
Adding Spatial Detail with Analysis Areas

Remsoft® Spatial Planning System

This white paper describes the Analysis Area Control feature in the Remsoft Spatial Planning System, and when it might be useful.



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This white paper describes the Analysis Area Control feature in the Remsoft Spatial Planning System, and when it might be useful.

The purpose of this white paper is to demonstrate how analysis areas can be used to address spatial forest management planning issues in Woodstock. By adding spatial resolution at the strategic level of planning we are able to define and control patterns that occur on the landscape and also control timing choices, i.e. when and where Woodstock schedules activities.

In this document, we offer a general overview of how you can use analysis area control to schedule pre-defined harvest units and sequence harvesting across operational units in the forest. This is not a detailed 'how to', but rather presents a general description of AA control in Woodstock and two examples of the types of problems that you can address using AA control.

Remsoft is still adding to this functionality, in particular the backend reporting and control of the AA schedule, and will follow-up with a detailed discussion of how to configure Woodstock models for AA control once development is complete.

1.0 What is an Analysis Area?

An analysis area (AA) is an aggregation of one or more polygons or development type classes into a single unit. The extent or scale of an AA can be anywhere from a few polygons to a watershed or a township.

2.0 Activating Analysis Area Control

To activate AA control you will need to modify two sections in your Woodstock model, the Areas and Control sections. You have to build the Areas section in AA format to

establish the groupings of development type classes in the forest. In the Control section you have to add the keyword *AACONTROL and set its value to ON.

3.0 Analysis Areas in Woodstock

The idea of AAs in Woodstock is not new. In the past, they were used exclusively as a means of reporting on activities in AAs. Now you can apply actions to AAs directly.

When you activate AA control, Woodstock issues a choice in the matrix for each combination of action and AA instead of separate choices for each combination of action and the occupant development type classes. Action eligibility is evaluated at the development type class level and at least 20% of the area in the AA must be operable for an action before Woodstock will create a choice for it in the matrix. AA yield coefficients represent the area-weighted average of the yield coefficients for the occupant development type classes. Once development types in an AA undergo a transition their AA identity is lost; thus, AA choices are only issued for existing types.

AA decision variables are not integral, which means that the optimizer may schedule any portion of the AA for treatment; Woodstock prorates the proportion of the AA scheduled to the occupant development type classes when it creates the Schedule section. However, there is no incentive for the optimizer to split an AA, short of tight constraints. In a similar fashion, Woodstock comments out development type classes in the schedule that were within a scheduled AA, but were not operable for the scheduled action in the scheduled planning period.

The AA schedule is stored in a separate database file. This file contains fields detailing the AA codes, number of resident polygons, total area, valid planning periods for scheduling, decision variable type (infinitely divisible by default), the periods in which the AA is scheduled and the percentage of the AA scheduled. Using this file, you can limit the planning periods in which AAs are available for treatment and switch to integer (all-or-nothing) variables. This backend functionality for reporting on and controlling the AA schedule is presently under active development.

4.0 Examples

There are often situations in which it is expedient to schedule forest tracts as a single treatment unit rather than individual development type classes. The following examples demonstrate how you can use AA control to schedule harvest units and sequence forest operations.

Example 1 Scheduling Harvest Units

In this example harvest units have already been delineated in the forest (Figure 1a) and we want Woodstock to schedule them for harvest.

To generate a unit-based harvest schedule you must build the Areas section in AA format using the harvest unit id as the AA code, and activate AA control in the Control sec-

Examples

tion by setting *AACONTROL ON. The result is a schedule of activities on AAs, harvest units in this case, which you can display on a map (Figure 1b).

Notice that some development type classes within the harvest units are not scheduled (e.g., Fig. 1b harvest unit in lower right hand corner) because they were not operable for the scheduled action in the scheduled planning period.

