THE ISBA BULLETIN

Vol. 11 No. 3 *September 2004*

The official bulletin of the International Society for Bayesian Analysis

A MESSAGE FROM THE PRESIDENT

by Jim Berger
ISBA President
berger@stat.duke.edu

Being president of ISBA provides a great excuse to go to lots of Bayesian meetings (not that I ever really needed an excuse). Activity stayed high after the 2004 World Meeting of ISBA in Chile, with wonderful ISBA meetings in June in Rome (the *Bayesian Nonparametrics IV Workshop*), and in July in Munich (the *International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering*).

The latter meeting, along with the excellent *Workshop on Bayesian Model Selection* that I attended in Utrecht in July, illustrate the crucial role for ISBA as the center for communication among Bayesians. The Munich meeting was the latest in a long series of *MaxEnt* meetings that have, for many years, been drawing together physical scientists interested in Bayesian analysis. The Utrecht meeting was a gathering of social scientists interested in Bayesian methodology. It is great that Bayesian analysis has become so prominent in other fields that Bayesian meetings dedicated to those fields are becoming commonplace. Yet this means that ISBA will become increasingly needed as the central link to Bayesianism for these disparate fields, the link through which ideas and methodology can flow between fields.

The two changes that will enhance ISBA's role as this central link are the new journal and the new sections. Coming any day now is the ISBA electronic journal *Bayesian Analysis*, under the direction of Rob Kass as Editor-In-Chief. This will be a new home for innovative research about Bayesian theory, methodology and application. At the meetings I mentioned above, there was great excitement about this new journal, with scientists enthusiastically looking forward to a journal that is dedicated to the Bayesian methodology upon which they wish to focus.

☛ Cont. in *page 2*

A MESSAGE FROM THE EDITOR

by J. Andrés Christen
jac@cimat.mx

Gladly I accepted being the new editor of the ISBA bulletin. I will do my best to continue the good quality of this bulletin as a source of information and exchange of ideas among the ISBA members. Please feel free to send all you comments and suggestions and consider participating in the bulletin with an article or a note, of interest for the ISBA community. Please contact any of the AE's or me. I hope you enjoy this issue; cheers, Andrés.

Contents

SUGGESTIONS

PLEASE, FEEL COMPLETELY FREE TO SEND US SUGGESTIONS THAT MIGHT IMPROVE THE QUALITY OF THE BULLETIN

jac@cimat.mx

A MESSAGE FROM THE PRESIDENT (CONT. FROM PAGE 1)

We are also moving forward with the creation of sections of ISBA, so that groups (such as the *MaxEnt* community) can play a more official (and central) role in ISBA. The Constitution and By-Laws committee, under Jay Kadane's leadership, has been focusing on needed changes to allow the incorporation of sections into ISBA. By the next Bulletin, I hope to be able to report that sections are up and running!

Sections will not, of course, detract from the great geographical spread of ISBA activities through our chapters and meetings. Over the next six months, we have meetings in Australia (October 4-8), Israel (December 5-7), India (January 5-8), Italy (January 9-11 and January 12-14), and Mexico (February 6-10). It will be great if this trend of one-meeting-per-month can be continued (although it will then become harder for the ISBA president to attend them all)!

Thanks are due to Ed George and the nominations committee for putting together such an excellent set of candidates for the upcoming election, as reported later in this Bulletin. The quality of these candidates ensures that ISBA will be in great hands in the upcoming years!

Thanks are also due to David Madigan, who established and has been maintaining the extremely useful Bayesians Worldwide webpage for many years. The webpage has been transferred to the ISBA website, and maintenance will now be performed under the direction of webmaster Michael Evans. Because of confidentiality issues, ISBA members will not automatically have their homepages linked to this page if you are not currently linked, but wish to be linked, go to the ISBA webpage for instructions. (Bayesians Worldwide will also remain open to non-ISBA members.)

Finally, this is the first issue of the Bulletin prepared under the direction of J. Andrés Christen, and I want to reaffirm how delighted we are that he has undertaken this task for ISBA. The Bulletin has been at the heart of ISBA's effort to be the major link between Bayesians, and it is great to have Andrés on board to continue this tradition.

THIS YEAR ELECTIONS

by Ed George
edgeorge@wharton.upenn.edu

The 2004 elections of future ISBA officers will take place electronically at the ISBA web-site from October 15 through November 15. Instructions for voting will be emailed to all current ISBA members prior to the election. I am delighted to announce that the 2004 Nominations Committee has assembled a remarkable slate of candidates for the election. In alphabetical order by office, the 2004 candidates are:

For President Elect:

- Alan Gelfand (USA)
- Fabrizio Ruggeri (Italy)

For Treasurer:

- Bruno Sanso (USA)
- Dongchu Sun (USA)

For Board Membership:

- Carmen Fernandez (UK)
- Val Johnson (USA)
- Hedibert Lopes (USA)
- Herbie Lee (USA)
- Peter Mueller (USA)
- Fernando Quintana (Chile)
- Jim Smith (UK)
- Jon Wakefield (USA)

Biographical information for each of the candidates appears below. The candidates for president have also included statements about what they intent to accomplish. This information is also currently accessible on the ISBA web-site.

The 2004 Nominations Committee was appointed by the ISBA Board under the direction of President Jim Berger. The members of the Committee were Nicky Best (UK), David Rios Insua (Spain), Ed George (USA), Raquel Prado (USA), Alexandra Schmidt (Brazil), Mark Steel (UK) and Brani Vidakovic (USA). Beginning our deliberations in early June, we compiled a large list of potential candidates for each office. The final slate was then selected through rounds of approval voting and ranking. Because of the abundance of talent in ISBA this was a nontrivial task, and I greatly

appreciate the diligence of the committee members in making some tough choices. Finally, I am very grateful to all the candidates for their willingness to serve and lead ISBA. Through them our future is as bright as ever.

President Elect Nominees

Alan E. Gelfand

Affiliation and current status: J B Duke Professor of Statistics and Decision Sciences, Institute of Statistics and Decision Sciences, Duke University. URL: and email address: `http://www.stat.duke.edu/~alan`. e-mail: *alan@stat.duke.edu*.

