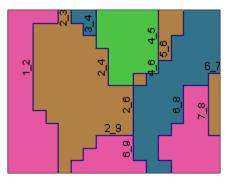
# **Adjacent Patch Metrics – Class Area and Length**

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 HawthsTools (<u>www.spatialecology.com</u>), 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
edge.shp	the RegionGroup function tool in Spatial Analyst 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
eBcA.dbf	areas for each edge reference
eAcB_PivotArea.dbf	pivot tables that reduce redundant areas for
eBcA PivotArea.dbf	each edge reference
eAcB_PivotLength.dbf	pivot tables that reduce redundant lengths for
eBcA_PivotLength.dbf	each edge reference
length.dbf	exported patch VAT for use in calculating total
area.dbf	lengths and areas by region/patch

### 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 HawthsTools and show ARCTOOLBOX

#### Create patches by grouping the cells within the landcover raster

- 4. Open ARCTOOLBOX >>> SPATIAL ANALYST TOOLS >>> GENERALIZATION >>> REGION GROUP
- 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)

H Extract Raster Edge	$\overline{\mathbf{X}}$
Input Integer raster layer: patch	<b>_</b>
Output Output edge shapefile:	
C:\WorkSpace\adjacent\edge.shp	
Web Help	OK Exit

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 HawthsTools extracts edges on a per cell basis, the dissolve is applied to simplify the references among edge values by reducing to single references

<sup>®</sup> Dissolve			
In	out Features		î
e	dge	<b>_</b>	E 1
01	itput Feature Class		
	:\WorkSpace\adjacent\e	:dge_Dissolve.shp	<b></b>
Di	solve_Field(s) (optional)		
	FID		
	Id EDGE		
	EDGE_A		
Ē	EDGE_B		~
	1111		>
OK	Cancel Er	vironments	Show Help >>

- 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	Туре
A	Short Integer
В	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 Data 🛛 🛛 🕅
Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.
What do you want to join to this layer?
Join attributes from a table
1. <u>Choose the field in this layer that the join will be based on:</u>
EDGE_A
2. Choose the table to join to this layer, or load the table from disk:
🔷 patch 🔽 🖆
☑ Show the attribute tables of layers in this list
3. Choose the field in the table to base the join on:
VALUE
Advanced
About Joining Data OK Cancel

- 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 CACLULATOR 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**

- <u>JOIN 1</u>: 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 CACLULATOR and enter [patch.vat:COUNT] \* 90 and click OK
- Right-click edge\_Dissolve and choose JOINS AND RELATES >>> REMOVE JOIN(S) >>> REMOVE ALL JOINS

Field Calculator		? 🗙
Eields: edge_Dissolve.FID edge_Dissolve.EDGE edge_Dissolve.EDGE_A edge_Dissolve.ADGE_B edge_Dissolve.A edge_Dissolve.A edge_Dissolve.B edge_Dissolve.B edge_Dissolve.B patch.vat:Rowid patch.vat:Rowid patch.vat:COUNT patch.vatLINK	Type: ✓ ⊙ Number ⊂ String ⊂ Date	Functions:       Abs ()       Ahn ()       Cos ()       Exp ()       Fix ()       Int ()       Log ()       Sin ()       Sor ()       *       /
edge_Dissolve.A_Area = [patch.vat:LINK]	Advanced	+ · = Load Save Help
Calculate selected records only		OK Cancel

Input Line feature layer:	edge_Dissolve	•
<ul> <li>Add new field(s)</li> </ul>		
C Update existing f	ield(s)	
Options		
New field name:	LENGT	Ή
Update field:		•
Convert length u	nits (multiply by this constant):	0.001

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	Туре
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

Summarize	? 🔀
Summarize creates a new table containing one record for each un of the selected field, along with statistics summarizing any of the c	
1. Select a field to summarize:	
eAcB	•
<ol><li>Choose one or more summary statistics to be included in the output table:</li></ol>	
Maximum Average Sum Sum LENGTH Minimum Average	
Sum	~
3. Specify output table: C:\WorkSpace\adjacent\eAcB.dbf	<b>1</b>
Gummarize on the selected records only  About Summarizing Data  OK  OK	Cancel

- 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

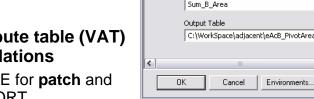
- Run the Pivot Table tool twice to transpose <u>AREA</u> sums by class: open ARCTOOLBOX >>> DATA MANAGEMENT TOOLS >>> TABLES >>> PIVOT TABLE
- 2. In the Pivot table tool, input eAcB, input field Min\_EDGE\_A, pivot field Min\_B, value field Sum\_B\_Area, and output table eAcB\_PivotArea.dbf
- 3. Click OK

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- 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

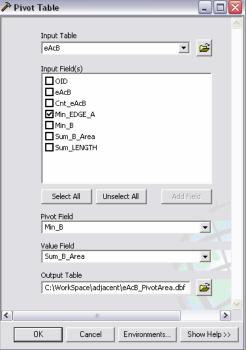
15. In the open area table click OPTIONS >>> EXPORT

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

1	Rowid	VALUE *	COUNT	LINK	AREA1	AREA2	<b>AREA3</b>	AREA4	AREA5	AREA6	LEN1	LEN2	LEN3	LEN4	LEN5	LEN6
Í	0	1	1046	4	203670	24840	0	0	218187	0	5580	7980	0	0	690	0
ĺ	1	2	44	2	121770	0	0	94140	0	0	390	0	0	180	0	0
1	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
1	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
٦	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**."