


A New Algorithm for Simulating Wildfire Spread through Cellular Automata

Full Text:  PDF  [Buy this Article](#)

Authors: [Giuseppe A. Trunfio](#) University of Sassari
[Donato D'Ambrosio](#) University of Calabria
[Rocco Rongo](#) University of Calabria
[William Spataro](#) University of Calabria
[Salvatore Di Gregorio](#) University of Calabria



 2011 Article

- Research
- Refereed



[Bibliometrics](#)

- Downloads (6 Weeks): 7
- Downloads (12 Months): 7
- Citation Count: 0

Tools and Re:

 [Buy this Ar](#)

 [Request Pe](#)

 TOC Servic

 [Email](#)  [RSS](#)  [RS](#)

 [Save to Bir](#)

 Export Form

[BibTeX](#) [EndNote](#)

Share:

Tags: [algorithm](#) [cellular automata](#) [model development](#) [validation and ana](#) [spread](#)

Published in:



- Journal
ACM Transactions on Modeling and Computer Simulation (TOMACS) [TOMACS Homepage](#) [archive](#)
Volume 22 Issue 1, December 2011
ACM New York, NY, USA
[table of contents](#) doi>[10.1145/2043635.2043641](#)



[Feedback](#) | Switch to [single page view](#) (no tabs)

[Abstract](#) [Authors](#) [References](#) [Cited By](#) [Index Terms](#) [Publication](#) [Reviews](#) [Comments](#) [Table of Contents](#)

Note: OCR errors may be found in this Reference List extracted from the full text article. ACM has opted to expose the complete rather than only correct and linked references.

- Albini, F. and Reinhardt, E. 1995. Modeling the ignition and burning rate of large woody natural fuels. *Int. J. Wildland Fire* 81--92.
- Albini, F. A. 1979. Spot fire distance from burning trees—a predictive model. Tech. rep. INT-56, USDA, Forest Service.
- Alexander, M. 1985. Estimating the length-to-breadth ratio of elliptical forest fire patterns. In *Proceedings of the 8th Co Fire and Forest Meteorology*. 287--304.
- Anderson, D., Catchpole, E., DeMestre, N., and Parkes, T. 1982. Modeling the spread of grass fires. *J. Aust. Math. Soc.* 451--466.
- Anderson, H. 1983. Predicting wind-driven wildland fire size and shape. Tech. rep. INT-305, USDA, Forest Service.
- Andrews, P. 1986. BEHAVE: Fire behavior prediction and fuel modeling system - burn subsystem, part 1. Tech. rep. INT-USDA, Forest Service.
- Arca, B., Duce, P., Pellizzaro, M. L. G., Salis, M., and Spano, D. 2007. Evaluation of FARSITE simulator in mediterranean. *Int. J. Wildland Fire* 16, 563--572.
- Avolio, M. V., Crisci, G. M., Di Gregorio, S., Rongo, R., Spataro, W., and D'Ambrosio, D. 2006. Pyroclastic flows modelling cellular automata. *Comput. Geosci.* 32, 7, 897--911.
- Blecic, I., Cecchini, A., and Trunfio, G. A. 2009. A general-purpose geosimulation infrastructure for spatial decision support. *Trans. Computat. Sci.* 6, 200--218.
- Bose, C., Bryce, R., and Dueck, G. 2009. Untangling the Prometheus nightmare. In *Proceedings of the 18th World IMACS/MODSIM Congress*. 74--80.
- Carmel, Y., Paz, S., Jahashan, F., and Shoshany, M. 2009. Assessing fire risk using monte carlo simulations of fire spread. *Ecol. Manage.* 257, 1, 370--377.
- Catchpole, E., Alexander, M., and Gill, A. 1992. Elliptical-fire perimeter- and area-intensity distributions. *Canad. J. Forest* 22, 968--972.
- Cui, W. and Perera, A. H. 2008. A study of simulation errors caused by algorithms of forest fire growth models. Tech. rep. Ontario Forest Research Institute.
- D'Ambrosio, D., Di Gregorio, S., Gabriele, S., and Gaudio, R. 2001. A cellular automata model for soil erosion by water. *Ph Chem. Earth-B* 26, 1, 33--39.
- D'Ambrosio, D., Iovine, G., Spataro, W., and Miyamoto, H. 2007. A macroscopic collisional model for debris-flows simulation. *Environ. Model. Softw.* 22, 10, 1417--1436.
- Di Gregorio, S. and Serra, R. 1999. An empirical method for modelling and simulating some complex macroscopic phenomena.

