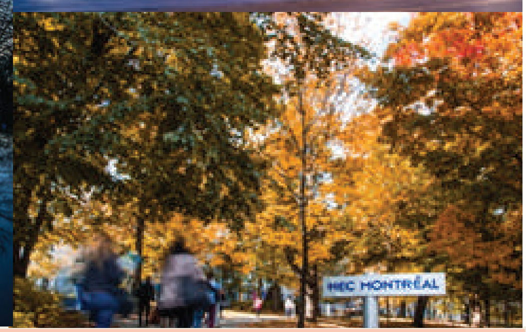
RMA

The Resource Modeling Association is an international association of scientists working at the intersection of mathematical modeling, environmental sciences, and natural resource management. We formulate and analyze models to understand and inform the management of renewable and exhaustible resources. We are particularly concerned with the sustainable utilization of renewable resources and their vulnerability to anthropogenic and other disturbances.

RMA Newsletter Fall 2018



Introduction to #WCNRM2019 Montréal

by G. Zaccour, Professor HEC Montreal

The 2019 World Conference on Natural Resource Modeling will be held on **May 22-24, 2019** in Montréal, Canada, hosted by HEC Montréal.

The theme of the conference is *"Uncertainty and risk in natural resource modelling"*; the conference focuses on balancing social, economic and ecological dimensions in the presence of uncertainty, extreme events, and environmental risk. Special attention will be devoted to fish, animal and forest biodiversity, natural resource management, and pollution mitigation and adaptation policies.

The three-day scientific program features four keynote speakers.

Prof. Jerzy Filar is the Director of the Centre for Applications in Natural Resource Mathematics in the University of Queensland, Australia, and the editor-in-chief of *Environmental Modelling and Assessment*. He is an applied mathematician with research interests spanning Operations Research, Stochastic Modelling, Optimisation, Game Theory and Environmental Modelling. He will present a plenary lecture on ***Risk and Uncertainty Quantification***.

Dr. Ussif Rashid Sumaila is Professor and Director of the Fisheries Economics Research Unit at UBC Fisheries Centre. He spe-

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cializes in bioeconomics, marine ecosystem valuation and the analysis of global issues such as fisheries subsidies, IUU fishing and the economics of high and deep seas fisheries. He will present a plenary lecture on *Interdisciplinary Ocean and Fisheries Economics with Examples from the Trenches*.

Prof. Debbie J. Dupuis is professor at HEC Montréal, Canada. A Fellow of the American Statistical Association, she is a well-known expert in Extreme Values, Robustness, and Statistical Modeling and Computing. She will present a tutorial titled *Extreme Value Analysis of Environmental Time-Series: A Primer.*

Dr. Ir. Florian Wagener is Associate Professor at the University of Amsterdam, The Netherlands. A recognized expert in optimal control, differential games and bifurcation theory, his research interests include ecological-economic conflicts of interest, heterogeneous agent models, and rationality. He will offer a tutorial on E*nlisting Poincaré to save the world: Geometry and the economic impact of ecological systems with tipping points.*

Montréal is a fascinating city located in the province of Québec. An island in the heart of the Saint-Lawrence River, Montréal offers a complex mix of contrasts built on a legacy of heritage and culture with a European flair. Montréal is a university city and a cultural metropolis, with over twenty classic museums, many theatres and countless performance halls to suit every taste, from fine arts to history to humor and sports. It is also a city of festivals that overflows with warmth year-round. The city is home to 1.8 million people and some 35 well-established cultural communities, with restaurants that serve food from all over the planet, and hotels for all budgets.

HEC Montréal is Canada's largest and oldest business school. Affiliated with the University of Montréal, HEC Montréal counts 12,000 students registered in a broad range of programs. Deadline for submitting an abstract : ***February 15, 2019.***

The conference is organized by ***Michèle Breton, Baris Vardar*** and ***Georges Zaccour.***

Introducing Oliver Schöttker,

new RMA Board officer

Doctoral student, researcher and lecturer at the Chair of Environmental Economics at the Brandenburg University of Technology Cottbus-Senftenberg, Germany. Before studying Computer Science at the University of Hanover, he graduated in Economics at the University of Bonn in 2008. After working for an oil and gas systems provider as a cost analyst, he started his doctoral research in Cottbus at the Chair of Prof. Frank Wätzold in 2010. His research interests are in the fields of ecological economics, transaction cost economics, ecological-economic modelling, biodiversity conservation, and conservation costs. Oliver has published peer-reviewed research papers in these fields, with a focus on utilizing integrated ecological-economic models to assess the cost-effectiveness of different governance structures for biodiversity conservation measures, as well as the assessment and formalization of cost for conservation measures. Further research interests are in the fields of climate change, experimental economics and machine learning in the economics-conservation nexus.

