

Chapter 5: Section Boundary Mapping in the Field Software

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5.0 Section Boundary Mapping in the Field software

Chapter 4.0 took you through how to identify individual Sections on the ground. The following Chapter details how to represent those Sections within the field software, so that your observations on Sectioning are accurately represented and recorded within the survey square geodatabase. You will be able to 'map' out the Section boundaries through being able to:

- Split Sections i.e. split a Section into two, smaller Sections.
- Modify Sections by moving/adding/deleting individual vertices.
- Copy existing geometry
- Merge Sections i.e. join two or more Sections together.
- Reshape Section boundaries by drawing a new shape that the Section will then adopt as the boundary. The newly drawn shape needs to cross the existing Section boundary twice to be accepted.
- Slide boundary nodes i.e. adjust the node that sits at the intersection of two or more Sections; without this tool it would be fiddly and involve multiple reshape/modify operations.

The tools provided all help facilitate the creation of a seamless map of the site and remove much of the need for specialist GIS knowledge to achieve this. For example the editing tools ensure that when editing shared boundaries between Sections that the Section boundaries do not overlap and do not have any empty areas, or 'white space', in-between them. However even with these tools some GIS expertise is required and this and following chapters set that out.

It is very important to get Section boundary mapping correct at the beginning of the survey. Having an accurate and representative map is fundamental to the stratification and sampling of the sample square overall and determines many later stages of the survey and ultimately its accuracy.

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Accurate Section mapping determines:

- Accurate reporting of all aspects of the NFI across the Regions and GB, including aspects such as woodland area and type.
- Effective stratification of the sample square so that subsequent observations and measurements are more representative and contain less variance.
- The number and location of sample plots.
- The number of storeys.
- What you get paid.

As the number, size, shape and landuse of Sections determine the number of sample plots it is important to have your sectioning correct before starting to input mensuration plot or point data.

If a Section boundary is changed after entering plot/point data, the software will, in most cases¹, automatically delete all the plots/points for all Sections sharing that boundary and the data will be lost.

¹ See the Section on re-measure squares at the end of this chapter

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5.1. Splitting Sections

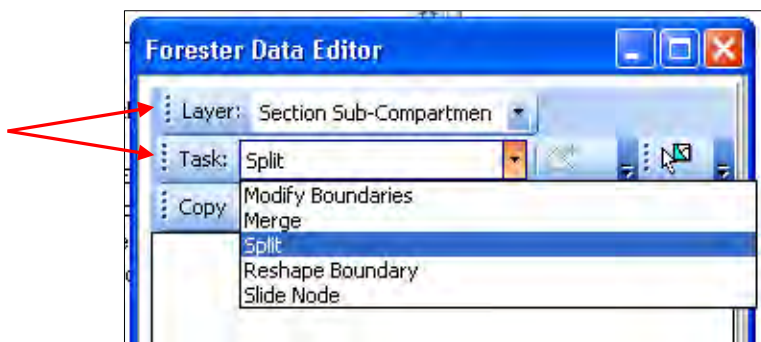
In a New Square (1st Assessment Square) you will receive a 'clean slate' square containing a single blank Section. This Section will have not been pre-assigned any type of landuse.

The best way to convert this clean slate to a map of Sections is to split that one Section down into the number and shape of Sections required. Of course occasionally the whole square will equal a single Section and no Section mapping is required. However on most occasions you find two or more Sections in a square and splitting down the original single Section to the two or three necessary is the most efficient way to achieve your Section map.

If the area you are splitting has similar components then it is a good idea to add in the Component data prior to splitting and then choose to copy this across into both split areas. This will save time and effort.

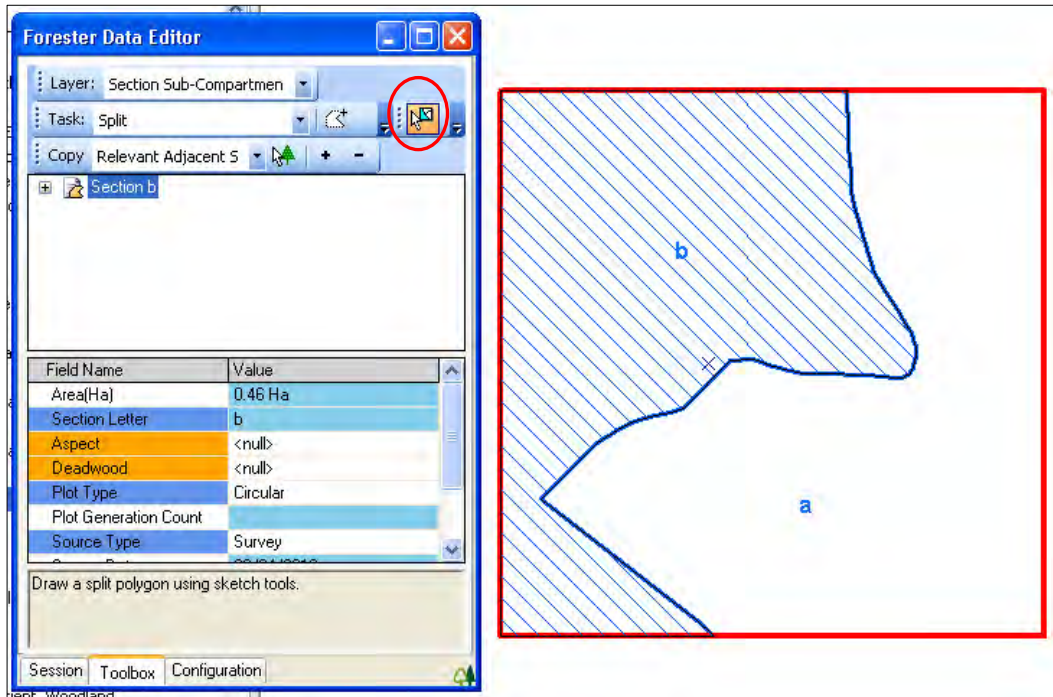
Once you have surveyed the area as per Chapter 4.0 and have a good idea of the Sectioning:

In the Forester Data Editor window, select "Section Sub-Compartment" from the Layer drop down menu, and select "Split" from the Task drop down menu.



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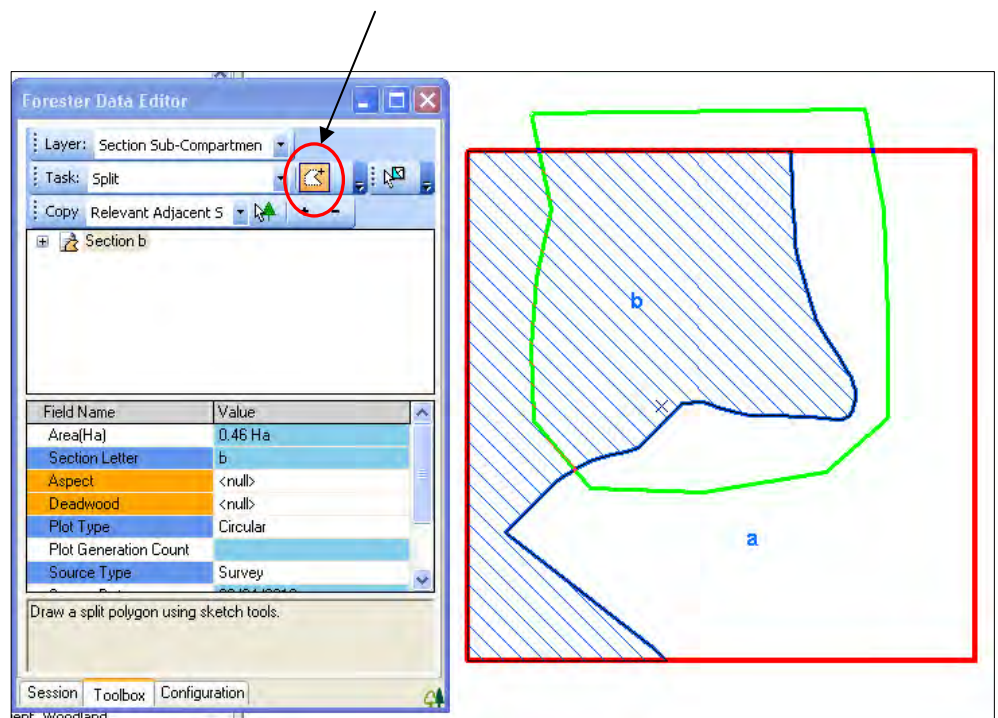
Click on the "Select Features" button and then select the Section to be split. The chosen Section is now highlighted in blue diagonal lines.



In the Forester Data Editor window, click on the "Add to Polygon Edit Tool" button immediately to the right of the Task box. Sketch out the shape of the Section you wish to 'split off'.

The shape can be further modified on a vertex by vertex basis, by selecting the 'Modify Edit Geometry' tool, or abandoned with the 'Delete Edit Sketch' tool if you don't get it quite right the first time.

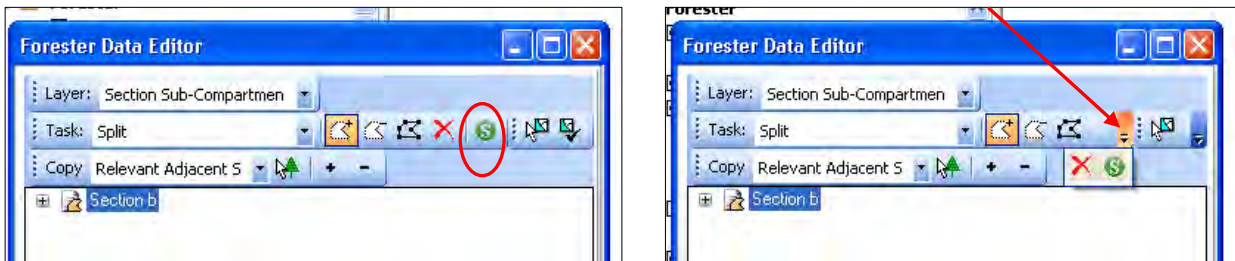
To re-draw the split, click on the "Select Elements" button on the ArcMap toolbar and have another go.



