How do I do that in ArcGIS/Manifold: illustrating classic GIS tasks

Edited by: Arthur J. Lembo, Jr.; Cornell University

How do I do that in ArcGIS/Manifold 1 © Arthur J. Lembo, Jr.

Introduction from the editor:

In 1988, the United States Geological Survey (USGS) created a classic document titled "The Process for Selecting Geographic Information Systems¹" (Guptil, et. al., 1988). The document provided an overview of the process for selecting geographic information systems, in addition to a checklist of functions that a GIS should include. The functions were broken into five separate categories: user interface, database management, database creation, data manipulation and analysis, and data display and presentation. The document became *required reading* for those of us involved in the selection of GIS, and was often used as a supplementary checklist in competitive benchmarks of GIS software. Although the document is over 15 years old, many of the functions listed are still relevant today, and represent some of the most commonly used features within GIS. In fact, the document was so forward thinking that most GIS software products are still unable to perform all the tasks listed.

Therefore, this document attempts to illustrate the GIS processes listed in the USGS document using two popular GIS software systems: ArcGIS 8.3 and Manifold 6.0. While the document does illustrate the steps required to complete the classic GIS tasks in a side-by-side format, it is not meant to be a comparison or an endorsement of either product (they just happen to be the two most popular products in our lab). Rather, it is meant to act as a *cheat-sheet* for GIS professionals needing some direction in performing classic GIS functions. Many individuals are beginning to experiment with Manifold GIS, and the large user base of ArcView 3.x user continues to migrate to ArcGIS. It is our hope that this document assists these users in performing some of the more common tasks.

This document represents a midterm examination assignment for 16 of our students in the upper level graduate course *Spatial Modeling and Analysis*. The students and instructor spent many hours in lab working through each of the tasks over a three week period.

The resources and time available to illustrate these tasks prohibited the ability to review every function listed in the USGS document. Therefore, we selected a large subset of the functions though to represent the common GIS functions employed by users today.

We are especially grateful to those individuals who volunteered as technical referees for each note. The referees represented long-time users of the software products, business partners, and certified trainers of the software from government, private industry, and academia. For the ArcGIS tasks, five referees were chosen, while four referees were chosen to evaluate the Manifold tasks.

¹ Guptill, S., D. Cotter, R. Gibson, R. Liston, H. Tom, T. Trainer, H. VanWyhe. 1988. "A Process for Selecting Geographic Information Systems". Technology Working Group – Technical Report 1. USGS Open File Report 88-105.

None of the referees were affiliated with Cornell University, and were anonymous to the authors.

One difficulty in creating this document was interpreting the actual meaning of some of the USGS defined tasks. Another difficulty was attempting to find the most suitable approach for solving the problem. As most users know, there are many ways to solve a particular problem using commercial GIS software. In this document we have attempted to illustrate the most straightforward method for performing the tasks, and have relied on the referees to make sure that a suitable approach was chosen. However, any errors remaining within the document are our own, and not the fault of the referees.

Also, while each of the GIS products allow the creation of sophisticated scripts, or integrate third-party software, we have attempted to only utilize those features accessible *out-of-the-box* in hopes that it will provide basic guidance for users of the software.

Time marches on, and some functionalities not envisioned by the USGS document now exist. We hope to expand the scope of this document to include more sophisticated functions now offered by the commercial GIS vendors.

It is our hope that this document provides a quick reference for users to find the necessary steps to complete the classic GIS tasks.

Arthur J. Lembo, Jr.; Ph.D. May, 2004 Cornell University

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Database Management

Database management functions provide for tracking, retrieval, storage, update, protection, and archiving of stored data.

Page 29, The Process for Selecting Geographic Information Systems.

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Adding a column to a table Pete Kane, Cornell University

This technical note compares the process of adding columns to a table using both ArcGIS and Manifold GIS. Simple tables are used to help illustrate the process.

Manifold Process	ArcGIS process				
Software: Manifold GIS	Software: ArcGIS				
Extensions: None	Extensions: None				
As an example, a simple table is opened in	As an example, a simple table is opened in				
Manifold.	ArcGIS.				
	P Attributes of LAKIS				
🔳 LAKES	FID Shape" AREA NAME				
	O Polygon 2353.441 Great Salt Lake				
FID Shape AREA NAME	1 Polygon 320,543 Lake Powel				
U Polygon 2359,441 Great Salt Lake	2 Polyton 321 310 Salido Sel				
1 Polygon 320.543 Lake Powell	4 Polycen 299 91 Univer Red Late				
2 Polygon 321.378 Salton Sea	5 Polygon 317.56 Lake Mead				
3 Polygon 591.433 Lake Okeechobee	6 Polygon 130.366 Claha Hill Lake				
4 Polygon 398.91 Upper Red Lake	7 Polygon 1795 #57 Lake of the Woods				
5 Polygon 317.56 Lake Mead	8 Polygon 410.115 Fort Peck Lake				
6 Polygon 130.366 Clarks Hill Lake	9 Polygon 752 154 Loke Cahe				
7 Polygon 1796.457 Lake of the Woods	10 Polygon 182.636 Mile Lacs Lake				
8 Polygon 410.115 Fort Peck Lake	11 Polygon 22228.402 Lake Michigan				
9 Polygon 752.154 Lake Oahe	12 Polygon 115.152 Velowitore Lake				
10 Polygon 182.636 Mille Lacs Lake	13 Polygon 185 737 Late Winebego				
11 Polygon 22228.402 Lake Michigan	14 Polygon 54 765 Gayuga Lake				
12 Polygon 115.152 Yellowstone Lake	15 Polygon 3912 683 Lake Eve				
13 Polygon 186,797 Lake Winnebago	15 Polygon 51.417 Seneca Lake				
14 Polygon 54,765 Gayuga Lake	10 Polypon 403.000 Late 51 Late 10 Polypon 21 212 Except day				
15 Polygon 9912.683 Lake Érie	10. Colymn 21. Classes 125 Heart Alone				
16 Polygon 61,417 Seneca Lake	20 Polydon 116 199 Lake Bakley				
17 Polygon 469.088 Lake St. Clair	21 Polygon 202,213 Kentucky Lake				
18 Polygon 21,213 Keuka Lake	22 Polygon 147.619 Loke Texoma				
19 Polygon 176 152 Lake Taboe	23 Polygon 597.43 Lake Sakakawea				
20 Polygon 116129 Lake Barklay	24 Polygon 74.745 Lake Winnpesaukee				
21 Polygon 20212 Karbuday	25 Polygon 491.698 Lake Champlain				
22 Polygon 147 610 Lake Toyoma	26 Polygon 32213.001 Lake Superior				
22 Polygon 147.019 Ears (exolina 23 Polygon 507.43 Lake Sakakawea	27 Polygon 23762.253 Lake Haron				
24 Dolugon 74.748 Lake Winningsoukee	28: Polygon 7745.332 (Lake Unkano				
25 Polygon 491.698 Lake Champlain	An and the second				
26 Polygon 32213 001 Lake Superior	Record 14 4 1 1 141 Show All Selected Records ID out of 29 Selected Options +				
20 Polygon 32213.001 Lake Superior					
27 Polygon 23762.235 Lake Huron					
	Adding a column to a table in ArcGIS				
Adding a column to the data table requires					
risang a column to the data table requires	requires a few simple steps				
a few simple steps:					
	1. Click the <i>options</i> button at the bottom				
1 Right-click on any of the column					
	right of the table and then click add				
headers at the top of the table					
	l field.				
	1				
Llow do Later :	n AraCIS/Manifold				
now do I do that I	IT AIGGIS/IVIAIIIIUIU				
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© Artnur J.	Lembo, Jr.				