PRESIDENT'S COLUMN

by Luc DOYEN

The publication of the RMA 'fall' newsletter is a tipping point every year for the Resource Modeling Association because it makes it possible to simultaneously assess the activities of the association during the previous year while also announcing the events of the upcoming year. This president's column is also an opportunity for me to send a warm welcome to all new RMA members, in particular those that joined from the last conference in China.

My general view is that 2018 has been a transient year for the RMA. We are still progressing towards our objectives to foster researches at the interface of ecology, economics, mathematics and computer sciences and devoted to the sustainable management of natural resource and ecosystems. As major outcomes, I first want to point out the new agreement signed with Wiley to guarantee the economic viability of both RMA and our journal NRM. In particular, the new contract clarifies the links between the NRM Editor in Chief, RMA and Wiley. I also want to emphasize the success of the conference WCNRM 2018 held in Guangzhou in collaboration with the South China Agricultural University. The conference, our first in Asia, is summarized in this newsletter by the organizers Paudel Krishna, Yiming Liu, and Wei Duan. In that regard I would like to thank again all the attendees as well as the keynote speakers Georges Zaccour (CA), Jeffrey Peterson (USA), Jun Wang (China) and Junchang Liu (China). The awarding of both the Rollie Lamberson Medal and the prize of best student presentation during the conference still reinforce the interest of our annual conferences. The laureate of the Rollie Lamberson prize 2018 is a paper published in NRM by Marie-Hélène Durand, Anna Desilles, Patrick Saint-Pierre, Valérie Angeon and Harry Ozier-Lafontaine. The paper offers a viability analysis to promote soil restoration as detailed below in this newsletter. Furthermore, the laureate of the Best student presentation in Guangzhou is Charlotte Gerling from the University of Cottbus in Germany as also explained latter on in this newsletter. Congratulations to all of them as well as to the winners of the SCAU prize during the conference. Let me also mention that another output of the WCNRM 2018 relates to the preparation of a special issue in journal NRM coordinated by Paudel Krishna. Among the other good news for RMA, I want to point out that our communication through electronic networking is still developing well. In particular, the use of Facebook, Twitter, ResearchGate or LinkedIn networks is now more intensive. In that respect, the young scientists engaged on the board and coordinated by Vanessa Trijoulet play a crucial role. Oliver Schöktter, doctorate student at the University of Cottbus, now relays Yi-Hsiu Chen. RMA website is also very active thanks to Harry Gorfine, the RMA webmaster. Do not hesitate to submit scientific information to these electronic tools. We can do better if everybody contributes.

Now let me speak of the future and launch the RMA activities of the upcoming year 2019. The conference WCNRM 2019 will be held on 22-24th May 2019 in Montreal, Canada. It is organized under the leadership of Professors Georges Zaccour and Michèle Breton with the support of HEC Montreal and GERAD. I am convinced that the outstanding keynote lecturers combined with the effectiveness and scientific skills of the organizing team as well as the major interest of Canada in sustainability and environmental issues will all contribute to the success of our next conference. Please send your abstract online as soon as possible and circulate far and wide the upcoming call.

Luc Doyen
President RMA,
Senior Scientist CNRS,
GREThA, University of Bordeaux

Agroecological transition :
a viability model to assess soil restoration

by Marie-Hélène Durand[a], Anna Desilles, Patrick Saint-Pierre, Valérie Angeon and Harry Ozier-Lafontaine

Laureates 2018 of the Lamberson Award

"Save the soil to save the earth",

this call by leading scientists for several years is remaining unanswered, soils are a neglected natural resource which is destroyed ten times faster than it is created. Using viability theory, this model indicates if it is possible to improve the quality of agricultural soil in a given time while keeping a profitable activity and provides the farm management options allowing to do it when .

This model was developed for a research project on the viability of family farming in French West Indies where these small farming have a great economic, ecological and cultural importance. These small tropical islands are faced with the loss of farm land that is on the one hand cornered by urban development and on the other hand banned from use because of past soil pollution by banana export agricultural industries that is still hazardous. In a context of limited land availability, the sustainable management of soil fertility through adapted agricultural practices is a central issue that requires experimental researches and exploration models. We used the viability theory, a mathematical framework that studies the regulation of dynamic systems with constraints. A main originality of the viability theory is the use of a reverse approach. It starts from constraint and target definitions and provides the set of all initial situations able to reach the target while always respecting the constraints, as well as the viable controls at each moment. Calculus have been done for this project with ViabLab, a generic viability software currently under development.

