To: Nishtman Hatami nishtmanhatami@gmail.com
Copy: Soleiman Mohammadi Limaei limaei.sm@gmail.com
From: Peter@Lohmander.com , peter.lohmander@icloud.com

Forest management optimization considering biodiversity, global warming and economics goals

Workshop at: Gorgan University of Agricultural Sciences and Natural Resources (GUASNR),
By Peter Lohmander, November 2017

Acknowledgements:
This workshop has been made possible thanks to a kind invitation from Vice-President for Research and Technology, PhD Mohammad Hadi Moayeri, Ministry of Science, Research and Technology.

Preparations before the workshop starts:

Lecture room preparations

It is important that the lecture room has PC projector and necessary cables, screen etc.

It is also important that the lecture room has WiFi connection to the internet.

It is also important that the lecture room has a large whiteboard (at least 3 meters wide and one meter high) and pens with different colors. A large ruler (one meter length) makes the graphs and drawings better.

Individual preparations

Preparations to be made before the excercises:
During the excercices, we will use QB64.
It is important that the participants have access to laptops where QB64 has already been installed.
This software can be downloaded for free from this link: http://www.qb64.net/
It is also good if the participants have already installed Lingo.
Here is the link: http://www.lindo.com/index.php/products/lingo-and-optimization-modeling .
During the excecises, it is sufficient to have a simple version, which is free, of Lingo installed. Of course, for more advanced problems, a more advanced version is better. Advanced versions of Lingo can however be very expensive.

In the end of this document, you find the ”Workshop references”.
These references contain central theories and methods that will be discussed and used in the sessions. In the schedule, you find the references that are connected to the different sessions. All references may be downloaded from the internet. Please download the references as soon as possible and store them in your computer since internet disturbances may occur some days.

Schedule

#1.	Saturday, 11 November, 10.00 – 12.00 References: 7,8,13,14,15,16,19,20,23,24,26	Lecture: **Forest management optimization when production economics, global warming and biodiversity are considered.**
#2.	Saturday, 11 November, 13.00 – 15.00 References: Case 3	Afternoon excercise session in computer lab: **Forest management optimization with consideration of production economics, the global warming problem and biodiversity.**
#3.	Sunday, 12 November, 10.00 – 12.00 References: 2,4,9,10,11,21,28	Lecture: **Economic forest management optimization under deterministic and stochastic conditions. Introduction to analytical and numerical methods including deterministic and stochastic dynamic programming. Optimal adaptive rotation forestry under risk.**
#4.	Sunday, 12 November, 13.00 – 15.00 References: Case 1	Afternoon excercise session in computer lab: **Harvest optimization via stochastic dynamic programming.** **Case 1: Rotation forestry.**
#5.	Monday, 13 November, 10.00 – 12.00 References: 1,3,5,6,12,17,18,22,25,27,29	Lecture: **Economic forest management optimization under deterministic and stochastic conditions. Dynamic population growth and differential equations. Optimal adaptive forestry under risk using continuous cover forestry methods.**
#6.	Monday, 13 November, 13.00 – 15.00 References: Case 2	Afternoon excercise session in computer lab: **Harvest optimization via stochastic dynamic programming. Case 2: Continuous cover forestry.**
#7.	Tuesday, 14 November References: 1,…, 29, Case 1,2,3	Panel presentation: **Should a forest be optimally managed or develop without control? Dynamic consequences for biodiversity, global warming and economics.** (The presentation is connected to the Caspian forest policy discussion. The panel presentation is based on the theories and methods described during the sessions #1. - #6. Hence, the participants in the sessions #1. - #6. should be well prepared for #7.)
#8.	Wednesday, 15 November	Lectures to Students. Meeting with Dept. of Agricultural Economics.
#9.	Thursday, 16 November	Excursion to the Caspian Sea and a Mud Volcano close to Turkmenistan.

Workshop References

The following literature and presentations will be used as background to the workshop sessions. In the schedule, the references of relevance to each session are printed.

