Spatial Distribution Analysis on Hot Spot of Forest Carbon Considering Forest Structure

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1 Introduction

In order to acquire higher reliability, spatially explicit quantification of carbon stock based on IPCC GPG tier 3 is needed. But existing forest statistics has limit for interpretation of spatial distribution of forest carbon because it is aggregated by administrative unit. Also an exploration of spatial cluster for high forest carbon is needed for effective forest management plan. In this study, to solve these problems we produced forest carbon map and explored carbon hot spot based on Getis-Ord Gi* statistics considering forest structure such as forest origin, forest type, age, DBH(diameter at breast height) and crown density.

2 Methods

In order to upscale forest carbon from plot into landscape level, forest stand variables compatible with attributes of forest type map were extracted from NFI data and used to develop AGB(aboveground biomass) regression models by species. Dominant height and crown density were used as explanatory variables of AGB regression models. Spatial distribution of AGB was estimated by AGB regression models by species which were combined with stand height map that was developed using forest type map and height regression models. Then AGB was converted to carbon stocks using CF(carbon fraction of dry matter) 0.5. Paired T-test for 117 plots was used to test mean difference of carbon between existing method based on national forest inventory data alone and spatial modeling method suggested by this study. Finally, we explored hot spot that was clustered with high forest carbon stocks using Getis-Ord Gi* spatial statistic. The standardized Gi*(d) is defined as

$$G_i^*(d) = \frac{\sum_j w_{ij}(d)x_j - W_i^*\bar{x}}{s\{[(nS_{1i}^*) - W_i^{*2}]/(n-1)\}^{1/2}}, \quad \text{all } j.$$

Where *wij(d)* is a symmetric one/zero spatial weight matrix with ones for all links defined as being within distance d of a given *i; W_i^*= Wi + wii, S^*_{1i} = $\sum_j w_{ij}^2$* (all *j*). $\bar{x}$ and s^2 denote the usual sample mean and variance.

3 Results

Mean carbon per hectare from this spatial modeling was 52.24 tonC/ha and same statistic from existing forest statistical method was 52.79 tocC/ha. These means were not significantly different at p=0.05 using paired t-test. Hot spot above 2.58 standard deviation was distributed in east of Danyang county, Korea. Most of hot spot consists of natural forests(88.42%). Major forest type of hot spot was broad leaved forests(57.79%). Major age, DBH and density class of hot spot were 30~50yrs(69.47%), above medium DBH class(98.74%) and high density class(73.55%).

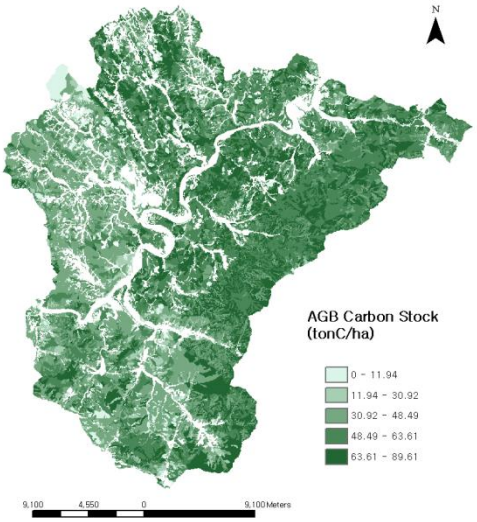

Fig. 1 Forest carbon map of Danyang county

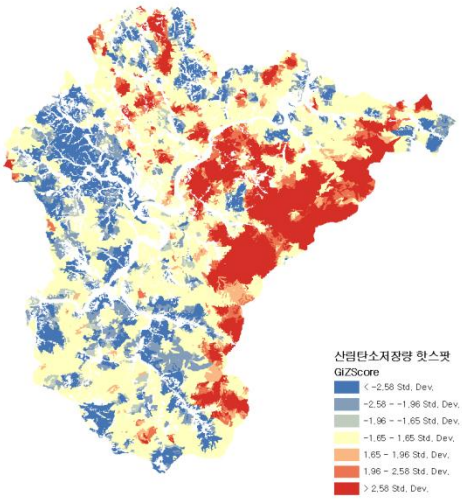

Fig. 2 Hot Spot of Forest carbon

References

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