Forest Inventory and Analysis
Vegetation Indicator

FIA Fact Sheet Series

The Vegetation Indicator is a set of variables collected on the Phase 3 (forest health) FIA plots. It is designed to assess the type, abundance, and spatial arrangement of all trees, shrubs, herbs, grasses, ferns, and fern allies (horsetails and club mosses) occurring on the plots.

Measuring vegetation allows us to report on the relative diversity of both native and introduced species. Information about the abundance and arrangement of species (structure) allows us to classify plots into community types. By remeasuring plots over time, we can monitor for change outside expected rates.

Why is the Vegetation Indicator Important? Information about forest vegetation diversity and structure can be used to:

- Examine which forest types are most prone to invasion by non-native species.
- Determine which states, ecoregions, and forest types are most diverse or contain unique species.
- Assess tree diversity on a plot more thoroughly than P2 measurements allow. Among other things, this allows us to predict succession on a plot.

The Vegetation Indicator also provides data to classify plot vegetation into community types.

- Forest community types based on both overstory and understory plant species are highly correlated with ecosystem properties, such as productivity, response to disturbance, and use by wildlife.
- This may allow us to extrapolate other forest health indicator results to broader areas than the plots themselves, and with more accuracy than by forest cover type.

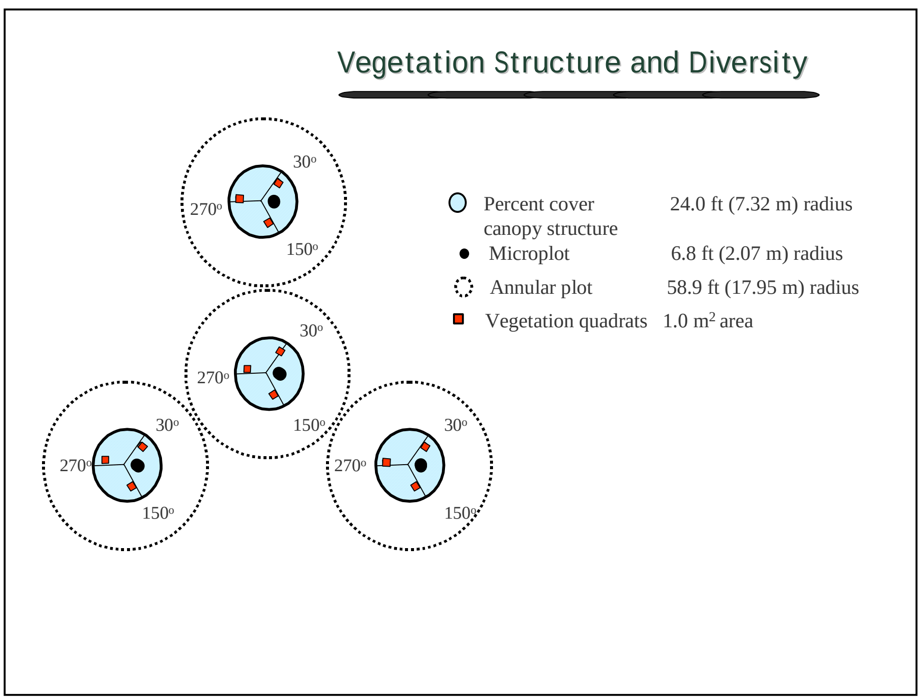
With remeasurement, we can:

- Assess trends over time in relation to other forest health indicators.
- Examine forest communities' resistance to and resiliency following disturbance.
- Provide an early warning indicator of forest response to stresses like pollution, certain land uses, and disturbance events.

How is the Vegetation Indicator Measured? The Vegetation Indicator is measured using a multiple-scale nested approach.

All vascular plants are identified and quantified on three permanently positioned $1m^2$ quadrats on each subplot, and on each of the four subplots. The general characteristics of the forest floor, such as litter, moss, bare ground, and rocks are also recorded for each quadrat. For each species on the subplot, cover is estimated and the vertical layer where the majority of the foliage occurs is recorded. Unknown species are collected near the plot, then pressed, dried, labeled, and mailed to a qualified herbarium for identification.

Vegetation measurements are made by experienced botanists who complete a thorough training course and are certified for the indicator. Field audits are conducted to improve data quality and minimize errors.



Where and When is Vegetation Measured? The Vegetation Indicator is measured on Phase 3 plots, which are a subset of the Phase 2 plots. There is one Phase 3 plot for every 16 Phase 2 plots (one Phase 3 plot per 96,000 acres of forest). FIA field personnel collect vegetation data during the "leaf-on" field season, which generally begins in early June and ends in early September.

Are There any Special Concerns When Measuring Vegetation? Conditions that can hinder or slow vegetation measurements include: (1) poor weather conditions such as gusting wind, heavy rain, and dark, overcast skies; (2) steep and/or unstable slopes; (3) dense and diverse vegetation; (4) plants in early or late stages of growth and maturity and ephemeral species that only appear for a short time in the growing season and (5) a dense mid-layer canopy directly overhead that obscures full view of taller vegetation. These effects are minimized by careful, thorough training and strict adherence to the data collection procedures.

How can Vegetation Data be Analyzed? We can analyze vegetation data and report on relative diversity, structure, and changes on the permanent plots we monitor. We can classify the Phase 3 plots by plant community types and then use these to stratify results of other forest health indicators.

Diversity: Diversity measures incorporate two distinct components 1) the total number of species (species richness) and 2) a measure of evenness (the distribution of abundance).

We can use several measures to express species richness, including:

- Alpha diversity (α) is simply the number of species within a sampling unit (plot).
- Overall or gamma (γ) diversity, the total number of species documented on all plots within a reporting area (ecoregion or state, for example).
- Beta diversity ($\beta = \gamma$/mean α) is a measure of species heterogeneity across a region or reporting area, or a representation of the number of distinct communities present.

By reporting the various scales of richness, we can better describe the distribution of species within a reporting area. We can aggregate plots in similar geographic areas, forest community types, or other meaningful ecological strata to assess trends and determine if more intensive investigation is required.

Structure*:* Structure can be summarized for each forest type group as mean cover of life form in each vertical layer. Abundance and spatial arrangement of plant species on a plot also provides the information so that the vegetation can be classified according to locally developed community types.

Change Detection: The nested sampling design allows us to assess changes in frequency. Cover alone can be influenced by seasonal moisture, phenology, and observer bias. Using frequency, analysts can more reliably assess distribution and changes in distribution over time than by using differences in cover alone**.**

Are Related Data Sets Used? Vegetation structure data, along with other Phase 2 and 3 variables (slope, elevation, aspect, soil texture, down woody debris, stand age, etc.) can be used to describe the habitat type (potential) of plots. Community types describe existing vegetation, whereas habitat types describe potential vegetation (potential climax community).

There are many questions that cross-analyses between indicators and Phase 2 variables can address. A few examples are:

- Do site conditions on a particular plot correlate to the forests' resistance or resilience to disturbance?
- How does vascular plant diversity of the plot compare to lichen diversity?
- Are changes in crown conditions reflected in changes to understory vegetation?
- Do the number of ozone sensitive plants and relative cover on a plot change over time?
- What is the relative diversity of native and introduced species in areas defined by high ozone damage, or air pollutant gradients determined by lichen diversity models?
- What are the fuel profiles generated from down woody debris and vegetation structure variables by community type?

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- See our "FIA Contacts" Fact Sheet