Value and Power of Collaboration:
Q & A with Colin Daniel, President, Apex Resource Management Solutions

Colin Daniel is a Systems Ecologist and President of Apex Resource Management Solutions (ApexRMS), a Canadian firm that specializes in developing ecological forecasts for government, industry and non-governmental organizations across North America.

Colin holds a Ph.D. in Ecology & Evolutionary Biology (University of Toronto), an M.Sc. in Zoology (University of British Columbia), and a B.A.Sc. in Systems Design Engineering (University of Waterloo). As an ecological consultant for over 25 years, much of Colin's work has focused on the development of tools and techniques to project landscape change, including projections of both vegetation and land use/land cover; major clients include the U.S. Geological Survey, U.S. Forest Service, and The Nature Conservancy. Since founding ApexRMS in 2007 Colin has overseen the development of the company's free ST-Sim software platform for developing spatially-explicit state-and-transition simulation models (STSMs) of landscape change.

Read on to see why Colin says that the development and success of ST-Sim demonstrates the value and power of collaborations between government agencies, NGOs, and the private sector. "Without that coordination, the ST-Sim and SyncroSim products would simply not exist today."

What is your LANDFIRE connection?

My connection with LANDFIRE dates to 2004. Kelly Pohl and Ayn Shlisky of The Nature Conservancy's (TNC) LANDFIRE Team approached me then about using the existing Vegetation Dynamics Development Tool (VDDT) in order to help create STSMs of the pre-settlement ecosystem structure and function for every Biophysical Setting (BpS). At the time I was working for a company called ESSA Technologies, the developers of VDDT and its sister product, TELSA. TNC then hired us to enhance the VDDT software in order to meet the needs of LANDFIRE. Later that same year Jim Smith joined TNC LANDFIRE team and immediately engaged with us in our work.

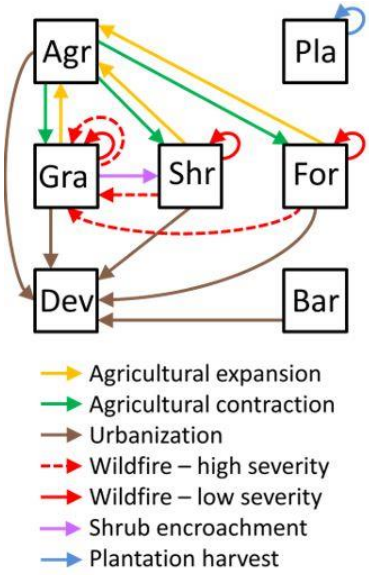
Who were the people you connected with, what ideas and/or needs prompted our affiliation with each other?

Over the ensuing 15 years ApexRMS has had an incredible collaboration with LANDFIRE, primarily through Jim Smith and his team at TNC, but also with Wendel Hann and Jeff Jones of the USFS. This began with the improvements to VDDT to support the LANDFIRE program in its early years, as the TNC team worked feverishly to deliver the first generation of BpS reference condition models in 2006. In addition to Jim and Kelly, our collaborators on the TNC LANDFIRE team included Darren Johnson, Kori Blankenship, Randy Swaty, and Jeannie Patton.

In 2008 Wendel approached us about extending the STSM approach to help both with refreshing the LANDFIRE data products and supporting projections of future conditions. It was this request that

kickstarted our development at ApexRMS of a new software platform, originally called Path (and subsequently renamed ST-Sim), to extend the capabilities of VDDT. Jim and others at TNC, including Louis Provencher, also threw their support behind this rework of the software, pushing hard for this new tool to include spatially-explicit functionality. By 2013 we had the first release of what is now called ST-Sim. Since then ST-Sim has been adopted by LANDFIRE as the new platform for the updated versions of the original BpS reference condition models. LANDFIRE also supported us recently in a pilot project demonstrating how ST-Sim can be used to do "on-the-fly" localized updates of LANDFIRE spatial data.

