**G481/581 Terrestrial Ecosystem Modeling: Final Class Project Topics and Reading Lists**

Fall Semester 2021

***Note:*** *this reading list serves as a guide. You do not need to present on all these papers but you should use them as a guide to what type of topics to present in your review and presentation. Undergraduates may choose to only present summaries of these papers. Graduate students should do a literature search for other papers from which you can learn about your topic.* ***Please also see class notes and the textbook for your topic for extra references.***

**G481**

**Thomas Rainbolt: Urban land use in TEMs**

Best, M. J., & Grimmond, C. S. B. (2015). Key conclusions of the first international urban land surface model comparison project. *Bulletin of the American Meteorological Society*, *96*(5), 805-819. And references therein e.g. Oleson and Best papers.

Oleson, K. W., & Feddema, J. (2019). Parameterization and surface data improvements and new capabilities for the Community Land Model Urban (CLMU). *Journal of Advances in Modeling Earth Systems*.

Best, M. J., & Grimmond, C. S. B. (2016). Modeling the partitioning of turbulent fluxes at urban sites with varying vegetation cover. *Journal of Hydrometeorology*, *17*(10), 2537-2553.

References here: <https://www.theurbanist.com.au/2020/01/urban-plumber-at-ams-2020/> <https://www.theurbanist.com.au/2020/01/AMS20_Poster_200106s.pdf> or here: <https://urban-plumber.github.io>

Lawrence, D. M., Hurtt, G. C., Arneth, A., Brovkin, V., Calvin, K. V., Jones, A. D., ... & Seneviratne, S. I. (2016). The Land Use Model Intercomparison Project (LUMIP) contribution to CMIP6: rationale and experimental design. *Geoscientific Model Development*, *9*, 2973-2998.

**Riley Seddon: Nutrient limitation in TEMs**

Davies-Barnard, T., Meyerholt, J., Zaehle, S., Friedlingstein, P., Brovkin, V., Fan, Y., ... & Wiltshire, A. J. (2020). Nitrogen cycling in CMIP6 land surface models: progress and limitations. *Biogeosciences*, *17*(20), 5129-5148.

Zaehle, S., Medlyn, B. E., De Kauwe, M. G., Walker, A. P., Dietze, M. C., Hickler, T., ... & Norby, R. J. (2014). Evaluation of 11 terrestrial carbon–nitrogen cycle models against observations from two temperate Free‐Air CO2 Enrichment studies. *New Phytologist*, *202*(3), 803-822. And references in Table A1.

Ziehn, T., Wang, Y. P., & Huang, Y. (2021). Land carbon-concentration and carbon-climate feedbacks are significantly reduced by nitrogen and phosphorus limitation. *Environmental Research Letters*, *16*(7), 074043.

Wang, Y. P., & Goll, D. S. (2021). Modelling of land nutrient cycles: recent progress and future development. *Faculty Reviews*, *10*.

Section 17.6 of the textbook.

Note: I can provide references on how specific models have implemented nitrogen and phosphorus limitations if this is useful.

**G581**

**Kevin Czachura: Optimality theory in relation to water limitation on vegetation**

Sabot, M. E., De Kauwe, M. G., Pitman, A. J., Medlyn, B. E., Verhoef, A., Ukkola, A. M., & Abramowitz, G. (2020). Plant profit maximization improves predictions of European forest responses to drought. *New Phytologist*, *226*(6), 1638-1655. And references in the introduction after they mention the WUEH, including Sperry et al., (2017), Wolf et al. (2016), Medlyn et al. (2011) etc.

Xu, H., Wang, H., Prentice, I. C., Harrison, S. P., & Wright, I. J. (2021). Coordination of plant hydraulic and photosynthetic traits: confronting optimality theory with field measurements. *New Phytologist*. (More about the data but with links to how this would be useful for modeling).

Mrad, A., Sevanto, S., Domec, J. C., Liu, Y., Nakad, M., & Katul, G. (2019). A dynamic optimality principle for water use strategies explains isohydric to anisohydric plant responses to drought. *Frontiers in Forests and Global Change*, *2*, 49.

Schymanski, S. J., Roderick, M. L., & Sivapalan, M. (2015). Using an optimality model to understand medium and long-term responses of vegetation water use to elevated atmospheric CO2 concentrations. *AoB Plants*, *7*.

Sections 4.5 and 12.6 of the textbook.

