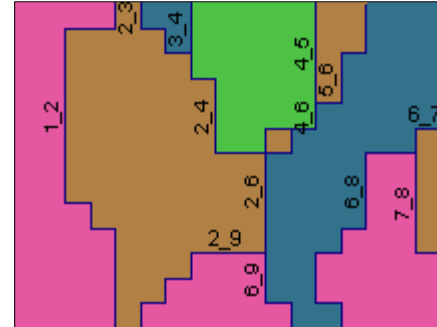


Adjacent Patch Metrics – Class Area and Length

These instructions show you how to determine the total lengths and areas of neighboring classes that exist for each patch in a landscape. Using ArcGIS 9.2 (**ArcInfo**) and HawthTools (www.spatial ecology.com), perform the following steps to calculate the edge and area of adjacent classes for each region 'patch' in a raster grid:

- Group the landscape into regions (aka patches)
- Extract the raster edges
- Dissolve the edge output
- Calculate new values for lengths, areas, and edge referencing
- Summarize and create pivot tables to add totals into the original region/patch table

Note: ArcView may be used in conjunction with MS Excel's pivot table report or MS Access' cross-tabulation query in place of ArcInfo's Pivot Table tool.



ORIGINAL DATA

landcover

a raster grid of landcover classes

CREATED DATA

patch

a raster grid of regions/patches resulting from the RegionGroup function tool in Spatial Analyst

edge.shp

a line shapefile resulting from extracting raster edge values from an input raster grid

edge_Dissolve.shp

a line shapefile resulting from the dissolve of edge.shp

eAcB.dbf

tables resulting from summarizing lengths and areas for each edge reference

eBcA.dbf

eAcB_PivotArea.dbf

pivot tables that reduce redundant areas for each edge reference

eBcA_PivotArea.dbf

eAcB_PivotLength.dbf

pivot tables that reduce redundant lengths for each edge reference

eBcA_PivotLength.dbf

length.dbf

exported patch VAT for use in calculating total lengths and areas by region/patch

area.dbf

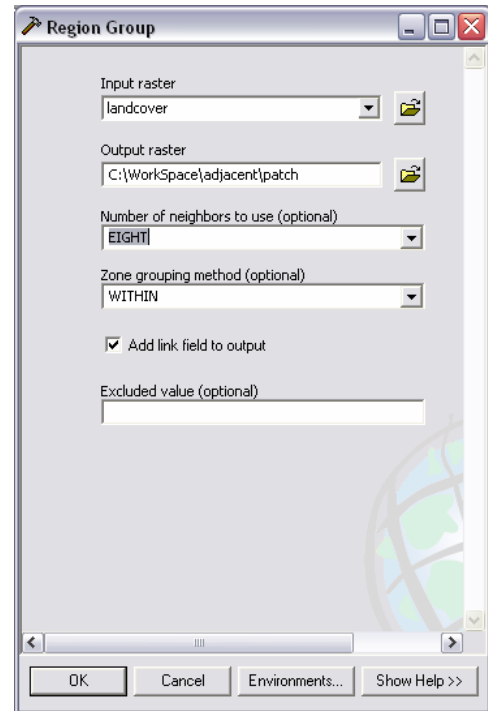
Identify edge references:

Start ArcMap

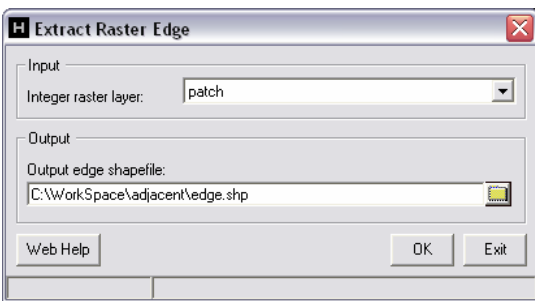
1. Start ARCMAP with a new empty map document
2. Add the raster grid of landcover classes; e.g. **landcover**
3. Enable/display HawthTools and show ARCTOOLBOX