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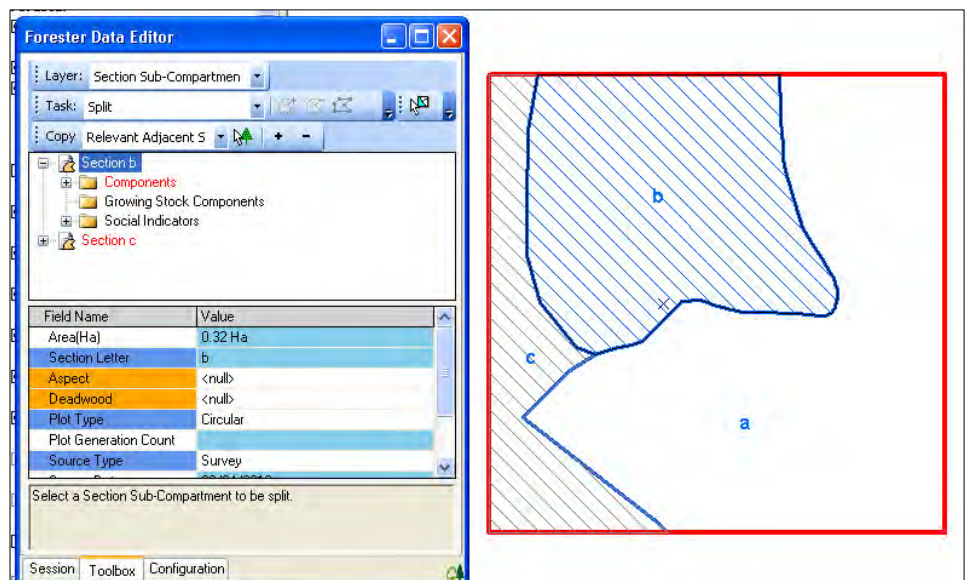
Double-click to finish the drawing. The new split-off Section is highlighted in red cross-hatching.

To complete the Split operation, click on the green "Split Edit Tool" button. This button may be hidden if the Forester Data Editor window is too narrow, in which case click on the Split toolbar drop-down button (or simply widen the window by dragging the margins).

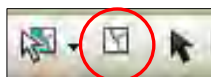


The software will ask whether any attributes and Components are to be copied to the new split-off Section. If "Yes", the Component data in the original Section will be copied across into the new Section, which means the bulk of the data entry has been completed, but it is **vital** to remember to check and **edit** the Component and sub-Component data in **both** Sections.

The software will perform the Split operation and the new Section will be highlighted in blue diagonals.



On the ArcMap toolbar, click on the "Clear Selected Features" button to remove the cross-hatching.



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Now that you have two Sections, you can split and re split these as necessary until you have your correct number of Sections and the correct Section boundaries.

5.1.1 Tip

A very useful way to reduce data entry time is to add any Section, component or subcomponent values that are common to all your Sections to the first Section before you start splitting. This way those values can be carried through to all the Sections and this removes the need to add those values to each Section separately. An example of this would be where a square has 5 Sections and all Sections have horse riding within them. In this situation if you add the horse riding value to the first Section and split that Section down to 5 Sections, those 5 Sections will already have the horse riding value and you do not have to enter that value 5 times, once per Section.

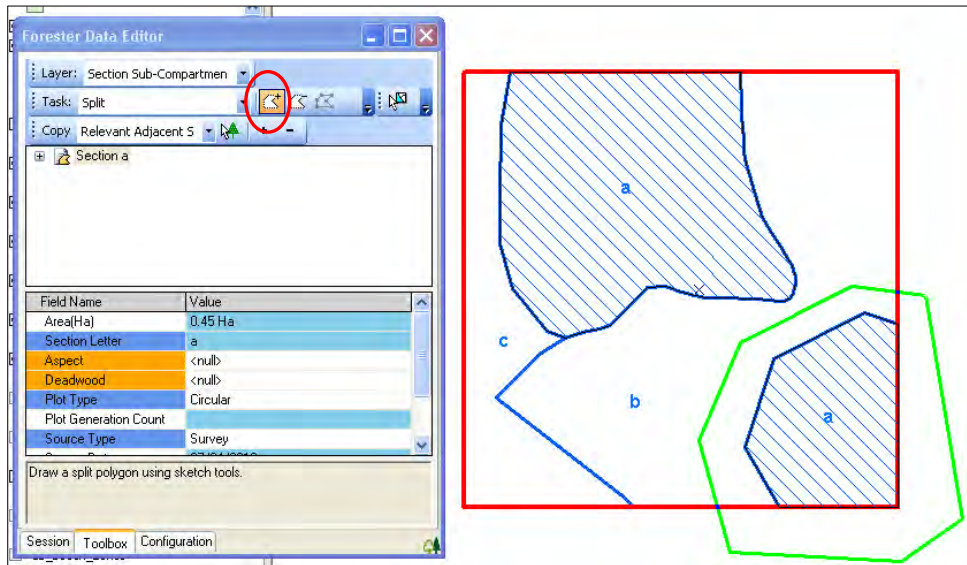
The copy / clone component tool is another way to achieve this. As you become familiar with the survey such shortcuts and their value will become apparent and you will learn how they can be used without detriment to the survey.

5.1.2 Exploding a multi-part Section

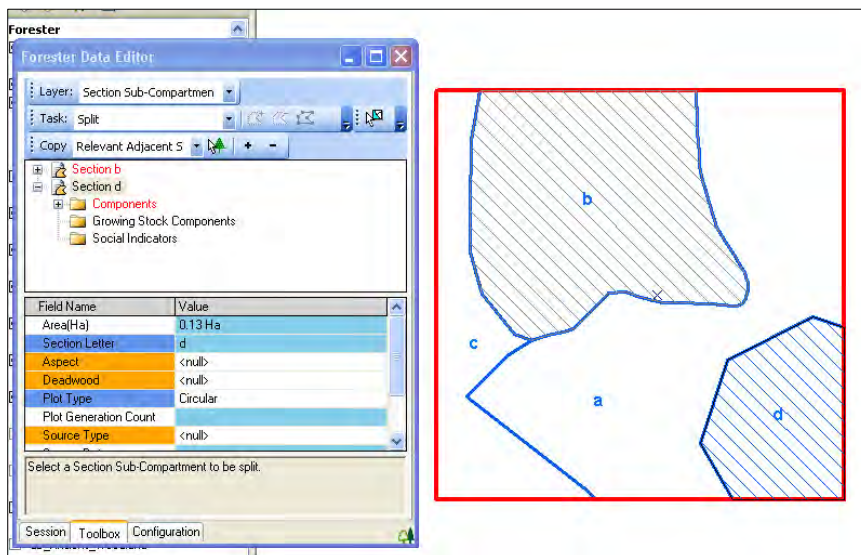
Sections can either be one single continuous area within the square, or they can be formed of two discrete areas of the same nature and composition located separately within the square. Two such discrete areas which form the same Section are called 'multi-part' Sections, as they are composed of multiple parts. It is appropriate to have multi-part Sections where stands or land uses have been separated or split, usually by human action; for example a road, or a track, but they are to all purposes still the same woodland type and entity. Allocating multi-part Sections is of benefit to the survey as it is a true and fair representation of the extent of that land type, plus it is of benefit to the surveyor as multipart Sections share the same plot allocation of 3 and this will reduce surveyor workload (as opposed to two sections have 3 plots each). However sometimes as the survey on the day progresses, it becomes apparent that what first appeared to be a multi-part Section is in fact two separate Sections. In such situations the multipart has to be 'broken up' into its separate entities and we call this 'exploding' the multi-part.

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Follow the Split procedure as outlined earlier, click around the multi-part to be split off, starting and finishing outside the Section.



In this example, multi-part Section A is exploded into new Sections B and D.



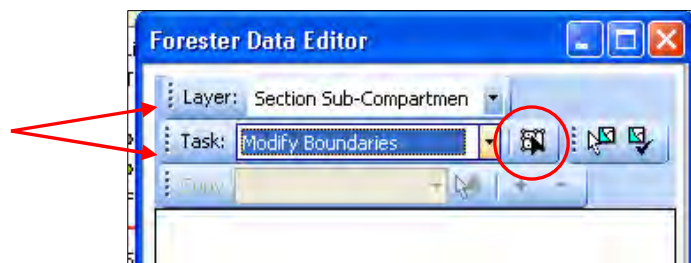
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5.2 Modify Section Boundaries

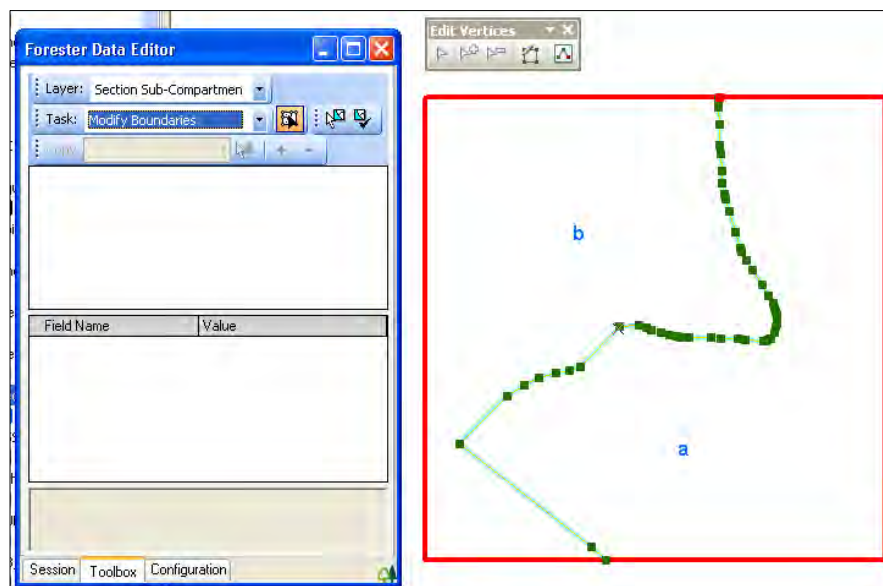
As part of the Sectioning process you may wish to further modify or align your Section boundaries after splitting them out. In these circumstances follow the process below.