2. Click on add and then columns in the dropdown menu.

- Ch	AREA	NAME
Az Sort Ascending	9.441	Great Salt Lake
K Sort Descending	1.543	Lake Powell
Add	🔹 🔶 Çolu	mn
Edt	Acti	ve Column
Edit Script	Ban	k.Column
Flatten	6,457	Lake of the Woods
Recompute	0.115	Fort Peck Lake
M	2.154	Lake Oahe
👗 Ogt	2.636	Mile Lacs Lake
Ba Copy	28.402	Lake Michigan
Reste	5.152	Yellowstone Lake
Raste Arrend	.797	Lake Winnebago
	765	Gayuga Lake
V Detece	2,683	Lake Ene
Rename	088	Lake St. Clair
Transfer Dates	213	Keuka Lake
Transfer Kules	5.152	Lake Tahoe
Format	3.189	Lake Barkley
week.	2.213	Kentucky Lake
11 Martin	1.619	Lake Texoma
üos	2.43	Lake Sakakawea
Change Type	740	Lake Winnipesauke
18		Lake Champiain
MS Language	13.001	Lake Superior
Order	16,253	Lake Huron

3. Type the name and select the appropriate data type of the new column in the box that appears.



4. The new column will appear to the right of all other columns in the table.

nin in	ules o	LAKIS				
F	D	Shape"	AREA	RAME		
	- 0	Pullygon	2389.445	Send Saltake		
	1	Polygon	320,543	Loke Powel		
	- 1	Polygon	221.378	Sahon Sea		
	- 3	Polygon	591,433	Late Directuber		
	- 4	Polygon	206.31	Upper Red Lake		
	- 5	Polygon	317.56	Lee Meet		
	- 4	Polygon	130.366	CaksHELete		
	- 1	Polypn	1796.457	Lake of the Woods		
	- 6	Polygon	410.115	Fot Peck Lake		
	. 9	Polygon	752,154	Leelate		
	- 10	Polygon	182.636	Mile Lacs Lake	A Fault Design	
	11	Polygon	22228.402	Laka Michigan	The second se	
	- 12	Polygon	115,152	Yelowatore Lake	E Select By Abritades.	4
	13	Polygon	166.797	Lake'winnebage	EE Select All	
	- 14	Polygon	54.765	Giskga Lake		
	15	Polygon	9912.683	Liéve Exe		
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	17	Polygon	469.005	Lete St. Dai	AM Pull	-
	- 18	Polygon	21 213	Kedalain	And Annual Contraction of the International Contractional C	-
	19	Polygon	176.152	Lake Table	Related Tables	
	- 20	Polygon	116.109	Lake Bahley	AND ADD ADD ADD	
	- 21	Polygon	202,213	KenalyLate	El Create order	
	- 4	Putygon	147.813	Late Textua	Add Table to Layout	
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	-8	Potygon	411 030	Lie e Diangtian	Expert	
	- 28	Putygon	1/213.001	Las Signo		

2. A window will pop up prompting you to input the name and data type for the column. Enter the name of the new column and the appropriate data type in the dropdown menu.

Add Field	
Name:	Column
Type: Field Proper Precision	Short Integer Short Integer Long Integer Float Double Text Date Blob
	OK Cancel

3. The new column will appear to the right of all columns in the table.

How do I do that in ArcGIS/Manifold 8 © Arthur J. Lembo, Jr.

2					thribules	of LAKES			
2					FID	Shape*	AREA	NAME	Column
NAME	FID	Shape	Column	•		Polygon	2359.441	Great Late	9
Great Salt L	ie 0	Polyaon	0			1 Polygon	320.543	Lake Powell	0
ake Powell	1	Polygon	0			2 Polygon	321.376	Safon Sea	0
labon Sea	2	Polygon	0			3 Polygon	191.433	Late OkeeChibee	0
Lake Okeed	obee 3	Polygon	0			4 Polygon	398.91	Uppei Red Lake	0
Upper Red I	oke +	Polygon	0		71	5 Polygon	317.56	Lake Mead	0
Lake Mead	5	Polygon	0			E Polygon	130.366	Claits Hill Loke	0
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Lake Oahe	9	Polygon	0		1	0 Polygon	182.636	Mile Lace Lake	-0
Mile Lacs La	ke 10	Polygon	0	<u></u>	1	1 Polygon	22229.402	Lala Michigan	0
ake Michig	n 11	Polygon	0		1	2 Polygon	115.152	Yellowstorie Lake	0
(elowstone	Lake 12	Polygon	0		.1	3 Polygon	106.797	Leke Winnebego	0
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ale St. Cla	17	Polygon	0		1	8 Polygon	21.213	KeukaLuke	0
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ake Tahoe	19	Polygon	0	B (3	0 Polygon	116.189	Loke Bahley	0
ake Barkler	20	Polygon	0		2	1 Polygon	202 213	Kentucky Lake	0
centucky La	ke 21	Polygon	0		2	2 Polygon	147.619	Lake Texona	0
ake Texon	a 22	Polygon	0		2	3 Polygon	597.43	Loke Sakakawea	0
ake Sakaka	wea 23	Polygon	0		2	# Polygon	74,748	Lala Winnipesaukee	9
ake Winnip	esaukee 24	Polygon	0		2	5 Pobgon	491.690	Late Danplain	0
ake Chang	an 25	Polygon	0		- 2	5 Polyain	32213 001	Lake Superior	0
Lake Superi	r 26	Polygon	0		0.021275		-	Second Compageon	and a second
ake Huron	27	Polygon	0	Rec	not 14 4	1 +14	H Show At	Selected Records El out of	(29 Selected.)
		2010/974 nd							
Cons	deratic	ons:		Other	Co	nsider	ations	S:	

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Sorting Tabular or Graphical Data Pete Kane, Cornell University

This technical note compares the process for sorting tabular or graphical data in ArcGIS and Manifold. Simple tables are used to illustrate the process.