**Naw Sweet Peace Thaw Mu Khu: Land use and cover change in TEMs**

*How land use and land cover change is implemented in TEMs*

Left column on page 15 of Friedlingstein, P., O'sullivan, M., Jones, M. W., Andrew, R. M., Hauck, J., Olsen, A., ... & Zaehle, S. (2020). Global carbon budget 2020. *Earth System Science Data*, *12*(4), 3269-3340. And references therein, particularly Hurtt et al. (2020) and Klein Goldewijk et al. (2017):

Hurtt, G. C., Chini, L., Sahajpal, R., Frolking, S., Bodirsky, B. L., Calvin, K., ... & Zhang, X. (2020). Harmonization of global land use change and management for the period 850–2100 (LUH2) for CMIP6. *Geoscientific Model Development*, *13*(11), 5425-5464.

Klein Goldewijk, K., Beusen, A., Doelman, J., & Stehfest, E. (2017). Anthropogenic land use estimates for the Holocene–HYDE 3.2. *Earth System Science Data*, *9*(2), 927-953.

Wilkenskjeld, S., Kloster, S., Pongratz, J., Raddatz, T., & Reick, C. H. (2014). Comparing the influence of net and gross anthropogenic land-use and land-cover changes on the carbon cycle in the MPI-ESM. *Biogeosciences*, *11*(17), 4817-4828.

Lawrence, D. M., Hurtt, G. C., Arneth, A., Brovkin, V., Calvin, K. V., Jones, A. D., ... & Seneviratne, S. I. (2016). The Land Use Model Intercomparison Project (LUMIP) contribution to CMIP6: rationale and experimental design. *Geoscientific Model Development*, *9*, 2973-2998.

*Issues, challenges and perspectives with how LULCC is implemented in TEMs*

Prestele, R., Arneth, A., Bondeau, A., de Noblet-Ducoudre, N., Pugh, T. A., Sitch, S., ... & Verburg, P. H. (2017). Current challenges of implementing anthropogenic land-use and land-cover change in models contributing to climate change assessments. *Earth System Dynamics*, *8*(2), 369-386.

Peng, S., Ciais, P., Maignan, F., Li, W., Chang, J., Wang, T., & Yue, C. (2017). Sensitivity of land use change emission estimates to historical land use and land cover mapping. *Global Biogeochemical Cycles*, *31*(4), 626-643.

Rounsevell, M. D. A., Arneth, A., Alexander, P., Brown, D. G., de Noblet-Ducoudré, N., Ellis, E., ... & Young, O. (2014). Towards decision-based global land use models for improved understanding of the Earth system. *Earth System Dynamics*, *5*(1), 117-137.

**Trung Nguyen: River routing in TEMs**

Mizukami, N., Clark, M. P., Gharari, S., Kluzek, E., Pan, M., Lin, P., ... & Yamazaki, D. (2021). A vector‐based river routing model for Earth System Models: Parallelization and global applications. *Journal of Advances in Modeling Earth Systems*, *13*(6), e2020MS002434.

Nguyen-Quang, T., Polcher, J., Ducharne, A., Arsouze, T., Zhou, X., Schneider, A., & Fita, L. (2018). ORCHIDEE-ROUTING: revising the river routing scheme using a high-resolution hydrological database. *Geoscientific Model Development*, *11*(12), 4965-4985.

Sheng, M., Lei, H., Jiao, Y., & Yang, D. (2017). Evaluation of the runoff and river routing schemes in the Community Land Model of the Yellow River basin. *Journal of Advances in Modeling Earth Systems*, *9*(8), 2993-3018.

Martínez-de la Torre, A., Blyth, E. M., & Weedon, G. P. (2019). Using observed river flow data to improve the hydrological functioning of the JULES land surface model (vn4. 3) used for regional coupled modelling in Great Britain (UKC2). *Geoscientific Model Development*, *12*(2), 765-784.

Towner, J., Cloke, H. L., Zsoter, E., Flamig, Z., Hoch, J. M., Bazo, J., ... & Stephens, E. M. (2019). Assessing the performance of global hydrological models for capturing peak river flows in the Amazon basin. *Hydrology and Earth System Sciences*, *23*(7), 3057-3080.

**Isioma Nwayor: Plant moisture stress (especially VPD) and its implementation in TEMs/drought impacts**

*VPD vs SM in controlling C fluxes, and how TEMs have been used to assess this question*

* Liu, Y., Kumar, M., Katul, G. G., Feng, X., & Konings, A. G. (2020). Plant hydraulics accentuates the effect of atmospheric moisture stress on transpiration. *Nature Climate Change*, *10*(7), 691-695.
* Humphrey, V., Berg, A., Ciais, P., Gentine, P., Jung, M., Reichstein, M., ... & Frankenberg, C. (2021). Soil moisture–atmosphere feedback dominates land carbon uptake variability. *Nature*, *592*(7852), 65-69.

