

PREDICTION OF TREE COVERAGE ACROSS UNITED STATES USING ARTIFICIAL NEURAL NETWORKS

Shivam S. Bhatia¹ and C. Vipulanandan¹, Ph.D., P.E.

Texas Hurricane Center for Innovative Technology (THC-IT)

Department of Civil and Environmental Engineering

University of Houston, Houston, Texas 77204-4003

Email: cvipulanandan@uh.edu Phone: (713) 743-4278

Abstract:

The importance of forests and green lands in the development of human race needs no evidence; due to their ecological, social and economic benefits. About 33.9% of total land area of United States is forest land. However, the distribution of tree cover varies across all the states in United States. The purpose of this study is to provide an overview on the current status of America's forests and determining their trend by using Artificial Neural Networks with different numbers of hidden layers.

1. INTRODUCTION: Some historians say that when Europeans first came to America, the forests were so dense and lush that a squirrel could have travelled from Atlantic coast to Mississippi without ever touching the ground. But since then these once-lush forests have thinned out due to various natural calamities and man-made activities (Yin 2007). Besides providing aesthetic view, forests provide a range of essential benefits such as improved air and water quality, diverse wildlife habitat, prevents soil erosion and aid noise pollution. The importance of forests extends well beyond the cities and towns where they are located (Yin 2007).

As per the statistics of Food and Agricultural Organization, in a period of last ten years, percent of land area covered with forests had increased from 33.2% to 33.93%. However, there's also a formidable trend in deforestation such that United States has experienced a tree cover loss of about 8 million hectares in last ten years (Seymor 2018). The care and management of these forests are complicated due to natural and social factors such as: wildfires, natural catastrophic events, climate change, lack of adequate management etc. As urbanization continues, these challenges are likely to increase, and new ones might emerge (Nowak 2010).

Researchers are now focused on new metric named "forest attrition distance"; this reflects on removal of isolated forest patches. When these patches are lost, adjacent forest become farther apart, potentially affecting bio-diversity, local climate and many other ecological conditions. Between 1992 and 2001, the average distance between forests increased by about one-third of a mile (Yang and Mountrakis 2017).

2. OBJECTIVE: The overall objective is to provide an overview on the forest cover of all the states of United States and determine their trend using Artificial Neural Networks.

3. LITERATURE REVIEW: Data regarding tree cover area of all the states in United States was collected since 2011 till 2018. States having the biggest gain and biggest losses in tree cover were then

analyzed on percentage basis with respect to the total land area of respective state. Artificial Neural Networks was then used to predict the trend of each state and determine the most accurate trend by using different number of hidden layers. Accuracy of the trends was decided on the basis of Root Mean Square Error.

4. RESULTS AND DISCUSSIONS: As per the statistics provided by Global Forest Watch (GFW), tree cover since 2011 has increased in 41 states with most increment being observed in states of Florida and Mississippi of about 4.06% and 3.41% respectively. However, biggest losses were observed in state of Texas and Wyoming by about 4.34% and 3.7% respectively.

All these losses can be attributed to the factors including urbanization, natural ageing and other natural calamities. For instance; Hurricane Katrina knocked out about one third of tree shade in New Orleans whereas nearly a thousand trees were killed due to insect damage in Detroit – a city located in the Midwestern part of Michigan.

Artificial Neural Networks provided nearly accurate prediction with the values of RMSE being as low as 0.1128 for the state of Delaware. Also, it was seen that three hidden layers predicted better results for 15 states whereas four number of hidden layers predicted better results for 10 states.

5. CONCLUSION: Based on the study, we can say that tree cover preservation is a major concern since, most of the current forest cover is a result of reforestation instead of preserving the old forests. Also, Artificial Neural Networks can be used as a potential tool to predict the future studies.

6. ACKNOWLEDGEMENTS: This study was supported by the Center for Innovative Grouting Materials and Technology (CIGMAT) and Texas Hurricane Center for Innovative Technology (THC-IT), University of Houston, Houston.

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