Model characteristics

The aim of this work was to study the technical and economic capacities of the sustainable soil management by the farmers, in particular the possibility of restoring the degraded soils while keeping a remunerative agricultural activity.

- The improvement of farm soil quality is a target defined by a minimum level of soil quality I* that must be reached before T a given time horizon. The desired soil quality and the allotted time set by this target have normative values that can be changed for explorative purpose.

- There are two controls: the choice of crops σ and the choice of agricultural practices π (known agricultural processes summarized in two classes: conventional and reasoned or organic farming). These choices can be modified each time the parcel is released and a new agricultural cycle is about to begin. The plant-soil interactions (impact of the soil quality at the beginning of the agricultural cycle on yields and profits for various crops and agricultural practices; impact of various crops and agricultural practices on soil quality at the end of the agricultural cycle) are known and quantified. All the costs and sale prices for various crops and agricultural practices are also known.

- The model is a discrete event model which evolves with the succession of crop cycles denoted by n. The time step of this discrete model corresponds to the duration of agricultural cycle denoted $\delta(\sigma(n),\pi(n))$ that may last some months (for salads) to some years (for sugar cane). The time step is then irregular, determined by the succession of crop σ(n) and agricultural practice π(n) resulting from the control selection. The dates of parcel release are therefore part of the solutions of the model and a priori unknown. The state variable τ was introduced to provide the occupancy status of the parcel, it represents the starting date of the current crop cycle.

$$\begin{cases} I(n+1) = \Phi(I(n),\sigma(n),\pi(n)) \\ \tau(n+1) = \tau(n) + \delta(\sigma(n),\pi(n)) \\ W(n+1) = W(n) + l(I(n),\sigma(n),\pi(n)) \end{cases}$$

The function Φ quantifies the changes of a soil quality indicator during a crop cycle. The function l provides the balance sheet of the crop cycle which is added to the evolution of the cumulative wealth W.

- Since the first two state variables I and τ do not depend on the third one w, the model can be decomposed in two parts. The first one is agronomic and allows to say if it is technically possible through agricultural activities to enhance the soil of a particular plot to the desired level of quality in the prescribed time. The second one is used for the economic evaluation and possibly to test various values of the economic constraints. For given agronomic and economic constraints, the lowest value of W_0 associated with each initial state (I_0,τ_0) and such that the triple (W_0, I_0,τ_0) belongs to the viability kernel with target, provides the minimal cost of restoration for the couple (I_0,τ_0) that is to say the minimum amount of capital that must be invested beforehand in this case. If the initial endowment is lower that this minimal value W_0 there is no possibility to restore the soil to the wished quality in the prescribed time with the given constraints.

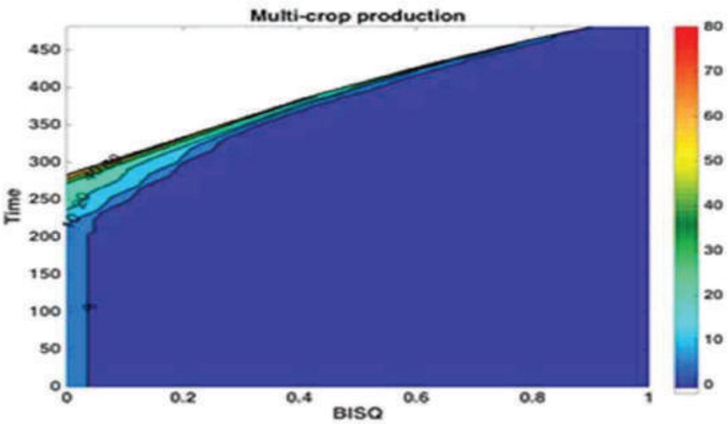
- Some constraints bear on the state and others bear at the same time on state and control variables (mixed state - control constraints).

 - *State constraints*: They are essentially normative to explore and compare various cases. The main one is set by the target definition $I(n) \geq I^*$ for $\tau \geq T$, while the economic constraint $w(n) \geq w_{min}$ allows to take into consideration the existence of bank facilities or the prohibition of financial losses.

