Statistical Geo-informatics of Hotspot Detection and Prioritization for Monitoring, Etiology, Early Warning, and Management for Digital Governance in Agriculture, Natural Resources, Environment, Ecology, and EcoHealth

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Geoinformatics for spatial and temporal hotspot detection and prioritization is a critical need for the 21st Century. A declared need is around for statistical geoinformatics and software infrastructure for spatial and spatiotemporal hotspot detection, prioritization, early warning, and sustainable management. A hotspot can mean an unusual phenomenon, anomaly, aberration, outbreak, elevated cluster, critical area. The declared need may be for monitoring, etiology, early warning, or management. The responsible factors may be natural, accidental, or intentional. The five year NSF DGP project has been instrumental to conceptualize hotspot geoinformatics partnership among several interested cross-disciplinary scientists in academia, agencies, and private sector around the world.

Our efforts are driven by a wide variety of case studies of interest to agencies, academia, and private sector involving critical societal issues, such as public health, ecosystem health, ecohealth, biodiversity and threats to biodiversity, emerging infectious disease, water management and conservation, carbon sources and sinks, persistent poverty, environmental justice, crop pathogens, invasive species management, biosurveillance, biosecurity, disease biogeoinformatics, social networks, sensor networks, hospital networks and syndromic surveillance, video mining, early warning, tsunami inundation, remote sensing, and disaster management. Also space-time disease, poverty, pollution, object identification and tracking, early detection, early warning, hotspot trajectories and trends with examples of West Nile Virus, urban poverty patch dynamics, etc. The project emphasis is on development of geoinformatic hotspot system. The system has two methodological components: hotspot detection and prioritization.

The emphasis of the proposed presentation is on geoinformatics of hotspot detection and prioritization motivated by a wide variety of subject areas and critical issues confronting agencies, academia, and industry involved with agriculture, natural resources, environment and ecology, and ecohealth. It will provide up-to-date exposition with live examples and illustrations. The audience will be encouraged to be in contact with the speaker before and after the presentation to help formulate and finalize their case studies for future presentation and publication.

For additional information and references:
1. It will be best if my websites are visited first for overview for web links. 
   http://www.stat.psu.edu/~gpp; http://www.stat.psu.edu/hotspots; DGOnline News
2. The following web links are precious web resources:
   http://www.dgrc.org/dgo2006/papers/workshops.jsp#hotspot
   (Article on the workshop program on hotspot geoinformatics.)
   http://www.satscan.org (Freeware for circular spatial scan program and information.)
   http://www.getsynapsed.de/ (Freeware for academia for Hasse program for Windows.)
The following are some specific papers and cited references.


**P2**

**Fitting Cumulative Size Mechanistic Models to Insect Population Data: A Nonlinear Random Effects Model Analysis**

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Recently a new class of mechanistic models for insect population size has been developed. The death rate in the new models is a function of the cumulative size of past generations. Prajneshu [14] developed the first such model, and others have followed. The models have been shown to fit data from diverse aphid populations well. This paper shows that the nonlinear regression model solution for aphid population size may be used as a basis for a nonlinear random effects model analysis of designed experiments. The experiment analyzed in this paper consists of a 3 x 3 factorial, of Water by Nitrogen levels, applied in a randomized block design, repeated two years. The fixed Water treatments are statistically significant in one year, and the fixed Nitrogen treatments in the other. The paper outlines possible generalizations.

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**Micronutrient Deficiency In India**

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1. In India, currently there is more emphasis on micronutrients as compared to macronutrients. This is because micronutrient deficiencies with respect to iron, vitamin A
and iodine deficiency disorders continue to be major nutritional problems. Micronutrient deficiencies result from inadequate dietary intake, poor absorption of nutrients, excessive losses, increased requirements or a combination of these factors.

2. Iron deficiency anaemia (IDA) impairs cognitive performance, behavior, and physical growth of infants, preschool and school-aged children. It affects adversely the immune status and increases the risk of morbidity. It also lowers physical capacity and work performance of adolescents and adults. IDA adversely affects pregnancy outcome by increasing the risk of maternal mortality, prenatal and perinatal loss.

3. Vitamin A deficiency (VAD) is the most important cause of preventable blindness in young children. VAD generally manifests as xerophthalmia, which includes all ocular manifestations; severe deficiency causes corneal xerosis/keratomalacia leading to irreversible blindness in young children. Even mild vitamin A deficiency, which is more widespread, is associated with increased risk of morbidity and mortality in children.

4. Iodine is an essential micronutrient for normal growth and development in humans. Iodine deficiency is the most common cause of preventable mental retardation in the world today. Iodine deficiency causes goiter, impaired brain development in the foetus and infant and retarded physical and psychomotor development in the child. The deficiency of iodine also impairs children’s learning ability. During pregnancy, iodine deficiency results in still birth, abortion and perinatal deaths.

5. In view of the importance an attempt has been made to review the information on prevalence of micronutrient deficiencies (iron, vitamin A, iodine), dietary intake levels, and to undertake analysis of trends and regional variations. The review is focused on vulnerable populations: i.e. children, adolescent girls, and pregnant and lactating women. Information on prevalence of deficiencies and dietary intake of micronutrients from 1950 to date has been reviewed from major studies carried out in the last five decades as well as individual research papers published in various national and international journals.

6. This effort identified 13 major studies on the subject, providing information on national/regional level, which are mainly multicentre and community based. About 600 published research papers from national and international journals were found having information on prevalence on micronutrients deficiencies and dietary intakes. The number of research studies on iron, vitamin A and iodine were 256, 219 and 87 respectively. As many as 567 research studies were on children, 165 on pregnant and lactating women, but only 62 on adolescent girls. Of these, community based studies accounted for 41%, hospital based for 28%, school based 21% and others fewer than 10%.

7. Based on the published research papers and reports, data have been analyzed for each micronutrient at national, regional, state and district level separately for infants, children of different age groups, adolescent girls, and pregnant and lactating women; Mapping of the country regarding to prevalence and dietary intake levels of micronutrients have also been attempted.
The talk will focus on the salient findings on these three micronutrients.

**P4**

**On the Analysis of Experiments in Affine Resolvable Designs**

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It is well known that for experiments with a large number of treatments, say 20 or more, incomplete block designs are recommended. Among them, resolvable block designs, and particularly the square lattice designs, the rectangular lattice designs and the more general so-called generalized lattice (GL) designs, have become very suitable for agricultural field experiments, especially for crop variety. In the broad class of GL designs, of particular interest are the affine resolvable proper block designs, i.e., those in which every pair of blocks from different superblocks has the same number of treatments (or varieties) in common. In the present paper, attention is drawn to obtain explicit formulae for analysing an experiment carried out in an affine resolvable proper block design. They follow from a randomization model, decomposed into stratum submodels. Analyses within the four relevant strata, and then the combined analysis, are considered in details. The paper is essentially an extension of some results presented in recent books, by the same authors, “Block Designs: A Randomization Approach”, Springer Lecture Notes in Statistics, Vol. 150 (2000) and Vol. 170 (2003).