Areas of interest: Spatial Statistics, Modeling and Model Determination, Nonparametric Bayesian Inference, Bayesian Computation. Most important journals and books: JASA; Biometrika; JRSS–B; the Valencia Volumes; Markov Chain Monte Carlo in Practice, Eds: Gilks, Richardson and Spiegelhalter, Chapman-Hall; Hierarchical Modeling and Analysis for Spatial Data (w/S.Banerjee and B.P. Carlin), Chapman-Hall; JABES; EES; Biometrics.

Honors: Elected Fellow, ASA, IMS; Elected Member, ISI, Mosteller Statistician of the Year Award, 2001; Tenth Most Cited Mathematical Scientist in the World, 1991-2001, Science Watch.

Previous service to ISBA: Member, International Advisory Committee for ISBA, 1996; Board of Directors, ISBA, 1998-2001; Program Chair-Elect 2003, Program Chair, 2004.

Service to Other Societies: Associate Editor, JASA Theory and Methods, Associate Editor, Bayesian Analysis, Editorial Board, Environmental and Ecological Statistics; previously Associate Editor, JASA Applications; Associate Editor, The American Statistician; Chair, ASA Section on Bayesian Statistical Science.

My view of ISBA

The twenty first century will be a Bayesian one for the statistical community, perhaps in a way that Dennis Lindley would not have imagined, but a Bayesian twenty first century nonetheless. Indeed, the explosive growth of hierarchical modeling fueled by the wide availability of inexpensive high speed computational power has led not only statisticians but a very wide range of scientific researchers to embrace the power of Bayesian thinking. To quote but one simple piece of evidence, at the recent Joint Statistical Meetings in Toronto there were 37 Bayesian sessions and 5 Bayesian short courses. Bayesian analysis is now secure; it "gets respect"!

As a professional society, ISBA reflects this development. Membership has increased by roughly 50% in the past three years to now nearly 500 members. The new journal, Bayesian Analysis, an exciting electronic enterprise, is ready to launch with a strong editorial board in place and a first issue due by January 2005. We are barely past the successful world meeting in Viña Del Mar, Chile in May, 2004 and we are already looking toward the second IMS-ISBA international joint meeting in Bormio, Italy this coming January. ISBA co-sponsors four prestigious research awards, the DeGroot Prize, the Lindley Prize, the Mitchell Prize, and the Savage Award. Both the ISBA Bulletin and the ISBA Website continue to reach new levels of excellence. By any yardstick, within just 12 years, ISBA has become a remarkable professional society.

So where should ISBA go from here? Certainly, increased growth and influence are part of the agenda and, in my view, while we should actively pursue this, it will also happen naturally due to the changing research climate I noted above. However, it is crucial to retain the marvelous spirit that has always been at the core of the community – a "work hard, play hard" perspective (characterized by magical locations for our gatherings), a strong camaraderie (built upon mutual respect and a unifying philosophy), and a commitment to mentoring and nurturing younger researchers (remembering how we benefited in this fashion).

More specific initiatives include a greater outreach to practitioners and to research communities more generally. (We are already seeing considerable response in such diverse fields as machine learning, climatology and genomics.) One way to attack this is to explore development of, participation in, and support of collaborative scientific meetings. Similarly, more focused statistical workshops with, perhaps, associated satellite events should be encouraged. Of course, our world meetings will still be our most visible gatherings and, evidently, we need to ensure that we continue to set a high scientific standard. But in addition, we need to introduce more tutorial presentations at these international conferences. The research world is becoming so specialized that most of us can really benefit from such tutorials to enable convenient access to the critical questions and the current state of the art in specialized areas.

In summary, our objective should be what has always characterized the Bayesian worldview. We should play a pro-active role in advancing the quantitative capability of scientific research.

Fabrizio Ruggeri

Affiliation: Istituto di Matematica Applicata e Tecnologie Informatiche - Consiglio Nazionale delle Ricerche (CNR - IMATI), Milano, Italy. Current Status: Research Director. Web Page: `www.mi.imati.cnr.it/~fabrizio` . e-mail Address: *fabrizio@mi.imati.cnr.it* .

Areas of Interest: Bayesian robustness, Stochastic processes (queues, Poisson processes), Reliability, Bayesian nonparametrics, Wavelets, E-democracy.

Most Important Journals or Books: Bayesian Statistics 7 (Valencia Meeting), Statistica Sinica, Journal of Computational and Graphical Statistics, Journal of Statistical Planning and Inference, Reliability Engineering and System Safety, Co-editor of Robust Bayesian Analysis (Springer Lecture Notes in Statistics) and Bayesian Robustness (IMS Lecture Notes).

Previous Services to ISBA: Bulletin Editor (1999 - March 2002), Member of Nominations Committees (1998 and 1999), Member of the Board of Directors (2002 - 2004), Chair of the Scientific Committee of ISBA 2004 in Chile, Editor of the ISBA electronic journal Bayesian Analysis, Chair of the series of workshops on Bayesian Inference in Stochastic Processes endorsed by ISBA.

Services to other Societies: European Network for Business and Industrial Statistics (various, including Board member since its foundation (2000), Vice-President (2002 - 2003), President-Elect (2004 - 2005)); Member of the Executive Committee of Baystat, Editor of Applied Stochastic Models in Business and Industry; Co-Director of ABS (Applied Bayesian Statistic) Summer Schools; Member of ASA, IMS, SBSS, SIS, UMI.

My view of ISBA

I do not know if the future will be Bayesian but, for sure, we should work to promote new developments and scientific results, cooperation among Bayesians worldwide and diffusion of Bayesian ideas, specially among young researchers and practitioners. ISBA has played an important role in the diffusion and success of Bayesian ideas, through its conferences, awards and editorial activity. The challenge ahead is about increasing ISBA influence, running smoothly the current activities and promoting new ones.

Although successful and well established, the current activities need a careful management to keep their high quality standard. ISBA President (in strict cooperation with the Executive Committee and the Board of Directors) has to provide full cooperation to people involved in ISBA meetings, awards, electronic journal, Bulletin and web site. I do not think major changes are needed for these activities. Current and past ISBA officers did a terrific work about them. Timely renewal of membership is another important issue, but the current Treasurer has been very active on it and no major improvement is needed.