Create patches by grouping the cells within the landcover raster

4. Open ARCTOOLBOX >>> SPATIAL ANALYST TOOLS >>> GENERALIZATION >>> REGION GROUP
5. Specify the input **landcover**, the output **patch**, and set the number of neighbors to use **EIGHT**
6. Click OK

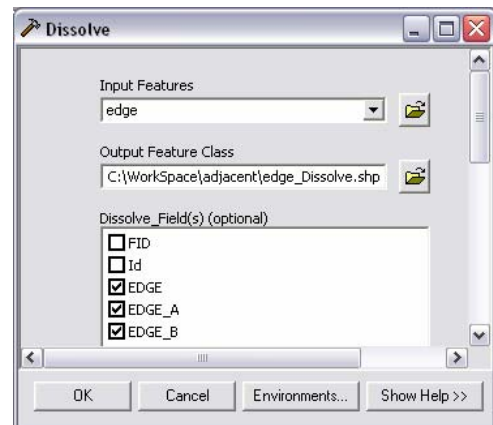


Identify edge references (extract, dissolve, join, add required attributes)



7. Choose HAWTH'S TOOLS >>> RASTER TOOLS >>> EXTRACT RASTER EDGE – *this will extract the edge values between patches*

8. Specify the input **patch** and the output **edge.shp**
9. Click OK



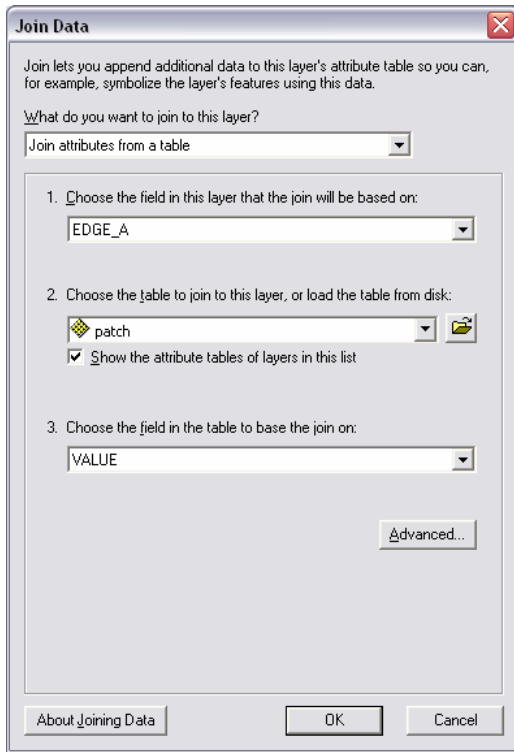
10. Open ARCTOOLBOX >>> DATA MANAGEMENT TOOLS >>> GENERALIZATION >>> DISSOLVE – *because Hawth's Tools extracts edges on a per cell basis, the dissolve is applied to simplify the references among edge values by reducing to single references*

11. Specify the input **edge.shp**, the output **edge_Dissolve.shp**, and the dissolve fields **EDGE, EDGE_A, EDGE_B**
12. Click OK

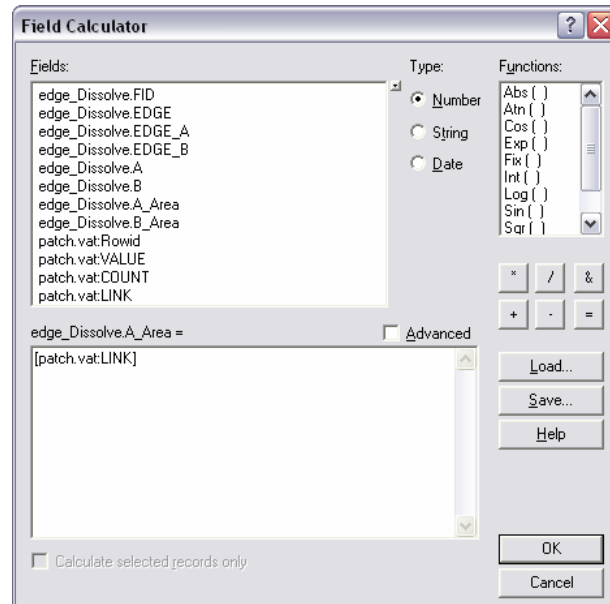
13. OPEN ATTRIBUTE TABLE for **edge_Dissolve** and choose OPTIONS >>> ADD FIELD – *add the following new fields to hold required attributes:*