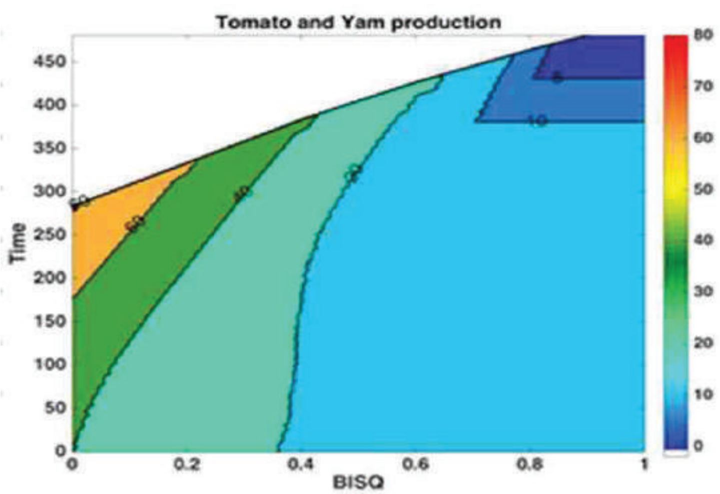
 - *Mixed state-control constraints:* Most of the crops are seasonal and eligible only at some months s of the year. This agronomic constraint is taken into account by checking the month $s = \tau \bmod 12 + 1$ at the dates τ of a parcel release in order to select the set of admissible controls which depends of the state variable τ. The cumulative wealth evolves with the incomes obtained at the end of a crop cycle. The previous economic constraint relates to the profitability of crop cycles and does not really reflect the daily economic constraints of farmers. Another economic constraint has been added in order to take into account the inflows and outflows of financial resources occurring within the crop cycle. The admissible controls are defined by the agronomic and economic constraints and depend on the value taken by the state variables at each iteration

Illustration

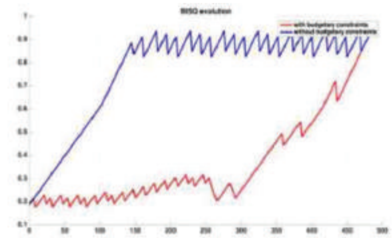
Computations of viability kernels with target have been made for the case of one parcel only. The soil quality indicator that has been chosen is the Biological Indicator of Soil Quality with values ranging from 0 and 1. The target of soil quality has been fixed to 0.9 and the time prescribed to realize the soil restoration has been fixed to a maximum of 40 years. Fourteen crops and two agricultural practices have been documented.

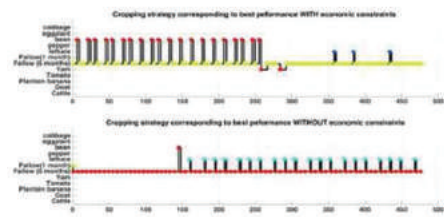


Projections of the viability kernel with target on a 2D plane (I,τ) show the minimum cost of restoration for each viable initial position (the current soil quality and time currently available). It show also on the frontier, the minimum time needed for the restoration according to various values of initial soil quality. The minimum cost of restoration (colored right y-axis) is higher when initial soil quality is lower, when the time for the restoration is shorter and if the crop diversification is lower.



Examination of viable trajectories shows that, starting from the same soil quality, same remaining time for restoration and same economic constraints, different choices of control lead to different evolutions of the cumulated income. It is always more profitable to invest firstly in the soil improvement at the expense of income in this first step. The viable trajectories are economically optimal (providing the best global economic performance) when the successive choices of control are such that the investment is always equal to the minimal cost of restoration at each new crop cycle.





Comparing the optimal trajectories from the same initial situation but with different levels of the economic constraint shows that soil restoration can be highly profitable but a farmer unable to cope with a deficit period will have a very low income expectation in the best of the cases. The question of sharing the costs of the agro-ecological transition and possibly of subsidies is raised if the farmers faced with economic constraints cannot bear the cost of soil restoration.Numerous questions can be explored with this model by devising and comparing scenarios, by using other soil quality indicator and other dataset. The limit for "real cases" analysis comes from the numerous agronomic and economic data that must be documented and from the difficulty to measure complex biological processes.

References:

Aubin, J. P., Bayen,A.M.,&Saint-Pierre, P. (2011). Viability theory. New directions. Berlin Heidelberg: Springer-Verlag.

DeLara, M. & Doyen, L. (2008). Sustainable management of natural resources, mathematical models and methods,environmental science and engineering. Berlin Heidelberg: Springer-Verlag.

Mariotte, P, Mehrabi, Z, Martijn Bezemer, T., De Deyn, G.B., &Kardol, P., (2018), Plant–Soil Feedback: Bridging Natural and Agricultural Sciences, Trends in Ecology and Evolution, 33(2): 129-142.

Matson, P., Parton, W., Power, A., & Swift, M. (1997). Agricultural intensification and ecosystem properties. Science,277(5325), 504–509.