*Mechanistic plant hydraulic schemes in TEMs*

* Section 3.2 of Naudts, K., Ryder, J., McGrath, M. J., Otto, J., Chen, Y., Valade, A., ... & Ghattas, J. (2015). A vertically discretised canopy description for ORCHIDEE (SVN r2290) and the modifications to the energy, water and carbon fluxes. *Geoscientific Model Development*, *8*, 2035-2065.
* Bonan, G. B., Williams, M., Fisher, R. A., & Oleson, K. W. (2014). Modeling stomatal conductance in the earth system: linking leaf water-use efficiency and water transport along the soil–plant–atmosphere continuum. *Geoscientific Model Development*, *7*(5), 2193-2222.
* Kennedy, D., Swenson, S., Oleson, K. W., Lawrence, D. M., Fisher, R., Lola da Costa, A. C., & Gentine, P. (2019). Implementing plant hydraulics in the community land model, version 5. *Journal of Advances in Modeling Earth Systems*, *11*(2), 485-513.
* Chapter 13 of the textbook and references therein

*How well do TEMs model water stress impacts on plants?*

* De Kauwe, M. G., Zhou, S. X., Medlyn, B. E., Pitman, A. J., Wang, Y. P., Duursma, R. A., & Prentice, I. C. (2015). Do land surface models need to include differential plant species responses to drought? Examining model predictions across a mesic-xeric gradient in Europe. (for context)
* Medlyn, B. E., De Kauwe, M. G., & Duursma, R. A. (2016). New developments in the effort to model ecosystems under water stress. *New Phytologist*, *212*(1), 5-7.
* Xu, X., Medvigy, D., Powers, J. S., Becknell, J. M., & Guan, K. (2016). Diversity in plant hydraulic traits explains seasonal and inter‐annual variations of vegetation dynamics in seasonally dry tropical forests. *New Phytologist*, *212*(1), 80-95.

**James Ryan: Snow in TEMs**

*Snow model evaluations and inter-comparisons*

Brunke, M. A., Welty, J., & Zeng, X. (2021). Attribution of snowpack errors to simulated temperature and precipitation in E3SMv1 over the contiguous United States. *Journal of Advances in Modeling Earth Systems*, e2021MS002640.

Menard, C. B., Essery, R., Krinner, G., Arduini, G., Bartlett, P., Boone, A., et al. (2021). Scientific and human errors in a snow model intercomparison. *Bulletin of the American Meteorological Society*, 102, 61–E79.

Günther, D., Marke, T., Essery, R., & Strasser, U. (2019). Uncertainties in snowpack simulations—Assessing the impact of model structure, parameter choice, and forcing data error on point-scale energy balance snow model performance. *Water Resources Research*, **55**, 2779–2800.

Mudryk, L., Santolaria-Otín, M., Krinner, G., Ménégoz, M., Derksen, C., Brutel-Vuilmet, C., et al. (2020). Historical Northern Hemisphere snow cover trends and projected changes in the CMIP6 multi-model ensemble. *The Cryosphere*, **14**, 2495–2514.

Toure, A. M., Luojus, K., Rodell, M., Beaudoing, H., & Getirana, A. (2018). Evaluation of simulated snow and snowmelt timing in the Community Land Model using satellite‐based products and streamflow observations. *Journal of advances in modeling earth systems*, *10*(11), 2933-2951.

*Individual models*

Golaz et al. (2019), Danabasoglu et al. (2020), Held et al. (2019) and Kelley et al. (2020) all cited in Brunke et al. (2021) (see first reference), plus:

Wang, T., Ottle, C., Boone, A., Ciais, P., Brun, E., Morin, S., ... & Peng, S. (2013). Evaluation of an improved intermediate complexity snow scheme in the ORCHIDEE land surface model. *Journal of Geophysical Research: Atmospheres*, *118*(12), 6064-6079.

Section 9.5 of the textbook

**Benjamin Sebastian: Grazing management**

Section 3.1.3 of Pongratz, J., Dolman, H., Don, A., Erb, K. H., Fuchs, R., Herold, M., ... & Naudts, K. (2018). Models meet data: Challenges and opportunities in implementing land management in Earth system models. *Global change biology*, *24*(4), 1470-1487, and references therein.

Chang, J. F., Viovy, N., Vuichard, N., Ciais, P., Wang, T., Cozic, A., ... & Soussana, J. F. (2013). Incorporating grassland management in ORCHIDEE: model description and evaluation at 11 eddy-covariance sites in Europe. *Geoscientific Model Development*, *6*(6), 2165-2181.

Chang, J., Ciais, P., Herrero, M., Havlik, P., Campioli, M., Zhang, X., ... & Mironycheva-Tokareva, N. (2016). Combining livestock production information in a process-based vegetation model to reconstruct the history of grassland management. *Biogeosciences*, *13*(12), 3757-3776.

Blanke, J., Boke-Olén, N., Olin, S., Chang, J., Sahlin, U., Lindeskog, M., & Lehsten, V. (2018). Implications of accounting for management intensity on carbon and nitrogen balances of European grasslands. *Plos one*, *13*(8), e0201058.