[1] Lohmander, P., Continuous extraction under risk, IIASA, International Institute for Applied Systems Analysis, Systems and Decisions Sciences, WP-86-16, March 1986
http://www.iiasa.ac.at/Admin/PUB/Documents/WP-86-016.pdf
http://www.lohmander.com/WP-86-016.pdf

[2] Lohmander, P., Pulse extraction under risk and a numerical forestry application, IIASA, International Institute for Applied Systems Analysis, Systems and Decisions Sciences, WP-87-49, June 1987
http://www.iiasa.ac.at/Admin/PUB/Documents/WP-87-049.pdf
http://www.lohmander.com/WP-87-049.pdf

[3] Lohmander, P., Continuous extraction under risk, SYSTEMS ANALYSIS - MODELLING - SIMULATION, Vol. 5, No. 2, 131-151, 1988
http://www.Lohmander.com/PL_SAMS_5_2_1988.pdf

[4] Lohmander, P., Pulse extraction under risk and a numerical forestry application, SYSTEMS ANALYSIS -MODELLING - SIMULATION, Vol. 5, No. 4, 339-354, 1988
http://www.Lohmander.com/PL_SAMS_5_4_1988.pdf

[5] Lohmander, P., Continuous harvesting with a nonlinear stock dependent growth function and stochastic prices: Optimization of the adaptive stock control function via a stochastic quasi-gradient method, Swedish University of Agricultural Sciences, Dept. of Forest Economics, No. 144, 1992
http://www.Lohmander.com/Lohmander_R144_1992.pdf

[6] Lohmander, P., Continuous harvesting with a nonlinear stock dependent growth function and stochastic prices: Optimization of the adaptive stock control function via a stochastic quasi-gradient method, in: Hagner, M. (editor), Silvicultural Alternatives, Proceedings from an internordic workshop, June 22-25, 1992, Swedish University of Agricultural Sciences, Dept. of Silviculture, No. 35, 198-214, 1992
http://www.Lohmander.com/Lohmander_SilvAlt_1992.pdf

[7] Lohmander, P., The multi species forest stand, stochastic prices and adaptive selective thinning, SYSTEMS ANALYSIS - MODELLING - SIMULATION, Vol. 9, 229-250, 1992
http://www.Lohmander.com/PL_SAMS_9_1992.pdf

[8] Lohmander, P., Economic two stage multi period species management in a stochastic environment: The value of selective thinning options and stochastic growth parameters,SYSTEMS ANALYSIS - MODELLING -SIMULATION, Vol. 11, 287-302, 1993
http://www.Lohmander.com/PL_SAMS_11_1993.pdf

[9] Lohmander, P., Optimal sequential forestry decisions under risk, ANNALS OF OPERATIONS RESEARCH, Vol. 95, pp. 217-228, 2000
http://www.Lohmander.com/PL_AOR_95_2000.pdf

[10] Lohmander, P., Adaptive Optimization of Forest Management in a Stochastic World, in Weintraub A. et al (Editors), Handbook of Operations Research in Natural Resources, Springer, Springer Science, International Series in Operations Research and Management Science, New York, USA, pp 525-544, 2007
http://www.amazon.ca/gp/reader/0387718141/ref=sib_dp_pt/701-0734992-1741115#reader-link
http://www.Lohmander.com/PL_Handbook2007.pdf

[11] Mohammadi, L.S., Lohmander, P., Stumpage Prices in the Iranian Caspian Forests, Asian Journal of Plant Sciences, 6 (7): 1027-1036, 2007, ISSN 1682-3974, 2007 Asian Network for Scientific Information, http://ansijournals.com/ajps/2007/1027-1036.pdf
http://www.Lohmander.com/MoLo2007.pdf

[12] Lohmander, P., Mohammadi, S., Optimal Continuous Cover Forest Management in an Uneven-Aged Forest in the North of Iran, Journal of Applied Sciences 8(11), 2008
http://ansijournals.com/jas/2008/1995-2007.pdf
http://www.Lohmander.com/LoMoOCC.pdf

[13] Lohmander, P., Guidelines for Economically Rational and Coordinated Dynamic Development of the Forest and Bio Energy Sectors with CO2 constraints, Proceedings from the 16th European Biomass Conference and Exhibition, Valencia, Spain, 02-06 June, 2008 (In the version in the link, below, an earlier misprint has been corrected.) http://www.Lohmander.com/Valencia2008.pdf

[14] Lohmander, P., Software for illustration of the CO2 and forest management issue in combination with CCS technology, 2008, *http://www.lohmander.com/co2ill2/co2ill2.htm*

