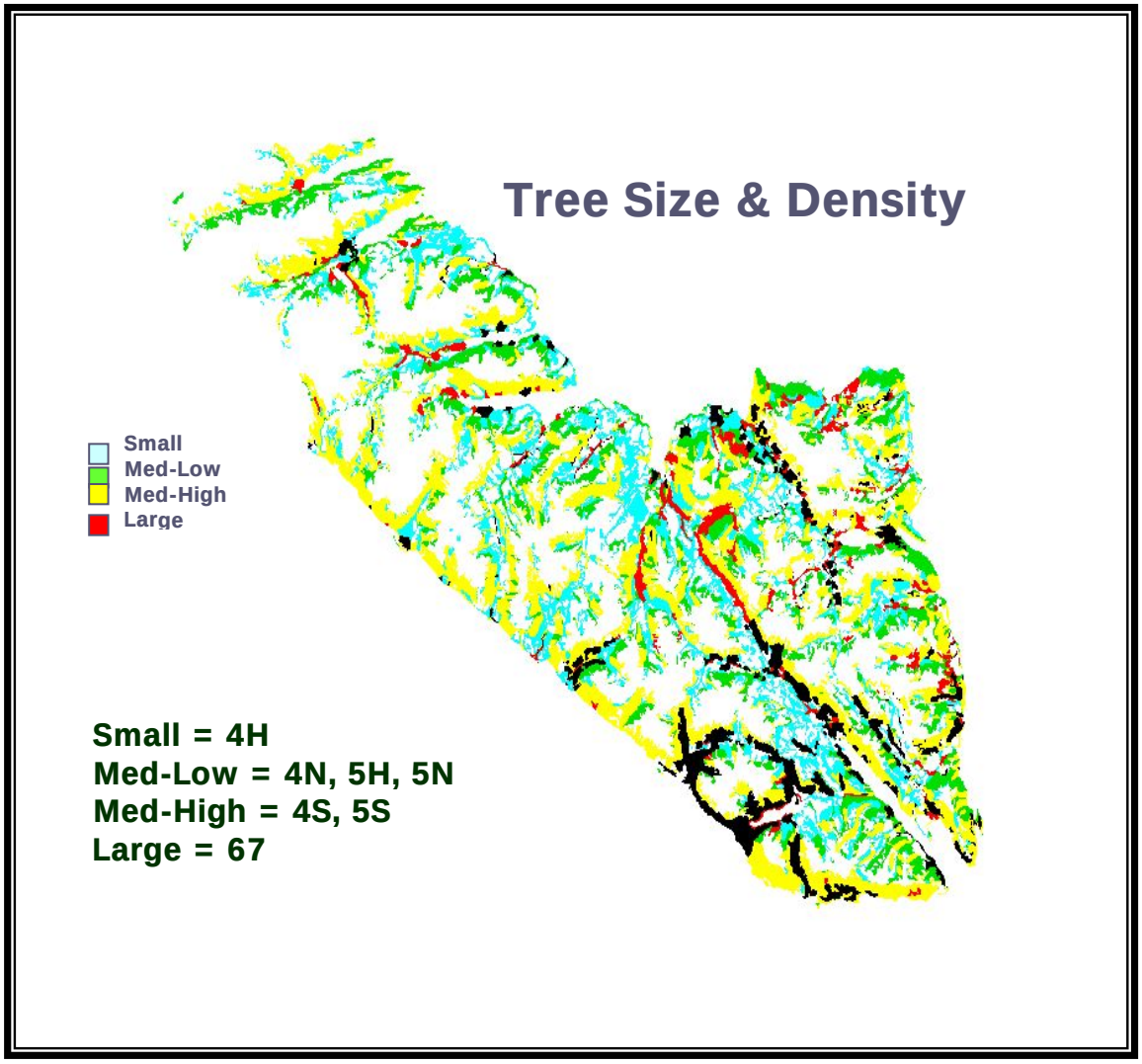
Tongass N.F. Size-Density Model:
Forest and Project Planning Applications



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Executive Summary

This document describes how the Size-Density model (SDM) was developed for the Tongass National Forest (NF), how it was used in the Tongass Land and Resource Management Plan Final Environmental Impact Statement - Final Amendment (2008), and how it may be used in project planning and analysis, both now and in the future.

The SDM is a recently developed forest-mapping model. The model uses average tree size (quadratic mean diameter) and average tree density (stand density index) to describe productive old-growth (POG) forest stand structure (Caouette and DeGayner 2008). The output product from the model is a GIS polygon cover that delineates up to seven different classes of tree sizes and densities within POG forest. This GIS cover is now referred to as SIZE_DENSITY and is located in the Tongass NF (tnf) library. This data was used in the analysis for the FEIS.

The SDM was developed to better differentiate old-growth forest types than the previously used timber volume from the 1980s timber type GIS layer (Existing_Veg). Tree size and density measures based on stand structure associated with stand age and site conditions, were used to better discriminate differences in forest structure.

This paper describes the background of the model, its development and critical data elements, including timber type, soil type and aspect. The paper further describes how the Forest Plan Amendment uses SIZE_DENSITY in analysis of several resources in the 2008 FEIS. The amended Plan uses the model to describe and analyze the overall forested vegetation types, biodiversity, timber resources, and wildlife habitat. The model was also used in the deer model, for Management Indicator Species (MIS) analysis and for a detailed logging system and transportation analysis (LSTA).