Manifold Process	ArcGIS process			
Software: Manifold GIS	Software: ArcGIS (ArcCatalog)			
Extensions: None	Extensions: None			
Tabular data can be sorted according to	Tabular data can be sorted based on			
data type (alpha numeric, date, time) and	alphabetical or numerical order. The user			
can use any number of columns	has the option to sort either by one column or			
	multiple columns.			
As an example, a simple table is opened in	As an example, a simple table is opened in			
Manifold.	ArcGIS.			
IAKES*	FID Share' AREA NAME			
NAME AREA FID Shape Column	0 Polypon 2353 441 Great Salt Lake			
Clarks Hil Lake 130.366 6 Polygon 0	1 Polypon 200543 Lake Powell			
Fort Peck Lake 410,115 U Polygon 0 Gavusa Lake 54,765 14 Polygon 0	2 Polygon 321.3/8 Salton Sea 3 Polygon 591.433 Lake Objechobee			
Great Salt Lake 2359.441 0 Polygon 0	4 Polygon 398.91 Upper Red Lake			
Kentudiy Lake 202.213 21 Polygon 0	5 Polygon 317.56 Lake Mead			
Lake Barkley 116.109 20 Polygon 0	5 Polygon 130 366 Claim Hill Lake 7 Polygon 1796 857 Lake of the Julionia			
Lake Champian 491.698 25 Polygon 0	Proppin Process P			
Lake Drie 9912.603 15 Polygon 0	1 Polypon 752154 Lake Date			
Lake Mand 312.56 5 Polygon 0	10 Polygon 182.636 Mile Lacs Lake			
Lake Michigan 22228-402 11 Polygon 0	11 Polygon 22228-402 Lake Michigan			
Lake Oahe 752.154 9 Polygon 0	12 Polygon 115 152 Yellowstone Lake			
Lake of the Woods 1796.457 7 Polygon 0	12 Polypon 106/797 Lake Writebage			
Lake Okkechobee 591.433 3 Polygon 0	14 Polygon 54765 Gauge Lake			
Late Powell 320,543 1 Potrazn 0	15 Polygon 3512.663 Lake Lile			
Lake Sakakawea 997.43 23 Polygon 0	17 Polson 463080 Leis SL Dat			
Loke St. Clair 469.088 17 Polygon 0	18 Polypon 21.213 Keulia Lake			
Lake Superior 32213,001 26 Polygon 0	19 Polypon 176 152 Lake Tahoe			
Lake Textoma 147,619 22 Polygon 0	20 Polypon 116 109 Lake Bakley			
Lake Wrinebago 186.797 13 Polygon 0	21 Polygon 202213 Kentucky Lake			
Lake Winipesaukee 74.748 24 Polygon 0	22 Polypon 147.519 Lake Texona 70 Disease NOV 72 Lake Caled and a			
Pres Lacs Lake 182,636 10 Polygon 0	24 Polycon 24 740 Lake Workson Alex			
Seneca Lake 61.417 16 Polygon 0	25 Polypon 431 599 Lake Chanplan			
Upper Red Loke 398.91 4 Polygon 0	26 Pulygon 32213.001 Lake Superior			
Yelowstone Lake 115.152 12 Polygon 0	27 Polygon 23762 253 Lake Huron			
	29 Polygon 7746.302 Lake Ontato			
	Record 14 1 0 101 Show All Selected Records (0 out of 29 Selected) Options +			
We will begin by sorting records in a table	We will begin by sorting records in a table by			
by one column.	one column.			
Sorting tabular data by a single column	Sorting tabular data by a single column			
involves a few simple steps.	involves a few simple steps.			
1				
1 Dight click on the heading of the	1 Pight click on the heading of the			
	I. Right-click on the heading of the			
How do I do that i	n ArcGIS/Manifold			
	0			

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column whose records you would like to sort, and select either "sort ascending" or "sort descending".



Data records can also be sorted based on more than one record. In this example, we will sort first by name and then by area. Both sorts will be in ascending order.

1. Click on the *View* pull down menu and then select sort. This will pull up the sort window.



 In the sort window, choose which column you would like to sort, pressing the up arrow until it is above the other columns on the list. Then choose which column you would like to sort second, third, etc. Continue ordering the columns until column whose records you would like to sort, and select either "sort ascending" or "sort descending".

ID Shape'	AREA	NAM	к <u>.</u>	_
0 Fridgen	2359.441	GealSatLake		Set Accerding
1 Puligon	320.543	Laie Frend		East Descending
2 Polygon	321.376	Sator Sea	5	but the second
3 Puligan	291.423	Lake Okeechubee		Lenets
4 Fulgon	398.01	Upper FiedLake	50	Calculate Values
5 Puligon	317.56	Late Mead	2	
E. Pulygon	130.564	Cata HELake	-	
7 Paligon	1796.457	Lake of the Woods		Preein/Livineau Cake
8 Fulgeri	410.115	For Peck Lake		Parista Parist
3 Puligon	752154	Lale Oale		Passa Lane
10 Polygon	152.638	MileLassLake		1.5
11 Faligon	22228 402	Late Wehgen		
12 Pulligon	115.152	Valesceture Late		
13 Polygon	196 797	Late Winnebago		
14 Polypon	54.765	GengsLake		
15 Polygon	9912.483	LateExe		
Hi Polypon	61-417	Senecaliake		
17 Polegon	403.088	Late St. Car		
18.Pstegon	21,213	Keskalake		
13 Pulsgon	176 152	Lake Tatoe		
20 Polegon	116.189	Lake Bailing		
21 Puligon	202.217	KentuckyLake		
22 Polygon	147 619	Lake Texate		
23 Philippon	597.43	Lee Latabases		
24 Plagon	74,745	Late Wrotpeia.4e		
25 Paligon	491.676	Lake Champion		
25 Polegon	32213.007	Lake Superve		
27 Polygon	21782.253	Lake Huton		
28 Polision	7746.322	Lale Driald		

Data records can also be sorted based on more than one record. In this example, we will sort first by name and then by area. Both sorts will be in ascending order.

- The data must first be arranged so that the column that will be sorted first is to the left of the column that will be sorted second. In this example, we will sort first by name and then by Area. The name and area columns will thus be furthest to the left.
- 2. Click the header of the column to sort first.
- Press the control button on the keyboard followed by the column that will be sorted second. Continue this step until all desired columns have been selected.
- 4. Right-click the heading of one of the selected columns and select either "sort ascending" or "sort descending."

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ort	
: ▲ ▼ ¥ Aa a ab	
Column	Order
NAME	ascending
AREA	ascending 🗸
ID	
ihape	ascending
Iolumn	descending

. . .

...

ELAKIS *

NAME

Carks Hill Loke fort Peck Loke

Gayuga Lake Graet Salt Lake Keritucky Lake Kerika Lake

ake Barkley

Loke Eriet

Lake Chanpla

AREA

130.366 410.115 54.765

2359.441 0 21 18 202.213 21.213

116.189

401,600

9912.603

- 3. An option also exists for case sensitive sorting. If this option is chosen, words beginning with capital letters will be placed on the top of the table while the same word in lowercase is placed at the bottom.
- 4. Click OK once all of the columns, orders, and options have been selected. The resulting table in our example shows the data sorted first by name and then by area.

NAME		ADEA Charge	FID
Great Salt Lake	- Dat	Assending	0
Lake Powell	W Sot	Descending	1
Salton Sea			2
Lake Okeechobee	-	marco	3
Upper Fied Lake	III Cak	slate Values	4
Lake Mead	-E ===	and the second se	5
DaksHilLake	Pro-	and the second data on	6
Lake of the Woods	110	CELOTION COLUMN	7
Fort Peck Lake	Dek	te Field	8
Loke Dahe	-	The rest of the party of the pa	9
Mile Lacs Lake		182.636 Polygon	10
Lake Michigan		22228-402 Polygon	11
Velovitine Lake		115.152 Polygon	12
Lake Winnebago		186.797 Polygon	12
Gayuga Lake		54.765 Polygon	14
Laka Ene		9912.683 Polygon	15
SenecaLake		61.417 Polygon	16
Loke St. Clar		403.000 Polygon	17
KeskaLake		21.213 Polygon	18
Lake Tahoe		176.152 Polygon	19
Loke Basiley		116 189 Polygon	20
KentuckyLake		202.213 Polygon	21
Lake Texona		147.619 Polygon	22
Loke Sakakawea		597.43 Polygon	22
Lake Winnpecakee		74.748 Polygon	24
Lake Chanplain		491.638 Polygon	25
Lake Superior		32213.001 Polygon	25
Lake Huron		20762.253 Polygon	27
Lake Ontario		7746.332 Polygon	28

4. The final step is to right-click on the heading of one of the selected columns and select either "sort ascending" or "sort descending.