5.2.1 Select the Section boundary to be modified

In the Forester Data Editor window, select "Section Sub-Compartment" from the Layer drop down menu, and "Modify Boundaries" from the Task drop down menu. Then click on the "Modify topology tool" button to the right of the Task box.



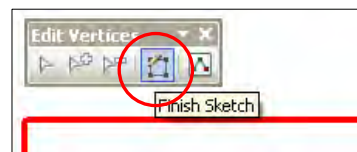
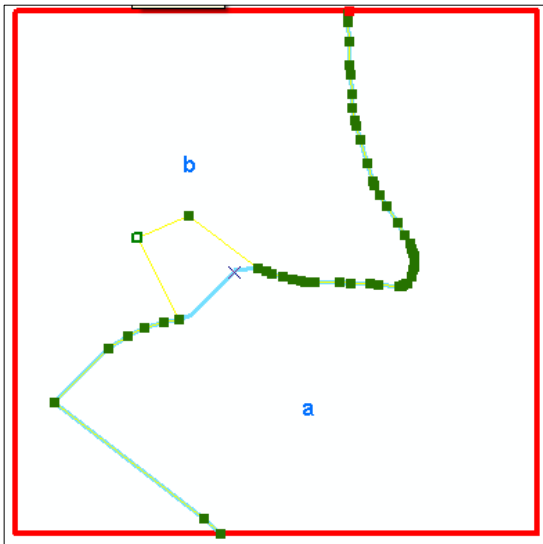
Left-click on the Section boundary to be modified and see it highlighted in blue. Double-click on the Section boundary and see the vertices displayed as tiny green squares. An "Edit Vertices" toolbar will also appear.



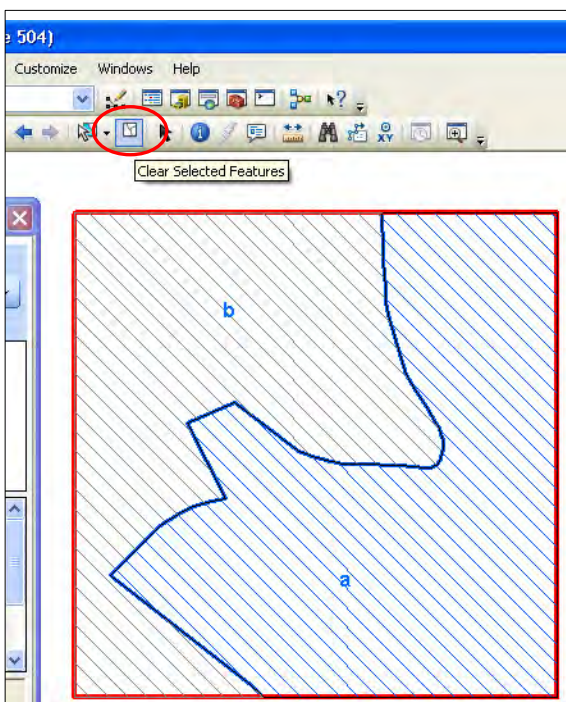
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5.2.2 Move individual vertices

Click-and-drag individual vertices to their new positions. The modified Section boundary will be temporarily highlighted in yellow. Finish by clicking on the "Finish Sketch" button in the "Edit Vertices" toolbar, or by double-clicking away from the Section boundary.



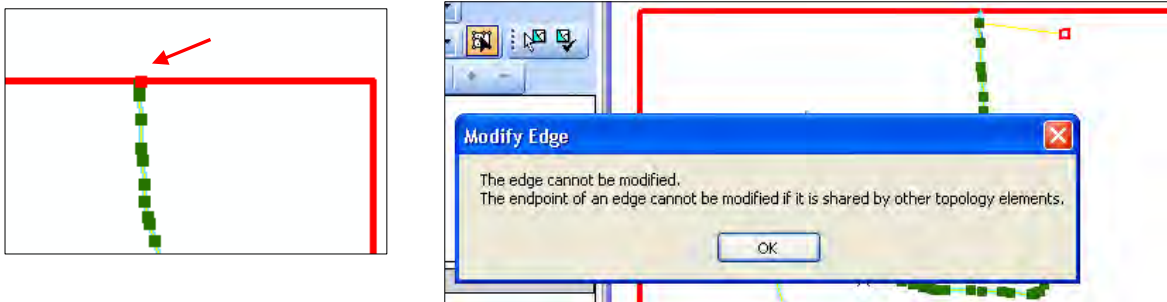
On the ArcMap toolbar, click on the "Clear Selected Features" button to get rid of the cross-hatching.



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5.2.3 Moving nodes

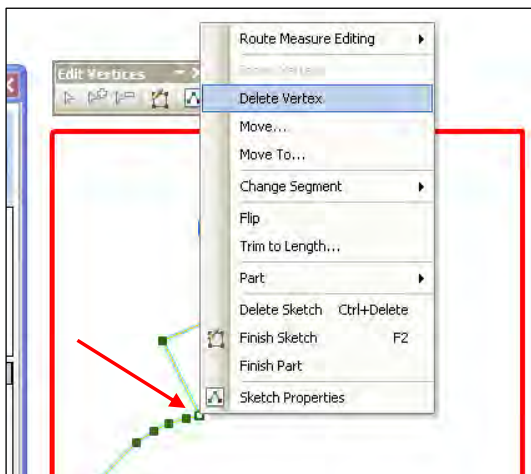
Nodes are the little red squares that occur where a Section boundary intersects another Section boundary, or the Square boundary. They **cannot** be moved using the Modify Tool (a message box pops up stating this when trying to finish the operation).



Nodes **can** be moved using the Slide Node Tool. See section 5.6 'Slide Section Boundary Nodes' for instructions on how to do this.

5.2.4 Delete individual vertices

Right-click on the vertex to be removed, then select "Delete Vertex" from the pop-up menu. Finish by clicking on the "Finish Sketch" button in the "Edit Vertices" toolbar, or by double-clicking away from the Section boundary.



5.2.5 Insert individual vertices

Right-click on the Section boundary, at the point where a vertex is to be added, then select "Insert Vertex" from the pop-up menu.

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5.3 Copying Existing Geometry

You can import your section boundaries from any GIS layer that you import into your GIS project / interface. This can improve the accuracy of your sectioning whilst greatly speeding up the task. For example you can import a GPS trace onto your tough book and in turn load that into your Forester session, using it to form your section boundaries. Similarly you can take boundaries from the NFI map layer if they are accurate, or indeed any other layer.

To do this select the copy feature tool in the Forester Data Editor dialogue box and in the drop down list choose the GIS layer you wish to copy your features from. Then press the select button immediately to the right of the drop down (symbolised with a tree and a pointer) and use this to select the polygon you wish to import. Click the plus symbol to add that feature and minus if you wish to drop it. The system will ask you if you want to clip the feature to the square boundary, say yes and the split polygon will be formed and will be highlighted with the blue hatching as usual. The split tool will become available as normal and you can choose to split. The software will ask you if you wish to copy components. If at any point you use another tool in this process you may lose the selection of the split geometry and the blue hatching. If that happens then use the select tool to select the new split geometry polygon and the split tool will become available again.

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5.4 Modifying Section boundaries after mensuration plots/points have been generated

This is generally to be avoided, as the sample plots have been located on the basis of the original Sectioning and modifying boundaries extensively could start to introduce bias, as the plot locations could become unrepresentative of the 'new' Section area. For example if the Section is made larger then the new areas brought in will not be sampled, or will not have had an equal probability of being sampled as other areas not sampled, as the plots are already established. In such instances, if the new areas are different in any way to the old Section area then the plots will become unrepresentative of the Section as a whole and some level of bias will have been introduced.

However it may be acceptable and necessary to do this in specific situations where, for example, during the course of navigating to and between mensuration plots, it becomes apparent that the Section boundary mapping is adrift and some minor editing to correct the boundary will give the benefit of providing a more accurate area of the Section and its contents without biasing the survey overall.

As a general rule of thumb, altering the boundaries of larger Sections no more than 10m would be acceptable, if they do not bring in new areas to the Section that are different in nature to the rest of the Section. If edits involve moving boundaries more than 10m and bring in different elements to the Section, then this would not be permissible.

Frequency is also another important consideration when accepting such modifications. If you need to do this at every square then your Sectioning approach is wrong and needs to be corrected. It is likely that you are not surveying the whole square thoroughly enough before you start Sectioning and repeated use of modifying boundaries will bias the survey. If use occurs once every 100 squares and is arising through occasional bad luck in not spotting something hard to spot, then at this frequency it is unlikely to cause bias.

