

Map of Potential Reforestation Sites in Lebanon

The Lebanon Reforestation Initiative (LRI) developed a dynamic platform of reforestation mapping resources to assist reforestation stakeholders in Lebanon identify optimal sites for planting that offer the best ecological conditions for tree survivability and promote longer-term reforestation success,.

LRI's team of mapping specialists adopted a two-phase methodology for development of the mapping resources, utilizing advanced satellite data, field verification, sophisticated computer modeling, and interactive web-mapping applications. The first phase emphasizes various biophysical characteristics as key criteria for the selection of optimal reforestation sites, while the second compliments the choice by emphasizing additional factors that respond to reforestation priorities in Lebanon.

Methodology Overview

- Phase one

LRI, in collaboration with Robert J. Hijmans, Associate Professor at the Department of Environmental Science and Policy, University of California Davis, generated reforestation suitability maps for 14 vegetation series in Lebanon. Each map reflects the presence probability of each vegetation series throughout Lebanon, the probabilities ranging from absent to very high. Only undeveloped land areas were considered. A map comprising 246 potential reforestation sites was generated. Data on land ownership is yet to be acquired and integrated.

The suitability maps are based on a rigorous tree species distribution modeling exercise. Scripts written with the statistical software "R" were used to run two models: Maximum Entropy and Random Forest. The approach consisted of combining the biophysical conditions of the existing vegetation series locations -- such as soil characteristics, mean precipitation, mean temperature, etc. -- and extrapolating the presence of the vegetation series to other locations with similar biophysical conditions.

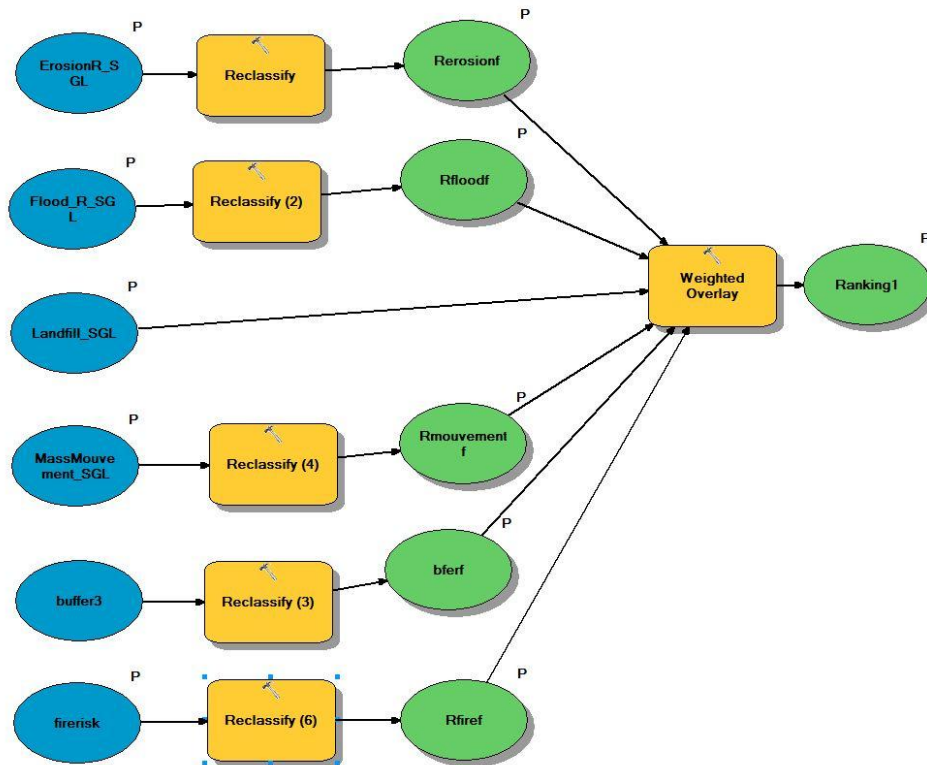
- Phase two

Additional factors were integrated in a second modeling exercise to rank the priority for reforestation of each of the proposed reforestation locations. Factors considered include erosion risk, flood risk, landslide risk, the distance from recognized bio-corridors, and fire risk.

The model ranks each potential reforestation site from 1 to 9, the latter reflecting the highest priority for reforestation. The model approach consists of reclassifying 5 factors into 9 classes and weighing their importance in the final ranking.

A location is more highly prioritized when it is closer to an identified bio-corridor, presents a medium erosion risk, low flood risk, low landslide risk, and low fire risk.

The figure below represents the model structure:



The following software, models and data were used to develop the mapping outputs:

- Administrative limits :
Obtained directly from Conseil du Developpement et de la Reconstruction, Government of Lebanon
- Climatic data:
Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climate surfaces for global land areas. [International Journal of Climatology 25:1965-1978](http://www.worldclim.org/). URL
- Erosion risk map, flood risk map, landslide map, bio-corridor;
Obtained directly from Conseil du Developpement et de la Reconstruction, Government of Lebanon

- Fire hazard map 2012:
Obtained directly from the Biodiversity Program, Institute of the Environment, University of Balamad. URL [http:// www.balamand.edu.lb/wildfire](http://www.balamand.edu.lb/wildfire)

- Maximum Entropy model:
Phillips, S. J., M. Dudik and R.E. Schapire. 2004. A maximum entropy approach to species distribution modeling. Proceedings of the 21st International Conference on Machine Learning. ACM Press, New York: 655-662 pp.

Phillips, S. J., R. P. Anderson, and R. E. Schapire. 2006. Maximum entropy modeling of species geographic distributions. Ecological Modelling 190:231-259

- Random Forest model:
Liaw and M. Wiener. 2002. Classification and Regression by randomForest. R News 2(3):18-22.

- “R” software:
R Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>

- Soil Map of Lebanon 1:200,000 :
T . Darwish, National Council for Scientific Research, National Center for Remote Sensing

- Table of Bio-climate Zones and Forest Types in Lebanon:
Regato, P. and F. Asmar. 2011. Expert Report for the “Development of a Project Proposal for a National Reforestation Programme in Lebanon.” Lebanese Ministry of Agriculture/FAO.