LANDIS-II Newsletter
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The LANDIS-II Foundation

We are continuing to roll out the **LANDIS-II Foundation**, a non-profit dedicated to model development, maintenance, training, and education. We are incorporated as a non-profit in Oregon and are currently applying for 501(3)(c) status.

In order to generate income for ongoing model maintenance and other activities, we will be seeking funding from multiple sources, including book sales (see below), training, and from grants.

If you are writing a proposal that substantially depends on LANDIS-II, we ask that you consider allocating up to $5000 per year to the LANDIS-II Foundation. Please contact us if you would like more information. Our current board members include: David Mladenoff as President, Robert Scheller as Treasurer, Jonathan Thompson as Secretary, Eric Gustafson, and Brian Sturtevant. The Technical Committee in charge of vetting all major modifications includes Brian Sturtevant, Jonathan Thompson, and Robert Scheller.

LANDIS-II Meeting and Training

We are planning our next LANDIS-II training and general meeting for **July 2015** in **Portland, Oregon** to coincide with the US-IALE Conference. Watch the Users Group for further information.

If you are interested in attending the two day introductory training session, **please contact us**. Training space is limited to 20.

In keeping with our mission to raise funds for model maintenance, we will be charging fees for both the training and the general session.

LANDIS-II Extension Updates

As always, a number of extensions have been updated to address minor bugs. Please check the extensions page to be sure you're updated.

LANDIS-II Meeting Recaps

Two training sessions were held this past year: Madison, Wisconsin and Harvard Forest, Massachusetts.

LANDIS-II Training Book!

We have formalized our annual trainings into a book: Scheller, R.M. and M.S. Lucash. Editors. 2014. Forecasting Forested Landscapes: An Introduction to LANDIS-II with Exercises. The LANDIS-II Foundation. Portland, Oregon.

The book is for sale for $50 on CreateSpace.com (https://www.createspace.com/4771081) and Amazon. All proceeds go to the Foundation.

Eastern Oregon

Publications

More exciting publications! The following have been published (or accepted) in the past 12 months:

De Bruijn, A., E.J. Gustafson, B.R. Sturtevant, J.R., Foster, B.R., Miranda, N.I. Lichti, and D.F. Jacobs. 2014. Toward more robust projections of forest landscape dynamics under novel environmental conditions: Embedding PnET within LANDIS-II. Ecological Modelling 287: 44-57.

Duveneck, M.J., R.M. Scheller, and M.A White. 2014. Effects of alternative forest management strategies in the face of climate change in the northern Great Lake region. Canadian Journal of Forest Research 44:700-710.

Birt, A.G., Y. Zeng, M.D. Tchakerian, R.N. Coulson, C.W. Lafon, D.M. Cairns, and D.A. Street. 2014. Evaluating Southern Appalachian Forest Dynamics without Eastern Hemlock: Consequences of Herbivory by the Hemlock Woolly Adelgid. Open Journal of Forestry 4: 91.

Lucash M.S., R.M. Scheller, A.M. Kretchun, K. Clark and J. Hom. 2014. Impacts of climate change and fire on long-term nitrogen cycling and forest productivity in the New Jersey Pine Barrens. Canadian Journal of Forest Research 44: 402-412.

Cantarello, E., A. Lovegrove, A. Orozumbekov, J. Birch, N. Brouwers, and A.C. Newton. 2014. Human impacts on forest biodiversity in protected walnut-fruit forests in Kyrgyzstan. Journal of Sustainable Forestry 33: 454-481.

Duveneck, M.J., R.M. Scheller, M.A. White, S.D. Handler, and C. Ravenscroft. 2014. Climate change effects on northern Great Lake (USA) forests: A case for preserving diversity. Ecosphere 5(2):23.

Loudermilk, E.L., A. Stanton, R.M. Scheller, T.E. Dilts, P.J. Weisberg, C. Skinner, J. Yang. 2014. Effectiveness of fuel treatments for mitigating wildfire risk and sequestering forest carbon: A case study in the Lake Tahoe Basin. Forest Ecology and Management 323: 114-125.

Gustafson, E.J. 2013. When relationships estimated in the past cannot be used to predict the future: using mechanistic models to predict landscape ecological dynamics in a changing world. Landscape Ecology 28: 1429-1437.

Loudermilk, E.L., R.M. Scheller, P.J.Weisberg, J. Yang, T. Dilts, S.L. Karam, C.N. Skinner. 2013. Carbon dynamics in the future forest: The importance of climate-fire interactions and long-term successional legacy. Global Change Biology 9: 3502-3515.

Newton, A.C., E. Cantarello, N. Tejedor, and G. Myers. 2013. Dynamics and conservation management of a wooded landscape under high herbivore pressure. International Journal of Biodiversity.

Sulman, B.N., A.R. Desai, and D.J. Mladenoff. 2013. Modeling Soil and Biomass Carbon Responses to Declining Water Table in a Wetland-Rich Landscape. Ecosystems 16: 491-507.

If you have published a manuscript, dissertations, white-paper, report, etc., of research that used LANDIS-II, please let us know!