Therefore, ISBA has to look ahead to the new scientific challenges (e.g. genomics, nanotechnology, without forgetting foundations of the Bayesian paradigm!) and go in search of the Bayesians who are not in ISBA and those (young researchers, practitioners, etc.) who have not embraced the Bayesian view of the world. We have to continue the successful work of spreading Bayesian ideas and showing their efficacy and soundness. As an example, a lot of work is needed to promote the Bayesian approach among people interested in industrial statistics. I am devoting a lot of work in this field, being very active in the European Network for Business and Industrial Statistics [www.enbis.org], a group of a thousand of people in industry and academy, of which I will become President in 2005.

The success of ISBA activities does not depend only on its officers (although they have to be energetic in their actions and decisions) but specially on the contributions by its members. In my past ISBA activity (Bulletin Editor and ISBA 2004 Scientific Committee Chair) I tried to get as many people as possible involved in ISBA activities, e.g. soliciting opinions (through bayes-news and the Bulletin) on them, appointing more than sixty people as members of the ISBA Bulletin Editorial Board, promoting students' participation in the Students' Corner in the Bulletin and many students sessions at ISBA 2004.

I think new activities should be inspired by the principles I stated earlier: diffusion of Bayesian ideas with the largest participation by ISBA members. In particular, I think it is important to:

- have a continuous dialogue between ISBA members and President on ISBA activities, through the Bulletin, bayes-news and private e-mail;
- promote local Chapters and interaction with local statistical societies;
- organise, as decided in the latest ISBA Board meeting, interest groups on specific topics, e.g. nonparametrics, genomics, industrial statistics, etc.;
- promote many courses at ISBA meetings on a regular basis (and study the possibility of running ISBA summer schools) [we had six, well attended, courses at ISBA 2004, at both introductory and advanced level];

- promote specialised workshops (like the one on stochastic processes) and exploratory ones on "hot" topics;

- promote students' sessions at ISBA meetings on a regular basis [we had 18 students at ISBA 2004, partially supported by ISBA, and they gave terrific talks];

- study the feasibility of a series of ISBA monographs, possibly in conjunction with a publisher, with both specialised volumes and divulgatory ones mostly targeted to practitioners.

The work is a lot but I think it is worth doing it (at least trying...)!

Nominees for Treasurer 2005–2007

Bruno Sansó

Bruno Sansó is Associate Professor in the Department of Applied Mathematics and Statistics, University of California Santa Cruz (`http://www.ams.ucsc.edu/~bruno`). His main interest is on space and space-time models with environmental applications. His most recent papers have appeared in JASA, JRSSB, Applied Statistics, Valencia Proceedings and Environmetrics. He has served as an Associate Editor of the ISBA bulletin and as member of the publication and the nomination committees of ISBA.

Dongchu Sun

Dongchu Sun (Ph.D. 1991, Purdue University) is currently a Professor of Statistics, The Univesity of Missouri. His areas of interest include objective Bayesian methods, survey sampling, multivariate time series and dynamic models, generalized linear mixed models, smoothing spline, optimal design, spatial and longitudinal models. Currently, he has several grants from NSF and NIH and Missouri Cancer Registry. He has advised 6 Master Thesis and 10 PhD Dissertation and is currently advising 5 doctoral students. He has published papers in Annals of Statistics, Biometrics, Biometrika, JASA, JBES, J. of Econometrics, Psychometrika and Statistica Sinica, Further information about him can be obtained from his Web page address `http://www.stat.missouri.edu/~dsun` . He has maintained the webpage of Objective Bayesians since 1997: `http://www.stat.missouri.edu/~bayes` .

Nominees for Board of Directors 2005–2007

Carmen Fernandez

Carmen Fernandez (PhD Universidad Autonoma de Madrid, Spain) is Lecturer in Statistics at Lancaster University (UK). She is interested in all aspects of Bayesian statistics. Her current research focuses on spatial and temporal modeling, the associated computational algorithms, and applications in ecology (mainly wildlife population assessment) and modeling of epidemics. She has published research articles in a range of journals, including JASA, Biometrika, Journal of the Royal Statistical Society (Series B and C), Journal of Econometrics and Journal of Business and Economic Statistics (in press). She has served twice in the ISBA Nomination Committee and was a member of the Scientific Committee for the ISBA 2004 World Meeting. URL: `http://www.maths.lancs.ac.uk/~fernanc1`.

Val Johnson

I am currently a Professor of Statistics, Department of Biostatistics, The University of Texas M.D. Anderson Cancer Center and my research interests include ordinal and rank data analysis, Bayesian goodness-of-fit diagnostics, statistical image analysis, and educational assessment. I've written two books (Ordinal Data Modeling, with Jim Albert, and Grade Inflation: A Crisis in College Education) and have published articles in the JASA, the Annals, and various imaging and other statistical journals. My previous ISBA service includes a stint as ISBA treasurer (1998-2001) and participation on the Savage Award committee. As a board member, I would support activities and expenditures to broaden the impact of Bayesian statistics in other scientific endeavors. In particular, I would like to see ISBA sponsor more expository workshops and tutorials, and to subsidize the attendance of junior researchers and researchers from non-statistical disciplines at these events.

Hedibert Lopes

Hedibert F. Lopes (Ph.D. 2000, Duke University) is currently an Assistant Professor of Econometrics and Statistics, in The Univesity of Chicago Graduate School of Business. Since 2000, when he graduated from Duke, he has already advice 5 Master Thesis and 2 PhD Thesis, mostly as an Associate Professor of Statistics at the Federal University of Rio de Janeiro. He has been working mainly on both univariate and multivariate time series and

dynamic models models, with active research also on factor analysis, extreme value theory, spatial statistics and mixture models. He has published papers in several journals, including Biometrics, Statistica Sinica, Statistical Modelling, Computational Statistics and Data Analysis, and Environmetrics. He was the ISBA Bulletin Editor for the term 2002-2004. URL: http://gsbwww.uchicago.edu/fac/hedibert.lopes/research.

Herbie Lee

Herbie Lee is an Assistant Professor of Applied Mathematics and Statistics at the University of California, Santa Cruz. His primary areas of interest are spatial statistics, inverse problems, and statistical perspectives of machine learning. He has a book "Bayesian Nonparametrics via Neural Networks" and has published in numerous journals including Technometrics, the Journal of Computational and Graphical Statistics, the Journal of Classification, the Statistician, and the Journal of Machine Learning Research. He has served on the ISBA nominating committee. URL: http://www.ams.ucsc.edu/~herbie.