This Project GAIA-TROP is financed by the French research national agency (ANR) with the references ANR-12-AGRO-0009-05

Marc Mangel Named Fellow of the American Academy of Arts & Science

by Catherine Roberts,

Executive Director, American Mathematical Society ,
Former Editor-in-Chief of Natural Resource Modeling from 2004 to 2016

The American Academy of Arts and Sciences is one of the oldest and most prestigious honorary societies in the United States. The academy announced 213 new members in April 2018. Our very own RMA member Marc Mangel was among them!

I first met Marc in 2007 when he gave the Olin College of Engineering Keynote at the **RMA's World Conference on Natural Resource Modeling on Cape Cod (USA).** His talk [1], titled Natural Resource Modeling in the 21st Century, captivated his audience. What impressed me the most about Marc during the RMA annual meeting was how welcoming he was to the students. He sat with students during meals and was supportive and encouraging. It does not surprise me at all that Marc has supervised more than 50 undergraduate research projects or senior thesis, 30 PhD students, and 31 post-doctoral colleagues.

Marc is Distinguished Research Professor Director, Center for Stock Assessment Research, which is a partnership between the University of California Santa Cruz and the Santa Cruz Laboratory of the National Marine Fisheries Service.

(1): download Marc's presentation here:
https://users.soe.ucsc.edu/~msmangel/research.htm.

He is also Professor of Applied Mathematics and Statistics in the Baskin School of Engineering at University of California Santa Cruz. He is recognized for his contributions in mathematical biology and much of his work connects to fisheries management and conservation. Marc will be inducted at a ceremony in October 2018 in Cambridge, Massachusetts.

Marc has been a member of the RMA for many years. He served on the Editorial Advisory Board for our journal, Natural Resource Modeling from 1984 through 1988. He published in our journal in 1986, and reviewed three books in NRM in 1989 and 1991. He has published several books, including *Dynamic Modeling in Behavioral Ecology* (with Colin Clark, 1988, Princeton), *The Ecological Detective. Confronting models with data* (with Ray Hilborn, 1997, Princeton), *Dynamic State Variable Models in Ecology: Methods and Applications* (with Colin Clark, 2000, Oxford), and *The Theoretical Biologist's Toolbox. Quantitative methods for ecology and evolutionary biology* (Cambridge, 2007).

Marc Mangel and Colin Clark at the first
RMA meeting in Arcata in 1982

To learn more about Marc's biography and professional work : https://users.soe.ucsc.edu/~msmangel/bio.html

For a complete list of academy members : https://www.amacad.org/content/members/members.aspx

Best Phd Student presentation from Guangzhou conference:

The impact of organic farming on biodiversity in the context of an agri-environment scheme

by Charlotte Gerling,

Chair of Environmental Economics, Brandenburg University of Technology Cottbus-Senftenberg, Germany

The intensification of agriculture has important impacts on the biodiversity in agricultural landscapes. Conservation schemes need to take into account both the effectiveness of measures and their costs in order to reach a cost-effective solution. Agri-environment schemes (AES), in which farmers are compensated for implementing measures aimed at biodiversity protection are one of the most prominent tools to halt the decline in agricultural biodiversity, but also organic farming is subsidised to protect biodiversity. In Saxony, Germany, the two types of measures may be combined, i.e. organic farmers may implement additional AES measures. While the existing literature analysing the impact of organic farming and AES measures consists of empirical work, we apply a modelling approach. We applied an ecological-economic modelling approach (Wätzold et al. 2016) to examine the impact of organic farming in combination with an AES scheme on 30 grassland bird and 30 butterfly species in Saxony (Figure 1).

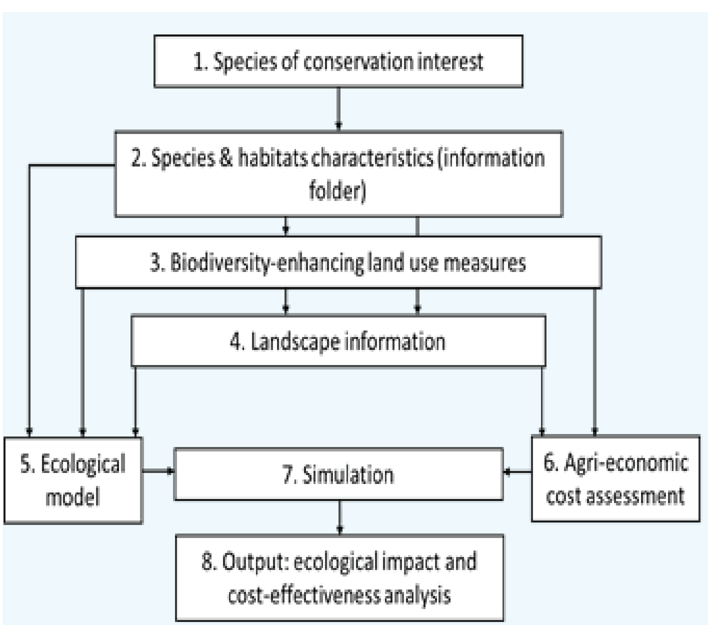


Figure 1: Structure of the modelling procedure; source: adapted from Wätzold et al., 2016