Name	Type
A	Short Integer
B	Short Integer
A_Area	Long Integer
B_Area	Long Integer

14. Join tables to calculate the required attributes by right-clicking **edge_Dissolve** and choosing JOINS AND RELATES >>> JOINS

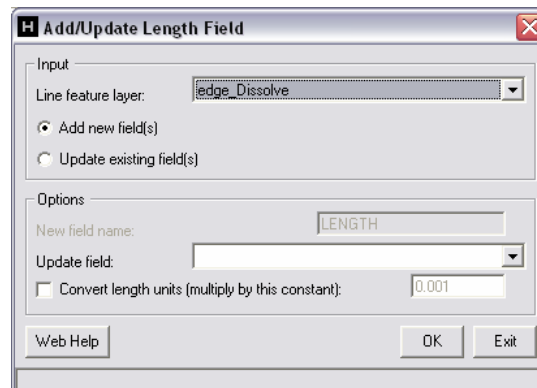


- **JOIN 1**: Perform a ‘Join attributes from a table’ >>> **EDGE_A** to patch VALUE
- Right-click **edge_Dissolve.A** field heading and click FIELD CALCULATOR and enter **[patch.vat:LINK]** and click OK
- Right-click **edge_Dissolve.A_Area** field heading and click FIELD CALCULATOR and enter **[patch.vat:COUNT] * 90** and click OK
- Right-click **edge_Dissolve** and choose JOINS AND RELATES >>> REMOVE JOIN(S) >>> REMOVE ALL JOINS



- **JOIN 2**: Perform a ‘Join attributes from a table’ >>> **EDGE_B** to patch VALUE
- Right-click **edge_Dissolve.B_Area** field heading and click FIELD CALCULATOR and enter **[patch.vat:COUNT] * 90** and click OK
- Right-click **edge_Dissolve.B** field heading and click FIELD CALCULATOR and enter **[patch.vat:LINK]** and click OK
- Right-click **edge_Dissolve** and choose JOINS AND RELATES >>> REMOVE JOIN(S) >>> REMOVE ALL JOINS

15. Choose HAWTH'S TOOLS >>> TABLE TOOLS >>> ADD LENGTH to add the length attribute to **edge_Dissolve**



16. Click **OPTIONS >>> RELOAD CACHE** to view the values – *now you have area and edge length for each adjacent patch*

Concatenate for multiple summarize (add field, calculate, summarize)

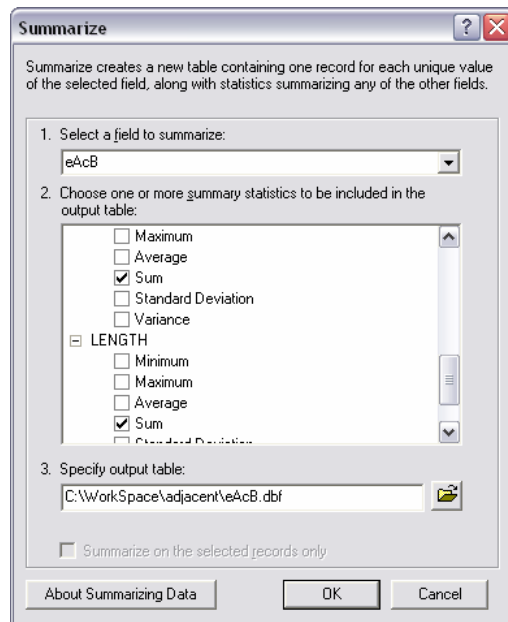
Note: Concatenation is the process of combining attribute values from multiple fields into a single field, which will then allow you to summarize on 'multiple fields'

17. OPEN **ATTRIBUTE TABLE** for **edge_Dissolve** and choose **OPTIONS >>> ADD FIELD** to add the following new fields:

Name	Type
eAcB	Text, 10
eBcA	Text, 10

18. Right-click **eAcB** field heading and click **FIELD CALCULATOR** and enter "**e**" & **[EDGE_A]** & "**c**" & **[B]** and click **OK**

