ISSN 1946-7664. MCFNS 2013
Vol. 5, Issue 1, pp. 14–15
Mathematical and Computational Forestry & Natural-Resource Sciences

AVAILABLE ONLINE AT HTTP://MCFNS.COM

Submitted: Mar. 23, 2013
Accepted: Mar. 30, 2013
Published: Mar. 30, 2013
Last Correction: Apr. 23, 2013

MICRO-DETAIL DETECTIONS AND THEIR SEEMINGLY UNRELATED SCIENTIFIC INQUIRIES

Edwin Green

Department of Ecology, Evolution & Natural Resources, Cook College, Rutgers University, USA

Abstract. This is an introduction of the initial publication of the new Special Section of the MCFNS journal on micro-detail detection and tracking problems and various related interdisciplinary studies in other disciplines, which are deemed to be synergistic or relevant to detection and tracking problems. The initial selection of publications presented here arose from the Smolensk Conference held on Oct. 22, 2012, in Warsaw, Poland. This Special Section originated out of a collaboration between the MCFNS editors and the organizers of the Smolensk Conference, but the submissions of the presented here manuscripts was independent from this organization; all authors submitted their manuscripts independently of each other. This issue contains four of the papers related to the conference. In what follows, I briefly review the background behind the creation of this Special Section series and introduce the papers contained herein.

Keywords: Remote Sensing, Micro-detection and tracking, land monitoring, multi-disciplinary studies, satellite imagery, simulation modeling, wood quality.

1 Background

Since its inception the journal of *Mathematical and Computational Forestry & Natural-Resource Sciences* has always upheld the tradition of publishing Special Sections related to scientific events rooted in various natural-resource sciences with any mathematical and computational aspects of their research. The nature of these sciences is evolving, especially due to computer technology, which is becoming ever more prominent in research and day-to-day activities alike. The forestry profession conceptually started centuries ago with mathematical theory of space and time orders, while at the same time, this profession used to depend strictly on operationally extensive on-ground human presence. However, modern forestry has been evolving for decades towards hi-tech implementation of new technologies relying on satellite imagery and communications for land management and monitoring, on Internet technology for communications and distributed computing, and on computer technology for scheduling optimization, sustainability analysis simulations and for all major operational decision making. Contemporary forester is more likely to look for insects, dead or stolen trees, ground water or draught damage, illegal dumping, or permit regulated building activities, on satellite imagery than on the ground. With this evolution of the technological profile of the forest, management and natural resource sciences, there are ever growing needs and opportunities for interdisciplinary studies of various related problems that can be identified from space over vast areas.

The Smolensk incident represents a prime example of how various scientists in diverse disciplines might be interested in conducting complementary studies related to one common event. The incident was the crash of the Polish Air Force One TU-154M plane near the Smolensk military airport. The data used by different scientists in various disciplines for the related analyses came from public, commercial, and private sources. From the forestry profession perspective the incident relates to two major topics: satellite imagery analysis and wood quality studies, but these two venues are merely the beginning of the studies that go way beyond them. The organizers of the Smolensk conference comprised 100 scientists from different disciplines at various universities around the world. The most frequently represented disciplines were by far Physics and Mathematics. Other represented disciplines included: chemistry, biochemistry, various engineering fields, and forest biometrics. The conference took place in Warsaw, Poland, on Oct. 22, 2012 and 18 papers were presented. All the presentations were broadcast real-time on the internet and recorded. The recorded presentations are currently available on the Internet on the official conference WebSite at

http://konferencjasmolenska.pl..., on the WebSite at http://smolenskcrash.com..., and on YouTube site dedicated to the conference at http://www.youtube.com....

Some of the conference papers were submitted to the MCFNS journal for publication in this Special Section, and those that have passed the peer-review process are presented here. This Special Section consists of four papers, one of which is a monograph comprising three presentation papers from the conference. A short summary of the presented here papers follows below.