The spatially explicit model requires the characteristics of the chosen species, a set of biodiversity-enhancing land use measures and landscape information in order to : (1) estimate the impact of a land use on a species ("ecological model") and (2) estimate the costs of this land use ("agri-economic cost assessment"). The ecological model (Johst et al. 2015) assesses the impact of a grassland measure m at time tm on a species j for each grid cell l by calculating the local habitat quality $q_j^{(l,m)}$ (t_m), which is a relative measure that can adopt values between 0 (reproduction impossible) and 1 (ideal reproductive conditions). It is calculated as follows:

$$q_j^{l,m}(t_m)=Q_j^{l,0}[\sum_{w=b}^{f} p_j^w \times S_j^{m,w}(t_m)\times Q_j^{l,m,w}(t_m)]$$

The component $Q_j^{l,0}$ contains factors that influence reproduction success independently of the timing of egg deposition w, e.g. grassland type. The second component (square brackets) contains factors that are influenced by the time of egg deposition w. Egg deposition of a species j occurs in a quarter month (QM) w with probability p_j^w. QM w lies between QM b and f. Survival is impacted by mortality through mowing machines $S_j^{m,w}$ (t_m) and vegetation height $Q_j^{l,m,w}$ (t_m). The total effective habitat area is calculated by multiplying the local habitat quality by its area if (1) the grid cell is close enough to existing habitat sites and (2) the local habitat quality is high enough. The land use (an AES measure or no measure) is determined in the agri-economic cost assessment (Mewes et al. 2015). As farmers are profit-maximising, they will adopt a measure m if the payment pm they would receive for implementing the measure covers their opportunity cost and transaction cost. Transaction costs are set to 40€ per hectare.

Opportunity costs are calculated as follows:

$$c^{l,m}(t_m) = \left[\left(y^l_{ref} - y^{l,m}(t_m)\right) \cdot p_f\right] - \left(c^l_{v,ref} - c^{l,m}_v\right) - \left[\left(la^l_{ref} - la^{l,m}\right) \cdot p_{la}\right]$$

It is assumed that farmers substitute the loss in yield y resulting from the implemented measure by feeding concentrated feed. To monetise this change, the change in yield is multiplied by the price of concentrated feed p_f. The second bracket of the equation describes differences in variable costs such as seeds, and the final bracket monetises the change in labour input by multiplying the change in labour *la* by the price of labour p_{la}. The ecological model and the agri-economic cost assessment are combined in the simulation to provide information on the ecological impact and cost-effectiveness as the final output. In order to adapt the model to organic farming, differences in yield, fertilisation and cost calculations are considered in two scenarios: the case study area is managed (1) conventionally and (2) organically. In both scenarios, an AES with a choice of 3 different mowing regimes (measures 5a, b and d of the current Saxon AES) is offered. In line with current legislation, organic farmers are offered a reduced payment for implementing AES measures. The modelling approach allows us to consider the decision-making of farmers to participate in an AES and takes into account the different economic conditions organic and conventional farmers face (i.e. different opportunity costs and payments).

The results show that for most species, organic farming results in smaller habitat areas than conventional farming (Figure 2). The reason for this is that AES measures are implemented on much larger areas in the conventional scenarios (Table 1) However, three species (corncrake, curlew and skylark) benefit more from organic farming (Figure 2). There are two reasons for this. The corncrake benefits mainly from measure 5d, which is implemented mainly in the organic scenario (Table 1). The curlew and lapwing benefit equally from measures 5a and 5d. Nonetheless, on large areas of conventional land the habitat quality is relatively low. They therefore benefit more from the small areas of high-quality AES land in the organic scenario.