Application of the Size-Density model in project planning is discussed, but not strictly defined in this paper. The *Legacy Forest Structure s*tandard and guideline is one of many areas where future application of SIZE_DENSITY will be used for project analysis. It is recommended that project plans display resource information in similar ways to the FEIS to allow for reference and comparison of project-level conditions vs. forest-level conditions. In addition, the resource specialist has the opportunity to use this information for any number of applications, including correlation analysis of resource conditions and trends related to size density classes. Vegetation structure is not only a descriptive tool for the existing condition of a landscape, it provides a quantative measure of stand size and density which may prove meaningful to our understanding of ecosystem functions, habitat requirements and their implications to our management.

At this time, the Tongass NF GIS group, in consultation with timber, silviculture, ecology and wildlife, are formulating the update process for all vegetation information. This process will be outlined in a separate paper. Related to this is the development of new vegetation map products and analytical tools using plot data, both within the Region and the Forest. At this time, several products are in development and may, in the future, provide better and more accurate vegetation information to Forest users. For now, SIZE_DENSITY is our best available information for vegetation structure on the Tongass National Forest.

1.0 Introduction

This document describes how the Size-Density model (SDM) was developed for the Tongass National Forest (NF), how it was used in the Tongass Land and Resource Management Plan Final Environmental Impact Statement - Final Amendment (2008) (referred to as the FEIS), and how it may be used in project planning and analysis, both now and in the future.

This document will also briefly address maintenance and updating vegetation data used as input to SDM. While these are important elements in any resource inventory, model, and/or database management system, we still have some work to do on developing the process for vegetation information in general.

2.0 Overview of Size-Density Model (SDM)

The SDM is a recently developed forest-mapping model. The model uses average tree size (quadratic mean diameter) and average tree density (stand density index) to describe productive old-growth (POG) forest stand structure (Caouette and DeGayner 2008). The output product from the model is a GIS polygon cover that delineates up to seven different classes of tree sizes and densities within POG forest. This GIS cover is now referred to as SIZE_DENSITY and is located in the Tongass NF (tnf) library. This data was used in the analysis for the FEIS.

The SDM was developed to better differentiate old-growth forest types than the previously used timber volume from the 1980s timber type GIS layer (Existing_Veg). Tree size and density measures based on stand structure associated with stand age and site conditions, were used to better discriminate differences in forest structure.

A consistent problem with using timber volume in past forest and project planning was that there was no statistical difference among volume classes 5, 6 and 7 with respect to mean board feet per acre and therefore should not be used to determine volume per acre (Brickell 1989, Caouette an) or stand structure. An interim strategy to address this problem during the 1997 Forest Plan Revision was the creation of the three volume strata (Julin, K. R., and Caouette, J. P. 1997). These strata were derived from intersecting the timber volume classes (from Existing_Veg) with soil information (hydric and non-hydric from CLU) and slope information to create the three volume strata (high, medium and low) (Caouette and DeGayner 2005). Since that time, this approach was further refined and strengthened by the creation of SDM, which included even more variables, such as aspect and landscape position. These variables are correlated to overall site quality and as such, are effective measures of stand size and density.

SDM represents the best available information for quantifying and portraying structural patterns across the old-growth portions on the Tongass N.F (Caouette and DeGayner 2008). Such information is more applicable for assessing conservation of biodiversity, estimating timber values and developing wildlife habitat models than using timber volume. Unlike the Existing_Veg layer, SDM includes statistical reliability due to the accuracy assessment that was conducted during model development.

SDM was developed to improve forest management and analysis in applications related to timber economics, wildlife habitat and conservation of diversity. Further, is intended to help in addressing conservation concerns on the Forest by showing differences in representation of individual mapping classes between a landscape and a management-defined subset of that landscape (Caouette and DeGayner 2008). The model has many potential applications for forest and project-level planning - most of which have yet to be developed. The polygon cover (SIZE_DENSITY) is simply a tool for forest managers and resource specialists, providing a classification system (structural classes) to use for analysis questions related to two specific vegetation attributes: tree size and tree density. These attributes have been shown to be important

metrics in addressing a multitude of Forest Service business needs (Brohman et. al 2005). Indeed, tree size (quadratic mean diameter of all live dominant and co-dominant trees) and tree densities (expressed as total canopy cover) are structural attributes used as a national standard for mapping vegetation (Brohman et al. 2005).

The FEIS used SDM for several analysis applications, which are described in the sections below. There are many more analysis opportunities that have not yet been pursued, but will be in the near future.

3.0 Background of the model

The SDM uses our most current existing vegetation, soils and aspect GIS layers to produce a map delineating seven tree size and density classes. The baseline cover for much of the modeling effort is the 1980s Tongass timber type map. The mapping model was created by intersecting selected attributes from these layers, namely, timber volume class 4, 5, 6 and 7 derived from CoverType map (previously known as TIMTYP, TIM86 and Existing_Veg), hydric soil class (H) from the soil resource inventory (previously known as CLU), and North (N) and South (S) aspect classes derived from DEMs. For wilderness areas where soil inventory data was lacking, the model used the National Wetland Inventory (NWI) for identification of hydric soils. These attributes were correlated with the stand density index and mean quadratic diameter to derive the various SDM classes.