It will be for you and your QA manager to determine what is acceptable in your exact circumstances. In addition to this control the software provides some checks and balances through applying the following rules:

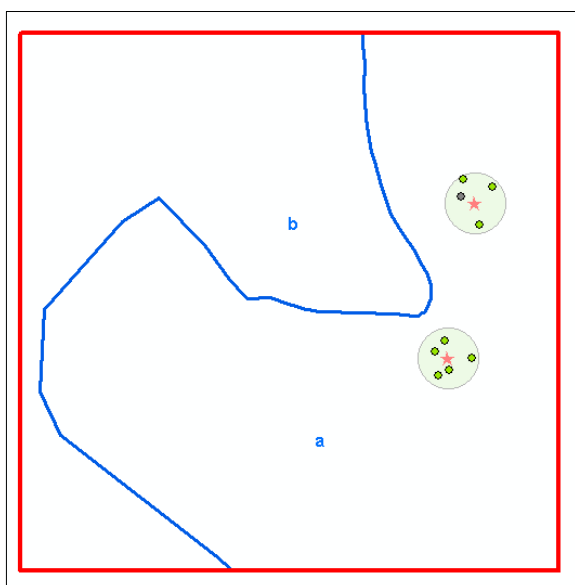
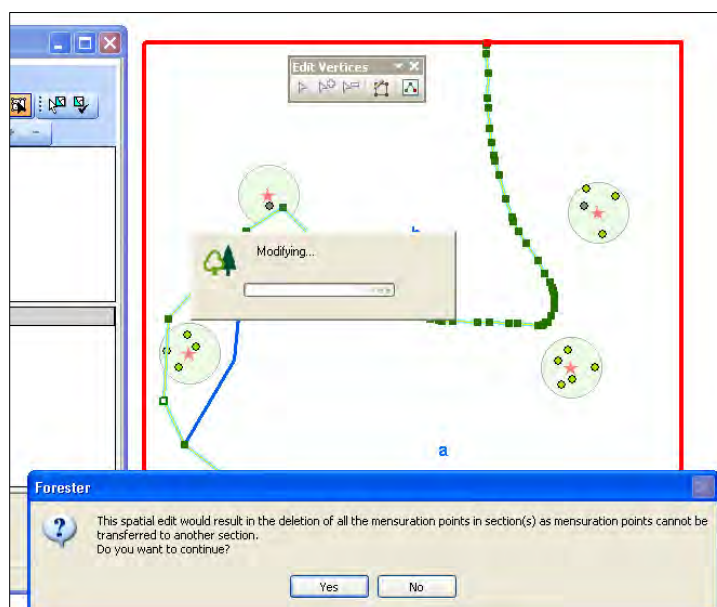
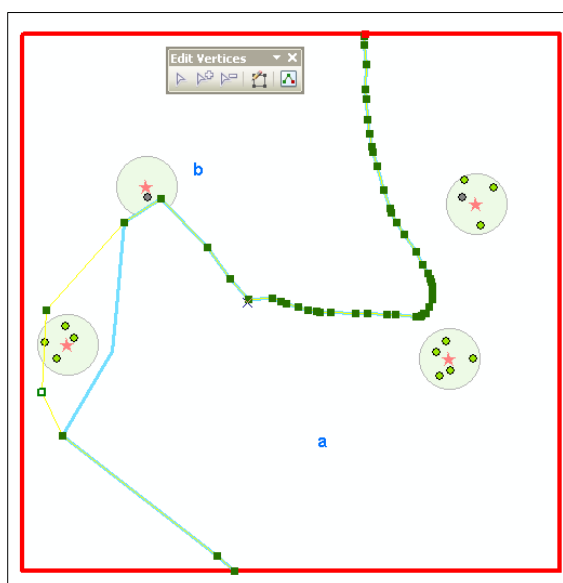
As long as the boundary modification does not result in any of the plots/points being transferred to a different Section, then the original set of plots/points is maintained, without loss of mensuration data already entered.

Where the boundary modification **would** result in any of the plots/points being transferred to a different Section, a message box will appear warning that the original

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set of plots/points for the affected Section(s) will be deleted if the modification is continued. If the decision is to continue with the modification, then a new set of plots/points to replace those that have been deleted must be generated.

In the example below, the original Section A plots are maintained because they are clear of the boundary modification, whereas the original Section B plots are deleted because at least one of the plot centres subsequently falls within Section A.



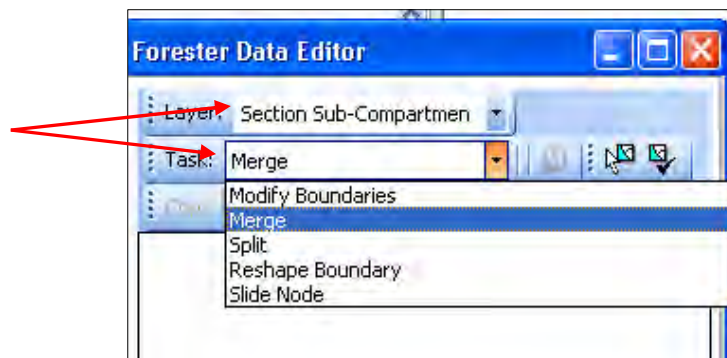
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5.4 Merging Sections

There will be instances where your initial Section assessment led you to creating two separate Sections, but after spending more time in the square you may realise that the two Sections are actually one.

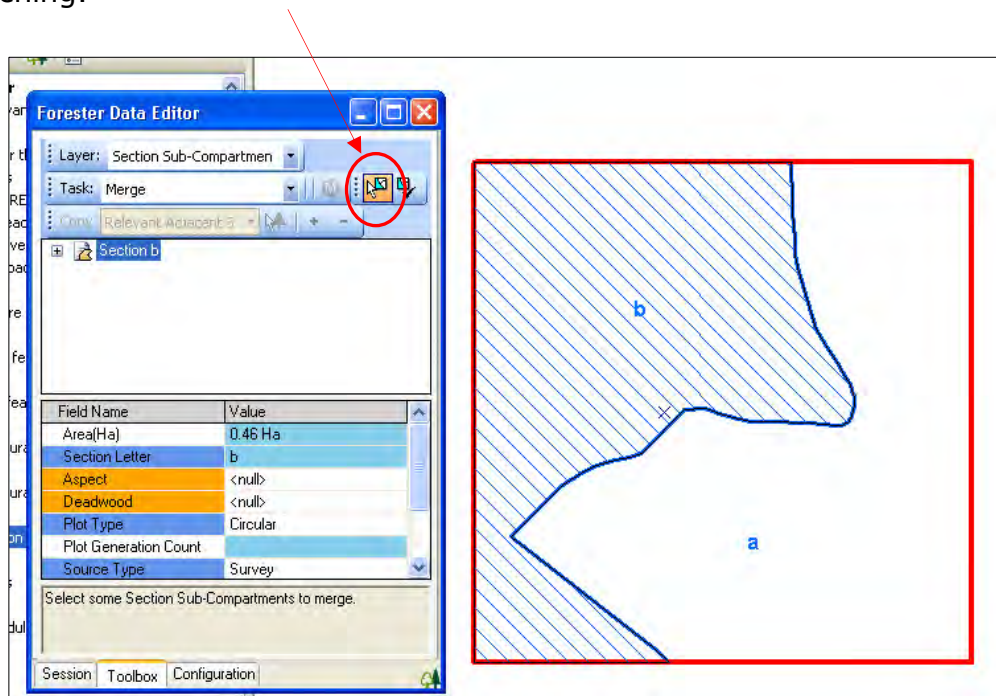
An example of this may be where a stand was originally split due to a fence running through a stand and excessive numbers of seedlings being observed on one side of the fence and not on the other. Here the surveyor concluded that one side of the fence was protected from herbivores and the other not and they felt that this left the woods either side heterogeneous with different compositions and condition. However after spending more time in the Sections, the seedlings can be found in both sides, the fence is permeable and the seedlings were less visible on one side due to deadwood or vegetation obscuring the initial visual assessment. In these instances the Sections should be combined to reflect that the area is one Section and homogenous. To achieve this you need to use the 'merge Sections' tool.

In the Forester Data Editor window, select the "Section Sub-Compartment" from the Layer drop down, and "Merge" from the Task drop down menu.

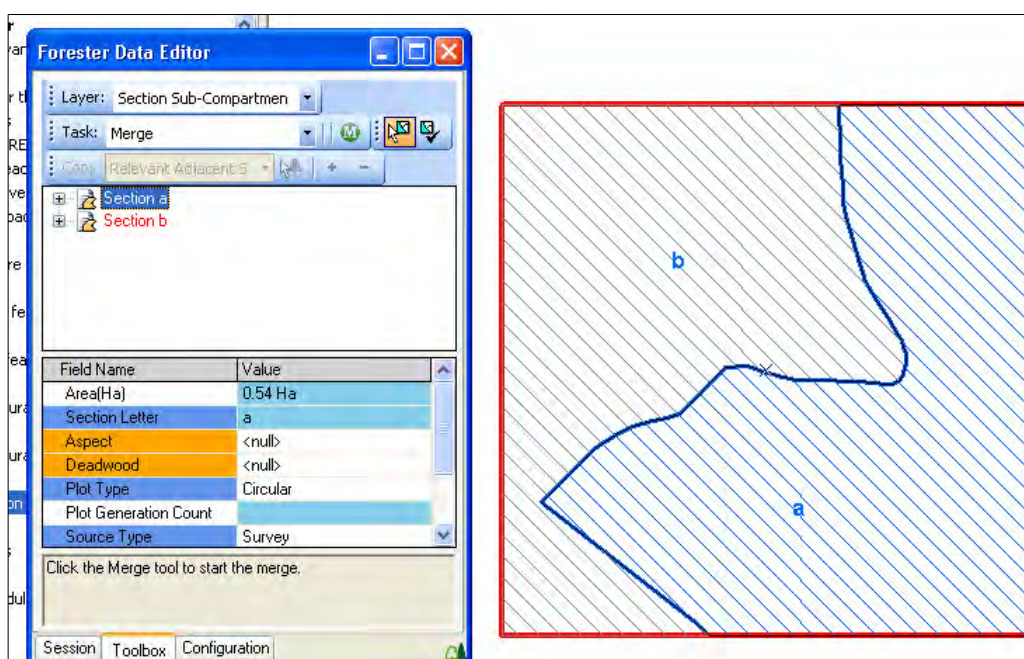


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Click on the "Select Features" button to the right of the Task box, then left-click in the first of the Sections that are to be merged. The Section is now highlighted in blue hatching.