Measure	Conventional	Organic
5a	14,012.5 ha	0 ha
5d	3,412.5 ha	8,113 ha
total area	17,425 ha	8,113 ha

Table 1: area implementing AES measures in the scenarios

The results show that the different cost structures of conventional and organic farmers influence their decision in whether to take part in an AES. This may also cause organic and conventional farmers to implement different AES measures, which may impact different species with other habitat requirements and breeding times. Through these decisions organic farming thus has an indirect impact on biodiversity. Given the current payment structure, AES measures are

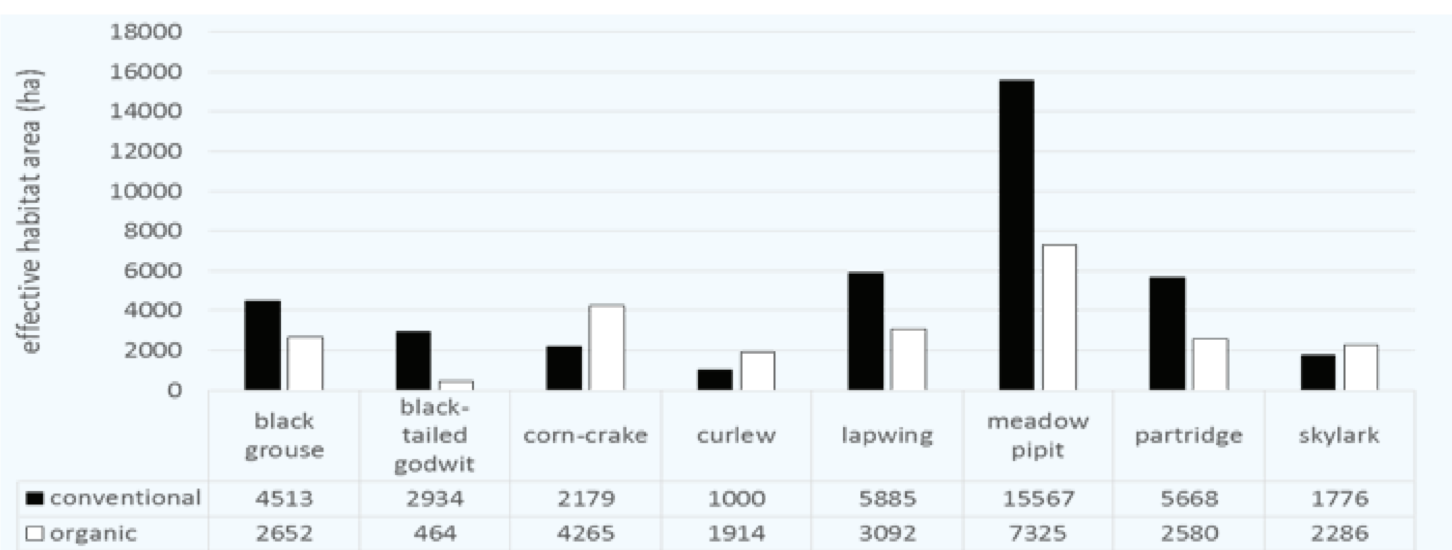


Figure 2: effective habitat area generated by the organic and conventional scenarios for each species

only adopted by few organic farmers in the model, and thus only lead to small habitat areas when compared to conventional farmers. However, certain species benefit more from organically farmed areas with AES measures, as organic farmers choose different measures which generates different habitat types.The results suggest important management implications for the design of AES. To protect species effectively and draw on the advantages offered by different cost structures, payments need to be adjusted to consider organic and conventional farmers' differing cost structures when designing an AES. By considering organic and conventional farmers' opportunity costs, policy makers may develop AES that result in cost-effective biodiversity protection.

Steve McKelvey rewarded Charlotte Gerling for her inspiring presentation

References:

Johst, K., Drechsler, M., Mewes, M., Sturm, A. & Wätzold, F. (2015). A novel modeling approach to evaluate the ecological effects of timing and location of grassland conservation measures. Biological Conservation, 182(02/2015), 44-52.

Mewes, M., Drechsler, M., Johst, K., Sturm, A. & Wätzold, F. (2015). A systematic approach for assessing spatially and temporally differentiated opportunity costs of biodiversity conservation measures in grassland. Agricultural Systems, 137(07/2015), 76-88.

Wätzold, F., Drechsler, M., Johst, K., Mewes, M., & Sturm, A. (2016). A novel, spatiotemporally explicit ecological-economic modelling procedure for the design of cost-effective agri-environment schemes to conserve biodiversity. American Journal of Agricultural Economics, 98(2), 489-512.

