**M2M Project: 7-9 November 2012 Meeting**

*Janet’s notes*

*Purpose:*

1. Build and test ‘conveyor belt of models.’ Run through model development and linkages for climate-field experiments-SDM-population model to help us better refine how we will implement the models in this project.
2. Updates from other project components; assess data, processing and server needs

**Day 1 - Weds Nov 7**

1. update on downscaled climate (Lorrie, Alan)

1. To produce the 30 m data for our 3 small model domains they did spatial downscaling of 270 m temperature, precipt. But to recalculate CWD at 30 m they had to calculate solar radiation (accounting for topographic shading) and PET at 30 m resolution
2. They evaluate their BCM against available streamflow data, e.g. for Teakettle area there is 5 yrs streamflow data for those small headwater basins
3. On our M2M ftp site they put data for 2 climate change scenarios – our old friends GFDL A2 and PCM B1. Based on coarse geology layer used in BCM. They plan to refine
4. What do they need to improve their estimates of CWD? Rooting depth
5. They showed time series averaged for Teakettle, increasing CWD, especially under GFDL A2 scenario
6. They also summarized future trends using 30-yr averages 2010-40, 2040-70, 2070-2100 across sites (averaged for domains)
7. The use topographic radiation to modify temperature (if >7.6 MJ/day increase T by 0.5 C, for example). QUESTION: is that just for BCM? Or are temperature variables ‘corrected’ for this effect?
8. They model cold air pooling and use it in snowmelt part of BCM. Temperature itself is not corrected for cold air pooling
9. They can correct/calibrate temperatures from 2 m height to near ground
10. The most recent PRISM historical data released at 800 m is 2010
11. They are developing downscaled climate data for 5 major Sierran basins at 90 m scale for another study (Note: would these data be sufficient for running LANDIS? The extent would be more that enough. The resolution is lower than for our domains… would that still work?)
12. The BCM data on the M2M ftp site are PRELIMINARY. Will be updated with new and improved products based on refined geology

2. SDMs (Alex S, Janet)

* Environmental Predictors
  + Nutrients? Soil factors?
  + Duration of snow pack – accounted for in CWD?
  + AET is part of CWD – include separately as predictor?? as in Stephenson graph AET (representing primary productivity) vs Ann Deficit (CWD) representing water stress?
  + Cold air pooling? Accounted for in CWD. But what about affect on temperature regime? Correct temperature for cold air pooling?
  + Radiation? Should not need to include separately – redundant with Temp if radiation affect on temp is accounted for
  + Don’t use annual CWD use growing season
    - Or use both – annual represents summer drought stress (seedling survival first year) while growing season related to seedling establishment
  + Kelly noted, don’t need to decide on the final set of predictors yet – that should fall out of the data analysis

3. population model (Helen)

* What does ‘suitability’ mean? In our current linking of SDMs to RAMAS, suitability translates to carrying capacity (K)
* Models uses lognormal distribution for vital rates
* Scenarios – fire frequency, climate change (via SDMs)… do we want to include other disturbances? Insects? As a second catastrophe? This may be more easily accommodated in LANDIS or BioMove if it is important
* How do you get ‘movement’ between patches with no dispersal? Because the patch location is shifting over time, patches break apart and then expand, so there is creep
* If we have SDM maps generated at yearly time steps from each year of projected climate data, does this include some portion of environmental stochasticity in the maps – that resulting from climate variability? (But this only adds variability to K, not vital rates, right?)
  + Helen’s dilemma – separating where species can be and how many from their probability of survival
  + If climate change (CC) only affects K and population is not near K in that patch there is no effect of CC on population
  + Could have an affect of climate change on seedling survival (or any stage) by introducing a trend in the survival rates
* Likewise, in RAMAS a global gradual trend in disturbance frequency can be implemented over a model run
* (from a later discussion) temporal correlations (runs of dry followed by wet years etc) do not need to be explicit in RAMAS – it comes out of the 1000 runs – MC simulation

4. LANDIS (Alex S) Landscape Disturbance Simulator

* Model is well vetted and LANDIS-II has a lot of modules or extensions that can be used
* LANDIS simulates community dynamics, accounting for competition
* Can have feedbacks between climate – fire regime and species
* The critical link between CC and species is the probability of establishment of each species on each land type (“ecoregion”)
  + “Ecoregions” defined by terrain and soil variables (clustering, overlay, a priori, other methods or sources…)
* Determined by implementing “PNet-II” and “biomass extension” – climate drives an ecosystem model
* Fire
  + Ignition and initiation of fire determined by defining fire ‘ecoregions’ and fuel moisture
  + These ecoregions can be defined differently than for species establishment
  + Fire spread patterns differ among seasons
  + Fire severity is a function of crown base height, fuel moisture, surface fuels, fuel parameters (fuel model?)
  + Mortality from fire is a function of species fire tolerance, fire severity, cohort age