19. Right-click **eBcA** field heading and click **FIELD CALCULATOR** and enter "**e**" & **[EDGE_B]** & "**c**" & **[A]** and click **OK**



20. Right-click **eAcB** field heading, click **SUMMARIZE** and check the following summary statistics:

- EDGE_A – Minimum
- B – Minimum
- B_Area – Sum
- LENGTH – Sum

21. Specify output table **eAcB.dbf** and click **OK**

22. Right-click **eBcA** field, click **SUMMARIZE** and check the following summary statistics:

- EDGE_B – Minimum
- A – Minimum
- A_Area – Sum
- LENGTH – Sum

23. Specify output table **eBcA.dbf** and click **OK**

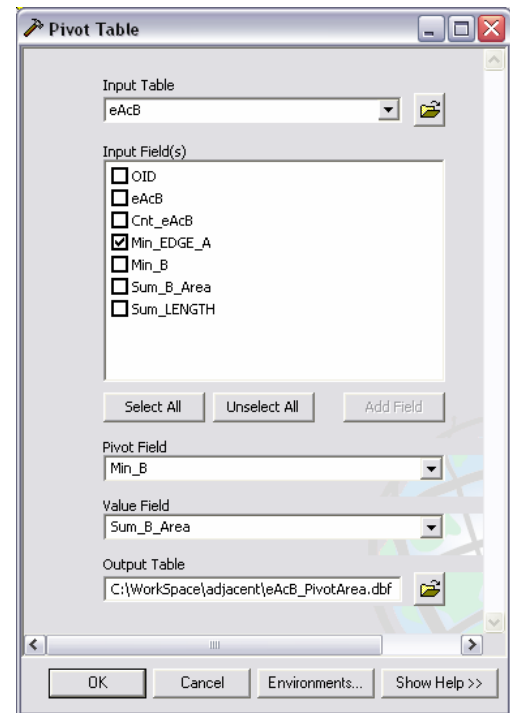
Both possible Edge-Class combinations must be addressed as above because the raster edge extraction tool does not create edge references in a systematic way.

Transpose class areas and lengths and calculate totals

Create pivot tables to transpose summary statistics by class

1. Run the Pivot Table tool twice to transpose **AREA** sums by class: open **ARCTOOLBOX >>> DATA MANAGEMENT TOOLS >>> TABLES >>> PIVOT TABLE**
2. In the Pivot table tool, input **eAcB**, input field **Min_EDGE_A**, pivot field **Min_B**, value field **Sum_B_Area**, and output table **eAcB_PivotArea.dbf**
3. Click **OK**

4. In the Pivot table tool, input **eBcA**, input field **Min_EDGE_B**, pivot field **Min_A**, value field **Sum_A_Area**, and output table **eBcA_PivotArea.dbf**
5. Click OK
6. Run the Pivot Table tool twice to transpose **LENGTH** sums by class: open ARCTOOLBOX >>> DATA MANAGEMENT TOOLS >>> TABLES >>> PIVOT TABLE
7. In the Pivot table tool, input **eAcB**, input field **Min_EDGE_A**, pivot field **Min_B**, value field **Sum_Length**, and output table **eAcB_PivotLength.dbf**
8. Click OK
9. In the Pivot table tool, input **eBcA**, input field **Min_EDGE_B**, pivot field **Min_A**, value field **Sum_Length**, and output table **eBcA_PivotLength.dbf**
10. Click OK



Export the patch value attribute table (VAT) to join in intermediate calculations