Peter Müller

Since I got my PhD from Purdue in 1991, I have been working at Duke University and, since 2001, at U Texas M.D. Anderson Cancer Center where I am currently Professor at the Department of Biostatistics. My main areas of interest are Bayesian nonparametrics, MCMC simulation, optimal design, and longitudinal data models. I have published papers in Applied Statistics, Biometrics, Biometrika, JASA, JCGS, and JRSSB. Further information about me (including postscript versions of unpublished papers) can be obtained from my Web page address http://odin.mdacc.tmc.edu/~pm. I was a member of the ISBA Board of Directors for 1995-1998 and treasurer, 2001-2004.

Fernando Quintana

Fernando A. Quintana is *Profesor Adjunto* (Associate Professor) at the Department of Statistics, Pontificia Universidad Catlica de Chile, where he has served as Director of Graduate Studies. His main areas of interest are Nonparametric Bayesian Models and their Applications, Bayesian Clustering, and Models for Longitudinal Binary Data. He has published in several journals, including the Journal of the American Statistical Association, Journal of the Royal Statistical Society Series B, Canadian Journal of Statistics, Journal of Computational and Graphical Statistics and Journal of Statistical Planning and Inference. He was also coorganizer of the ISBA 2004 World Meeting in Viña del Mar, Chile. URL: http://www.mat.puc.cl/~quintana.

Jim Smith

Jim Smith is Professor in the Department of Statistics at the University of Warwick UK. Jim's main interests are in Bayesian Decision Theory, Bayesian Networks, and Bayesian Time Series. I have published widely in these and other areas, written one book and edited two others on Bayesian Statistics. I have published articles on Bayesian Statistics in 4 papers in the Annals of Statistics, 5 in J R. Statist.Soc B, 1 in Biometrika, Bayesian Statistics 1,3,4,5,7 and have over 50 other refereed publications. I have consulted widely as a Bayesian statistician, in areas such as emergency risk management, designing decision support systems for forensic scientists and asset management and am the current chairman of RISCU, the statistical consulting arm at Warwick University. I served ISBA this year appraising the theses submitted for award - a very enjoyable experience!! (http://www.warwick.ac.uk/fac/sci/statistics)

Jon Wakefield

I am a Professor in the Departments of Statistics and Biostatistics at the University of Washington in Seattle. My main areas of interest are Spatial Epidemiology; Ecological Studies; Modeling gene expression within the cell cycle; and Motif finding. I have published in a variety of journals including the Journal of the American Statistical Society, the journals of the Royal Statistical Society and Biometrics, as well as a number of subject-matter journals. More details of my interests and background can be found at http://faculty.washington.edu/jonno/cv.html.

I am currently writing a book on regression analysis, stressing a complimentary role for Bayesian and frequentist approaches to inference.

ISBA/SBSS ARCHIVE FOR ABSTRACTS

All authors of statistics papers and speakers giving conference presentations with substantial Bayesian content should consider submitting an abstract of the paper or talk to the ISBA/SBSS Bayesian Abstract Archive. Links to e-prints are encouraged. To submit an abstract, or to search existing abstracts by author, title, or keywords, follow the instructions at the abstract's web site,

http://www.isds.duke.edu/isba-sbss/

EXPLAINING SPECIES DISTRIBUTIONS AND BIODIVERSITY THROUGH BAYESIAN HIERARCHICAL MODELS

by Alexandra M. Schmidt
alex@im.ufrj.br

Introduction

Why are there so many species in some areas and so few in others? Understanding spatial patterns of species diversity and the distributions of individual species is a consuming problem in biogeography and conservation.

This was one of the projects that I was involved with while I was doing a Post-Doc with Alan E. Gelfand at the University of Connecticut, USA, between 2001 and 2002. In my opinion, besides the practical appeal it has, one interesting point of this project was the opportunity to do research with people coming from very different backgrounds, like Ecology and Geography. But for us, Statisticians, the most enriching experience was the challenge of making them understand that the Bayesian Paradigm would be able to provide not only sensible answers to some very important questions they had in mind, but also (and mainly) our models would naturally assess the uncertainty associated with these estimates.

The aim of this article is to briefly describe the model that we have proposed and some of the interesting outcomes which naturally result from it. For more details and references, the reader is addressed to Gelfand *et. al.* (2005a), Gelfand *et. al.* (2005b) and Silander Jr. *et. al.* (2004). This article is organized as follows. We start by describing the dataset which motivated this work. We then discuss the proposed model. Finally, we present some of the important statistics that directly result from the model, showing an output based on the analysis presented in Gelfand *et. al.* (2005a).

Motivation and Data Description

The focal area for this study of patterns of species distributions and biodiversity is the Cape Floristic Kingdom or Region (CFR), the smallest of the world's six floral kingdoms. This encompasses a very small region of southwestern South Africa, about 90,000 km^2, centered on the Cape of Good Hope. The main motivation is the data available from the Protea Atlas Project, with some 60,000 site records across the region, providing an extraordinarily rich data set to model biodiversity patterns. These data were collected beginning in 1991 as part of a 10-year project to document the distribution of Proteaceae, the flagship family in Southern Africa.

The original purpose of the project was to provide adequate data to determine the biogeographical and vegetation patterns within the CFR; to determine the optimal areas, reserve location and strategies to conserve the flora; and to obtain data at a scale suitable for modeling biogeographic patterns. Data were collected at "record localities": relatively uniform, geo-referenced areas typically of 50m in diameter. In addition to the presence (or absence) at the locality of protea species, abundance of each species along with selected environmental and species-level information were also tallied. To date some 60,000 localities have been recorded (including null sites), with a total of about 250,000 species counts from among some 375 proteas.