2 Contents of the Special Section

The included here four papers from the Smolensk Conference describe studies in the following areas:

1. satellite imagery analysis,
2. computer simulations of mathematical modeling,
3. analysis of electrical systems and related experimental studies, and
4. wood quality analysis.

All four papers included here describe research and analysis related to the various studies of different aspects of the common incident of the Polish Air Force One TU-154M plane crash on Apr. 10, 2010, in Smolensk, Russia. The first paper by Cieszewski et al. (2013a) describes analysis of satellite imagery from various dates preceding and following the incident. Using the assumption of micro-detail land monitoring and disturbance detection, the authors compare patterns and spatial distributions of plane debris on different images and they compare their observations against published information on relevant subjects. The authors used various image analysis techniques and image correlation analysis to enhance the readability of high-resolution imagery for better illustration of various observations. The study reveals temporal changes in the debris patterns and calls into question official accounts of the subject published by the Polish and Russian governments.

The second paper by Zhang et al. (2013) describes computer simulation studies of a detailed finite element mathematical model of the plane collision with a large birch tree. Simulations are based on models developed by the US Department of transportation LS-DYNA and ANSYS CFX. The authors tested several material models, which they verified using leading-edge bird strike and wood bending experiments. Using multiple scenarios and different parameter values the model simulations in this study showed that in all cases the plane wing would break the tree and not vice versa.

The third paper in this section by Gieras (2013) consists of three parts, focusing on the Tu-154M power electric system and various aspects of the plane crash related to its electrical installations. In the first part, the author analyzes the electric system and wiring of the Tu-154 M. In the second part, the author analyses the fuel system and the possibility of an explosion of the fuel vapors in the left wing of the plane due to arcing and/or static electricity. In the third part, the author describes a comparative analysis of hypothetical collision of the subject plane with the large birch tree, and compares the data on this event against other data from full-scale dynamic crash tests of a Douglas DC-7 and a Lockheed Constellation 1649.

The collection of the papers in this Special Section is concluded with the article by Cieszewski et al. (2013b), which describes a wood quality study related to the large birch tree, which was allegedly impacted by the Tu-154M plane on Apr. 10, 2010. The authors use a sample of wood from the very tree branch to estimate the wood properties of tree trunk. In addition to the wood sample from the branch the authors use auxiliary wood samples from other trees of a similar species and tabular data from published wood quality tables for other species. The authors also analyze the proportion of knots on the subject tree, so that they can more realistically estimate the tree wood quality parameters, which could be used in other studies.

References

Cieszewski, C.J., F. Antony, P. Bettinger, J. Dahlen, R.C. Lowe, M. Strub. 2013. Wood quality assessment of tree trunk from the tree branch sample and auxiliary data based on NIR Spectroscopy and SilviScan. Math. Comput. For. Nat.-Res. Sci. (MCFNS), 5(1): 86–111. Last accessed online on Mar. 30, 2013, at: http://mcfns.com.

Cieszewski, C.J., R.C. Lowe, P. Bettinger, A. Kumar. 2013. Micro-detail comparative forest site analysis using high-resolution satellite imagery. Math. Comput. For. Nat.-Res. Sci. (MCFNS), 5(1):16–37. Last accessed online on Mar. 30, 2013, at: http://mcfns.com.

Gieras, J.F. 2013. Selected technical aspects of tu-154m smolensk air crash on April 10, 2010. Math. Comput. For. Nat.-Res. Sci. (MCFNS), 5(1):38–70. Last accessed online on Mar. 30, 2013, at: http://mcfns.com.

Zhang, C., Binienda, W., Horvat, F., & Wang, W. 2013. Application of Numerical Methods for Crashworthiness Investigation of a Large Aircraft Wing Impact with a Tree. Math. Comput. For. Nat.-Res. Sci. (MCFNS), 5(1):75–85. Last accessed online on Mar. 30, 2013, at: http://mcfns.com.