**Day 2 - Thurs Nov 8**

**Morning-**

a) Lee H.-- Biomove

* This model is sort of intermediate between RAMAS and LANDIS
* each model has different assumptions about how CC affects species so this makes an interesting comparison – qualitatively the same results, or not, when using these models to address our study questions?
  + RAMAS CC affects species through K
  + LANDIS prob establishment and climate-fire-species feedbacks
  + BioMove …? I can’t remember
* HR: since BioMove has not been used in published studies, how would you design modeling experiments with replication? And how would you report that results? (maps showing how many replicated runs agreed… graphs of species percent of landscape occupied over time steps with error bars…)

FD suggested modeling Site Index as a function of climate/soil/water data to make growth rates (vital rates) dynamic with climate

Alan/Kelly/Lorrie: ensemble climate modeling aims to choose models that cover all the quadrant of wetter/drier versus warmer/lots warmer

Alan Lorrie John in Sierra project are running 100 model scenarios (they are interested in covering the full range of projected water deficit vs AET)

Lorrie showed the distribution of our 5 study species in CWD x AET space (historical climate). Friday she showed how each study species “moves” out of that space (nudged to the right – higher CDW in most cases) under future climate scenarios

b) Max M. – Fire Modeling

* Several ongoing projects in his lab:
* Completed project: Megs’ Fire and CC in Calif. CEC report
* Global models of fire frequency using 16 GCMs, looking at model agreement with regard to sign – more of less frequent fire projected worldwide
* For our project he plans to re-do models of fire frequency for CA based on new climate data and projections from USGS – he uses 270 m projections but averages to 1 km
* With Mark Schwartz and David Ackerley they have a project hindcasting effects of native American burning on CA landscape
* In a TNC project post-doc Mike Mann is using Landis’s urban growth model to project urbanization patterns to mid century and then use that to predict fire risk; exurban sprawl versus smart growth scenarios
* L and ownership (public, private) also affects fire risk
* Alex S: “in this project fire is a gap creator”
* Estimates of fire frequency that change over time will be used in scenario generation in RAMAS and BioMove

**Afternoon**

**Updates** on other project components -- progress reports and planning:

* Peter S.—Data processing update
  1. Data access via Drupal
  2. What would we like to see in terms of level 3/4 processing of the microclimate field data?
     1. Min/max daily temp single locations
     2. Min/max monthly temp
     3. Averaged for the three scales
     4. Vertical profiles for weather stations
* Frank lead discussion of flow diagram for linking the data, models, defining unmet data needs, reminding us of linkages
  + Maps of initial conditions for tree species / community models
    - RAMAS needs patch map of trees or stands
    - LANDIS also needs to represent distribution of associated species/functional types, and age structure
      * Maybe derive from existing southern Sierra LANDIS project?
      * Tejon use forest inventory maps?
  + Helen asked about the transfer function between ‘habitat suitability’ and seedling survival (if the model uses seedling survival as the dependent variable the relationship is 1:1)
    - Is the “SDM” developed only to predict survival rates of seedlings? OR K of adults too?
  + What are the critical stages to distinguish for our species e.g. year 1, year 2… seedlings

**Day 3 - Fri Nov 9**

**Morning**:

9:15 Lynn S., Ian M. -- field experiment updates, developing field approaches

* 3 extra met stations at Teakettle; now all gardens a Teakettle have a met station courtesy of Malcolm
* hemispherical photos – one per garden
* spherical densitometer at other locations
* 2011 emergence and survival data almost complete, finishing SJER and Tejon
* have all species from both areas (North South) planting in progress – planted by end of Nov
* data analysis
  + wants to derive new variables a predictors from temp sensor and met station data
  + needs to enter survivorship data
  + what is first year survival? Oct 11 –Oct 12? or after the winter (Mar 13)? Frank, Lynn and Helen should talk about this
* (Ian) Are gardens keeping out herbivores? Not gophers… adding gopher proof wire cages in the garden and ‘control’ plots outside the garden. 2 plots per treatment (unprotected, protected) garden

9:30 Lorrie -- present update on climate trajectories for gardens

* shift in climate space for each species locations from present to end of century one scenario, plotted in CWD versus AET
* for gardens, low elevation sites go to higher CWD, high elevation sites go to higher AET and higher CWD
* what limits seedlings?
  + lethal temperatures at surface may keep them from germinating
  + whereas summer ‘drought’ may not kill them if they have shut down
* Note by FD: Tejon gauging stations may not be accurate- unknown amounts of water are being drawn from Tejon Creek (troughs, etc.)