A large number of climatological traits are available as GIS raster layers with a minimum pixel resolution of 1 minute latitude by 1 minute longitude. We used the following geographical data as explanatory variables: elevation, mean annual precipitation, inter-annual coefficient of variation in precipitation, July (winter) minimum temperature, and January (summer) maximum temperature. In the analysis presented in Gelfand *et. al.* (2005a) we restricted the areal extent of our analysis to a small sub-region (rectangular) of the full CFR. We further restricted the analysis to 23 species of Proteaceae out of roughly 150 found within this

rectangular area. For each species we scored the following traits: height (continuous), local population size (ordinal), dispersal mode (categorical), and ability to resprout after fire (categorical).

Transformed areas (by agriculture, afforestation, alien plants and urbanization) were obtained as a GIS data layer from R. Cowling (private communication). 25% of the Cape has been transformed, mainly in the lowlands on more fertile soils where rainfall is adequate. Most of the transformation outside of these areas, on the infertile mountains, is due to dense alien invader species, which are a major threat to Fynbos vegetation and, in particular, to the Proteaceae. There is no sampling in transformed areas since no protea are currently found there. Therefore, our model has to take into account the possibility for "holes" in the region under study. It will also take into account holes arising due to irregular sampling intensity - see below.

Our Proposed Model

In order to model potential presence/absence for a species we have to clarify the meaning of this binary outcome. Ecologists customarily view species range as an areal construct, e.g., the range of occupancy interpreted as the convex hull of the occurrence locations. This suggests that we adopt an areal unit conceptualization for presence/absence. In fact we view presence/absence with regard to a regular grid of cells. Moreover, the data layers providing local features have been prepared in minute by minute grid cells. So, we assume this scale for presence/absence as well resulting in roughly $37,000$ units for the entire CFR and 1554 areal units (pixels) in our study region. In this subregion the pixels are rectangular, approximately 1.85 km $\times$ 1.55 km. If we were to formalize potential presence/absence as a binary spatial process over this region, the value of the process on a grid cell becomes a block average. With probability 1 the value will belong to $(0,1)$; a binary response for an areal unit can not be modeled using a binary process. However, it can be modeled using a latent binary process.

Suppose we let $X_i^{(k)} = 1$ denote the event that a randomly selected location in grid cell i is suitable for species k. Then we set $P(X_i^{(k)} = 1) = p_i^{(k)}$ as the probability of this event. We can conceptualize $p_i^{(k)}$ using a binary process. That is, let $\lambda^{(k)}(\mathbf{s})$ be a binary process over the region and let $p_i^{(k)}$ be the block average of this process over unit i. That is,

$$p_i^{(k)} = \frac{1}{|A_i|} \int_{\text{cell i}} \mathbf{1}(\lambda^{(k)}(\mathbf{s}) = 1)\, d\mathbf{s} \tag{1}$$

where $|A_i|$ denotes the area of unit i. The interpretation associated with (1) is that $\lambda^{(k)}(\mathbf{s})$ indicates the *suitability* of species k at location $\mathbf{s}$. The more $\lambda^{(k)}(\mathbf{s})$ in A_i which equal 1, the more suitable cell A_i is for species k, hence the greater the chance for potential presence. The set of $p_i^{(k)}$'s presents the potential distribution for species k in the absence of transformation.

Next, let $V_i^{(k)} = 1$ denote the event that a randomly selected untransformed location in grid cell i is suitable for species k. Let $T(\mathbf{s})$ be an indicator process indicating whether location $\mathbf{s}$ is transformed ($T(\mathbf{s}) = 1$) or not ($T(\mathbf{s}) = 0$). Then at $\mathbf{s}$ we need both $T(\mathbf{s}) = 0$ and $\lambda^{(k)}(\mathbf{s}) = 1$ in order that location $\mathbf{s}$ be suitable under transformation, i.e., we need both suitability and availability. If we make the simplifying (and hopefully plausible) assumption that, for each species, availability is uncorrelated with suitability, then we have that

$$P(V_i^{(k)} = 1) = (1 - U_i)p_i^{(k)} \tag{2}$$

where U_i denotes the proportion of area in the i^{th} cell which is transformed, $0 \le U_i \le 1$.

Next, assume that unit i has been visited n_i times in untransformed areas within the unit. Further, let $Y_{ij}^{(k)}$ be the presence/absence status of the k^{th} species in the i^{th} unit at the j^{th} sampling location within that unit. We need to model $P(Y_{ij}^{(k)} | V_i^{(k)} = 1)$. Given $V_i^{(k)} = 1$, we view the $Y_{ij}^{(k)}$ as i.i.d. Bernoulli trials with success probability $q_i^{(k)}$. That is, for any location in unit i, $q_i^{(k)}$ is the probability that species k is present there given the location is suitable and available. Of course, given $V_i^{(k)} = 0$, $Y_{ij}^{(k)} = 0$ with probability 1. Based upon its interpretation as a conditional probability, $q_i^{(k)}$ is thought of as a ratio of integrals, i.e.,

$$q_i^{(k)} = \frac{\int_{\text{cell i}} 1(T(\mathbf{s}) = 0) 1(\tilde{\lambda}^{(k)}(\mathbf{s}) = 1) d\mathbf{s}}{\int_{\text{cell i}} 1(T(\mathbf{s}) = 0) 1(\lambda^{(k)}(\mathbf{s}) = 1) d\mathbf{s}} \tag{3}$$

In (3), $\tilde{\lambda}^{(k)}(\mathbf{s})$ is another binary process which indicates actual presence/absence of species k at location $\mathbf{s}$. Note that $\tilde{\lambda}^{(k)}(\mathbf{s}) = 1$ implies that $\lambda^{(k)}(\mathbf{s}) = 1$, i.e., presence implies suitability so $0 \le q_i^{(k)} \le 1$. But also, $\tilde{\lambda}^{(k)}(\mathbf{s}) = 1$ implies $T(\mathbf{s}) = 0$, i.e., presence implies availability. So the numerator simplifies to $\int_{\text{pixel i}} 1(\tilde{\lambda}^{(k)}(\mathbf{s}) = 1) d\mathbf{s}$ which, divided by $|A_i|$ is the expected probability of presence/absence at a randomly selected location in unit i. As a result, using (2), $P(Y_{ij}^{(k)} = 1) = q_i^{(k)}(1 - U_i)p_i^{(k)}$.