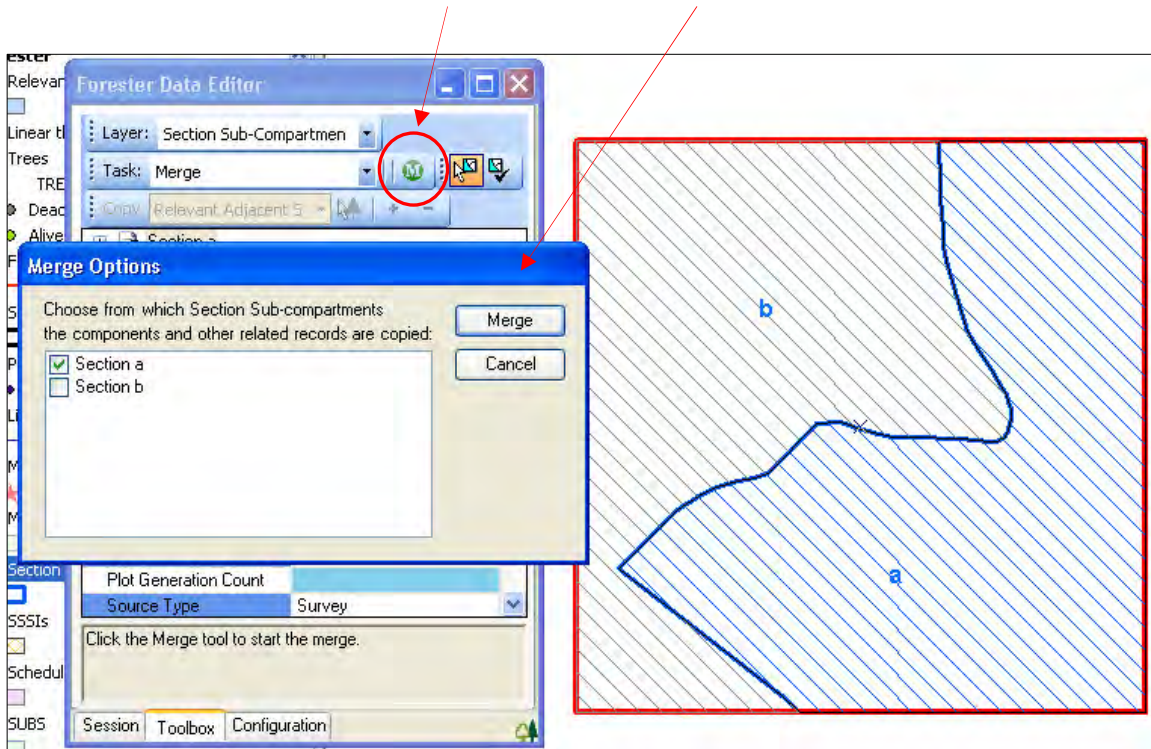


On the keyboard, hold the Shift key down and left-click in the Section that is to be merged with the first Section. Both Sections are now highlighted in blue and grey hatching, and the Section names are listed in the Forester Data Editor window.

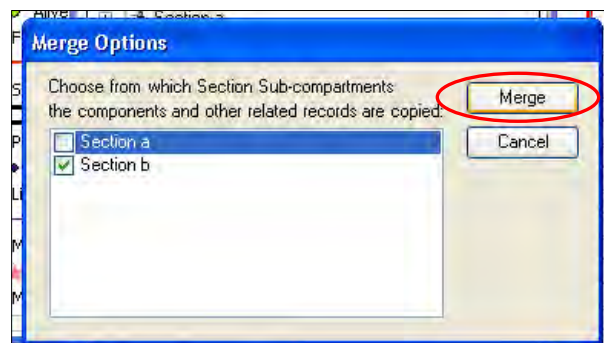


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In the Forester Data Editor window, click on the green "Merge edit tool" button immediately to the right of the Task box. A "Merge Options" box appears.

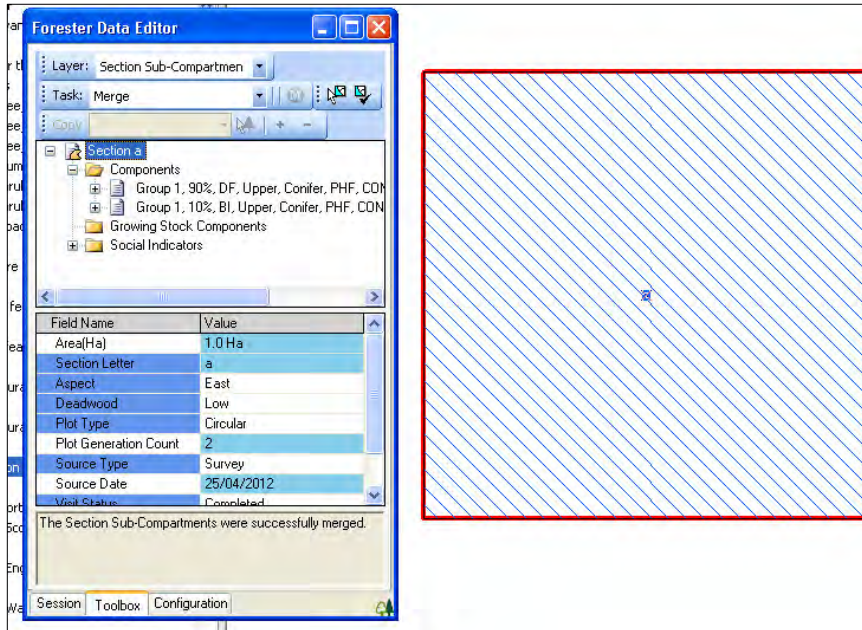


In the "Merge Options" box, place a tick against the Section(s) to copy data across from (obviously this is only relevant where the Sections already contain some Component data). Then click on the "Merge" button.



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In the above example, Sections A and B will be merged into one, and the original Section B Component data will be copied across to the newly merged Section.



5.4.1 Merging Sections after mensuration plots/points have been generated

This should be avoided where at all possible and will always result in deletion of the original set of plots/points within the Sections being merged, and therefore loss of any mensuration data entered prior to the merge. In such a case, a new set of plots/points **must** then be generated for the newly merged Section.

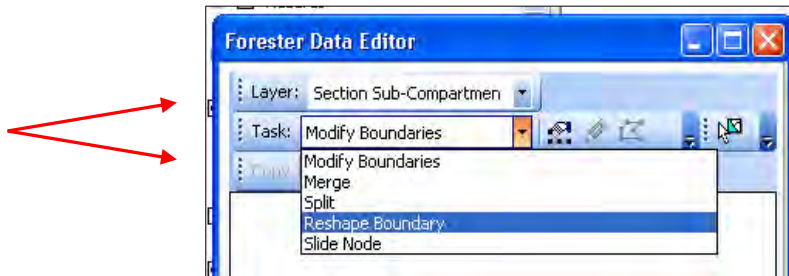
5.4.2 Splitting Sections after mensuration plots/points have been generated

This should be avoided where at all possible and will always result in deletion of the original set of plots/points within the Section being split, and therefore loss of any mensuration data entered prior to the split. In such a case, surveyors **must** then generate a new set of plots/points for the two new Sections.

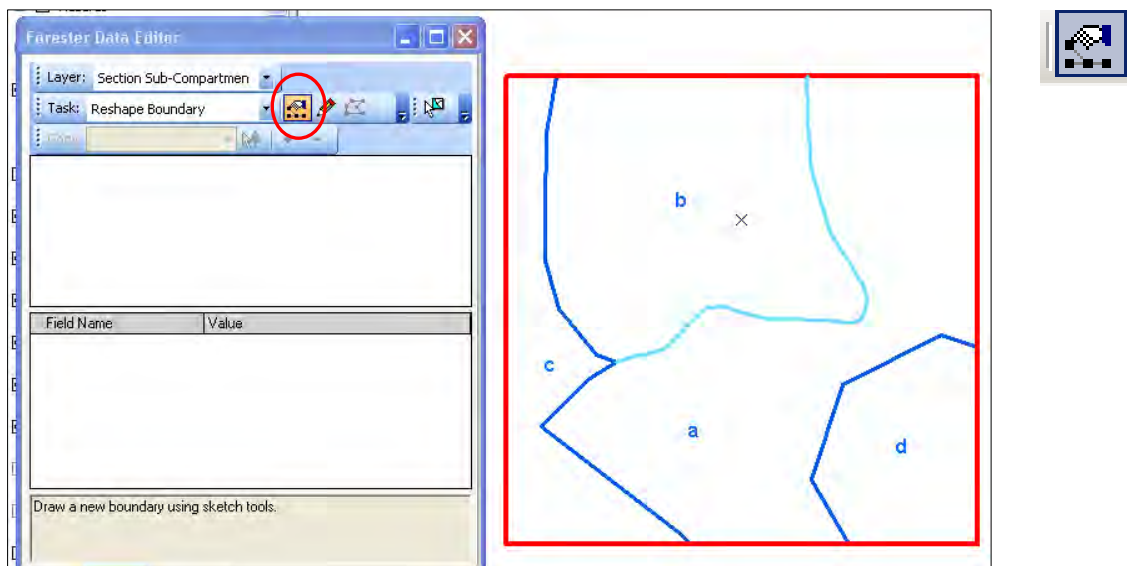
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5.5 Reshape Section Boundaries

In the Forester Data Editor window, select the "Section Sub-Compartment" from the Layer drop down menu, and "Reshape Boundary" from the Task drop down menu.

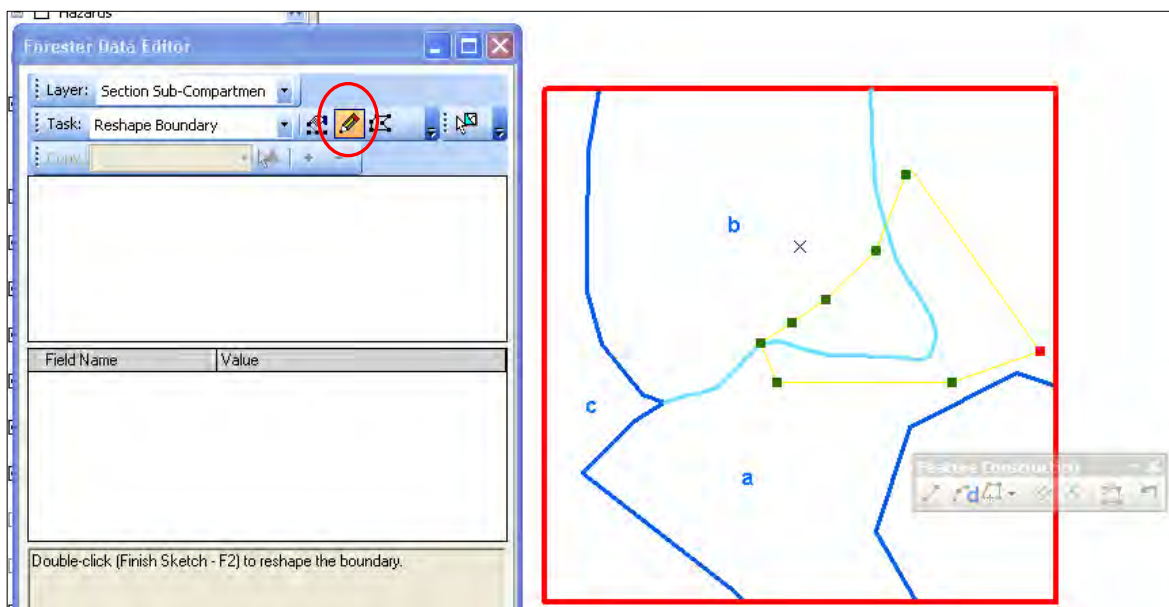


Click on the "Select Shared Boundary" button to the right of the Task box, then left-click on the Section boundary to be reshaped and see it highlighted in blue.