4.0 Use of the Size-Density Model in the 2008 FEIS

The FEIS was the first opportunity to use the seven size-density classes created by the SDM since the 1997 Tongass National Forest Land Management Plan Revision. For a thorough discussion of the model, the seven structural classes and their use in the 2008 FEIS, please refer to the *Biodiversity* section, pages 3-139 to 3-170. Pages 3-141 and 3-142 provide an excellent description of each SD class and illustrate the most probable forest type based on landform and forest condition (Figure 3.9-4). The model is also mentioned in many other sections of the FEIS, including *Timber* (pages 3-326 through 3-327), *Wildlife* (pages 3-219 through 3-292), and *Appendix B - Modeling and Analysis.*

The administrative record also contains descriptions of the model including the following:

- Overview of SDM
- Updates made to the model during the planning process
- The final SD model
- Collapsing the model into four classes
- Collapsing the model into three volume strata
- Using the model for inventory purposes
- Using the model for conservation of biodiversity
- Using the model for wildlife habitat

A summary of some of these key areas where SIZE_DENSITY was used in the FEIS are presented below.

4.1 Vegetation Inventory

Existing vegetation is defined as the plant cover, or floristic composition and vegetation structure, occurring at a given location at the current time (Brohman et al. 2005). Vegetation inventories include the components of vegetation cover and structure. For National Forest System (NFS) lands, two separate polygon layers delineating existing vegetation information from the Tongass GIS library were used in the FEIS.

Vegetation Structure

The SDM uses tree size and density measures based on stand structure associated with stand age and site conditions to define differences in forest structure. The output product from the model is a GIS polygon layer, SIZE_DENSITY that delineates up to seven different classes of tree sizes and densities within POG forest. The SIZE_DENSITY polygons represent existing POG as well as young-growth stands that may or may not have originated as POG. This layer provides the data used for the forest's corporate vegetation structure map.

SIZE_DENSITY delineates POG into seven classes (see above) and delineates young growth forest into six classes.
The class labels help identify those spatial data attributes used to create them (Caouette and DeGayner, 2008).

POG classes:

- SD4H: Volume class 4 on hydric soils
- SD4N: Volume class 4 on non-hydric soils, north aspect or flat
- SD4S: Volume class 4 on non-hydric soils, not north aspect or flat
- SD5H: Volume class 5 on hydric soils
- SD5N: Volume class 5 on non-hydric soils, north aspect or flat
- SD5S: Volume class 5 on non-hydric soils, not north aspect or flat
- SD67: Volume classes 6 and 7

Young-growth classes depend on the approximate age and origin of the stand and are defined as follows:

- Natural young growth originating from blowdown or other natural disturbances:
  - S1 - size class = 1
  - S2 - size class = 2
  - S3 - size class = 3
- Other young-growth growth originating from time harvest:
  - HS1 - cut age less than or equal to 20
  - HS2 - cut age greater than 20 and less than or equal to 50
  - HS3 - cut age greater than 50

In the FEIS, analysis of POG was used to help evaluate the level of disproportionate past harvest. Original POG is defined in the FEIS as the POG that existed prior to all mapped timber harvest. Therefore, all young growth originating from timber harvest was assumed to be original POG. Natural young growth was assumed to be in a steady state of succession and replacement; therefore it was not assumed to be original POG.

To address the levels of harvest and compare these to existing POG, the seven size density classes were collapsed into three classes of POG:

1. Total POG = SD4S, SD4N, SD4H, SD5S, SD5N, SD5H, SD67 (all productive old-growth)
2. High volume POG = SD5S, SD5N, SD67 (the three SD types that represent the highest volume stratum)
3. Large tree POG = SD67 (this class represents the most productive of the POG types and typically contains the highest density of large trees).

Vegetation Composition (Cover Type)

Vegetation composition is defined as the amount or proportion of the plant species on a given area (Brohman 2005). The Tongass NF describes vegetation composition based on dominant cover type which is derived from the 1980s timber type map. Cover type is a designation based on the plant species forming a plurality of composition in a given area, e.g. Sitka spruce or Western hemlock (Brohman et. al, 2005). Historically, the Tongass NF has used the TIMTYP, Tim86 and most recently, Existing_Veg data layers for cover type information. Because Existing_Veg is essentially a cover type map containing attributes describing the dominant and co-dominant overstory species, we have recently changed the name of this layer in GIS to CoverType. CoverType has been and remains today the GIS layer used to document changes in existing vegetation, namely attributing stands that have been cut over. Indeed, CoverType is an existing vegetation map defining all vegetation types and their corresponding successional stages (defined by cut age and stand size class). This layer is located in the tnf GIS library. CoverType[1] includes both productive and unproductive forest lands, as well as non forest lands.

Species composition, or cover type, is a broad, large-scale vegetation composition classification system and as such is often less meaningful in wildlife habitat analysis than stand structure. Stand structure is one of the most commonly used factors for determining wildlife habitat in a productive forest stand. However, dominant cover types may provide valuable information on describing habitats for rare plants, biodiversity, timber products (such as music wood or cultural wood products), or simply in describing the overall vegetation types found in a given area.

In summary, the overall vegetation inventory on the Tongass NF is represented in two separate GIS covers (CoverType and SIZE_DENSITY). Since there is overlap between structural classes and cover types, it is best to keep these two layers separate, although they may be used together for analysis purposes (for example, show all SD4S Western hemlock types). Structural information in SDM is provided for only the POG portion of the Forest and is therefore a subset of the total vegetation inventory. The unproductive forest (Forest types less than 8,000 board feet per acre, canopy cover < 10%) and the non-forest lands that includes sparsely vegetated areas of shrub and herbaceous types (e.g., muskegs, alpine, estuaries), non-vegetated areas (e.g., snow, rock, ice), and aquatic sites (e.g., streams, ponds, and lakes) do not contain vegetation structural information. SIZE_DENSITY labels the non-POG land areas as follows:

- NF - non-forest
- UF - unproductive forest
- FM - forested muskeg

4.2 Biodiversity

Because other habitat types (non-forested and unproductive forest habitats) are fully represented across the Tongass and have not changed appreciably from original levels, the old growth ecosystem is the primary focus for the analysis of biological diversity in the FEIS. In addition, elevation zones are described and the acreages for these components are divided between the productive and unproductive old growth. The biodiversity section of the FEIS displayed the following:

1. Forest-wide distribution of POG Forest:
    - Total acres for each size-density class
    - Total acres POG = SD4S + SD4N + SD4H +SD5S + SD5N + SD5H + SD67
    - Total acres of High Volume POG = SD5S +SD5N + SD67
    - Total acres of Large Tree POG = SD67

[1] See Appendix B for data dictionary for CoverType.