20 25 15 Lake Hurún Lake Mead Lake Michigan 23762.253 27 317.56 28.402 11 ake Cahe ake of the Wo 752.154 Lole of the Wo Lole Oleechob Lole Ontario Lole Solutionel Lole SL Clar Lole SL Clar Lole SL Clar Lole SL Clar Lole Tance Lole Tance 591.433 7746.332 120.543 597.43 469.088 17 32213.001 26 176.152 19 147.419 22 13 24 10 2 10 4 12 321.078 61.457 Apper Red Lak 398.91 115.152 Other Considerations: Other Considerations:

- 10 🗙

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Calculating values for new fields using arithmetic or related tables-making field calculations

Pete Kane, Cornell University

This technical note compares the process for calculating values for new fields in database tables using ArcGIS and Manifold. Simple tables are used to illustrate the process.

Manifold Process	ArcGIS process
Software: Manifold GIS Extensions: None	Software: ArcGis (ArcMap) Extensions: Editor Toolbar
As an example, the active table in Manifold is used to convert the area of several lakes in a table from square miles to square kilometers.	As an example, the field calculator in ArcMap is used to convert the area of several lakes in a table from square miles to square kilometers.
 Open up the table you wish to perform calculations on. Click on a column heading and select <i>add</i>, then click active column. In the Add Active Column dialog, choose a name for the desired function, a name for the new resulting column, and the appropriate computation control to determine when and how often the calculation is performed. 	 Start an edit session by clicking on the tools menu from the toolbar and then "Editor Toolbar." Open the table you wish to perform calculations on. On the editor toolbar, select "start editing."
Eunction: Multiplication Language: VBScript ✓ Add references for standard .NET modules Name: square KM Iype: Integer (32-bit)	Duik
 After you click OK in the active column dialog, a script window will appear. This is where you enter the appropriate formula to carry out your 	 In the "start editing" window, select which folder or database you want to edit from. The calculations will be
How do I do that i 1	n ArcGIS/Manifold
© Arthur J.	Lembo, Jr.

desired task. When referring to a field such as area, it is important to reference it as:

Record.Data("Area").

This is how you reference the records with active columns. Close the script window after the formula is complete.



5. After closing the script window, open the associated table, right-click on the newly formed column and choose re-compute. This will run the script and provide the results in the new column. applied to all of the records if you don't select any of the records.



5. Right-click on the field heading and select "calculate values."

NAME	ARF: ' ··· · ·	1
Great Salt Lake	2 Sort Ascending	
Lake Powell	F Sort Descending	
Salton Sea	Summarize	
Lake Okeechobee	Calculate University	ł
Upper Red Lake	Calculate values	
Lake Mead	Σ Statistics	
Clarks Hill Lake	Freeze/Unfreeze Column	
Lake of the Woods	1	
Fort Peck Lake	Delete Field	
Lake Oahe	752.154 Polygon	
Mille Lacs Lake	182.636 Polygon	
Lake Michigan	22228.402 Polygon	
Yellowstone Lake	115.152 Polygon	
Lake Winnebago	186.797 Polygon	
Gayuga Lake	54.765 Polygon	
Lake Erie	9912.683 Polygon	
Seneca Lake	61.417 Polygon	
Lake St. Clair	469.088 Polygon	
Keuka Lake	21.213 Polygon	
Lake Tahoe	176.152 Polygon	
Lake Barkley	116.189 Polygon	
Kentucky Lake	202.213 Polygon	
Lake Texoma	147.619 Polygon	
Lake Sakakawea	597.43 Polygon	
Lake Winnipesaukee	74.748 Polygon	
Lake Champlain	491.698 Polygon	
Lake Superior	32213.001 Polygon	
Lake Huron	23762.253 Polygon	
Lake Ontario	7746.332 Polyaon	

 Use the fields and functions in the field calculator to build your desired calculation. In the example below, area is being converted from square miles to square kilometers.

LAKIS * Fields Ts MME APEA PD Shipe Pphysic Ts Great Sait Lake 2059/41 0 Pohysicn 630 Fields Ts Great Sait Lake 2059/41 0 Pohysicn 630 Fields Ts Galary Size Saiton Size 2210 2 Pohysicn 632 Fields Field Fields Fields	pe Functions Number Abs() An() O String Exp() Date Fo()
Groups Labe 94-705 14 Pohypan 142 Labe Trev 912-205 15 Pohypan 159 Smeas Labe 91-417 14 Pohypan 159 Kabe State 91-425 19 Pohypan 159 Kabe State 72-23 19 Pohypan 95 Labe State 91-23 21 Pohypan 95 Labe State 22 Pohypan 95 95 Labe State 22 Pohypan 95 95 Labe State 22 90 95 95 Labe State 220 7 Pohypan 950 Labe State	Setting table shown below en modified by a calculation, ing the area from square miles re kilometers.
Lide 5 dividence. Lide 1 dividence. Cide 1 Service Lide 5 Service Lide 5 Service Lide 5 Service Lide 6 Service	1902 307 Prégan 23 113058 (Prégan 24 1272 403 (Prégan 25 4614 128) (Prégan 25 2005 2901 (Prégan 25) 2005 2901 (Prégan 25)
Other Considerations: Other Consid	lerations:
A simpler method is to use the transform Calculations m toolbar in two steps: Calculations m	nay be faster outside of an edit e edit session is advantageous
First use the intrinsic fields to populate a new column	ows you to save changes.
Then use the multiply feature to calculate the value.	

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Relating Data Files and Fields

Pete Kane, Cornell University

This technical note compares the process of relating data files and fields using both ArcGIS and Manifold GIS. Simple tables are used to help illustrate this process.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: None	Extensions: None
As an example, we will use the lakes table to help illustrate the relate process by relating the lakes table to a table representing water pH.	As an example, we will use the Lakes table to help illustrate the relate process by relating the lakes table to a water table listing the pH of each lake.
1 Open the table that you would like	1 Right-click on the layer you would like to
related	relate in the table of contents and select
	"ioins and relates" ->"relate "
NAME AREA FED Shape	😞 lakes.mxd - ArcMap - ArcInfo
Great Salt Lake 2359.441 0 Polygon Lake Powel 300.543 1 Polygon Salton Saa 201.378 2 Polygon	Ble Edit Yew Insert Selection Iools Window Help
Lale Okeschobee 591.433 3 Polygon Lipper Red Lale 398.91 4 Polygon	D 📽 🖬 🍘 👗 🕸 🖏 📉 😰 🖓 🏚
Clarke Medical 337.56 5 Polygon Clarke Hill Leke 130.366 6 Polygon Leke of the Woods 1396.467 7 Polygon	E 💋 Layers
Fort Peck Lake 410.115 8 Polygon Lake Oxhe 752.154 9 Polygon	
Vielowstone Lake 115,152 12 Polygon	
Lake Winnebago 106.797 13 Polygon Gayuga Lake 94.785 14 Rolygon	8 8 X Bauone
Lale St. Clair 469.088 17 Polygon	😸 🥶 ndjar 🛄 Open Attribute Iable
Koula Lale 21.213 18 Polygon Lale Tahoe 176.152 19 Polygon Lale Ravier 115.199 20 Polygon	Zoins and Relates Zoin Zoins and Relates Zoin Renove Join(s)
Kerbudy Lake 202,213 21 Polygon Lake Texona 147,609 22 Polygon	Relation
Lale Salakawea 997.43 23 Polygon Lale Winipesalke 74.748 24 Polygon Lale Chancian 419.648 25 Polygon	E Parc Selection Regove Relate(s)
Lale Superior 32213.001 26 Polygon Lale Huron 23762.253 27 Polygon	Convert Labels to Annotation
Late Orkano 7746.332 26 Polygon	Convert Beatures to Graphics
	Save As Layer File
	Properties
2. Click on the table menu and then on	2. In the relate window, choose the field
relations.	to base the relate on as well as the
	table you wish to relate.

relation window. Image: Constrained of the state of th	onsiderations:

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Database Creation

Database creation functions are those functions required to convert spatial data into a digital form that can be used by a GIS. This includes digitizing features found on printed maps or aerial photographs and transformation of existing digital data into the internal format of a given GIS.