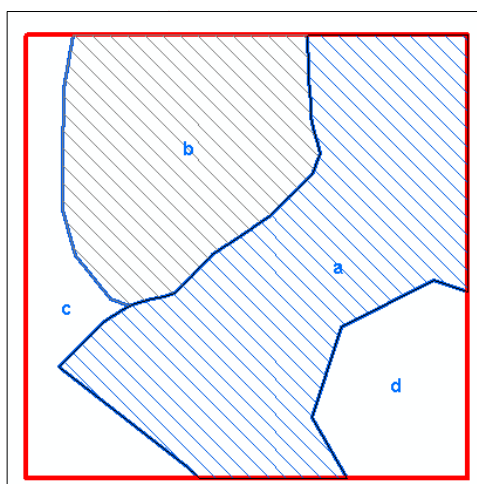
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Click on the "Construct Edit Geometry" (pencil) button to the right of the Task box, and then click around the part of the boundary to be reshaped. The "Feature Construction" tool bar will appear and fade out.

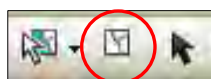


To amend the re-shape, press "Control and z" on the keyboard and this will undo the last vertex. Repeat until back at the start of the drawing.

Double-click to finish the drawing, or press F2 on the keyboard. The software will re-shape the boundary.



On the ArcMap toolbar, click on the "Clear Selected Features" button to get rid of the cross-hatching.



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5.5.1 Re-shaping Section boundaries after mensuration plots/points have been generated

This is generally to be avoided, as the sample plots have been located on the basis of the original Sectioning and modifying boundaries extensively could start to introduce bias, as the plot locations could become unrepresentative of the 'new' Section area. For example if the Section is made larger the new areas brought in will not be sampled, or will have had an equal probability of being sampled, as the plots are already established. In such instances if the new areas are different in any way to the old Section area then the plots will become unrepresentative of the Section as a whole and some level of bias will have been introduced.

However it may be acceptable and necessary to do this where, for example, during the course of navigating to and between mensuration plots, it is discovered that the Section boundary mapping is adrift.

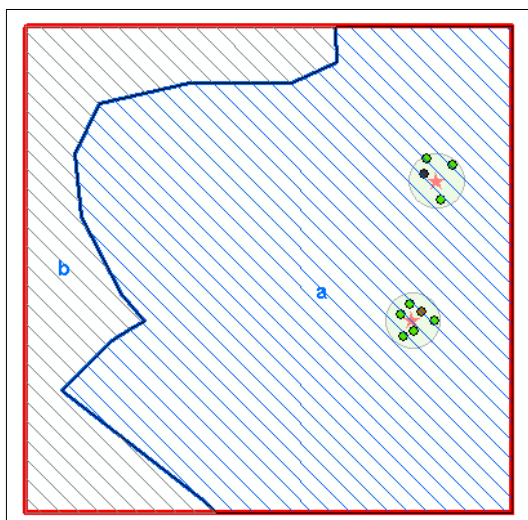
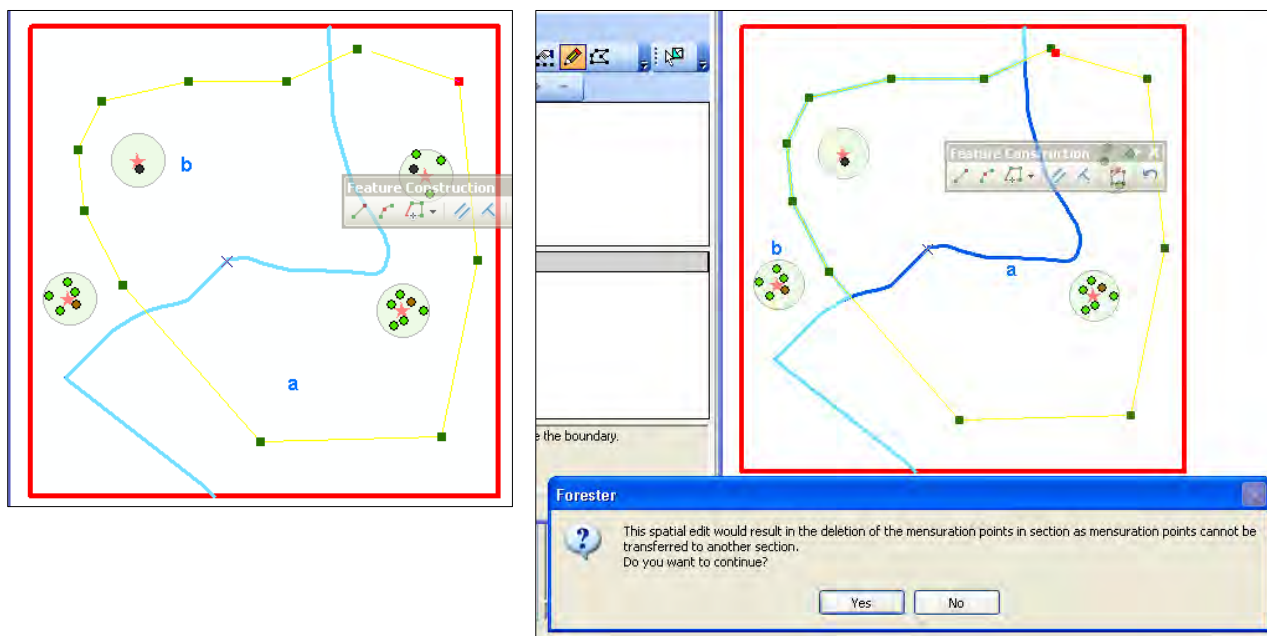
It will be for you and your QA manager to determine what is acceptable in your exact circumstances. In addition to this control the software provides some checks and balances through applying the following rules:

As long as the boundary re-shape does not result in any of the plots/points being transferred to a different Section, then the original set of plots/points is maintained, without loss of mensuration data already entered.

Where the boundary re-shape **would** result in any of the plots/points being transferred to a different Section, a message box will appear warning that the original set of plots/points for the affected Section(s) will be deleted if re-shape is continued. If the decision is to continue with the re-shape, a new set of plots/points **must** be generated to replace those that have been deleted.

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In the example below, the original Section A plots are maintained because they are clear of the boundary modification, whereas the original Section B plots are deleted because at least one of the plot centres subsequently falls within Section A.



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5.6 Slide Section Boundary Nodes

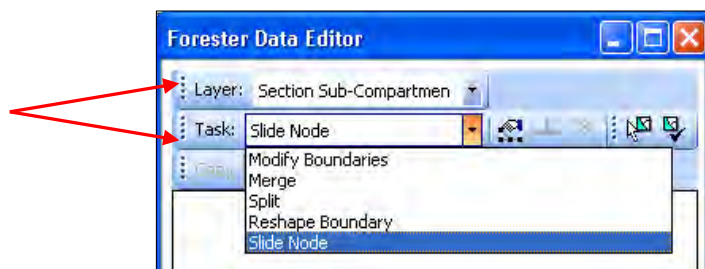
5.6.1 What are Section boundary nodes?

Nodes mark the point where a Section boundary intersects another Section boundary or the Square boundary. When using the Modify Tool to amend a Section boundary, the nodes are displayed as little red squares.

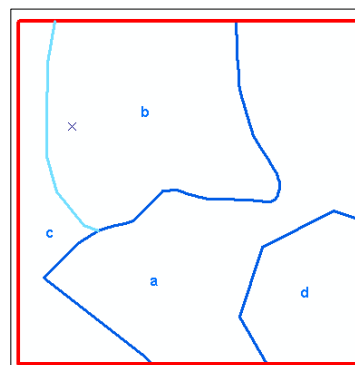
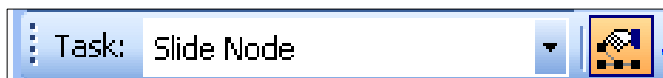
5.6.2 Sliding boundary nodes

Nodes can be moved by sliding them to another point along the Section or Square boundary, using the Slide Node Tool.

In the Forester Data Editor window, select "Section Sub-Compartment" from the Layer drop down menu, and "Slide Node" from the Task drop down menu.



Click on the "Select Shared Boundary" button to the right of the Task box, and then left-click on the Section boundary that contains the node to be moved. See the boundary highlighted in blue.



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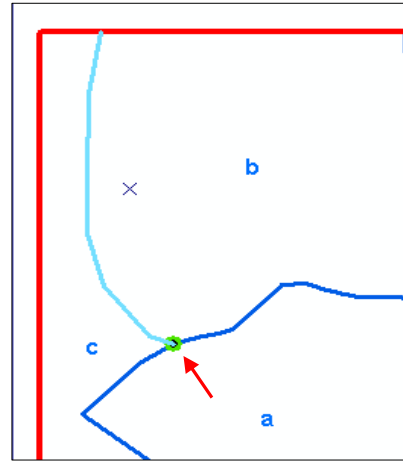
Click on the "Slide Node Edit Tool" button to the right of the Task box, and then run the cursor along the Section boundary to the point where the node is located.



