Quantification of Vegetation Parameters in Fire-Prone Ecosystems in the Netherlands

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Introduction

Similar to the United States, deforestation nearly completely cleared the Netherlands of forests. Since the start of the 19th century afforestation efforts increased the amount of forested land to 10% of the country's total area. Recently there is an increasing concern in the Netherlands about higher risks of wildfire due to warmer and drier climates in northeastern Europe. These effects have heightened the need for a more efficient way to estimate fuel loads, especially in nonforested covertypes where structural complexity can complicate fuel load estimations. A more streamlined approach to measuring fuel loads may provide natural resource managers with the ability to mitigate wildfire risks as climate conditions continue to change.

The goal of this research is to determine a more efficient method of measuring biomass fuels using data collected over a period of five years (2012-2017) in the Netherlands by students from Stephen F. Austin State University in Nacogdoches, Texas. Objectives are to synthesize collected data and organize it, then analyze it using regression techniques to determine which variables are most related to estimating fuel loads.

Methods

Different covertypes were measured each year, with most sites located in the Netherlands:

- **2012:** Forested Veluwe region: Douglas-fir, Scots pine, Beech, grassland, and heather
- **2013:** Dune ecosystems: (grassland, heather, valley, and open) on Texel Island and the mainland coast dune region
- **2014:** Peat ecosystems: (bog, heather, shrub, and forest) in Northumberland National Park in the United Kingdom
- **2015:** Drunense dunes: (area of dunes with little to no overstory), dune forest, peat forest, and beech forest in the province of North Brabant
- **2016:** Conifer covertypes: Black pine, Douglas-fir, and Scots pine. Additionally surface area volume (SAV) measurements were taken in grassland, heather, and Scots pine ecosystems
- **2017:** Surface fuels: Grassland, heather, open dune, and dune grassland. SAV measurements were also taken at these sites

Figure 1. A) Establishing transect lines in a Scots pine plot. **B)** Separated live/dead foliage and stem clippings to be used for SAV measurements. **C)** Shrub clippings laid out on a grid for SAV measurement. **D)** Basal diameter being measured with a digital caliper.

Important Parameters

Table 1. Many vegetation measurements were taken over the years, but not all of them are relevant to estimating fuel loads. These variables are the most likely parameters to determine biomass fuel loading following regression analysis of data.

	Important parameters			
Year	**Trees**	**Shrubs**	**Grasses**	**Litter**
2012	Diameter at breast height (cm), Total height (m)	Basal diameter (cm), Density (%), Height (cm)	Wet/dry weights (g), Line intercept	Litter/duff depths (cm), Bulk density (g/cm³)
2013	_	Basal diameter (cm), Density (%), Height (m)	Line intercept, Herbaceous density (%)	Litter/duff depths (cm)
2014	DBH (cm), Total height (m)	Basal diameter (cm), Density (%), Height (m)	Line intercept, Herbaceous density (%)	Litter/duff depths (cm)
2015	DBH (cm), Total height (m)	Basal diameter (cm), Density (%), Height (m)	Line intercept	Litter/duff depths (cm), Bulk density (g/cm³)
2016	DBH (cm), Total height (m)	Basal diameter (cm), Density (%), Height (m), Surface area volume	Line intercept	Litter/duff depths (cm)
2017	DBH (cm), Total height (m)	Basal diameter (cm), Density (%), Height (m), Surface area volume	Line intercept	Litter/duff depths (cm)

Figure 2. E) Measuring grass heights with a vinyl tape in a dune plot. **F)** Transect lines established in a grassland plot. **G)** Measuring transect lines in a heather plot. **H)** Shrub widths measured with a vinyl tape in a grassland.

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