

## **Appendix 2.** Methods for land cover representation and construction of the Bayesian Belief Networks.

Land cover is represented by 16 functional groups with distinct characteristics in the agroecosystem model (Figure 10). The creation of land-cover maps through time for each scenario began with a full inventory of 2010 land cover compiled from multiple sources (CCLID 2005, WDNR 2008, Fry et al. 2011, USDA 2011, RCPECDA 2012, CARPC 2013, USDA 2013). Land-cover changes at a decadal scale up to 2070 were then quantified based on changes described in the qualitative narrative. Decadal watershed population was also quantified for each scenario to guide the appropriate changes in urban land cover.

In constructing the BBNs for land use/cover transitions of each scenario, we selected a set of variables based on current literature, changes stated in scenario narratives, and expert knowledge about this watershed (McCloskey et al. 2011, Swetnam et al. 2011, Celio et al. 2014). Variables were dependent on the particular scenario, time of change, and land use/cover types and included soil crop suitability, soil hydric condition, proximity to stream, proximity to road, distance to current land use/cover, slope, zone of protected areas, etc. Once the transition probabilities were calculated, we used the Netica BBN and ArcGIS software to create the land cover maps (Fig. 10).

### LITERATURE CITED

- CARPC. 2013. Dane County 2010 Land Use Inventory. Capital Area Regional Planning Commission, Madison, WI.
- CCLID. 2005. Columbia County 2005 Land Use Inventory. Columbia County Land Information Department, Portage, WI.
- Celio, E., T. Koellner, and A. Grêt-Regamey. 2014. Modeling land use decisions with Bayesian networks: Spatially explicit analysis of driving forces on land use change. *Environmental Modelling & Software* **52**:222-233.
- Fry, J. A., G. Xian, S. M. Jin, J. A. Dewitz, C. G. Homer, L. M. Yang, C. A. Barnes, N. D. Herold, and J. D. Wickham. 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States. *Photogrammetric Engineering & Remote Sensing* **77**:859-864.
- McCloskey, J. T., R. J. Lillieholm, and C. Cronan. 2011. Using Bayesian belief networks to identify potential compatibilities and conflicts between development and landscape conservation. *Landscape and Urban Planning* **101**:190-203.
- RCPECDA. 2012. Rock County 2012 Land Use Inventory. Rock County Planning, Economic, and Community Development Agency, Janesville, WI.
- Swetnam, R. D., B. Fisher, B. P. Mbilinyi, P. K. T. Munishi, S. Willcock, T. Ricketts, S. Mwakalila, A. Balmford, N. D. Burgess, A. R. Marshall, and S. L. Lewis. 2011. Mapping socio-economic scenarios of land cover change: A GIS method to enable ecosystem service modelling. *Journal of Environmental Management* **92**:563-574.
- USDA. 2011. United States Department of Agriculture National Agricultural Statistics Service 2010 Cropland Data Layer.
- USDA. 2013. Soil Survey Geographic (SSURGO) Database for Columbia, Dane, and Rock counties, Wisconsin. United States Department of Agriculture, Natural Resources Conservation Service, Soil Survey Staff.
- WDNR. 2008. Wisconsin Wetland Inventory for Columbia, Dane, and Rock counties. Wisconsin Department of Natural Resources.