Featured Research

Lake Tahoe Basin: Climate Change, Fire, Insects, and Management
PIs: Louise Loudermilk and Robert Scheller
Co-PIs: Matt Hurteau, Carl Skinner, Alison Stanton, Peter Weisberg, Jian Yang

In the Lake Tahoe Basin (LTB, see figure), managers must balance forest health objectives to restore fire-adapted ecosystems and protect wildlife habitat while reducing the threat of wildfire that protects communities. In the near future, these objectives may also include storing carbon (C) or limiting C emissions. Emerging commitments to reduce C dioxide emissions at all levels have increased interest in terrestrial C sequestration as a way to mitigate climate change. For instance, the California Global Warming Solutions Act has focused renewed attention on the crucial role California forests play in the state's C budget.

Forests in the US are an important sink of C that currently offsets about 20% of the nation's fossil fuel emissions. However, the strength of the U.S. forest C offset may weaken as forests age, climate shifts, and natural disturbances increase. Managing the forested landscape in the LTB to meet the multiple goals of improved forest health, reduced fire risk, and atmospheric C regulation presents new challenges, especially in the context of changing climate regimes and altered disturbance regimes. Forestry practices such as thinning or prescribed fire could reduce the risk of sudden and large C emissions due to wildfire. Bark beetles also play an important role in the C budget, as outbreaks cause pulses of live C loss and changes in fuel characteristics across large stands. Beetle outbreaks are expected to increase as trees become increasingly drought stressed with climate change. In addition, forest soils also hold large stocks of C and fuel treatments will reduce detrital inputs resulting in reduced long-term soil C accrual and storage. In the coming decades, strategic forest planning and management decisions will need to incorporate current and projected ecosystem C dynamics with fire, insect, and vegetation succession dynamics and feedbacks.

Wildland fires have burned progressively larger areas of U.S. National Forests than occurred historically, due to excessive fuel accumulation resulting from nearly a century of fire suppression and several decades of climate warming.

Although the benefits of forest treatments for reducing intense fire behavior have been widely documented at the stand level, fuel treatment effects are not well understood at the landscape level and over longer time periods. Our understanding of fuel treatment effectiveness at a landscape scale is further complicated by recent and projected climate change, which may lead to overall drier and warmer conditions. Climate change is expected to increase frequencies of wildfire and insect outbreaks, significantly alter species composition and vegetation dynamics, and consequently affect forest C pools in significant, but unknown ways.

Increasingly managers need to balance the use of forest treatments for reducing fire risk against the implications for C sequestration. Properly balancing the spatial arrangement of management activities in order to achieve multiple objectives on the landscape requires more information about the inherent trade-offs among the objectives and improved awareness of the opportunities for optimizing management at the landscape scale. For example, fuels management (e.g., mechanical thinning and prescribed burning) will require consideration of the immediate loss of C from soil disturbance, fuel consumption, tree mortality and decay, and the potential longer-term decline in soil C due to reduced detrital inputs. Moreover, the magnitude and direction of these costs and benefits will shift as the climate changes. The ability of both treated and untreated forests to sequester C over the long-term in the face of a changing climate represents another important knowledge gap for effective forest management.

Climate change is a certainty as is the threat of wildfire and insect outbreaks in the LTB. Managers need a robust toolbox to assess potential trade-offs among management objectives for reducing fire risk, improving forest resiliency to changes in drought and insects and wildfire, and sequestering C or reducing C emissions. Our team paired LANDIS-II with empirical datasets from within the LTB, including pre- and post-treatment stand conditions, tree-ring estimates of past growth, insect fly-over maps, flux tower estimates of C flux, and other data. We used the Century succession extension for LANDIS-II to track aboveground live C, detrital C, and soil organic C, the Dynamic Fire and Fuel System extension to model fire spread, as well as the Leaf Biomass Harvest extension to model fuel treatment scenarios. We evaluated the landscape-level effectiveness of different treatment scenarios on wildfire risk, overstory and understory succession and fuel loads, and aboveground C. We collaborated with managers to identify realistic forest treatment scenarios for maximizing C sequestration or limiting C emissions over a range of time scales from years to decades. In summary, the LTB project demonstrated an operational method for the explicit consideration of climate change, shifting fire ignition patterns, shifting insect dynamics, and C storage capacity.

Our results indicate that landscape legacies from prior human land use during the Comstock era will continue to have a large influence on the future landscape trajectory, even as climate change increases future wildfire activity (Loudermilk et al. 2013). And although climate change will reduce overall productivity and shift tree species on the landscape, it will not necessarily generate larger fires due to effective suppression in the LTB. Furthermore, our results indicate that management has substantial promise for managing wildfires and are a net benefit to maintaining C on the landscape (Loudermilk et al. 2014). Fuel treatments have the capacity to 'bend the C curve' and generate some climate resilience across the landscape. The role of insect outbreaks across the LTB will increase under climate change causing large shifts in tree species dominance and reducing overall productivity, further supporting the need for pro-active forest management to increase forest resilience.

We are now concluding the project and more publications are well underway. It was a tremendous effort with many outstanding collaborators including fire managers and scientists and with generous financial support from the Sierra Nevada Public Lands Management Act.

References

Loudermilk, E.L., R.M. Scheller, P.J. Weisberg, J. Yang, T. Dilts, S.L. Karam, C.N. Skinner. 2013. Carbon dynamics in the future forest: The importance of climate-fire interactions and long-term successional legacy. Global Change Biology 19: 3502-3515.

Loudermilk, E. L., A. Stanton, R. M. Scheller, T. Dilts, P. J. Weisberg, C. N. Skinner, and J. Yang. 2014. Effectiveness of fuel treatments for mitigating wildfire risk and sequestering forest carbon: A case study in the Lake Tahoe Basin. Forest Ecology and Management 323: 114-125.