Page 29, The Process for Selecting Geographic Information Systems.

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Digitizing Jackie Grant, Cornell University

This technical note compares the process for digitizing points, lines and polygons in Manifold and ArcGIS. Simple line drawings are used to illustrate this example.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: None	Extensions: None
A map of parcel boundaries is displayed,	A map of parcel boundaries is displayed, and
and road centerlines are traced.	road centerlines are traced.
Result Same Jacob Same T	
	● Intribut diversing databage
	b is in the latter in the set of interference. A ≠ 2.5 (2.5 ± 2.5 B)
A CONTRACTOR OF A CONTRACTOR O	
ACCURATE OF AND A THE PERSON OF A STREET AND	
The <i>Tools</i> toolbar includes facilities for	auto and another sector sector the
digitizing points, lines, and areas. To add	The <i>Editor</i> toolbar includes facilities for
features, simply enable the appropriate	digitizing points, lines, and areas. To add a
button and begin digitizing the leatures.	draw points, lines, or areas
Tools	
\$\$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$	rden Killey + ▶ Ø + Tele Deda teor hatan → Telet Paula →
Other Considerations	Other Considerations
Manifold also includes facilities to snap	ArcGIS also includes facilities to span
features to existing points, lines, or	features to existing points, lines, or polygons.
polygons, or auto complete polygons.	
Lloore can mix facture times together (i.e.	Users cannot mix feature types together (i.e.
points, lines, and polygons).	points, lines, and polygons).
	1

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Assigning Topology Identifying Intersection Points

Jerry Brian, Department of Applied Economics and Management, Cornell University Stephen Shaw, Department of Biological and Environmental Engineering, Cornell University

This technical note compares the process for identifying the intersection points of overlapping lines. Simple line drawings are used to illustrate this example.





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	the first lines have a linese that the state
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	D#9819382918
	landinen and the sale of a state A + 5 + d + ± + and the sale of a state A + 5 + d + ± +
	Repeat as desired for other intersection points.
Other Considerations: None	Other Considerations: This is a flexible method to selectively choose intersections. The user can also use the topology tools in ArcEditor to apply a more global approach.

Creating a Polygon from Line Segments

Jerry Brian, Department of Applied Economics and Management, Cornell University Stephen Shaw, Department of Biological and Environmental Engineering, Cornell University

This technical note compares the process for creating polygons from line segments. Simple line drawings are used to illustrate the process. For ArcGIS, the task assumes that the line segments were created as a feature class within a Geodatabase.

Manifold Process	ArcGIS process
Software: Manifold GIS Extensions: None	Software: ArcGIS (ArcCatalog) Extensions: None
As an example, a simple line drawing is created in Manifold.	 This task uses a geodatabase with line features. (If you are starting with a shapefile, create a new geodatabase and export your shapefile as a new feature class to the geodatabase.) 1. In ArcCatalog, navigate to the geodatabase containing the line feature and right click on the data set containing your line feature.
 Select all lines in the window. In the Transformation Toolbar, select Bounded Areas from the dropdown menu. 	
intege 0 marge	2. In the dropdown menu, select New -> Polygon Feature Class from Lines
Transformation Toolbar	3. Name your new Polygon feature class, and select a cluster tolerance for your line feature class.
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Correcting Topological Errors Eliminating Overlaps, Undershoots, and Dangles

Jerry Brian, Department of Applied Economics and Management, Cornell University Stephen Shaw, Department of Biological and Environmental Engineering, Cornell

University

This technical note compares the process for finding, and correcting topological errors. A simple line drawing is used to illustrate the process.



Image: Construction of the state of the	Fix Topology Error Tool With the Fix Topology Error Tool open, a drop down menu provides operations to fix the given error such as "Snap," "Trim," or "Extend."
Each error can be visited one at a time and fixed if desired. Other Considerations:	Other Considerations:

Import and Export Importing database tables, raster data, and vector data

Rebecca L. Loughner, Department of Entomology, Cornell University

This technical note compares the process for importing database tables, raster data, and vector data using both ArcGIS and Manifold GIS. Data for this example includes a digital orthophotograph in Ithaca, New York (TIFF file), and the database and shape file for U.S. counties.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: none	Extensions: none
1. Database tables, raster data, and vector	1. To import database tables, raster data,
data are all imported under File \rightarrow Import.	and vector data:
a) To import database tables, select "Table."	a) In ArcMap right click on the layers label and select <i>Add Data</i> . The imported file is listed under layers, and select the appropriate data set.
Geren Ctrl+O ➡ Close	
Save Col+S	 Londing - Arching - Arching Die 198 (per pert penter bei greine (pin
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Import Comments Ctrl+Shft+C	R Brann
Page Setup Image Ctrl+Shift+I	
Ctrl+p Script Ctrl+p Script Ctrl+shit+s	
ithaca.map Isbe Col+Shit+T	
Component Component from Server	
Select the type of file to be imported and	Disker ■ 0 0 *. Questy * A □ * A * 0 0 000
the specific file.	SPEAK WE TO DAMAGE LIKE
<u> </u>	<u> </u>

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The filename will appear in the Properties window. Click on the file name to open a window containing the dataset.



b) To import raster data, select "Image" or Surface depending upon the format you are interested in.

View Tools Hel	p		
New	Ctrl+N		
Open	Ctrl+O		
⊆lose			
≦ave	Ctrl+S		
Save <u>A</u> s			
Create	,		
(mport	•	Comments	Ctrl+Shift+C
jink.	,	Drawing	Ctrl+Shift+D
Page Setup		Image	Ctrl+Shift+I
Print	Ctrl+P	Query	Ctrl+Shift+Q
1		Script	Ctrl+Shift+S
)geotechnosp.ma	P	Surface	Ctrl+Shift+U
)ithaca.map		Table	Ctrl+Shift+T
Exit		Component	
		Component from	Server

b) To import raster data, right click on the layers label to bring up the Add Data window. Select the file to add.



This will add the raster dataset in the ArcMap window.



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Select the file to import and the specific fields to be imported by checking boxes in the dialog window.



c) To import vector data, the add data button will allow you to open shapefiles, coverages, or geodatabases. Other formats will require the use of ArcToolbox.

Open ArcToolbox and select the tool for the type of file that requires conversion to ArcGIS, such as a digital linegraph.