Note that the probabilities associated with $X_i^{(k)} = 1$, $V_i^{(k)} = 1$ and $Y_{ij}^{(k)} = 1$ all have interpretations through extent of "switches turned on". That

is, in modeling for the $p_i^{(k)}$ and $q_i^{(k)}$, we look for ecological variables or species attributes which are expected to affect the "number" of $\lambda^{(k)}(\mathbf{s})$ or $\tilde{\lambda}^{(k)}(\mathbf{s})$ turned on in cell i. Also, note that given $V_i^{(k)} = 1$, by sufficiency, we can work with $Y_{i+}^{(k)} = \sum_{j=1}^{n_i} Y_{ij}^{(k)} \sim Bi(n_i, q_i^{(k)})$. For an unsampled pixel ($n_i = 0$) there will be no contribution to the likelihood. For a sampled pixel ($n_i \geq 1$) there will be a contribution to the likelihood and, in fact, we can marginalize over $V_i^{(k)}$ to give, for $y > 0$, $P(Y_{i+}^{(k)} = y) = \binom{n_i}{y} \left(q_i^{(k)}\right)^y \left(1 - q_i^{(k)}\right)^{n_i - y} (1 - U_i) p_i^{(k)}$, and for $y = 0$, $\left(1 - q_i^{(k)}\right)^{n_i} (1 - U_i) p_i^{(k)} + \left(1 - (1 - U_i) p_i^{(k)}\right)$. The two components of this latter expression have immediate interpretation. The first provides the probability that the species exists in pixel i but has not been observed while the second provides the probability that it is not present in the pixel.

We next turn to modeling $p_i^{(k)}$ and $q_i^{(k)}$. For $p_i^{(k)}$ we use a logistic regression conditional on unit level characteristics, unit level spatial random effects, species level attributes and species level random effects. Let

$$\log\left(\frac{p_i^{(k)}}{1 - p_i^{(k)}}\right) = \mathbf{w}_i' \boldsymbol{\beta}_k + \Psi_k + \rho_i, \tag{4}$$

where $\mathbf{w}_i$ is a vector of pixel-level characteristics, and the $\boldsymbol{\beta}_k$'s are species level coefficients associated with the pixel-level covariates. Therefore, the model allows the flexibility of each species having a different coefficient for each pixel-level covariate, i.e., that each species can react differently to the local environment. The assumption that $\boldsymbol{\beta}_k$ is constant across species converts (4) to an additive form in i and k which need not be appropriate. The prior distributions for the Ψ_k's are defined using species level attributes and an overall intercept. They are viewed as an intercept specification for each of the species. Hence, there is no intercept in $\boldsymbol{\beta}_k$. The ρ_i's denote spatially associated random effects. In other words we believe that the potential probability of presence/absence of species k at pixel i, is also affected by its direct neighbors. We expect pixels which are close together to behave in a similar fashion in terms of their species distribution.

We model $q_i^{(k)}$ on the logit scale setting

$$\log\left(\frac{q_i^{(k)}}{1 - q_i^{(k)}}\right) = \tilde{\mathbf{w}}_i{}' \tilde{\boldsymbol{\beta}}_k + \tilde{\mathbf{z}}_k \tilde{\boldsymbol{\gamma}}. \tag{5}$$

In (5), $\tilde{\mathbf{w}}_i$ are location characteristics and $\tilde{\mathbf{z}}_k$ are species attributes which are anticipated to affect $q_i^{(k)}$.

From the equations above and defining $\boldsymbol{\theta}$ as the vector containing all the parameters involved in the model, we can thus immediately write the logarithm of the likelihood for $\mathbf{Y} = \{Y_{i+}^{(k)}\}$. With priors on $\boldsymbol{\beta}_k$, Ψ_k, $\tilde{\boldsymbol{\beta}}_k$, $\tilde{\boldsymbol{\gamma}}$, and ρ_i, we have a fully specified Bayesian model. See Gelfand *et. al.* (2005a) for more details about the prior specification. As the posterior distribution does not have an analytical closed form, we make use of Markov Chain Monte Carlo (MCMC) methods to obtain samples from it.

The special case where $U_i = 1$ implies $n_i = 0$. In this case there will be no contribution from the i^{th} pixel to the likelihood. However, from (4), we can learn about $p_i^{(k)}$. That is, $\mathbf{w}_i$ is known, we learn about $\boldsymbol{\beta}_k$ and Ψ_k from other pixels and, due to the spatial modeling for ρ_i, we can still learn about it from its neighbors through $\rho_i \mid \rho_j, j \neq i$. Hence our modeling can accommodate "holes" in the region resulting from totally transformed regions or unsampled regions.

Inference with regard to biodiversity

The model developed above evidently enables information about the importance of particular environmental factors as well as species attributes in explaining species presence or absence. However, it also enables us to introduce several model summaries which shed light on key issues in the study of biodiversity. Here we discuss only two of them, the species range and species richness.

We begin with species range. Common presentation of species range is based upon extent of occupancy and range of occupancy. For the observed $\{Y_{ij}^{(k)}\}$, the convex hull of the set $\{Y_{ij}^{(k)} = 1\}$ provides the "observed" range. This estimate is purely descriptive allowing no inference. It fails to recognize holes in the hull where the species almost surely can not be present. It also fails to recognize edge effects in that presence/absence need not have a *hard* edge but perhaps a *soft* edge characterized by diminishing chance of presence. This is precisely what $p_i^{(k)}$ can capture. Moreover, since $p_i^{(k)}$ is a parametric function of $\boldsymbol{\theta}$, given samples from the posterior distribution of $\boldsymbol{\theta}$, we obtain a posterior distribution for $p_i^{(k)}$ at each k and i.

Using, for example, $E(p_i^{(k)}|\mathbf{Y})$ we can create a posterior surface for potential presence of species k. In fact, the display could take the form of a chloropleth or grey scale map or a smoothed contour plot. We can also obtain lower and upper surfaces to capture individual $1 - \alpha$ intervals estimates for the $p_i^{(k)}$. We suggest using the posterior mean surface

as a species range. It is obviously more informative than the above observed range and it allows quantification of uncertainty. The range can be hardened by replacing expected probabilities below a specified threshold by 0. The surface plot of the $E(p_i^{(k)}|\mathbf{Y})$ provides a picture of the potential range for species k. That is, in the absence of human intervention, where in the region it is likely that the species would be found. A surface plot of $(1-U_i)\,E(p_i^{(k)}|\mathbf{Y})$ provides an adjusted or *transformed* range reflecting where the species is likely to be found, adjusting for human intervention. We note that the ranges we have proposed can only be interpreted with respect to the domain of study.