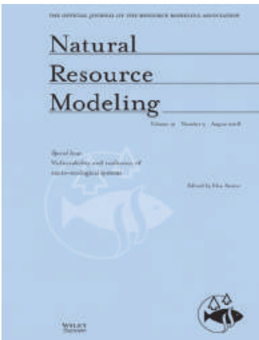
A brief overwiew on WCNRM2018

From June 9 to 12, 2018, the World Natural Resources Model Conference was held in South China Agricultural University. The conference was co-sponsored by the Resource Modeling Association (RMA) and the Forest Resources and Environmental Economics Committee of the Chinese Forestry Economics Association. Experts and scholars from more than ten countries including the United States, France, Canada, Australia, Germany, Finland, Sweden, and Israel gathered together with Chinese scholars to discuss extensively on the theme of "ecological protection and sustainable development", covering a wide range of disciplines such as economics, management, ecology, mathematics and computer science. It was a cross - national, cross - domain, interdisciplinary academic event. The opening ceremony was held in Hongmantang conference hall and was presided over by Professor Wan Junyi, Dean of the School of Economics and Management. Professor Yang Zhou, the Vice President of South China Agricultural University, gave a welcome speech to the conference, and expressed warm welcome to the scholars at home and abroad. He also expressed warm congratulations on the convening of the conference and gave a comprehensive introduction to the development of South China Agricultural University. Subsequently, RMA Chairman and Professor Doyen Luc of the French National Science Research Center delivered a speech. Professor Doyen introduced the development of the Resource Modeling Association and introduced the World Conference on Natural Resource Modeling (WCNRM) hosted by RMA in North America and Europe. And he expressed his expectation for his first visit to China and cooperation with Chinese scholars. Professor Wang Qianjin, Secretary-General of the China Forestry Economics Association, also addressed the conference, introduced the general situation of the China Forestry Economics Association, and congratulated the conference. Professor Jeffrey Peterson from Minnesota, USA, Georges Zaccour from the University of Montreal, Canada, and Professor Liu Junchang from Beijing Forestry University and Professor Wang Jun from South China Agricultural University brought us four wonderful thematic reports. Many scholars showed their latest research in the fields such as forests, fisheries, and environment protection.

On the closing part of the conference, the organizer of the next conference, Professor Georges Zaccour of the University of Montreal, Canada, expressed his welcome to the guests. Chairman Doyen Luc and members of the RMA Organizing Committee held an award ceremony for outstanding papers. Four PhD students from the Cottbus Land Brandenburg Industrial University in Germany, the University of Oregon in America, the Northwest University of Agriculture and Forestry, and the South China Agricultural University were awarded. Finally, Professor Gao Lan, the director of the Forest Resources and Environmental Economics Committee from the School of Economics and Management of South China Agricultural University made a concluding speech and announced the end of the conference.

Natural Resource Modeling special issue:

Vulnerability and resilience of socio-ecological systems,vol 31 (3) August 2018



Natural Resource Modeling, the journal of the Resource Modeling Association, publishes a special issue from the WCNRM 2107 .

"Presentations held at the 2017 WCNRM, in Barcelona, covered a wide range of modeling techniques for vulnerability and resilience assessment applied to multiple socio-ecological systems. This special issue reflects this variety, giving evidence of the complex nature of current sustainable development problems and challenges. The eight papers included in this special issue provide informed management recommendations for different types of socio-ecological systems (e.g., forests, fisheries, and farming systems) to face disturbance events (fires, environmental shocks, and management strategies) and to help decision making for sustainable activities and processes." *Elsa Pastor*

Introduction to the special issue on "vulnerability and resilience of socio-ecological systems", Elsa Pastor.

Bounded set of economic uncertainty and robust viability: An illustration from farming systems, Samuel Bates ,Valérie Angeon, Anna Désilles, Patrick Saint-Pierre.

Resilience of socially valued properties of natural systems to repeated disturbance: A framework to support value-laden management decisions, Mary Lou Zeeman, Katherine Meyer, Erika Bussmann, Alanna Hoyer-Leitzel, Sarah Iams, Ian J. Klasky, Victoria Lee, Stephen Ligtenberg.

Why do farmers not convert to organic farming? Modeling conversion to organic farming as a major change, Qing Xu Sylvie Huet, Christophe Poix, Isabelle Boisdon, Guillaume Deffuant.

An integrated approach to analyzing risk in bioeconomic models, Biswo N. Poudel, Krishna P. Paudel.

Modelling the management of forest ecosystems: Importance of wood decomposition, Juan A. Blanco, Deborah S. Page-Dumroese, Martin F. Jurgensen, Michael P. Curran, Joanne M. Tirocke, Joanna Walitalo.

Modelling trends including effects of natural disturbance in an abalone dive fishery in Australia, Harry Gorfine, Jim Thomson, Daniel Spring, Michael Cleland.

Allocation of harvest between user groups in a fishery with habitat effect, Rachel Nichols, Satoshi Yamazaki, Sarah Jennings.

Uncertainty in the modeling of spatial big data on a pattern of bushfires holes, Alfred Stein, Valentyn A. Tolpekin.

contact: editor@resourcemodeling.org.

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John Hearne rewarding Marie-Hélène Durand, laureate of the Lamberson Award

The official newsletter of the Resource Modeling Association

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