Open the wizard for the particular file conversion and enter the input file and the coverage information (depending on the data file format, the wizard may present a slightly different, yet easy to follow interface).

Shapefile to Covera Input shapefile: N:\u	ge scounty.shp	- 21	2 DK
Item name mapping: @ De	efault mapping C Define mapping		Cancel Help
Shapefile field	RPSCD K		
Field name: FIPSCD	Item pame: FIPSCD	-	
Output feature class: Poly			
Output coverage:	/orkSpace/uscountynew	-	Batch 🔻

The data can then be opened in ArcGIS.

How do I do that in ArcGIS/Manifold 29 © Arthur J. Lembo, Jr. Imported files are shown in the Project window in Manifold. Select and open the file like you did with the database table.

2. Recognized file types under database tables, raster data, and vector data include:

- a) **Database tables**: CSV, DB, DBF, OLE and ODBC DB tables, HTML, MDB, UDL, WKx, and XLS
- b) Raster data (Image option in Manifold): BMP, CADRG/CIB, DOQ, ECW, EMF, ENVI IMG, ERDAS IMG, ERMappper ERS, GIF, HDF, JPEG, NITF, PCX, PNG, PPM, SGI, SPOT, SRTM, SUN, TGA, TIFF
- c) Raster data (surface option in Manifold): ADF, AVHRR, CEOS, SeaWiFS Satellite, CTG, LULC CTG, DAT, SPOT,DDR, LAS, DEM, STDS, DEM GLOBE, GTOPO30, DTED, E00, ENVI, ERDAS IMG, ERMapper, ESRI ASCII Grid, ESRI Fload Grid, GeoSPOT, GRASS, SeaWiFS, ENVI IMG, IDRISI, SDTS SRTM Space Shuttle terrain, Surfer GRD, MapInfo TAB grid files, Generic XYZ
- d) Vector data (Drawing option in manifold): BNA, CSV, DB, DBF, DGN, DLG, DSN, DWG, DXF, E00, GDF, GML, HTML, IDRISI VCT, LULC GIRAS, ETAK MapAccess, ETAK MapBase, MDB, MFD, MIF, MWS, NTAD, NTF, SDTS, SHP, TAB, TAIF, TIGER/Line, UDL, VMAP, WKx, XLS

Other Considerations:

Database table files also may be linked from their original locations rather than imported into the Manifold .map file by going to File \rightarrow Link \rightarrow Table. This may 2. Recognized file types for database tables, raster data, and vector data include:

- a) **Database tables**: TXT, OLE and ODBC DB tables, PMF, StreetMap Europe SDC, DBF
- b) Raster data: ESRI GRID, ESRI SDE Raster, ESRI Raster Catalogs, ERDAS Imagine, ERDAS 7.5 Lan, ERDAS 7.5 GIS, ERDAS Raw, ESRI BIL, ESRI BIP, ESRI BSQ, ESRI GRID stack, ESRI GRID stack file, BMP, CIB, CADRG, DTED level 0, 1 and 2, ER Mapper, GIF, ADRG Image, ADRG Overview, ADRG Legend, JPG, NITF, PNG, SID, TIFF
- c) Vector data: Shapefiles, Geodatabases, ArcInfo coverages, ArcIMS Feature Services, ArcIMS Map Services, Geography Network connections, PC ARC/INFO coverages, SDE layers, TIN, DXF, DWG, DGN, VPF
- d) Other types supported by importers in ArcInfo: ADS, DFAD, DIME, DLG, ETAK, GIRAS, IGDS, IGES, MOSS, S-57, SDTS, SLF, TIGER, Sun Raster
- e) Other types supported by importers in ArcView and Arc Editor: AGF, MIF, SDTS

Other Considerations:

Text files may be converted to database format (DBF) in ArcCatalog, or added as event themes in ArcGIS.

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be advantageous if the data file is particularly large or if the file will be modified outside of Manifold.	
Manifold 6.0 also reads Geodatabase (MDB), and OGC WKB databases.	

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Data Manipulation and Analysis

Data manipulation and analysis functions provide the capability to selectively retrieve, transform, restructure, and analyze data.

Retrieval options provide the ability to retrieve either graphic features or feature attributes in a variety of ways. **Transformation** includes both coordinate/projection transformations and coordinate adjustments. **Data restructuring** includes the ability to convert vector data to raster data, merge data, compress data, reclassify or rescale data, and contour, triangulate, or grid random or uniformly spaced z-value data sets

Analysis functions differ somewhat depending on whether the internal data structure is raster or vector based. Analysis functions provide the capability to create new maps and related descriptive statistics by reclassifying and combining existing data categories in a variety of ways. Analysis functions also support: replacement of cell values with neighboring cell characteristics (neighborhood analysis); defining distance buffers around points, lines and areas (proximity analysis); optimum path or route selection (network analysis); and generating slope, aspect and profile maps (terrain analysis).

Page 29, The Process for Selecting Geographic Information Systems.

Data Retrieval

Dehui Wei, Department of City and Regional Planning, Cornell University

This technical note compares different data-selecting methods in both ArcGIS and Manifold GIS. A vector parcel map representing the City of Ithaca and a raster DEM of the Ithaca East Quadrangle are used to illustrate this example.

Manifold Process	ArcGIS Process
Software: Manifold GIS	Software: ArcGIS
Extensions: none	Extensions: none
Select by Graphic Window:	Select by Graphic Window:
 On the "Selection" toolbar choose the "Select Box" button, and draw a graphic window on top of the "parcels" layer. Parcels overlapping with the window drawn will be selected. 	 Use the "Select Features" button on the "Tools" toolbar and draw a graphic window on top of the polygon map in view window. Polygons overlapping with the window drawn will be selected.
Other Considerations: Manifold can also perform selecting by	Other Considerations:
graphic window on raster data.	



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 Select the "Create Areas" button then "Insert Box" or "Insert Circle" on "Tools" toolbar and draw a box or a circle on top of the "parcels" layer in "Map" window and select it.



2. On the "Transform" toolbar, select "All Objects in Parcels"→"Select Intersecting"→"Selection in Parcels".



 Click "New Rectangle" or "New Circle" button on the "Draw" toolbar and draw a rectangle or a circle on top of the polygon features in the view window.



 Keep the rectangle or circle selected and go to menu "Selection", then "Select By Graphics". Polygons overlapping the rectangle or circle will be selected.



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Raster Analysis Select data by area masks

Dehui Wei, Department of City and Regional Planning, Cornell University

This technical note compares the process for clipping out sections of a raster data set using both ArcGIS and Manifold GIS. A digital elevation model for the Ithaca East Quadrangle, and a polygon map representing northeast corner of the quad sheet are used to illustrate this example.



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3.	Right click in the project pane to
	paste the selected features into a
	new surface.



2. In the raster calculator, select the IEDEM grid and press Evaluate. A new grid will be produced.



Other Considerations:

Alternatively, a user can use the mouse to select any irregular shape they want (as shown below), or use points, lines, areas or another raster dataset to select raster grids. The datasets must reside within the Manifold project file.



Other Considerations:

Alternatively, the user can select any geographic dataset they want, either points, lines, polygons, or another raster dataset.

However, the user cannot use a mouse to draw areas to select, copy, or paste the raster features.

The datasets do not have to exist within the ArcMap project file, but can reside elsewhere on the disk.