Another important feature is the species richness. The *observed* species richness in pixel i is $\sum_{k=1}^{K} 1(Y_{i+}^{(k)} > 0)$ for pixels where $n_i > 0$ and $1 - U_i > 0$. Again, this is a purely descriptive summary. Under our model, the analogue for pixel i is the posterior distribution of $\sum_{k=1}^{K} X_i^{(k)}|\mathbf{Y}$. This posterior speaks to potential richness. That is, in the absence of human intervention, it is the *number* of species we would expect to find in pixel i. Converting to the distribution of $(1-U_i)\sum_{k=1}^{K} X_i^{(k)}|\mathbf{Y}$ modifies to transformed richness, i.e., the number of species we expect to find in the pixel, adjusting for human intervention. Each is of ecological interest but the latter will better align with observed richness.

Using the posterior mean across i we can create a posterior potential richness surface by plotting $E(\sum X_i^{(k)}|\mathbf{Y}) = \sum E(p_i^{(k)}|\mathbf{Y})$ versus i; similarly a posterior transformed richness surface can be obtained. These can be displayed in a fashion similar to that proposed above for species range. It is important to note that, under our modeling, species richness can only be inferred within the domain of study and is only relative to the set of species which have been modeled. As previously mentioned, Gelfand *et. al.* (2005a) fit the model to a subregion within the CFR comprising 1554 areal units and 23 species. As an illustration, Figure 1 shows the observed, potential and adjusted richness, for this particular dataset.

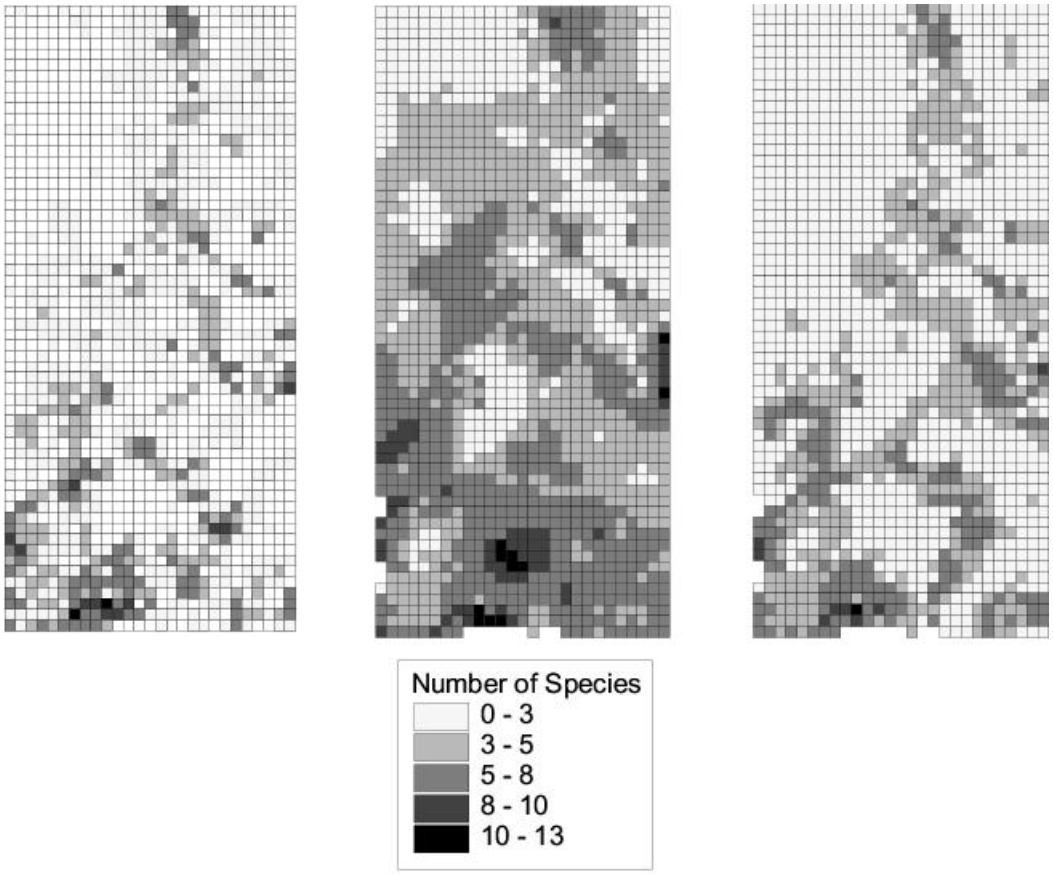
References

- Gelfand, A.E., Schmidt, A.M., Wu, S., Silander Jr., J.A., Latimer, A. and Rebelo, A.G. (2005a) *Modelling Species Diversity Through Species Level Hierarchical Modeling*, **JRSS, Series C, Applied Statistics** (to appear).

- Gelfand, A.E., Silander, J.A., Jr., Wu, S., Latimer, A., Lewis, P.O., Rebelo, A.G., and Holder, M., (2005b) Explaining Species Distribution Patterns through Hierarchical Modeling, Bayesian Analysis (to appear)

- Silander Jr., J.A., Latimer, A., Wu, S., Rebelo, A.G., Cowling, R.M., Schmidt, A.M., Smit, W., and Laurie, H. (2004) *Explaining Species Distributions and Biodiversity: Bayesian Hierarchical Models for South African Proteas*, Technical Report EEB, University of Connecticut, 2004 (Submitted).

Figure 1: From left to right: Observed, potential and adjusted richness.