2. Old-Growth Distribution by Elevation:
   a. Elevation categories: less than 800 feet, 800 to 1,500 feet and greater than 1,500 feet
   b. Total acres POG = SD4S + SD4N + SD4H +SD5S + SD5N + SD5H + SD67 for each elevation zone
   c. Total acres unproductive old-growth (UF) by elevation zones
   d. Total Old Growth = (b) + (c)

3. Old-Growth Forest distribution by Ecological subsection and SDM Class: See FEIS pages 3-143 through 3-147

4. Past Old-Growth: Historical harvest acres stratified into NFS and Non-NFS lands were then further stratified into five classes for each Biogeographic Province. Acres of original POG and percent of original POG remaining are displayed in Table 3.9-7 of FEIS (page 3-147).

- Total POG
- High volume POG
- High volume, low elevation POG (<800 feet)
- Large Tree POG
- Large Tree, low elevation POG (<800 feet)

4.3 Timber

As mentioned in Section 2.0, the 1997 Forest Plan Revision used volume strata to assign timber volume to lands currently supporting old-growth forests. This was an interim strategy for better differentiating forest structure associated with stand age and site conditions than timber volume classes 4, 5, 6 and 7. Statistical analysis indicated that three strata could be distinguished for the available forest lands using the 1980s timber type map along with information on soils and slopes. In the development of SDM, these strata were redefined using improved information on hydric soils and aspect. The current SIZE_DENSITY cover provides the same three redefined volume strata classes (high, medium and low) and were used in the FEIS to model timber outputs for analysis. While the three-stratum approach is useful for estimating timber volume for forest planning purposes, it is not a good tool for identifying other important forest elements, including forest structure, ecosystem diversity and wildlife habitat.

Some of the differences between the volume strata classes derived in 1997 Forest Plan model vs. from SDM are the following:

- The SDM classifies all volume class 6 and 7 as high volume, whereas the 1997 Plan model classified only the non-hydric volume class 6 and 7 as high volume (hydric volume class 6 and 7 was classified as medium volume)[2].
- SDM can separate out large-tree POG (SD67) whereas 1997 volume strata could not. This vegetation type is limited in its Forest-wide distribution and therefore important to track.
- SDM does a better job separating out the differences in productivity within the same volume class. For example, Volume class 5 can be grouped into high volume POG (SD5S and SD5N) and medium volume POG (SD5H). As well, volume class 4 can be grouped into medium volume POG (SD4S and SD4N) and low volume POG (SD4H).
- The SDM uses up-to-date soils lookup tables. The 1997 model used older lookup tables. There have been many changes in the hydric/non-hydric calls in the soils lookup table since 1997.

[2] The basis for this was the assumption that the volume class 6 and 7 occurring on hydric soil was due to error in overlap between coverage layers. There were/are positional and classification errors, and most of the instances where "hydric" soils overlay VOLC 6 and 7 appear to be "slivers" due to either or both types of errors.

- The SDM includes National Wetland Inventory (NWI) information for those portions of the Forest where soils were not mapped (wilderness areas). This provides more information on POG with hydric soils that were not mapped by the soil resource inventory.

Table 1 displays a cross-walk between the three vegetative classifications for POG forest. A comparison of SD classes (SIZE_DENSITY), the four volume classes (Existing_veg) from the 1997 Forest Plan and the three volume strata (Vol_strat) approach used in the 1997 Forest Plan are shown in Figure 3.9-5 (page 3-142).

Table 1. Cross walk between Existing_veg and SIZE_DENSITY volume strata.

Vol strata class	**Existing_Veg (1997)**	**SIZE_DENSITY (2008)**
High	Volume class = 5 and non-hydric 6, & 7	SD67, SD5N, SD5S
Medium	Volume class = 4 & 5 and hydric 6 & 7	SD5H, SD4S, SD4N
Low	Volume class = 4	SD4H

SIZE_DENSITY also has the ability to nest the seven SD classes into four tree size and density classes (as seen on the GIS map on the front of this document). One advantage of the four class model is that the size and density labels are directly measurable on the ground. These classes include the following:

- Small = SD4H
- Med-Low = SD4N, SD5H, SD5N
- Med-High = SD4S, SD5S
- Large = SD67

Extensive inventory data collected by the PNW Research Station, FIA program from 1995 to 2001 were used to estimate average timber stand characteristics for mapping classes in the SDM. Estimated stand characteristics are mean (quadratic) tree diameter, and per acre values for number of trees, basal area, net growing stock volume, defect volume and salvable dead volume. Results are presented as Tongass NF wide averages for four geographic regions: North Islands, South Islands, North Mainland, and South Mainland. These data could be used to estimate timber inventories in specific project areas during Gate I analysis.

4.3.1 Logging Systems and Transportation Analysis - LSTA

A detailed logging system and transportation analysis was completed in 2007 for the FEIS. The LSTA covered all suitable land supporting POG forest and young growth at least 35 years old. POG was based on information derived from SDM.