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Data Restructuring Convert from raster to vector

Ben Liu, Biological & Environmental Engineering, Cornell University

This technical note compares the process for converting raster data into the vector format. An aquifer map for the Ithaca East Quadrangle is used to illustrate this example.

Manifold Process	ArcGIS process
Software: Manifold System 6.00	Software: ArcGIS 8.3
Extensions: none	Extensions: Spatial Analyst
Extensions: none Manifold is not able to perform this procedure for categorical data in a batch mode. However, the <i>Trace Area</i> function on the Tracing toolbar is able to convert features on a one-by-one basis with some manual effort.	 A grid must be loaded in ArcMap. Image: A grid must be loaded in ArcMap. In the Spatial Analysis Toolbar, select Convert -> Raster to Features Select the appropriate field to use for the vector attribute (only one field will be transferred) and the feature type. Image: A grid must be loaded in ArcMap. Image: A grid must b
L	L n ArcGIS/Manifold

39 © Arthur J. Lembo, Jr. The Generalize lines option will smooth lines to avoid jagged edges. The resulting vector map is shown below.

> How do I do that in ArcGIS/Manifold 40 © Arthur J. Lembo, Jr.

Convert from vector to raster

Ben Liu, Biological & Environmental Engineering, Cornell University

This technical note compares the process for converting vector/drawings into the raster/surface format. An aquifer map for the Ithaca East Quadrangle is used to illustrate this example.

Manifold Process	ArcGIS process
Software: Manifold System 6.00	Software: ArcGIS 8.3
Extensions: none	Extensions: Spatial Analyst
The vector drowing must be leaded in	
Manifold	A vector feature must be loaded in ArcMan
	A vector reature must be loaded in Arciviap.
L Andrea Jones Jones (and 1985) (Andrea 5)	Denters, somselet and 20 day (1998) (b) (d den part part (1998))
	* # 100000 # 10000# 10000# 10000# 10000# 10000# 10000# 10000# 10000# 10000# 10000# 10000# 10000## 10000## 10000## 1000### 1000### 1000### 1000### 1000### 1000#### 1000########
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Lan ger Lan & Jack States General States of Add	ten limi
Unitarilence beservae matrixence ime mosti ture be	pergy & DY AT I For SIN 2 + 7 x At At 2 + 2 +
	1 In the Spatial Analysis Tealbar, calest
1. In the Tools Menu, select Make	Convert -> Features to Raster
Image (or use hotkey F6).	
	2. Select a field to assign the value in the
Marke Image	new raster.
Description:	
	Features to Raster
Paint: entire component at current scale	Input features: aquifer 💽 🖻
Size: centered view at current scale current window	Field: AQUIFERTYP
entire component entire component at current scale	Output cell size: TYPE
329.36 Kbytes OK Cancel	AQUIFERTYP CNTYCODE
	OK Cancel
I ne resulting image (left) is shown below	A temporary file is created unless a file
	name and location are specified for the
	Output raster. The default output is an
	ESKI GRID, DULTIFF OF ERDAS
How do I do that	in ArcGIS/Manifold
	11

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Modify raster cell size by resampling Ben Liu, Biological & Environmental Engineering, Cornell University

This technical note compares the process for changing cell sizes in a raster/surface. An aquifer map for the Ithaca East Quadrangle is used to illustrate this example.

Manifold Process	ArcGIS process
Software: Manifold System 6.00	Software: ArcGIS 8.3
Extensions: none	Extensions: Spatial Analyst
Software: Manifold System 6.00 Extensions: none The surface must be loaded in Manifold. If the surface mean of the series of the	Software: ArcGIS 8.3 Extensions: Spatial Analyst A grid must be loaded in ArcMap.
The default Method, bicubic, normally gives the best results for distributed data, such as temperature, while	
How do I do that i	n ArcGIS/Manifold
4 © Arthur J.	ය Lembo, Jr.

nearest neighbor should be chosen for	Rester Calculator
discrete data such as land use (where	Layers:
values must fall within a given set).	- 7 0 9 - O And
	/ 4 5 6 5 3= Or
In the example, a surface of resolution 255	- 1 2 3 ((* Xar
x 333 was resized to 53 x 70 pixels as	e + 0 . () Not
shown below. This corresponds to a cell	resample(IAOUIFER_CRID1200)
size increase from 42 to 200.	conduction and an a break
Manufil/Lanae (Print) 7 5 20 20 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	a la
DENGRE- AT PEPPER SEREFEERS	About Building Expressions Evaluate Cancel >>
Participant (1997)	
	The default resampling algorithm is
	NEAREST neighbor, but BILINEAR and
	CUBIC interpolations in addition to
	extended neighbor SEARCH can be
	specified (extended information can be
	found in the software's Spatial Analyst
	Functional Reference help).
Man Billion	
and have been loss and and the basis	In the example, raster cell size was
	increased from 42 to 200 as shown below.
	Contraction and the second secon
	Plane 1
	5.
	a D sale
	The limit of the second
	and a second discrete second and a second
Other Considerations:	Other Considerations:
Area ourrently represented by one pixel	The area represented by and pixel (adleter)
Area currently represented by one pixel	The area represented by one pixel (cellsize)
an the surface in the Droiset Dane and	the table of contents and chassing
on the surface in the Project Pane and	the table of contents and choosing
L choosing Projection	Properties

Data Restructuring changing raster values by selected area

Zachary M. Easton, Department of Biological and Environmental Engineering, Cornell University

This technical note compares the process for changing raster values in a DEM for selected areas using both ArcGIS and Manifold GIS. The data used in this example includes the digital elevation model for the Ithaca East Quadrangle.

Manifold Process	ArcGIS process
Software: Manifold GIS Extensions: Surface Tools	Software: ArcGIS (ArcMap, Arc Catolog) Extensions: Spatial Analyst
To perform the analysis the DEM is loaded into Manifold.	1. Display the grid you want to edit in ArcMap and in Arc Catalog create a new point or polygon theme. This example uses a polygon theme.
Changing raster values for selected areas involves:	 Click on the new polygon layer in Arc Map, and then in the editor toolbox click start editing edit polygon Digitize points
 On the tool bar select the type of shape desired, (select touch, shape freeform, box, etc). For this example the freeform tool is used to select the area containing Beebe Lake. 	or polygons over the individual/groups of cells you want to edit (here we made a new polygon over Beebe Lake).
	Editor Editor Task: Create New Feature Target: New_Shapefie



3. Under the Surface menu select the transform option, and in the transform dialogue box choose selection under scope and select the DEM as the surface.



4. Enter the value (single value or a function) that you wish to change the selected area to.



3. Open the value attribute table and create a "value" column or similar column in the new theme's table with the appropriate replacement cell values.



4. Using Spatial Analyst convert the theme to a grid using the "value" column. Make sure the extent and pixel size of the new grid is the same as the grid you want to edit (DEM).



5. Click on the box "save results as new component" to create new grid. Hit OK to perform calculation.



New DEM is created containing the adjusted values in the area we created the polygon.



5. In the Map Calculator use the "con" request (See ArcGIS Help) to conditionally replace the original grid values with the values in the new grid you've just created. You will need to only replace with the values that are not equal to NULL in the new grid.