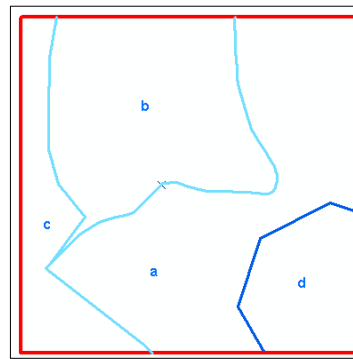
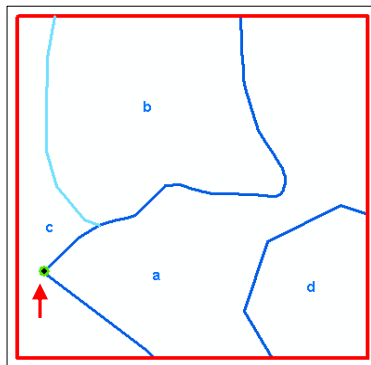
The cursor will change from a No Entry sign to this symbol.



Click on the node and see it turn green.



Slide the node along the Section boundary to the point where it is to be relocated. Double click to finish the slide operation. The software will update the Section boundary.

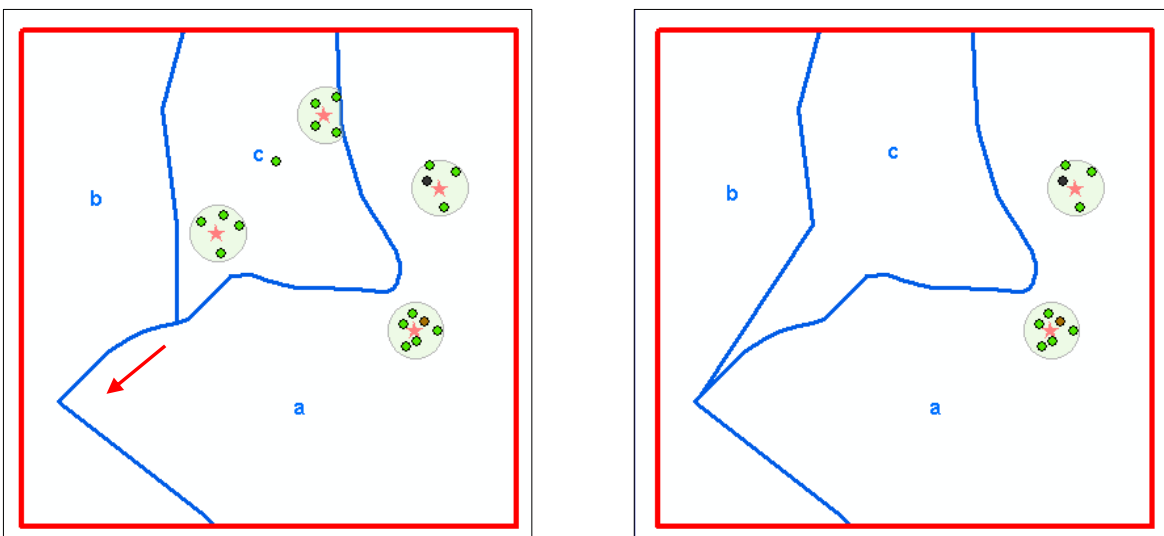


Use the Modify Tool to move the Section boundary vertices, as required.

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5.6.3 Sliding Section boundary nodes after mensuration plots/points have been generated

This will **always** result in deletion of the original set of plots/points within the Sections sharing the amended boundary, and therefore loss of any mensuration data entered prior to the slide node operation. In such a case a new set of plots/points **must** be generated for the affected Sections. In the example below, sliding the node at the point where the Section A/B/C boundaries intersect has resulted in the Section C plots being deleted.



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5.7 Variations in Section boundary editing when assessing Re Measure Squares.

The tools for splitting, merging and modifying Sections boundaries are exactly the same for Re measure squares as for New Squares.

In general you will need to use them less, as you will be presented with an existing Section map of the sample square as produced by the previous surveyor.

The more involved aspect concerning Re measure squares is deciding when you need to use the Section boundary edit tools. The need to use them or not will be based upon your assessment of the Section boundaries as they stand today and how that compares to what the previous surveyor recorded. This will allow you to ascertain if:

1. The previous boundaries (from the 1st cycle) were correct and should remain unchanged.
2. The previous boundaries were correct but real change on the ground has occurred.
3. The previous boundaries were incorrect and show previous surveyor error.

To ascertain this you will walk the bounds of the square and assess the general layout of the site and its broad composition, picking up the Section boundaries where they cross the square boundary. Then you will walk the whole square until you have established the Sections.

Sometimes it may be easier and faster to first traverse the square in part or in full if there are good paths etc. and this may help you to build a mental picture of the site faster. The point is for you to cover the whole site in what you deem to be the most efficient manner, but you must walk the bounds, the Section boundaries and confirm the nature and location of any significant features such as tracks, streams or hedges.

As per the standard protocol once you have assessed the whole square you can confirm if the Section boundaries provided represent the site as you find it. Assuming that they do then the next stage is to assess the Sections in depth.

If the Sections do not match what you have been provided with from the 1st cycle, see the Section on 'tolerances in assessing differences and change in Sections' and this will help you decide if the Sections boundaries need to be edited or not.

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5.7.1 Assessing the Sections in depth

By this stage you should already have a feel of the nature of the Section, its landuse and if appropriate; its number of stories, components, component groups and species. Now that you are assessing this Section 'in depth', look at the Section visualisation tool and the components and gain a detailed view of what the previous surveyor found and recorded.

Walk the Section and look out for:

1. The features previously identified.
2. Are they still evident?
3. How have they changed?
4. Are they missing?
5. And are there any new features?

At this stage it is best to reconfirm that you are still broadly content with the definition of the Section, its storey structure and basic composition.

If you feel that the stand is pretty much as described and has simply 'grown on' for 5 years, a few changes to the component attributes may be all that it requires to bring the Section up to date, such as the revision of the storey height bands, estimated crown diameters and stocking.

Some stands may have evolved more significantly and you may have to identify and record factors such as:

1. A thinning event:
 - a. Its impact on stocking.
 - b. Its impact on component / species %'s.
 - c. The presence of new rides or racks.
 - d. A change in silvicultural practice.
 - e. The presence of tree damage such as bark skimming.
 - f. Notice its impact on the amount and type of deadwood.
2. Any other new management practice.
3. The loss of a seedling layer.
4. The change of a seedling layer to a sapling layer.
5. A new tree species colonising the stand.

The point is to identify what has changed since the last survey and to assess, measure and record that.

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You will also need to decide if any such factors necessitate the creation of new Sections, the merging of exiting Sections, or the modification of boundaries.

5.7.2 Likely levels of real change

Around 10% of conifer sites will have been clear felled since the last survey and if all things are equal 10% of such clearfell sites will have been restocked. The proportion of broadleaved clearfelling will be low, nearing 0%, but sites may have been thinned and will have grown. Where clearfelling does occur it introduces significant change to the stand structure and may involve changes to Section boundaries, the removal of components (such as high forest) and the creation of new components (such as clearfell and seedlings).

This will reduce the amount of work required to assess the stand overall, as it will reduce your amount of mensuration work, but time will need to be put into assessing the extent and nature of any new clearfell and restocking.

Sites may also have been thinned; there will have been wind damage, fire and development. These and many other agents of change could impact on the Sectioning.

5.7.3 Tolerances in assessing differences and change in Sections

Once you have confirmed or updated the basic Section structure of the square in your own mind and have confirmed or amended the stands characteristics and its associated component structure (as per Chapter 4) you will need to record your findings within the field software. This may or may not include editing the Section boundaries.

Sometimes there will be no change, sometimes there will be obvious and real change on the ground and occasionally you may find a site where you disagree with the previous surveyors basic Sectioning and stratification of the site. In each instance we give guidance on what to record, what to accept and what to reject.

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5.7.3 Identifying change at Section level.

You are offered four choices when assessing change between the two cycles at the Section level; no change, real change, surveyor error and spatial error.

5.7.3.1 No change.

No change means that in your assessment there has been no material or no **significant change** since the last survey 5 years ago.

In most instances you will be looking at stands and stand boundaries. In most circumstances stand boundaries will not have changed unless significant events such as felling or windblow have occurred.

Processes such as tree growth and competition over the 5 years are not seen as significant events and are unlikely to have caused significant change, and are especially unlikely to have changed Section boundaries. Younger stands may have 'expanded' a metre or two at their peripheries as the trees have grown and the branches at the outer edge of the stand have lengthened, but this does not constitute significant change.

When assessing such small differences in the assessment of the location of Section boundaries it is also worth considering the inherent inaccuracies of the measurement techniques used in both surveys. Unless extensive and expensive GPS assessments are utilised, standard GPS and survey techniques are unlikely to have accuracies of less than 10 metres. With such a good general rule of thumb is to accept or tolerate differences in Section boundary assessments of less than 10metres unless there is strong evidence that real change has occurred.

For example; the categorisation of a Section as a pond in the first cycle is unlikely to have changed by the 2nd cycle unless significant and obvious pond drainage and or / civil engineering activity has occurred within the last 5 years, but you need to check if that is so.

It is possible to check this by looking to other data sources to help you make a decision, such as the OS data, the old aerial photography and the previous surveyor's assessment, including the point feature for a pond.

If they corroborate that the pond was there in the past, still is and it has not changed since, then record 'no change' and do not edit the Section boundaries.

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If the evidence shows that the pond has not changed in extent, but that the two surveyors assessed the locations to be slightly different, say by less than 10 metres, again record no change and do not edit the Section boundaries.

5.7.3.2 Real change in landuse.

It is likely that some Sections have undergone a complete change in landuse between surveys; the most probable will be a change from high forest to clearfell or clearfell to young trees. These will generally be obvious to detect and may or may not require editing of Section boundaries.

You will have to contend with less obvious real changes though and to date the NFI has found there are more of these than we generally may think.