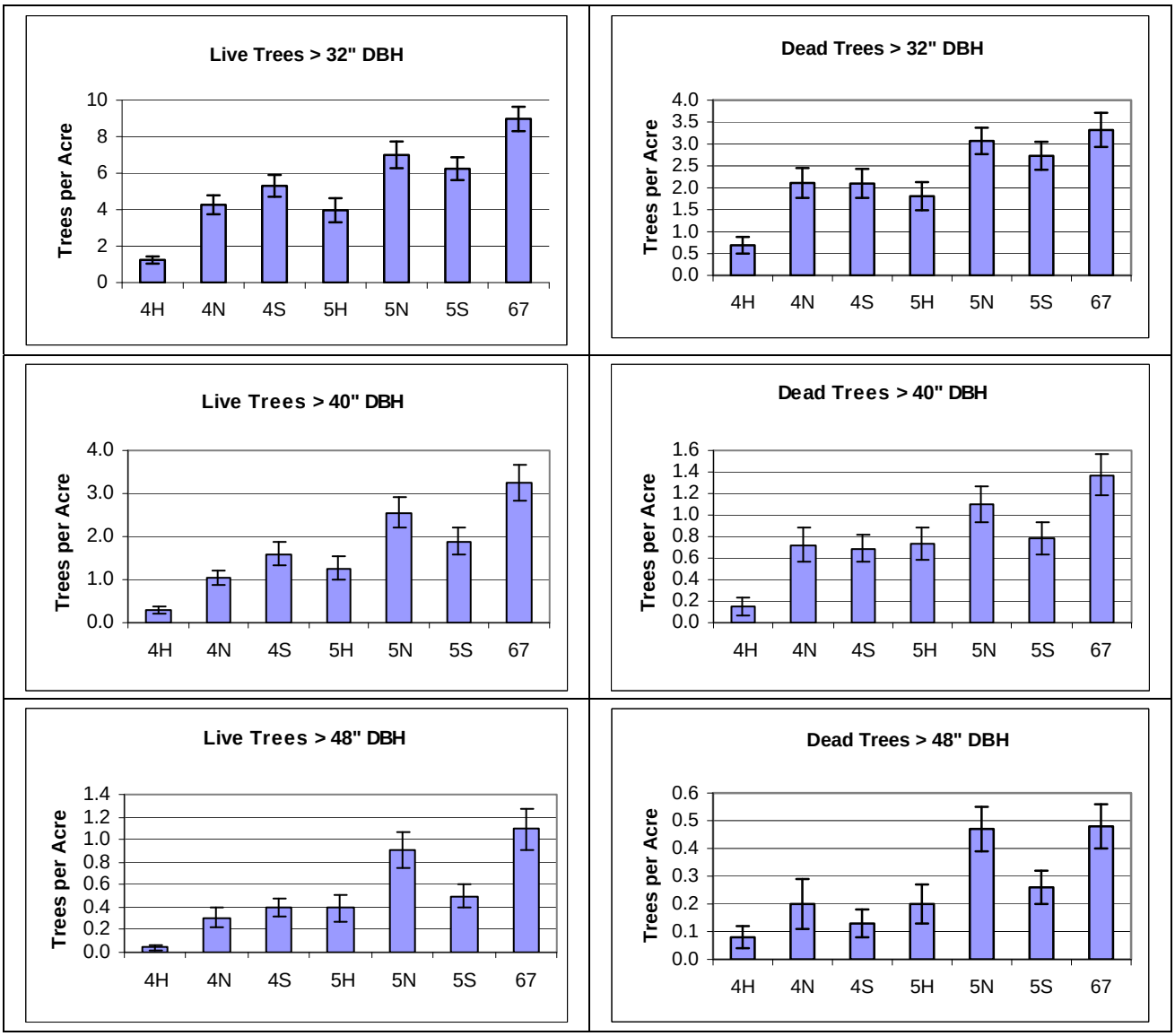
4.4 Wildlife Habitat

Although many wildlife species on the Tongass are associated with more than one habitat type, most forest-dwelling species inhabit old-growth forests or prey on species that inhabit old-growth forests. While the three-volume strata approach for productive old-growth is useful for estimating timber volume for forest planning purposes, it is not as useful for describing other important forest elements, including wildlife habitat. Tree size and densities are considered more applicable for assessing wildlife habitat and in the development of wildlife models. Many of these correlations between SD classes and wildlife habitat have

yet to be analyzed. These information needs/opportunities should be discussed by Wildlife biologists and Forest planners.

The densities of large diameter trees (live and dead) have been one of the most commonly-used factors for determining quality wildlife habitat in a productive forest stand. SDM provide estimates for the density of large-diameter trees for each of the seven mapping classes. For example, classes SD67 and SD5N result in significantly larger densities of the large-diameter trees, whereas class SD4H shows very small densities of large-diameter trees (figure 1).

Figure 1. Average TPA for (per SDM mapping class), for three large-diameter tree classes.



In essence, the wildlife analysis used the standard three classes of POG taken from the biodiversity section (total POG, large tree POG, and high volume POG). These classes were often combined with several elevation categories representing wildlife habitat constraints or opportunities.

The wildlife conservation strategy assessed the percentage of existing POG acreage in wildlife reserves, protected/unscheduled in the matrix, and suitable for timber harvest (see FEIS page 3-258).