10:00 Lee H. -- Identifying patterns of veg on landscape- remote sensing & NEON

* Needs fine scale veg maps to initialize our models for our model domains
  + Need patches of species for RAMAS
  + For LANDIS need age cohorts per species per pixel (stage or structure mapping)
* NEON is doing those airborne sensor runs (including LIDAR) – is this an opportunity for imagery to develop these maps? They are meeting with the NEON people in SB and will ask:
  + Can they fly Tejon? For free?
* Who can do this? Ian M, John D, Dar…?
* FD: Can we sample the distribution of size and age as a function of topography, and then use that relationship to predict species – size – age over landscape
* FD: John Melack asked about our project – thinks we need thermal imagery for this study. Tethered balloon with thermal camera. Measure skin temperature over larger footprint

10:30 (Frank) wrap up of goals and implementation (staffing) of modeling, and timeline

revisit schedule

* on schedule except for vegetation mapping…
* starting analysis of microclimate data – who?
* Analysis of microclimate data – who? Maybe Ian? With help from Kelly. In collaboration with John, Lorrie and Alan on comparisons. Lynn and Peter supporting data project development
  + Preliminary, based on year 1 data
  + Compare sensor data to 30 m downscaled data – relative variation as they will not be calibrated
  + Compare 2 m to 5 cm data
  + Eventually compare to Alex Hall models?
* Species climate response function analysis
  + Lynn’s analysis of the garden experimental data, with Ian (with consultation from Janet
  + Lynn and Frank’s literature review -- Microclimate and seedling establishment of trees in MTEs
* Species distribution modeling
  + Lynn and Janet + post-doc (Pep) relating experimental data, and
* Disturbance regime modeling
  + Max – what does he need in terms of staffing the fire modeling? He is not sure yet. He and Alex S agreed to share a post-doc and Alex would like for her ‘part’ of that to support Pep to help with LANDIS
* Population and Community modeling
  + RAMAS – Helen UCR with post-doc. Spinning up RAMAS, 5 species, lots of scenarios, will be a huge amount of work, and so this post-doc will have to be dedicated to RAMAS.
    - HR would like input from the group on parameterizing models (from Frank, UCSB, etc)
    - FD: Form a study subgroup using skype or gotomeeting with regular contact…
  + BioMove population model with species interactions / competition
    - Alex S is excited to explore BioMove because it is similar to RAMAS
    - Frank also wants to work with it, so they will work together or in parallel, sharing parameterization and data development and comparing notes…
    - Lee wants to bring in Ian Davies at some point who coded BioMove to maybe tailor the code for us… (how would we support this?)
  + LANDIS landscape disturbance simulator is a forest community dynamics model
    - Alex S would like to persue LANDIS as a comparative community modeling framework. But it is a bear. A lot of work. But if a post-doc, Pep, can support this effort, it would be a great addition to his sill set and a really appropriate approach for answering our research questions

1130 Review and consider authorship policy for working groups

* Drafts sent around. Frank and Lynn will edit a version for our group to use.

1145 Lee -- TREE review – microscale MS

* Substantive comments – Lorrie gave some comments about terminology. Microrefugia versus micropockets… micro-refuges
* Authorship? Tree only allows 5 authors total. Can include the group as the group. Or as a footnote
* Alex S, Janet, Lorrie, Alex Hall, Max? Frank?

**Planning -- logistics - scheduling**

* put up powerpoints from this meeting (Convert to pdf?) Folder on ftp site for meetings. Please, anyone who has slides presented at our meeting, please upload!
* Next conference call pushed off til Dec 19
* Next meeting…??

**Things we need:**

1. “PRISM-like” data for 2011, 2012, 2013 (John & Flints can develop their own climate point estimates for garden locations from weather station data) to correlate with seedling establishment and survival data
   1. For this they would like site specific soil properties (from UCSB) –
   2. From SURGO the use soil depth, porosity, water content at wilting point (15 bars), field capacity which comes from soil texture. So in field they need to measure depth and texture
2. Instrument data, temperature sensors (and weather stations) calculate daily minimum, maximum temperatures, and average at our three scales. Total daily radiation summarized for weather stations.
3. Lorrie asked for a list of species (“plant functional types”) for the modeling domains (LANDIS, BioMove)
4. Site-wide surveys of vegetation, especially Teakettle, in order to generate data on occurrence and size distribution of target tree species (and associated species?). This is needed to generate initial species maps for population and community models, either by image classification (species maps) or by ‘distribution modeling’ (relate size class distribution to topographic variables for interpolation). Also generates additional seedling establishment data at site scale. Plots along transects is what Frank suggested, I think.