Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title:	**Spatiotemporal changes in carbon turnover time and its drivers and mechanisms in forests**
Project ID:	143
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PROJECT DESCRIPTION

Forests cover ~33% of the land's surface area and they represent a prominent control on global carbon cycling. The capacity of forests to sequester atmospheric CO_2 in a changing climate depends not only on the response of carbon uptake but also on the simultaneous change in carbon turnover time. Unlike carbon uptake, spatiotemporal trends of carbon turnover time remain poorly studied and we lack a basic understanding of the dominant drivers and mechanisms governing carbon turnover times across landscapes. This constrains our capability to predict future changes of the forest carbon sink and its feedbacks to climate. Our previous project shows that there was pervasive decrease of carbon turnover time in multiple forest biomes. In this proposed project, we would aim: 1) compile more datasets include the data from ICP to generate a global map of spatial and temporal trends of carbon turnover time; 2) study the drivers and mechanisms underlying the spatial and temporal trends of carbon turnover time.

The data we would need would meet the following standards: (1) all plots had at least three consecutive censuses spanning more than 10 years. (2) Plots were natural forest stands that have not been disturbed by fires, tree cutting, flood, avalanche, or other manmade damage. (3) As a general rule, plots had records of individuals of trees with a certain size and its status (i.e., dead, live, or recruited) and these individuals were clearly marked and repeatedly measured.

To be specific, the dataset we would need include longitude and altitude of each site (plot), forest age (if possible).
In each plot, we would need species, diameter at breast height (DBH) of each individual, tree height (aboveground biomass if available), tree status (dead or alive, or new recruits), crown conditions (also dead or alive, new recruits).

This proposed project will quantify vegetation carbon residence time (τ) across forest biomes using a dynamic approach (*1*) where changing vegetation carbon stock (dCS) over time (dt) is determined by changes in net primary productivity (NPP) and the residence time of carbon in living vegetation,

$$\frac{dCS}{dt} = NPP - \frac{CS}{\tau} \quad (1)$$

where NPP include the biomass increase from recruitment (new trees) and surviving trees.

Using this dataset, we would like to test the hypothesis that there is pervasive decrease of carbon turnover time across forest biomes using linear mixed model which accounts for random effects of each plot.