The wildlife section of the FEIS is full of references to the SD classes, in particular the use of the three POG classes. Described below are a few of the key areas of analysis where SIZE_DENSITY was used in the wildlife section:

4.4.1 Deer Model

A cross-walk was developed to classify the SD classes into volume strata that are used in the DeGayner deer model's vegetation categories. The seven POG forest size-density classes were collapsed into the three volume strata classes. These are the same as those shown in Table 1 under the section 4.3 - Timber. Here is the vegetation categories used in the deer model:

- High volume stands: SD67, SD5N and SD5S
- Medium volume stands: SD4N, SD4S and SD5H
- Low volume stands: SD4H

4.4.2 Management Indicator Species (MIS)

Table 3.9-4 in the *Biodiversity* section of the FEIS displays the elevational distribution of productive and unproductive old growth on the Tongass, based on different elevation constraints thought important for many of the MIS.

The FEIS used two SD classes to show the relative importance of conifer successional stages as habitats for MIS (page 3-231):

- Low-Medium POG = SD4S, SD4N, SD5H
- High POG = SD5S, SD5N, SD67

4.4.3 Legacy Forest Structure (Standards and Guidelines)

The new legacy structure standard is described in Chapter 4 of the Forest Plan (pages 4-90 through 4-91). This standard states that, "Legacy forest structure shall be representative of the existing old-growth stand characteristics, including age, size class, species composition, and structural components." As such, it is expected that SIZE_DENSITY will be one of the GIS layers used to evaluate existing stand structure for project planning.

5.0 Application of Size-Density Model in Project Planning

Vegetation structure (tree size and densities) are useful forest measurements for multiple applications in forest and project planning. The SDM developed by Caouette and DeGayner created a GIS cover that now allows us to evaluate stand structure. This is considered the best available information for assessing vegetation structure at this time.

How we use this layer in project planning will not be strictly defined at this time. The information provided in section 4.0 points to key areas where the SD classes were used in the FEIS. It is recommended that project plans display resource information in similar ways to the FEIS to allow for reference and comparison of project-level conditions vs. forest-level conditions. In addition, the resource specialist has the opportunity to use this information for any number of applications, including correlation analysis of resource conditions and trends related to size density classes. Vegetation structure is not only a descriptive tool for the existing condition of a landscape, it provides a quantative measure of stand size and density which may prove meaningful to our understanding of ecosystem functions, habitat requirements and their implications to our management.

One of the initial motivations for developing SDM was to track and monitor the conservation of biodiversity. SDM could be used to describe the background composition of forest structure types on any given landscape. Then, one can compare the composition within reserve areas, or timber-harvest units, to the overall composition of the surrounding landscapes. For example, if on a given landscape SIZE_DENSITY may indicate that the old-growth reserves are representative of the overall composition on the landscape, but the timber harvest units are not. Timber harvest units appear to have higher proportions of acres in the SD5H and SD5N classes. If this was a major concern, then we could provide some mitigating strategies using SIZE_DENSITY layer such as: 1) choose the location for small old-growth reserves to include more SD5H and SD5N; 2) choose the selected timber sale alternative to reduce the number of acres in SD5H and SD5N, and 3) choose the location of the future timber sale harvest units so they don't disproportionately harvest areas mapped as SD5H and SD5N.

5.1 Location of SIZE_DENSITY Coverage in GIS

The current SIZE_DENSITY coverage is located in the TNFLIB librarian library. There is SIZE_DENSITY coverage in each of the tiles (e.g. Petersburg, Sitka, Ketchikan, Fanshaw, etc.)
For example, the Prince of Wales tile:

/fsfiles/library/gis/tnf/tnflib/pow/size_density.

In addition, the SIZE_DENSITY coverage is also found on the V-Drive found on the second copy PC. The example below represents the location on the example Prince of Wales tile:

V:\gis\tnf\tnflib\pow\size_density

It is important to note that this cover has undergone a naming revision. In the past, the cover was referred to as Veg_Mod and SD7. Versions of this cover in the tnf library with these earlier names have been replaced by the official cover now called SIZE_DENISTY.

SIZE_DENSITY has enough polygons that it is extremely awkward to use as a single coverage. In the very near future, this polygon cover will reside in Arc SDE 9.2 as a geodatabase. Our plan, which is not yet completed, is to provide the SizeDensity featureclass within the Vegetation featuredataset, along with the CoverType featureclass.

It is important to consider that SIZE_DENSITY is only one data source providing vegetation information. The other is CoverType, which is the corporate data coverage providing vegetation composition information, including stand age and size classes (seedling, sapling and pole) as well as all non-forest classes. Together or separately, these layers may be used for describing and analyzing the vegetation for any given project.

5.2 A note on accuracy

All project plans or other applications requiring the use of stand structure will use the official TNF version of the GIS cover now referred to as SIZE_DENSITY. It is important to consider that this layer contains an inherent accuracy of 70% within the SD classes. This accuracy measure means that any given polygon attributes in the GIS layer is accurate 70% of the time. Conversely, it also contains an inherent inaccuracy; meaning that the other 30% of the time, the polygon attributes (tree size and density) will be inaccurate. With this known accuracy comes the understanding that there will be times when field data may not validate the polygon labels in the GIS layer.

Additionally, we have issues related to accuracy of polygon edges. Usually, we have error in "edge capture", plus some edges are not distinct while others represent sharp breaks in vegetation that coincide with the

classification polygon edge. Some of our accuracy issues extend from the misalignment between the layers used in the model (Soil, TimType, Aspect", NWI). These errors are often identifiable and can be corrected. How to reconcile these differences is the topic in the next section, Updating Vegetation Inventory and re-running SDM.

