Dr. Yakov Ben-Haim
Professor
Yitzhak Moda'i Chair in
Technology and Economics

Technion
Israel Institute of Technology
Faculty of Mechanical Engineering
Haifa 32000 Israel

yakov@technion.ac.il
http://www.technion.ac.il/yakov
Tel: +972-4-829-3262 Fax: +972-4-829-5711

1-Day Workshop on
Info-Gap Theory and Its Applications in Biological Conservation

ACERA and AEDA, University of Melbourne, 2 August 2007

The **aim of the workshop** is to bring participants to a level of competence at which they can use info-gap theory to formulate and solve basic problems of analysis and planning in the face of severe uncertainty.

The workshop involves lectures as well as problem solving by the participants, in approximately equal proportions. By the latter I mean exercises on formulating info-gap models and calculating robustness and opportuneness functions. The participants work on these problems, and I wander around giving assistance and explanation where needed. The goal is to bring the participants to the position of being able to:

- Recognize an info-gap uncertainty, as distinct from more structured probabilistic uncertainties, both for parameter uncertainty and uncertainty in functional forms.
- Be able to specify a quantitative info-gap model for the info-gap which has been identified.
- Formulate a decision problem regarding that info-gap, and calculate robustness and opportuneness functions for that problem.
- Use those immunity functions (robustness and opportuneness) to make planning recommendations.

Following is an **outline of the workshop.** Each item is a 50-minute unit, followed by a 10-minute break.

1. Lecture: Info-gaps, probabilities, and the robust-satisficing strategy. 2-envelope paradox, Keynes' riddle. Saving the Sumatran Rhino.[1]
2. Lecture: Project scheduling with uncertain task times.[2]
3. Exercise: Budget allocation with uncertain costs.[3]

Lunch Break.

4. Lecture: Assay design for monitoring with spatial uncertainty.[4]
5. Exercise: Monitor deployment. Value of marginal detector.[5]

Coffee Break.

6. Lecture: Setting conservation priorities for land rehabilitation.[6]
7. Exercise: Uncertain return on investment for bio-diversity. Investments are in species and the returns are increases in population size.[7]

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[1] ○ *Info-Gap Decision Theory,* 2nd ed., sections 2.2, 2.5, 10.3.
○ Lecture Notes on Info-Gap Uncertainty, pp.2–17, 27–34.
○ Lecture Notes on Conservation Management, or: Robustness, Expected Utility and the Sumatran Rhinoceros, pp.1–8.
[2] ○ *Info-Gap Decision Theory,* 2nd ed., section 3.2.6.
○ Lecture Notes on Info-Gaps in Project Management, pp.16–28.
[3] ○ Problem Set on Info-Gap Risks in Project Management, #3.
[4] ○ *Info-Gap Decision Theory,* 2nd ed., section 3.2.10.
○ Lecture Notes on Robustness and Opportuneness, pp.73–79.
[5] ○ Problem Set on Robustness and Opportuneness, #33 (and #34 for a challenge).
[6] ○ Lecture Notes on Problems in Conservation Biology, pp.2–9.
[7] ○ Problem Set on Robustness and Opportuneness, #35.

Source Material on Info-Gap Applications in Biological Conservation

• Yakov Ben-Haim, *Info-Gap Decision Theory: Decisions Under Severe Uncertainty,* Academic Press, London, 2nd edition, 2006.

• Burgman, Mark, 2005, *Risks and Decisions for Conservation and Environmental Management,* Cambridge University Press, Cambridge.

• Helen M. Regan, Yakov Ben-Haim, Bill Langford, Will G. Wilson, Per Lundberg, Sandy J. Andelman, Mark A. Burgman, 2005, Robust decision making under severe uncertainty for conservation management, *Ecological Applications,* vol.15(4): 1471–1477.

• Yohay Carmel and Yakov Ben-Haim, 2005, Info-gap robust-satisficing model of foraging behavior: Do foragers optimize or satisfice?, *American Naturalist,* 166: 633–641.

• Atte Moilanen, Michael C. Runge, Jane Elith, Andrew Tyre, Yohay Carmel, Eric Fegraus, Brendan Wintle, Mark Burgman and Yakov Ben-Haim, Planning for robust reserve networks using uncertainty analysis, *Ecological Modelling,* vol. 199, issue 1, pp.115–124.

• David R. Fox, Yakov Ben-Haim, Keith R. Hayes, Michael McCarthy, Brendan Wintle and Piers Dunstan, 2007, An info-gap approach to power and sample size calculations, *Environmetrics,* vol. 18, pp.189–203.

• John K. Stranlund and Yakov Ben-Haim, 2007, Price-based vs. quantity-based environmental regulation under Knightian uncertainty: An info-gap robust satisficing perspective, to appear in *Journal of Environmental Management.*

• McCarthy, M.A., Lindenmayer, D.B., 2007, Info-gap decision theory for assessing the management of catchments for timber production and urban water supply, *Environmental Management,* 39 (4) pp. 553–562.

• Nicholson, Emily and Hugh P. Possingham, Conservation planning for the persistence of multiple species under uncertainty: an application of info-gap decision theory, to appear in *Ecological Applications.*

• See also: http://www.technion.ac.il/yakov/IGT/igt.htm

And especially: http://www.technion.ac.il/yakov/IGT/bio-conserv.htm