NEWS FROM THE WORLD

by Gabriel Huerta
ghuerta@stat.unm.edu

✻ *denotes an ISBA activity*

➤ Events

✻ The 3rd Winter Workshop on Statistics and Computer Science. Scientific Applications of Bayesian Analysis *December 5-7, 2004. Ein-Gedi Resort and Conference Center, Ein-Gedi, Dead Sea,Israel*
On-line registration is now open
Please visit the Workshop website `www.cri.haifa.ac.il/events/2004/csstat/csstat04.shtml` for full details of the meeting and to submit on-line registration.
Final call for submissions of talks
Following the recent extension of the Workshop schedule we are now pleased to invite submissions for additional talks at the meeting. Individuals interested in participating should email a proposed title and abstract to the organising committee via Amnon Magid: amnon@cri.haifa.ac.il and register on-line as soon as possible.
The Workshop brings Bayesian statisticians and decision theorists together with scientific practitioners who use, or may use, Bayesian methods in scientific research. Workshop participants include leading researchers from statistics and computer science together with a range of applied social, natural, biomedical and engineering scientists, in a forum conducive to free-flowing exchange and discussion of Bayesian ideas and applied Bayesian methods. Invited presentations address issues pervasive in scientific inference, recent developments in the theory, methods and computational aspects of Bayesian statistics and decision analysis, and a range of scientific applications.
The Workshop is co-sponsored by
- Caesarea Rothschild Institute, Haifa University -

Center of the Study of Rationality, Hebrew University - Hebrew University of Jerusalem and is endorsed by ISBA, the International Society for Bayesian Analysis.
For more information on the scientific program, participants, and other workshop details, visit `www.cri.haifa.ac.il/events/2004/csstat/csstat04.shtml` or send email to the Chair of the Organising Committee, Yoel Haitovsky, at *msyoel@mscc.huji.ac.il*

ICOTS 7 *July 2-7, 2006. Salvador, Bahia, Brazil.*
CALL FOR PAPERS FOR ICOTS 7, 2006
The 2006 Conference will be held in the city of Salvador, in the state of Bahia, Brazil, July 2-7. It will be organised by the International Association for Statistics Education (IASE) and the Brazilian Statistical Association (ABE), with support of the Brazilian Institute of Geography and Statistics (IBGE).
Statistics educators, statisticians, teachers and educators at large are invited to contribute to the scientific programme. Types of contribution include invited papers, contributed papers and posters. No person may author more than one Invited Paper at the conference, although the same person can be co-author of more than one paper, provided each paper is presented by a different person.
Voluntary refereeing procedures will be implemented for ICOTS7. Details of how to prepare manuscripts, the refereeing process and final submission arrangements will be announced later.
INVITED PAPERS
Invited Paper Sessions are organized within 9 different Conference Topics 1 to 9. The list of Topic and Sessions themes, with email contact for Session Organisers is available at the ICOTS-7 web site at
`http://www.maths.otago.ac.nz/icots7`, under "Scientific Programme". Those interested in submitting an invited paper should contact the appropriate Session Organiser before December 1, 2004.
CONTRIBUTED PAPERS
Contributed paper sessions will be arranged in a variety of areas. Those interested in submitting a contributed paper should contact either Joachim Engel (Engel Joachim@ph-ludwigsburg.de) or Allan MacLean (alan.mclean@buseco.monash.edu.au) before September 1, 2005.
POSTERS
Those interested in submitting a poster should contact Celi Lopes (celilopes@uol.com.br) before February, 1, 2006.
GENERAL ISSUES
It is important for you to know that all participants have to register for the Conference. Details about the registration procedure will be given later.
If requested, the IASE is normally happy to give permission for authors to submit their papers (or a more comprehensive version) to other journals, such as Statistics Education Research Journal, Journal of Statistics Education, International Statistical Review or Teaching Statistics. If this occurs the author must seek approval of the editors of the ICOTS7 Proceedings and the IASE President. The paper must have an acknowledgement saying "This article was written for, and published in, the ICOTS7 Proceedings and is reprinted (in revised form, if relevant) here with the permission of the IASE".
More information is available from the ICOTS-7 web site at
`http://www.maths.otago.ac.nz/icots7` or from the ICOTS IPC Chair Carmen Batanero (batanero@ugr.es), the Programme Chair Susan Starkings (starkisa@lsbu.ac.uk) and the Scientific Secretary John Harraway (jharraway@maths.otago.ac.nz).

➤ Miscellanea

Bayesian Analysis. The Journal.
To all interested parties:
We plan to begin taking submissions for this new ISBA electronic journal as soon as our on-line manuscript-handling system has been further revised and tested. The "mission" statement is copied below. Please note that the journal will be freely available from our web site. We expect the system and journal to be fully operational in about eight weeks. Please watch for an announcement then. I'll look forward to receiving your papers!
Rob Kass. Editor-in-Chief. Bayesian Analysis.
Mission Statement:
Bayesian Analysis is an electronic journal of the International Society for Bayesian Analysis. It seeks to publish a wide range of articles that demonstrate or discuss Bayesian methods in some theoretical or applied context. The journal welcomes submissions involving presentation of new computational and statistical methods; reviews, criticism, and discussion of existing approaches; historical perspectives; description of important scientific or policy application areas; case studies; and methods for data collection, data sharing, or data mining. Evaluation of submissions will be based on importance of content and effectiveness of communication. Bayesian Analysis is dedicated to prompt review and publication of manuscripts.

INTERNATIONAL SOCIETY FOR BAYESIAN ANALYSIS

Executive Committee

President: Jim Berger
Past President: Ed George
President Elect: Sylvia Richardson
Treasurer: Peter Müller
Executive Secretary:
Deborah Ashby

Program Council

Chair: Alan Gelfand
Vice Chair: José Bernardo
Past Chair: Luis Pericchi

Web page:
http://www.bayesian.org

Board Members

Brad Carlin, Merlise Clyde, Michael Goldstein, David Higdon, Pilar Iglesias, Jun Liu, David Madigan, Sonia Petrone, Christian Robert, Fabrizio Ruggeri, Marina Vannucci, Robert Wolpert.

EDITORIAL BOARD

Editor

J. Andrés Christen <jac@cimat.mx>

Associate Editors

Annotated Bibliography
Vacant

Applications
Bruno Sansó <bruno@ams.ucsc.edu> (last issue)

Interviews
Brunero Liseo<brunero.liseo@uniroma1.it>

News from the World
Gabriel Huerta < ghuerta@stat.unm.edu>

Software Review
Ramsés Mena <ramses@sigma.iimas.unam.mx>

Student's Corner
Vacant

Bayesian History
Antonio Pievatolo <marco@mi.imati.cnr.it>