6.0 Updating Vegetation Inventory and re-running SDM

Updating Forest-level vegetation inventory data is a complex subject and will not be specifically addressed in this document. At this time, the Tongass NF GIS group, in consultation with timber, silviculture, ecology and wildlife, are formulating the update process for all vegetation information. Related to this is the development of new vegetation map products and analytical tools using plot data, both within the Region and the Forest. At this time, several products are in development and may, in the future, provide better and more accurate vegetation information to Forest users.

At the project level, it is recognized that plot data (stand exams, rare plant surveys, wildlife surveys, soil plots) provide site specific data that may be considered "more accurate" than the forest-level inventory data generated from SIZE_DENSITY and CoverType. This data may be used in project analysis, but will not be "updated" in the corporate data layers at this time. The exception to this is the on-going update process for stand treatments (timber harvest) and maturation of young-growth stands (grow forward) that are incorporated into CoverType. This process, as delineated in FSH 2409.26d (January 2009), will continue as part of the silviculture program of work.

District specialists have the option to make corrections or updates to the Size and Density class polygons to reflect what they find in their project areas if the change will influence project analysis. Standards for transferring this information into the corporate SIZE_DENSITY cover are currently being developed. In the future as we move toward geodatabases and use of Arc SDE 9.2, protocols will be developed in order to support a "direct edit approach" to the featuredataset containing both CoverType and SIZE_DENSITY featureclasses.

Project vegetation maps may be generated using SIZE_DENSITY, CoverType, and other forest-level inventories. Before changes are made, careful examination of the plot data relative to the overall spatial extent of the polygon in question will be required. As well, new polygons may be drawn representing smaller spatial units of vegetation attributes that are important to track. With application of updating standards that are currently being developed, project maps may be incorporated into Forest inventory layers to track changes in the future.

Re-running the size density model on newly revised vegetation or soil data layers may be considered in the future. Before doing so, the update process will need to be fully developed. Re-running the model in the future will be executed only by the SO GIS department. Since the model was specifically designed to be run from the 1980s timber inventory (Existing_Veg layer), it will not be appropriate apply it to any new vegetation map products that are currently being developed (e.g. LANDFIRE). Perhaps new models representing vegetation structure will need to be developed with the onset of these new map products, but this is something in the distant future. Suffice to say that there will be no apparent reason for any IDT member, including GIS specialists, to re-run SDM on any project vegetation maps at this time.

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Appendix A - SIZE_DENSITY Data Dictionary

SIZE_DENSITY

POLYGON: Created using the vegmod_nw .aml, existing_veg and aspect20 layers

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N. DEC	ALTERNATE NAME	INDEXED?
1	AREA	8	18	F	5		
9	PERIMETER	8	18	F	5		
17	SIZE_DENSITY #	4	5	B			
21	SIZE_DENSITY -ID	4	5	B			
25	VEGCODE	4	4	C			
29	VOLSTRAT	1	1	C			
30	YEAR_ORIGIN	4	4	I			
34	CUT_AGE	3	3	I			
37	HYDRIC	1	1	C			
38	CLU	1	1	C			
39	OLS-SLOPE-CLASS	1	1	I			

ITEM	CODE	DESCRIPTION
VEGCODE		
	F99	Miscellaneous/Unknown Forest
	FM	Foreseted Muskeg
	HS1	Cut age le 20
	HS2	Cut_age gt 20 and le 50
	HS3	Cut_age gt 50
	NF	Non-Forest
	S1	Natural Young Growth (SSIZEc = 1)
	S2	Natural Young Growth (SSIZEc = 2)
	S3	Natural Young Growth (SSIZEc = 3)
	SD4H	SSIZEC=4 and volc=4 and hydric
	SD4N	SSIZEC=4 and volc=4 and non-hydric and Harris_asp ne 1 (flat & north)
	SD4S	SSIZEC=4 and volc=4 and non-hydric and Harris_asp eq 1 (not north)
	SD5H	SSIZEC=4 and volc=5 and hydric
	SD5N	SSIZEC=4 and volc=5 and non-hydric and Harris_asp ne 1 (flat & north)
	SD5S	SSIZEC=4 and volc=5 and non-hydric and Harris_asp eq 1 (not north)
	SD67	SSIZEC=4 and Volc=6 or volc=7
	UF	Unproductive Forest
	W	Water
	X99	Unknown
VOLSTRAT		**Modeled volume stratia used for 1997 TLMP**
	E	Harvest or natural regeneration 25 years to 200 years age
	I	Harvest or natural regeneration less than 25 years

	H	High
	L	Low
	M	Medium
	N	Anything else (non-productive, unknown, etc.)
	O	“Left over” areas (lack of data from input)
	W	Water
YEAR_ORIGIN		**Accomplished year**
CUT_AGE		
	Numeric in years	**Age since harvest**
HYDRIC		**Hydric soil**
	Y	
CLU		
	Y	Soil layer used for hydric information
	N	NWI layer used for hydric information
	‘ ‘	No hydric information available
OLD-SLOPE-CLASS		**Slope percentage**
	0	
	1	0 – 35% slope
	2	35 - 55% slope
	3	56 - 75% slope
	4	Over 75% slope

Appendix B - Data Dictionary for CoverType

CoverType. The CoverType feature class is updated for new stands created through timber sales as well as naturally occurring landslides, windthrow, and so forth. Units identified in the sale administrator's monthly report as having been yarded are updated on this layer. Reserve (deferred) areas that fall on the boundary are not mapped as individual polygons with unique stand numbers and on this layer. CoverType displays the "net" treated area within the harvest unit.