[15] Lu, F., Lohmander, P., Optimal Decisions for Mixed Forests under Risk, Scientia Silvae Sinicae, Vol. 45, No. 11, Nov. 2009
http://www.Lohmander.com/Lu_Lohmander_2009.pdf

[16] Lohmander, P., Zazykina, L., Rational and sustainable utilization of forest resources with consideration of recreation and tourism, bioenergy, the global warming problem, paper pulp and timber production: A mathematical approach, Proceedings of the II international workshop on Ecological tourism, Trends and perspectives on development in the global world, Saint Petersburg Forest Technical Academy, April 15-16, 2010
http://www.Lohmander.com/SPb201004/Lohmander_Zazykina_SPbFTA_2010.pdf
http://www.Lohmander.com/SPb201004/Lohmander_Zazykina_SPbFTA_2010.doc
http://www.Lohmander.com/SPb201004/PPT_Lohmander_Zazykina_SPbFTA_2010.ppt
http://www.Lohmander.com/SPb201004/PPT_Lohmander_Zazykina_SPbFTA_2010.pdf

[17] Lohmander, P., Zazykina, L., Methodology for optimization of continuous cover forestry with consideration of recreation and the forest and energy industries, Report and Abstract, Forests of Eurasia, Publishing House of Moscow State Forest University, September 19 - 25, 2010
http://www.lohmander.com/Moscow10/Moscow10_PL_LZ.pdf
http://www.lohmander.com/Moscow10/Moscow10_PL_LZ.doc
http://www.lohmander.com/Moscow_PL_2010.pdf
http://www.lohmander.com/Moscow_2010/Lohmander_Zazykina_Moscow_2010.ppt
http://www.lohmander.com/Moscow_2010/Programma-LE_10_01.doc

[18] Lohmander, P., Zazykina, L., Dynamic economical optimization of sustainable forest harvesting in Russia with consideration of energy, other forest products and recreation, SSAFR-2011, 14th Symposium for Systems Analysis in Forestry, Abstracts, Maitencillo, Chile, March 8-11, 2011,
http://www.lohmander.com/Chile_2011/Chile_2011_Dynamic_Lohmander.ppt

[19] Lohmander, P., With expanded bioenergy based on forest resources, we may simultaneously and sustainably reduce global warming, improve economic results, international relations and environmental conditions, BIT'S 4th Annual World Congress of Bioenergy-2014, Qingdao International Convention Center, China
http://www.Lohmander.com/PLWCBE2014A.pptx
http://www.Lohmander.com/PLWCBE2014A.pdf
http://www.Lohmander.com/WCBE2014_Expansion.pdf
http://www.bitcongress.com/wcbe2014/

[20] Mohammadi Limaei, S., Lohmander, P., Olsson, L., Sub models for optimal continuous cover multi species forestry in Iran,
The 8th International Conference of Iranian Operations Research Society,
Department of Mathematics, Ferdowsi University of Mashhad, Mashhad, Iran, 21-22 May 2015
http://www.Lohmander.com/SML_PL_LO_IRAN_ABS_2015.pdf
http://www.Lohmander.com/PL_IRAN_B_2015.pdf
http://www.Lohmander.com/PL_IRAN_B_2015.pptx
http://www.Lohmander.com/PL_OR8_Abs_15.pdf
http://www.or8.um.ac.ir

[21] Lohmander, P., Applications and mathematical modeling in operations research, KEYNOTE, International Conference on Mathematics and Decision Science, International Center of Optimization and Decision Making & Guangzhou University, Guangzhou, China, September 12-15, 2016
http://www.Lohmander.com/PL_KEYNOTE_MATH_2016.jpg
http://www.Lohmander.com/PL_ICODM_2016_KEY.pptx
http://www.Lohmander.com/PL_ICODM_2016_KEY.pdf
http://www.Lohmander.com/PL_ICODM_2016_KEY_PAPER.pdf
http://www.Lohmander.com/PL_ICODM_2016_KEY_PAPER.docx
http://icodm2020.com/en/

