Florence	PhD student; world modeling, resources
Dale Rothman	University of Denver	Associate prof. Internationa futures simulation software
Russel Standish (via Skype)	Sydney, Australia	Computational Scientist, Sydney, http://www.hpcoders.com.au/rks.html

Afternoon slides

MOSES – Interactions Models – Real-World Demonstrators



The MOSES Sub-Projects



MOSES Project Important Points

- **World-leading Modelica** modeling, simulation, and **analysis** techniques applied to **financial** systems,
- **FWorld** Financial System comprehensive modeling **inspired by World3** (Modelica version)
- **Financial** Systems Modeling **integrated** with **Ecological** and **Societal** issues, allowing non-linearities
- Techniques for handling financial system **model variants** – explore different **assumptions**
- **Sensitivity** analysis of model parameter settings
- **Uncertainty** handling in models and stochastic data
- Dynamic **optimization** (moving horizon optimization) of financial system model
- **Analysis use cases**
- **Application case studies**