For example, going back to the pond example above. It is possible that between surveys that a pond has been removed and if the previous surveyor recorded a pond and you cannot find it, as well as making your own observations on the ground you can again check your findings by looking to other data sources, such as the OS data and the old aerial photography. If these confirm the previous surveyor's assessment of a pond being there, and your assessment finds that now it is not there, then edit the Section accordingly and record real change.

Other examples of 'unusual' landuse changes found within a 5 year period within NFI:

- High forest to river
- High forest to quarry to young trees
- High forest to road construction site to young trees
- High forest to urban development
- High forest to agriculture

Alternately if the evidence shows that the pond was extended by 5 metres, please edit the Section boundaries and record this as real change.

5.7.3.3 Real change in extent.

These do and will occur. Clearfells are expanded, restocks are expanded, stands can expand or contract through natural processes, water features can shift and grow.

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We do need to record such differences, as they will be the largest driver for significant change in the woodlands between the two cycles. This is especially so when they include permanent and irretrievable loss in woodland area, such as in urban development.

Therefore it is important that you map any significant changes in Section extent.

Again picking up on our pond example; if the pond looks to have extended through either natural or human processes and this is significant (more than 5m or 10% in area) then edit the Section boundaries to reflect this.

5.7.3.4 Surveyor error

There will be instances where the previous surveyor clearly got the previous assessment wrong. This could be obvious in nature, i.e. they forgot to map a trunk road, or they missed a clearfell site. These should be dealt with by creating a new Section and classifying the change as surveyor error.

You will however find other examples where differences are more subtle or subjective in nature and are harder to classify as either real change or error. For example if the surveyor did not separate out two closely related woodland types, or two areas of a woodland that were of the same type but of a slightly different structure.

These if not significant can be accepted or given tolerance and would be recorded as no change.

If however the differences are more significant in nature and would lead to an incorrect assessment then the Sections need to be edited and recorded as surveyor error.

See the Section on tolerances for guidance on where such lines should be drawn.

In our pond example if the historic photo and the previous surveyors assessment do not corroborate with what you see and you believe that the last surveyor made a mistake in not accounting for the pond correctly, correct the landuse and / or edit the Section boundary and record 'surveyor error'.

5.7.3.5 Spatial error

This category should prove rare but will occur. It often goes unknown that most OS data has some level of spatial inaccuracy associated with it and since all the old FC aerial photo imagery used in the first cycle survey was stretched to fit the OS map, it too inherited any spatial inaccuracies from the OS mapping. These inaccuracies occurred as

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a high proportion of OS data was collected before the advent of GPS and satellites and was collected using manual methods such as 'rod and chains', sometimes as far back as the early 19th century. Whilst impressively accurate most of the time, these old measurements can be out by as much as 40m to 80m, especially so in the uplands. Indeed if you check the small print on OS mapping, OS give no guarantee as to the accuracy of their data no greater than +/- 4 m or 8 m in rural and upland areas respectively.

The issue we have to contend with then is that sometimes the first cycle square location, Sectioning and plot locations will have been referenced to these inaccurate maps and photos and since OS do have a programme to correct these inaccuracies, in some areas the underlying aerial photography and OS data will have been improved and will have 'shifted' between the two surveys.

In these rare instances, instead of re locating and re mapping the whole square, we expect you to look at the old AP to confirm that this is the case and treat it as 'spatial error'. As long as we have sampled a portion of the woodland consistently within itself, even if it is not located exactly and indeed could be offset by 10 or 20m or even 40m that is acceptable.

Similarly if the first surveyor miss located the original square corner and subsequently the whole square because of this factor, we will continue with the assessment at that location, as even though the square is offset from the original survey design intent, as long as the square gives a fair and unbiased picture of the woodland within the square we can still use that data. Again in these instances if you record that the square was located incorrectly within the 'peg comments' field at the square level and as 'spatial error' within the Sections, FC analysts can track and manage this distortion.

To help ascertain change and spatial issues since the last survey, copies of the original Aerial Photography used at the time of last survey will be issued.

5.7.4.1 Impact on plots of editing Section boundaries

The treatment of plots in relation to Section boundaries is quite different in Re Measure squares as compared to New squares in that **plots are not deleted** if Sections are merged, split or their boundaries are modified.

This difference in approach is because there is only one main objective of New squares and that is to assess woodland through the objective stratification and measurement of that woodland.

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Whilst for a Re measure square there are two main objectives and one is to similarly assess woodland through the objective stratification and measurement of that woodland, but two is also to assess change in that woodland since the last assessment.

It is that last objective of seeking to assess change in the woodland that leads to us looking for continuity in stratification, continuity in plot location, and continuity in tree measurements. This in turn leads to plot locations only being changed in very rare circumstances, irrespective of Section editing.

If you do change boundaries there will be minimal impact on plots and they will not be deleted as they are in New squares. The aim being to maintain continuity in the plot location and data capture. This allows for a much greater depth of change assessment within stand, within plot and on a tree by tree basis. Enabling us to tell how individual trees, have grown, died or been harvested.

5.7.5 Tolerances in Sectioning

Tolerance in Sectioning is given to:

1. Minimise the amount of unnecessary work involved in establishing false accuracy in relation to establishing 'absolute' interpretations of where boundaries lay.

2. Maximise continuity in stratification and sampling in measurements.

5.7.5.1 False Accuracy

This tolerance is necessary because most survey methods have some level of inbuilt inaccuracy which can lead to surveyors either becoming confused over differences between surveys or recording such differences as 'real change'. Not applying tolerances for false accuracy can lead to the reporting of the inherent inaccuracy in measurement as either real change or surveyor error.

The Section on 'Spatial Error' covers this in more depth but to recap:

Most OS data has some level of spatial inaccuracy associated with it and since all the old FC aerial photo imagery used in the first cycle survey was stretched to fit the OS map, it too inherited any spatial inaccuracies from the OS mapping. These inaccuracies occurred as a high proportion of OS data was collected before the advent of GPS and satellites and was collected using manual methods such as 'rod and chains'. These old

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measurements can be out by as much as 40m to 80m, especially so in the uplands. Indeed if you check the small print on OS mapping, OS give no guarantee as to the accuracy of their data no greater than +/- 4 m or 8 M in rural and upland areas respectively.

Similarly GPS units, unless equipped with a base station have margins of error up to 20 plus metres, so again previous readings must be interpreted in this light.

Taking the changing inaccuracies of the underlying OS data, AP and GPS into account, we advise that differences of less than 10m in Section boundaries should be tolerated unless there is string evidence to support real change.

5.7.5.2 Maximise continuity in stratification and sampling measurements

As previously discussed this factor arises as some measures within the survey have a subjective element in their assessment. If we reduce the amount of difference between the two surveys due to such subjectivity in survey there are multiple benefits.

Examples of these 'grey areas' would be Sectioning within mixtures, or within fragmented habitats or within continuums of species change.

Another would be storey allocation, where two 'good' surveyors may disagree or spend a long time debating over whether a stand is 2 or 3 storeys. Where there are no definitive 'right' answers we need to isolate this factor from the change picture.

Fundamental differences in Section and storey stratification can lead to more or less sample plots and samples trees. This can lead to significant differences in the assessment of the square, purely through the random nature of sampling. This would not impact of regional level comparisons and assessments between the two cycles but would start to impinge on our ability to assess change within the stand and within trees.

Therefore there is little to gain from having two surveys of the same square with different basic stratification (e.g. 3 Sections versus 4), but much to gain through keeping the same stratification (3 versus 3), as any differences in these situations are more likely due to real change as opposed to stratification / sampling differences.

Only when the basic stratification in the original survey is so poor that it does not represent the stand significantly should it be corrected or abandoned. This should be a rare incidence, whilst the smaller subjective differences will be frequent.

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Surveyors need to be given guidance as to what is acceptable subjectivity and what is not (error or real change).

Specific advice on tolerances for each element of the survey are provided in situ with each Section of the field manual. A good general 'rule of thumb' though is that if the previous surveyor was no more than 10% different in their assessment from you, in the areas of the survey which are more subjective, run with that.

Examples at which to split out sections:

- If the section area is out by more than 10%
- If the area is over 0.05 ha
- If a homogenous area of over 0.05 ha is sat within a section of a very different nature:
 - One species vs another
 - One landuse versus another
 - Open versus forest
 - Non native versus native
 - Conifer versus broadleaved
 - NFI / Non NFI

Examples at which to consider not making splits

- If the section area would change less than 10%
- If the proposed new section was smaller than 0.05ha and if similar in nature to the remaining section - up to 0.1ha
- If a 'suspect' area is not very homogenous and shares many traits with the remainder of the section.
- If a component group already represents the area
- *If a potential area is sat within a section of a similar nature:*
 - *One set of mixtures versus another set of mixtures, with an overlap in species*
 - *Two non natives*
 - *Two natives*
 - *Different by only one storey*
 - *Different by the presence of only one minor species*

Examples when to merge sections

- When they are exactly alike
- When they are only different to a very minor degree
 - Different by a weak / thin understory

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- Different by a weak / low impact treatment
- A very minor species composition difference (less than 10% of canopy)
- Through a poor NVC assessment

Examples when not to merge sections

- When the sections are notably or significantly different by the factors set out in Chapter 4.

Boundaries should be modified when they are out by more than 10m and/or the section area is out by more than 10%, unless there is strong evidence of actual change (e.g. road widening, river erosion etc.)

Once we look at differences that are more than what could be construed as a 'fair and reasonable' interpretation of that site, say 50% or 90% different then that must be corrected.

In extreme circumstances, where the Sectioning is absolutely wrong and the component grouping and component allocation is so different that it would undermine both the representation of the stand as a 'true and fair' picture and your ability to complete the square within one or two days, then the final option is to forget trying to align the two surveys and to wipe the previous survey data (from your copy – the original will be held by FC) and start from scratch as per a new survey. Additional payments can be made to compensate for the extra time taken to do this.

Once you have these factors in mind you have to make your best assessment of whether to make changes to Section boundaries and to assess and record as appropriate the reason for this.