Chang, J., Ciais, P., Gasser, T., Smith, P., Herrero, M., Havlík, P., ... & Zhu, D. (2021). Climate warming from managed grasslands cancels the cooling effect of carbon sinks in sparsely grazed and natural grasslands. *Nature Communications*, *12*(1), 1-10.

Myrgiotis, V., Blei, E., Clement, R., Jones, S. K., Keane, B., Lee, M. A., ... & Williams, M. (2020). A model-data fusion approach to analyse carbon dynamics in managed grasslands. *Agricultural Systems*, *184*, 102907.

**Rodoshi Sinha: Fauna-vegetation interactions in TEMs (disturbances and feedbacks from insect outbreaks and herbivory)**

Zhu, D., Ciais, P., Chang, J., Krinner, G., Peng, S., Viovy, N., ... & Zimov, S. (2018). The large mean body size of mammalian herbivores explains the productivity paradox during the Last Glacial Maximum. *Nature ecology & evolution*, *2*(4), 640-649.

Pachzelt, A., Rammig, A., Higgins, S., & Hickler, T. (2013). Coupling a physiological grazer population model with a generalized model for vegetation dynamics. *Ecological Modelling*, *263*, 92-102.

Dietze, M. C., & Matthes, J. H. (2014). A general ecophysiological framework for modelling the impact of pests and pathogens on forest ecosystems. *Ecology letters*, *17*(11), 1418-1426.

Kautz, M., Anthoni, P., Meddens, A. J., Pugh, T. A., & Arneth, A. (2018). Simulating the recent impacts of multiple biotic disturbances on forest carbon cycling across the United States. *Global change biology*, *24*(5), 2079-2092.

Landry, J. S., Price, D. T., Ramankutty, N., Parrott, L., & Matthews, H. D. (2016). Implementation of a Marauding Insect Module (MIM, version 1.0) in the Integrated BIosphere Simulator (IBIS, version 2.6 b4) dynamic vegetation–land surface model. *Geoscientific Model Development*, *9*(3), 1243-1261.

Landry, J. S., Parrott, L., Price, D. T., Ramankutty, N., & Matthews, H. D. (2016). Modelling long-term impacts of mountain pine beetle outbreaks on merchantable biomass, ecosystem carbon, albedo, and radiative forcing. *Biogeosciences*, *13*(18), 5277-5295.

Jönsson, A. M., Schroeder, L. M., Lagergren, F., Anderbrant, O., & Smith, B. (2012). Guess the impact of Ips typographus—An ecosystem modelling approach for simulating spruce bark beetle outbreaks. *Agricultural and Forest Meteorology*, *166*, 188-200.

**Herbert Sizek: Crop rotations and cover cropping impacts on the water cycle**

Levis, S., Bonan, G. B., Kluzek, E., Thornton, P. E., Jones, A., Sacks, W. J., & Kucharik, C. J. (2012). Interactive crop management in the Community Earth System Model (CESM1): Seasonal influences on land–atmosphere fluxes. *Journal of Climate*, *25*(14), 4839-4859.

Relevant sections of Pongratz, J., Dolman, H., Don, A., Erb, K. H., Fuchs, R., Herold, M., ... & Naudts, K. (2018). Models meet data: Challenges and opportunities in implementing land management in Earth system models. *Global change biology*, *24*(4), 1470-1487, e.g. future/planned implementation in models.

Relevant sections of Erb, K. H., Luyssaert, S., Meyfroidt, P., Pongratz, J., Don, A., Kloster, S., ... & Haberl, H. (2017). Land management: data availability and process understanding for global change studies. *Global change biology*, *23*(2), 512-533.

Relevant sections of McDermid, S. S., Mearns, L. O., & Ruane, A. C. (2017). Representing agriculture in E arth S ystem M odels: Approaches and priorities for development. *Journal of advances in modeling earth systems*, *9*(5), 2230-2265.

Introduction and discussion in Müller, C., Elliott, J., Chryssanthacopoulos, J., Arneth, A., Balkovic, J., Ciais, P., ... & Iizumi, T. (2017). Global gridded crop model evaluation: benchmarking, skills, deficiencies and implications, Geosci. Model Dev., 10, 1403–1422.

Silva, J. V., & Giller, K. E. (2020). Grand challenges for the 21st century: what crop models can and can't (yet) do. *The Journal of Agricultural Science*, *158*(10), 794-805.

Mathison, C., Challinor, A. J., Deva, C., Falloon, P., Garrigues, S., Moulin, S., ... & Wiltshire, A. (2021). Implementation of sequential cropping into JULESvn5. 2 land-surface model. *Geoscientific Model Development*, *14*(1), 437-471.