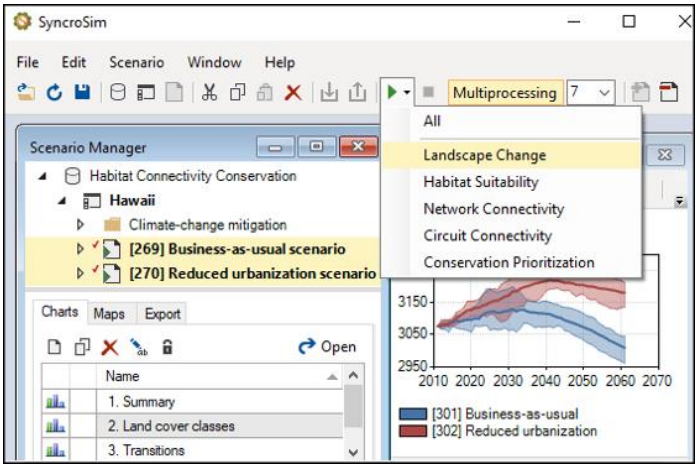
Briefly describe the kinds of work being done with ST-Sim and SyncroSim.



Pathway diagram for a ST-Sim model of land cover change. Boxes represent state types (Agr=Agriculture, Pla=Plantation, Gra=Grassland, Shr=Shrubland, For=Forest, Dev=Developed, Bar=Barren. Arrows represent possible transitions. From Daniel et al. (2016)

One of the major projects currently using ST-Sim is the U.S. Geological Survey's LandCarbon Program. Here ST-Sim is being used to forecast future land use, land cover and land management across the U.S., including the effects of these changes on terrestrial carbon dynamics. This project has supported the development of a major new piece of functionality in ST-Sim that allows continuous state variables, such as carbon, to be integrated into traditional state-and-transition simulation models of landscape change. Other work by the USGS includes integrating STSMs with other models such as species distribution models, fire behavior models and agent based models. The integration of ST-Sim with other models has been applied in several geographic locations to assist land managers coping with problems such as insect outbreaks or increased fire risk driven by invasive grass species. Another application of ST-Sim is TNC's use of the software to project the potential of various land use interventions for reducing CO_2 emissions in California. TNC has also used ST-Sim, in combination with models adapted from the original LANDFIRE BpS reference condition models, to support restoration planning in the Great Basin. And a recent project with researchers at the USFS Rocky Mountain Research Station looked at evaluating the risk of climate change impacts on achieving grazing and vegetation targets in rangelands.

In late 2018 we released a new software platform, called SyncroSim, for running and managing any kind of scenario-based simulation. SyncroSim allows you to chain together various models, including existing off-the shelf programs (such as ST-Sim) and scripts written in languages such as R, Python and C#, and to then deliver the resulting model workflow to non-technical users. The release of SyncroSim has opened new opportunities for model integration, particularly with ST-Sim. An early example of this is a project we have been working on to prioritize future habitat conservation efforts in the province of Quebec, Canada; here we are integrating ST-Sim with a series of other models, including existing



User interface for the SyncroSim modeling framework.

custom R scripts for calculating habitat suitability, the Circuitscape tool for assessing habitat connectivity, and the Zonation conservation planning software.

How has the LANDFIRE Program impacted your state-and-transition modeling platform?

It has had a major impact on the development of our ST-Sim and SyncroSim modeling platforms. Firstly, LANDFIRE provided seed funding and support for the very first version of ST-Sim. The development and success of ST-Sim, I believe, demonstrates the value and power of collaborations between government agencies, NGOs, and the private sector. Also, while many different agencies have supported the development of ST-Sim and SyncroSim over the past 15 years, the one constant has been the role of the TNC LANDFIRE team in coordinating these inter-agency collaborations. Without that coordination, the ST-Sim and SyncroSim products would simply not exist today.

Where's the LANDFIRE "fun"? What needs work?

It has always been a pleasure working with the TNC LANDFIRE team. What I think I've enjoyed the most is their openness to new ideas. The team has a wonderful attitude towards getting things done, and has ear to the ground, looking for new and creative ways of solving problems. To be a part of this process has been a career highlight for me.

In terms of what needs work, that is a tough question. The one area I wonder about at times is Wendel Hann's original vision from 2008 of using an STSM approach to help with LANDFIRE data updates. I still believe there is great potential in this approach. Another area is improving the way scientific models are delivered to end-users – I think there is still lots to be done to make it easier for stakeholders to gain access to the models that we, as scientists, develop.

Contact:
Colin.Daniel@ApexRMS.com
Head Office: Ottawa Ontario, Canada
(613) 729-9871
http://www.apexrms.com/

Selected publications

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