- 18 Finney, M. A. 2004. FARSITE: Fire area simulator-model development and evaluation. Tech. rep. RMRS-RP-4, USDA, Forest Service.
- 19 Forthofer, J., Shannon, K., and Butler, B. 2009. Simulating diurnally driven slope winds with windninja. In *Proceedings of Symposium on Fire and Forest Meteorological Society*.
- 20 French, I. 1992. Visualisation techniques for the computer simulation of bushfires in two dimensions. M.S. thesis, Department of Computer Science, University of New South Wales - Australian Defence Force Academy.
- 21 French, I., Anderson, D., and Catchpole, E. 1990. Graphical simulation of bushfire spread. *Math. Comput. Model.* 13, 67-
- 22 Green, D. G. 1983. Shapes of simulated fires in discrete fuels. *Ecolog. Model.* 20, 1, 21--32.
- 23 Green, D. G., Gill, A. M., and Noble, I. R. 1983. Fire shapes and the adequacy of fire-spread models. *Ecolog. Model.* 20, : -45.
- 24 Hu, X. and Ntaimo, L. 2009. Integrated simulation and optimization for wildfire containment. *ACM Trans. Model. Comput.* 19, 4, 1--29.
- 25 Johnston, P., Kelso, J., and Milne, G. 2008. Efficient simulation of wildfire spread on an irregular grid. *Int. J. Wildland Fire* -627.
- 26 Kourtz, P. H. and O'Regan, W. G. 1971. A model for a small forest fire to simulate burned and burning areas for use in a model. *Forest Sci.* 17, 7, 163--169.
- 27 Lopes, A. M. G., Cruz, M. G., and Viegas, D. X. 2002. Firestation - An integrated software system for the numerical simulation of fire spread on complex topography. *Environ. Model. Softw.* 17, 3, 269--285.
- 28 McAlpine, R., Lawson, B., and Taylor, E. 1991. Fire spread across a slope. In *Proceedings of the 11th Conference on Fire and Forest Meteorology*. 218--225.
- 29 Moore, E. F. 1962. Machine models of self reproduction. In *Proceedings of the Symposia in Applied Mathematics* 14. 17--
- 30 O'Regan, W. G. 1976. Bias in the contagion analog to fire spread. *Forest Sci.* 22.
- 31 Peet, G. 1967. The shape of mild fires in Jarrah forest. *Australian Forestry* 31, 121--127.
- 32 Peterson, S. H., Morais, M. E., Carlson, J. M., Dennison, P. E., Roberts, D. A., Moritz, M. A., and Weise, D. R. 2009. Using GIS for spatial modeling of fire in shrublands. Tech. rep. PSW-RP-259, USDA, Forest Service, Pacific Southwest Research Station, Albany, CA.
- 33 Richards, G. D. 1990. An elliptical growth model of forest fire fronts and its numerical solution. *Int. J. Numer. Meth. Eng.* 1163--1179.
- 34 Richards, G. D. 1999. The mathematical modeling and computer simulation of wildland fire perimeters for heterogeneous meteorological conditions. *Int. J. Wildland Fire* 9, 3, 213--221.
- 35 Rongo, R., Spataro, W., D'Ambrosio, D., Avolio, M. V., Trunfio, G. A., and Di Gregorio, S. 2008. Lava flow hazard evaluation through cellular automata and genetic algorithms: An application to Mt. Etna Volcano. *Fund. Inf.* 87, 2, 247--267.
- 36 Rothermel, R. C. 1972. A mathematical model for predicting fire spread in wildland fuels. Tech. rep. INT-115, USDA, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.
- 37 Rothermel, R. C. 1983. How to predict the spread and intensity of forest and range fires. Tech. rep. INT-143, USDA, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.
- 38 Salles, T., Lopez, S., Cacas, M., and Mulder, T. 2007. Cellular automata model of density currents. *Geomorphology* 88, : -20.
- 39 Salles, T., Mulder, T., Gaudin, M., Cacas, M., Lopez, S., and Cirac, P. 2008. Simulating the Capbreton canyon turbidity currents with a cellular automata model. *Geomorphology* 97, 3-4, 516--537.
- 40 Sanderlin, J. and Sunderson, J. 1975. A simulation for wildland fire management planning support (FIREMAN). Mission Res Corp. Contract 21-343, Spec. 222.
- 41 Sullivan, A. 2009. Wildland surface fire spread modelling, 1990-2007. 3: Simulation and mathematical analogue models. *Int. J. Wildland Fire* 18, 387--403.
- 42 Tan, P.-N., Steinbach, M., and Kumar, V. 2005. *Introduction to Data Mining* 1st Ed. Addison-Wesley Longman Publishing
- 43 Torrens, P. M. and Benenson, I. 2005. Geographic automata systems. *Int. J. Geograph. Inf. Sci.* 19, 4, 385--412.
- 44 Trunfio, G. A. 2004. Predicting wildfire spreading through a hexagonal cellular automata model. In *Proceedings of the ACM Lecture Notes in Computer Science*, vol. 3305, Springer, 385--394.
- 45 Tymstra, C., Bryce, R., Wotton, B., Taylor, S., and Armitage, O. 2010. Development and structure of Prometheus: The Canadian wildland fire growth simulation model. Tech. rep. NOR-X-417, Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta.
- 46 Van Wagner, C. 1969. A simple fire growth model. *Forestry Chron.* 45, 103--104.

models. *Adv. Remote Sensing* 4, 3, 54--62.

- 49 von Neumann, J. 1966. *Theory of Self Reproducing Automata*. University of Illinois Press, Urbana.
- 50 Wainer, G. A. and Castro, R. 2010. A survey on the application of the cell-devs formalism in cellular models. *J. Cell. Auto* 6, 509--524.
- 51 Yassemi, S., Dragicevic, S., and Schmidt, M. 2008. Design and implementation of an integrated GIS-based cellular automaton model to characterize forest fire behaviour. *Ecolog. Model.* 210, 1-2, 71--84.

Powered by **THE ACM GUIDE TO COMPUTING LITERATURE**

The ACM Digital Library is published by the Association for Computing Machinery. Copyright © 2012 ACM, Inc.

[Terms of Usage](#) [Privacy Policy](#) [Code of Ethics](#) [Contact Us](#)

Useful downloads:  [Adobe Acrobat](#)  [QuickTime](#)  [Windows Media Player](#)  [Real Player](#)