ITEM NAME	DataType	Length	Precision
OBJECTID	Object ID	4	10
TM_COMPARTMENT	Long	4	10
STAND	Long	4	10
FCT	String	1	0
NFCON	String	1	0
FPROD	String	1	0
FTYPE	String	1	0
CSC	String	1	0
SSIZEC	String	1	0
VOLC	String	1	0
TTSOURCE	String	1	0
DATE_ORIGIN	Long	4	10
STAND_ORIGIN	String	1	0
OWNERSHIP	String	1	0
RESERVE_AMOUNT	Short	2	4
RESERVE_UOM	String	1	0

TM_COMPARTMENT	TM_Compartment made up of VCU, sub-VCU and compartment number		00100 to 86409	Tm_compartment 00100 to Tm_compartment 86409
STAND	Unique stand number within TM-Compartment	00001 to 99999	Stand Number 00001 to Stand Number 99999	
FCT	Forest Cover Type	F N	Forested cover Non-forested cover	

NFCON	Non-Forest Condition Class	A	Nonforest Condition is Alder Brush
		B	Nonforest Condition Brush
		C	Census Freshwater
		D	Nonforest Condition Sand Dunes
		F	Nonforest Condition is River Fill
		G	Nonforest Condition is Natural Grassland
		H	Nonforest Condition is Alpine
		I	Nonforest Condition is Ice/Snow Field
		L	Nonforest Condition is Uplifted Beach
		M	Nonforest Condition is Muskeg- Meadow
		N	Noncensus Freshwater
		O	Nonforest Condition is Other
		P	Nonforest Condition is Borrow Pit
		R	Nonforest Condition is Rock
		S	Nonforest Condition is Recurrent Slide
		T	Nonforest Condition is Willow
		U	Nonforest Condition is Urban/agricultural
		W	Nonforest Condition is Mass Wasting
FPROD	Forest Productivity	2	Productivity Greater Than 20 Cu. ft/acre
		A	Low Productivity Due to Alder
		G	Low Productivity as a Glacier
		H	Low Productivity Due to High Elevation
		L	Low Productivity Due to Low Site Index
		M	Low Productivity Due to Muskeg
		R	Low Productivity Due to Rock Cover
		S	Low Productivity in Recurrent Slide Zone
		T	Low Productivity Due to Willow
		9	NULL (FCT = 'N'). Fill with 9 for non-forest condition. Leaving the field blank would result in questions as to whether the field was blank by intention or by omission.
FTYPE	Forest Type *Species canopy composition GT 50%*	A	Red Alder
		B	Birch
		C	Cedar
		H	Hemlock
		L	Lodgepole Pine
		M	Black Spruce
		O	OTHER SPECIES
		P	Black Cottonwood (poplar)
		Q	Aspen
		S	Spruce
		W	White Spruce
		X	Hemlock-Spruce (*SS between 30-49% canopy composition)*
		Z	Cottonwood with Sitka Spruce Understory

CSC	Current Stocked Condition	A	Nonstocked due to Alder
		B	Nonstocked due to Brabazon
		F	Nonstocked due to Fire
		G	Nonstocked due to Water or Glacier Action
		I	Nonstocked due to Insects
		N	Nonstocked due to Logging GT or EQ 5 Years
		O	Nonstocked due to Other Causes
		R	Nonstocked due to River fill
		S	Nonstocked due to Slides
		T	Nonstocked due to Willow
		U	Nonstocked due to Beach Uplifting
		W	Nonstocked due to Wind throw
		X	Nonstocked due to Logging LT 5 Years
		1	Poorly Stocked 10-39 % of the crown closure
		2	Medium Stocked 40-69% of the crown closure
		3	Well Stocked 70-100% of the crown closure
		9	Non-forested
SSIZEC	Stand Size Class	1	Seedling or Saplings; Trees under 5: Dbh
		2	Poletimber; Trees w/Dbh between 5" and 9"
		3	Young-growth Sawtimber; 9"+, but not over 150 yrs.
		4	Old-growth Sawtimber; 9", and over 150 yrs.
VOLC	Volume Class	3	0 to 8 MBF/acre
		4	8 to 20 MBF/acre
		5	20 to 30 MBF/acre
		6	30 to 50 MBF/acre
		7	More than 50 MBF/acre
TTSOURCE	Source of Arc on CoverType layer	S	Code came from Stand Exam
		T	Code came from TM Inventory
DATE_ORIGIN	Stand origination date		From ActivityPolygons YYYYMMDD format Eg- 20051125
STAND_ORIGIN	Origin of the Stand	A	Alluvial outwash Origin
		F	Fire Origin
		G	Glacial Retreat (recent) Origin
		H	Harvest Origin
		L	Landslide Origin
		S	Small Gap Origin (old growth stage)
		U	Unknown Origin
		W	Windthrow Origin
		9	Null (lakes, rockpits, non-forested, etc.)

OWNERSHIP	Ownership - general	F	National Forest System Lands
		N	Non-national Forest System Lands

RESERVE-AMOUNT *	amount reserves left in the unit will be determined by unit of measure	0 to 999	0-999 valid codes; 1-100 (percent) if using B as UOM; 1-500 (trees/acre) if using T as UOM; use 999 only if reserves are present in an unknown amount
RESERVE-UOM *	Reserve amount Unit of Measure	T B	Trees/acre or % Basal area

*The same unit of measure is used for all sub-units within the harvest area. In order to calculate the percentage reserved within the unit as a whole, the original basal area or trees per acre must be known from stand examination and or timber cruise information. These fields should not be used to determine if TLMP Revision standards and guidelines for goshawk, marten, and so forth, are being achieved. Each polygon sub-unit will have a different reserve amount if reserves vary by sub-unit.