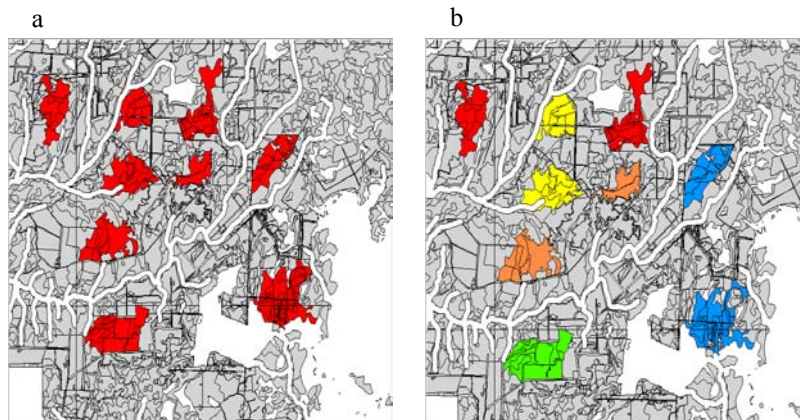


Figure 1. (a) Harvest units prior to scheduling. (b) Scheduled harvest units (colors indicate the scheduled planning period).

Example 2 Sequencing Operational Units

In some regions forest operations are sequenced across relatively large operational units. In this example the forest is subdivided into operational units, called map sheets, each representing approximately 4,000 hectares of forest land; harvesting is only permitted in map sheets that have been allocated for harvest. The problem is to determine the order in which to allocate map sheets for harvest to maximize the volume harvested. Thus, there are two management decisions, which map sheets to allocate, and which development types to harvest within allocated map sheets.

To model the allocation decision, you will need to add an allocation action to the Woodstock model that precedes the harvest actions. The allocation action transfers development types from an unallocated to an allocated state thus rendering them eligible for harvest. Thus, you will need to add thematic attributes to your Landscape section to differentiate allocated and unallocated units. All development types in the model are initialized in the Areas section in an unallocated state.

Build the Areas section in an AA format using map sheet as the AA code. Activate AA control in the Control section by setting *AACONTROL ON. Woodstock builds decision variables for AAs for existing types only; thus, allocation choices operate at the map sheet or AA level because it is the first action in the Actions section, and harvest choices operate at the development type class level because the AAs are lost after the allocation transition.

The resulting AA schedule details the AA-based allocation choices (Figure 2a) and the Woodstock schedule details the schedule of harvest activities on development type

classes within the allocated map sheets (Figure 2b). This optimized allocation schedule acts as a convenient starting point for developing your own map sheet sequencing.

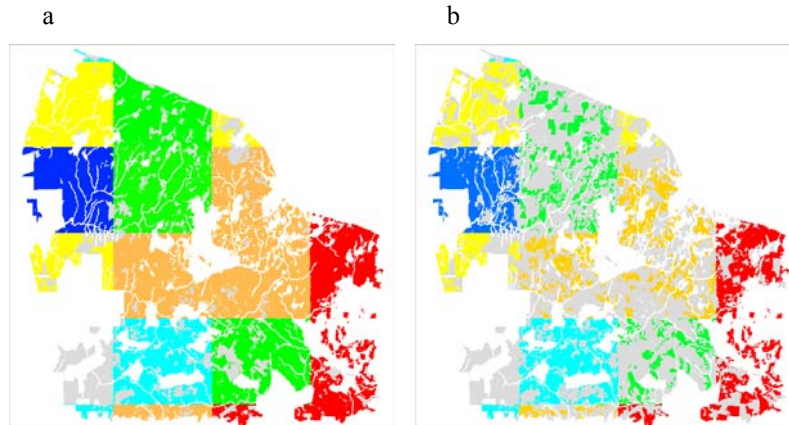


Figure 2. (a) Allocation choices. (b) Harvest choices. Colors indicate the scheduled planning period.

5.0 Summary

Analysis areas allow you to establish the geographic arrangement of development types in the forest; analysis area control allows you to apply actions directly to these groups. AA control is established through column generation; when you activate AA control in the Control section and build your Areas section in AA format, Woodstock issues action choices in the matrix for the AAs rather than the resident development type classes.

The primary benefit of using AAs to represent geographic location is that it does not inflate the size of the LP matrix because you avoid adding additional theme attributes to your Landscape section to differentiate the units. In fact, because there are typically far fewer AAs than development type classes in the forest, the LP representation of AA control models tends to be a lot smaller than equivalent stratum-based models.

AA control leverages Spatial Woodstock functionality for building Areas sections and editing database tables directly in the editor. You can establish AA control in Woodstock as well, but it is most effectively accomplished using Spatial Woodstock.

At present we are actively developing the backend reporting and AA schedule control parameters. Once complete, we will follow-up with a 'how to' document describing in detail how to use AA control to impose a geographic pattern in the treatment schedule.

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