11. OPEN ATTRIBUTE TABLE for **patch** and click OPTIONS >>> EXPORT
12. Save as **area.dbf** – *this will be used for totaling class areas*
13. OPEN ATTRIBUTE TABLE for **area** and click OPTIONS >>> ADD FIELD
14. Add 18 new fields of Type **Long Integer**:
 - A1, A2, A3, A4, A5, and A6
 - B1, B2, B3, B4, B5, and B6
 - C1, C2, C3, C4, C5, and C6
15. In the open **area** table click OPTIONS >>> EXPORT
16. Save as **length.dbf** – *this will be used for totaling class lengths*
Join pivot tables to exported patch VAT copies and calculate total class values for each region/patch
17. Right-click **area** and choose JOINS AND RELATES >>> JOINS
 - **JOIN 1**: Perform a ‘Join attributes from a table’ >>> **VALUE** to eBcA_PivotArea **MIN_EDGE_B**
 - Right-click **area.A1** field heading and click FIELD CALCULATOR and enter [**eBcA_PivotArea.Min_A1**] and click OK (disregard the warning about the inability to copy Null into a number field)
 - REPEAT for each A1, A2, A3, A4, A6, and A7
 - Right-click **area** and choose JOINS AND RELATES >>> REMOVE JOIN(S) >>> REMOVE ALL JOINS
 - **JOIN 2**: Perform a ‘Join attributes from a table’ >>> **VALUE** to eAcB_PivotTable **MIN_EDGE_A**

- Right-click **region_classes.A1** field heading and click FIELD CALCULATOR and enter [**eAcB_PivotTable.Min_B1**] and click OK (disregard the warning about the inability to copy Null into a number field)
 - REPEAT for each B1, B2, B3, B4, B6, and B7
 - Right-click **area** and choose JOINS AND RELATES >>> REMOVE JOIN(S) >>> REMOVE ALL JOINS
18. Right-click **C1** field heading and click FIELD CALCULATOR and enter [**A1**] + [**B1**] and click OK
19. REPEAT for each C1, C2, C3, C4, C6, and C7 – *this adds up all adjacent patches of the same class (regardless of the ‘side’ of the edge)*
20. Repeat the above steps #17 through #19 substituting **length** wherever it states area above

Transfer totals to the original patch VAT

21. Join **area** table to **patch** value attribute table to transfer new class values
22. OPEN ATTRIBUTE TABLE for **patch** and click OPTIONS >>> ADD FIELD
23. Add 12 new fields of Type **Long Integer**:
- Area1, Area2, Area3, Area4, Area5, and Area6
 - Len1, Len2, Len3, Len4, Len5, and Len6
24. Right-click **patch** and choose JOINS AND RELATES >>> JOINS
25. Perform a ‘Join attributes from a table” >>> VALUE to **area** VALUE
26. Right-click **patch.vat:Area1** and click FIELD CALCULATOR and enter [**area.C1**] and click OK
27. REPEAT for each Area1, Area2, Area3, Area4, Area5, and Area6 (use the corresponding C1, C2, C3, C4, C5, and C5 fields)
28. Right-click **patch** and choose JOINS AND RELATES >>> REMOVE JOIN(S) >>> REMOVE ALL JOINS
29. Repeat the above steps #21 through #28 substituting **length** wherever it states area above

Rowid	VALUE *	COUNT	LINK	AREA1	AREA2	AREA3	AREA4	AREA5	AREA6	LEN1	LEN2	LEN3	LEN4	LEN5	LEN6
0	1	1046	4	203670	24840	0	0	218187	0	5580	7980	0	0	690	0
1	2	44	2	121770	0	0	94140	0	390	0	0	180	0	0	0
2	3	1353	1	0	18900	0	135810	218187	0	0	1620	0	3660	1080	0
3	4	864	2	2072880	0	0	96930	218187	0	1230	0	0	9660	2040	0
4	5	427	4	2072880	78390	0	0	218187	0	780	2880	0	0	390	0
5	6	24243	5	4369941	336582	254988	1190214	0	282060	82932	83760	14538	43995	0	12510
6	7	1	4	2072880	0	0	0	0	0	90	0	0	0	0	0
7	8	23032	1	0	414090	5220	231570	218187	0	0	19740	3270	62370	54360	0

The final table (i.e. the patch VAT) will contain area and length fields for each class (1 through 6) that sum the total for all adjacent patches of that class.

TIP: Use the BATCH grid control when opening a tool in ArcToolbox to repeat the use of a tool such as ADD FIELDS – see the HELP topic “Using the batch grid control.”