[22] Lohmander, P., Optimal stochastic control of spatially distributed interdependent production units, International Conference on Mathematics and Decision Science, International Center of Optimization and Decision Making & Guangzhou University, Guangzhou, China, September 12-15, 2016
http://www.Lohmander.com/PL_BEST_PAPER_AWARD_MATH_2016.jpg
http://www.Lohmander.com/PL_ICODM_2016_CCF.pptx
http://www.Lohmander.com/PL_ICODM_2016_CCF.pdf
http://www.Lohmander.com/PL_ICODM_2016_CCF_PAPER.pdf
http://www.Lohmander.com/PL_ICODM_2016_CCF_PAPER.docx
http://icodm2020.com/en/

[23] Lohmander, P., A general dynamic function for the basal area of individual trees derived from a production theoretically motivated autonomous differential equation, National Conference on the Caspian Forests of Iran, "Past, Current, Future", University of Guilan, Rasht, Iran, April 26-27, 2017
http://www.Lohmander.com/PPT_GUILAN_PL_DIFF_2017.pptx
http://www.Lohmander.com/PPT_GUILAN_PL_DIFF_2017.pdf
http://www.Lohmander.com/Paper_Guilan_Dynamic_170215.pdf
http://www.Lohmander.com/Paper_Guilan_Dynamic_170215.docx
http://conf.isc.gov.ir/forestnorth

[24] Hatami, N., Lohmander, P., Moayeri, M.H., Mohammadi Limaei, S., A basal area increment model for individual trees in mixed species continuous cover stands in Iranian Caspian forests, National Conference on the Caspian Forests of Iran, "Past, Current, Future", University of Guilan, Rasht, Iran, April 26-27, 2017
http://www.Lohmander.com/PPT_GUILAN_JOINT_2017.ppt
http://www.Lohmander.com/PPT_GUILAN_JOINT_2017.pdf
http://www.Lohmander.com/Paper_Guilan_joint_170321.pdf
http://www.Lohmander.com/Paper_Guilan_joint_170321.docx
http://conf.isc.gov.ir/forestnorth

[25] Lohmander, P., Optimal stochastic control in continuous time with Wiener processes: - General results and applications to optimal wildlife management, KEYNOTE, The 10th International Conference of Iranian Operations Research Society, Balbosar, Iran, May 3-5, 2017
http://www.Lohmander.com/PPT_OR10_PL_KEYNOTE_2017.pptx
http://www.Lohmander.com/PPT_OR10_PL_KEYNOTE_2017.pdf
http://www.Lohmander.com/Paper_OR10_KEYNOTE_170127.pdf
http://www.Lohmander.com/Paper_OR10_KEYNOTE_170127.docx
http://www.icordm.ir/en/index.php

[26] Lohmander, P., ICMDS 2016 Conference report, Fuzzy Information and Engineering, Elsevier, Vol. 9, Issue 2, June 2017
https://authors.elsevier.com/sd/article/S1616865817301486

[27] Lohmander, P., Olsson, J.O., Fagerberg, N., Bergh, J., Adamopoulos, S., High resolution adaptive optimization of continuous cover spruce forest management in southern Sweden, SSAFR 2017, Symposium on Systems Analysis in Forest Resources, Clearwater Resort, Suquamish, Washington, (near Seattle), August 27-30, 2017
http://www.Lohmander.com/SSAFR_2017_Lohmander_et_al.pptx
http://www.Lohmander.com/SSAFR_2017_Lohmander_et_al.pdf
http://www.Lohmander.com/SSAFR_2017_Lohmander_Soft.txt
SSAFR 2017

[28] Lohmander, P., Applications and Mathematical Modeling in Operations Research, In: Cao BY. (ed) Fuzzy Information and Engineering and Decision. IWDS 2016. Advances in Intelligent Systems and Computing, vol 646. Springer, Cham, 2018, Print ISBN 978-3-319-66513-9, Online ISBN 978-3-319-66514-6, eBook Package: Engineering, LAMMOR, https://doi.org/10.1007/978-3-319-66514-6_5

[29] Lohmander, P., Optimal Stochastic Dynamic Control of Spatially Distributed Interdependent Production Units. In: Cao BY. (ed) Fuzzy Information and Engineering and Decision. IWDS 2016. Advances in Intelligent Systems and Computing, vol 646. Springer, Cham, 2018
Print ISBN 978-3-319-66513-9, Online ISBN 978-3-319-66514-6, eBook Package: Engineering, LOSDCSDI, https://doi.org/10.1007/978-3-319-66514-6_13