Con(IsNull(newGrid), (originalGrid, newGrid)

APRE .								Aitmet	6 T T	Trigonom	elic
Calculation		7	8	9		0	And	Abi	Int	Sm	ASin
NEW_CHIPERIN	$ \mathbf{x} $	ă.	5	. ¥.	- iii	14	0	Cel	Post	Cm	ACe
	100	- ŧ.	2	3	. 4	-	Xar	Floor	Intel	Tan	ATor
¢ >	•	0		-	1	1	Not	Logathere		Powers	
NEW_SHAPEFULL	Null) Co	o[]ie_d	en] (N	IEW_S	HAPEP	D	6	(sp	Log	Sat	
								Esp2	Log2	Sa	
								Exp10	Logit	Puer	

The new surface should appear with the adjusted values in place of the original.



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Changing raster values by geographic feature

Zachary M. Easton, Department of Biological and Environmental Engineering, Cornell University

This technical note compares the process for changing raster values in a DEM by a geographic feature in both ArcGIS and Manifold GIS. The data used in this example includes the digital elevation model for the Ithaca East Quadrangle and the wetlands polygon coverage.

Manifold Dragon	AraCIS process
Natiliou Plocess	Alcois piocess
Software: Manifold GIS	Software: ArcGIS
Extensions: Surface Tools	Extensions: Spatial Analyst
To perform the analysis, both the DEM and the polygon map (wetlands) must be loaded into Manifold.	To perform the analysis, both the DEM and the polygon map (wetlands) must be loaded into ArcMap.
	A Market and A Solds Image: Sold Solds Image: Sold Sold Sold Sold Sold Sold Sold Sold
Changing raster values by geographic feature involves:	We must first clip out the DEM values with the wetland coverage. This requires two
1 Open the DEM and the layer with	steps:
geographic feature in the same map (in this case we will modify the DEM where it intersects with wetlands).	1. Under the spatial analysis options, set the analysis mask to the wetlands map.
2. Make sure the wetlands base map is the active layer and select (by clicking on it) the layers polygons (wetlands).	



- Under the Drawing menu, select Transfer selection, and in the dialog box make sure that you are modifying the wetlands using the DEM.
- In the surface transform dialog box, update the selected features in the DEM. In this example, we will multiply the height by 10.

Transform	n
<u>S</u> cope:	[Selection]
Syrfaces:	v∰Aquifers Image 2 V∰Aquifers Image 3 V⊒7elu
<u>F</u> ormula:	[U27elu] * 10
	Save result as <u>n</u> ew component

6. The raster will contain adjusted raster values (in this case the original values * 10).

neral Extent Ce	4 Size	
/orking directory:	a Merrol	6
nalysis mask:	x\css420\data\lab4\ne_	- 🛋
Analysis Coordinat	e System	
 Analysis output system as the multiple inputs 	t will be saved in the same coo input (or first raster input if there [rdinate are
Analysis output system as the	t will be saved in the same coo active data frame.	rdinate
Display warning projected during	message if raster inputs have to analysis operation.	be

2. In the raster calculator, select the DEM grid and press Evaluate. A new grid will be produced.



3. The wetlands will be clipped from the DEM with the elevation data attached.



4. In the raster calculator select the grid you created above, and apply a value or function to it (in this case we multiplied it by 10).

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5. Again open the raster calculator and using the conditional statement combine the two grids.



6. The new surface should appear with the adjusted values in place of the original. In purple are the wetlands that now have an elevation 10 times higher than original.



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Reducing Unnecessary Coordinates – Weeding

John Taber, Applied Economics and Management, Cornell University

This technical note compares the process for reducing coordinates within a vector object using ArcGIS and Manifold GIS. A single digitized line is used to illustrate the example.



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Smoothing Data to Recover Sinuosity

John Taber, Applied Economics and Management, Cornell University

This technical note compares the process for smoothing data to recover sinuosity of a line, using ArcGIS and Manifold GIS. A single digitized line is used to illustrate the example.



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TIN from Point Data

Maria Vicenta Valdivia, Cornell University

This technical note compares the process for creating a TIN (Triangulated Irregular Network) from point data using both ArcGIS and Manifold GIS. Elevation points corresponding to the Ithaca East Quadrangle are used to illustrate this example.

Manifold Process	ArcGIS process					
Software: Manifold GIS	Software: ArcGIS (ArcMap)					
Extensions: Surface Tools	Extensions: 3D Analyst					
To perform the analysis, the layer containing the elevation points must be loaded into Manifold.	To perform the analysis, the layer containing the elevation points must be loaded into ArcMap.					
1. Open the layer, and select all elevation points using Ctrl+A. Copy the points using Ctrl+C	1. Click the 3D Analyst dropdown menu, and point to Create/Modify TIN – Create TIN from Features					
2. Click the dropdown menu of the <i>Paste</i>						
tool to in the project pane, and select						
Surface.	Press () () Press () () () () () () () () () (
	 2. Check the box of the layer from which you want to create a TIN. 					
3. Click the <i>Height</i> dropdown arrow, and select the attribute for which you want to	 Click the <i>Height source</i> dropdown arrow, and select the attribute for which you want to create a TIN 					
create a TIN.	4. Specify other desired parameters, and					
4. Click the <i>Method</i> dropdown arrow, and select <i>Triangulation</i> (flat). Specify other	type a name for the Output TIN. Press					
desired parameters. and press OK.	OK.					
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oo © Arthur J. Lembo. Jr.						

Paste As S	urface 🔀	Create TIN From Features
	234 points	Inputs
<u>H</u> eight:	Height	Check the layer(s) that will be used to create the TIN. Click a layer's name to specify its settings.
<u>T</u> ype:	Floating-point (single)	Lavers:
<u>P</u> ixel size:	425.00 x 425.00 Degree V	Settings for selected layer
	✓ Same size in X and Y direction	Feature type: 2D points
Method:	Triangulation (flat)	Height source: Height -
	Set corner values to 0.00	Tan value field
		Output TIN: M:\Vin 😂
71×100 27		DK Cancel
		1 di mana
	100 100 100 100 100 100 100 100 100	
her Cons	iderations:	Other Considerations:

Kriging from Point Data Maria Vicenta Valdivia, Cornell University

This technical note compares the process for performing Kriging interpolation from point data using both ArcGIS and Manifold GIS. Elevation points corresponding to the Ithaca East Quadrangle are used to illustrate this example.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS (ArcMap)
Extensions: Surface Tools (if using the	Extensions: Spatial Analyst
auto-model approach), otherwise none	
 To perform the analysis, the layer containing the elevation points must be loaded into Manifold. 1. Open the layer, and select all elevation points using Ctrl+A. Copy the points using Ctrl+C. 2. Click the dropdown arrow of the <i>Paste</i> tool to the <i>Paste</i> tool and select <i>Surface</i>. 	To perform the analysis, the layer containing the elevation points must be loaded into ArcMap. 1. Click the Spatial Analyst dropdown menu, and point to Interpolate to Raster - Kriging.
	2 Click the Z value field drandown arrow
The Ref Han Ref International States Review Relation Relations Relations	and select the attribute you want to
3. Click the <i>Height</i> dropdown arrow.	interpolate.
and select the attribute you want to	3. Select the Kriging Method and
interpolate.	Semivariogram Model.
4. Click the <i>Method</i> dropdown arrow, and select <i>Kriging</i> Specify the	other desired parameters.
number of neighbors, the Kriging model, and other desired parameters. Press <i>OK</i> .	5. Type a name for the <i>Output raster</i> , and press <i>OK</i> .
<u> </u>	

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Paste As S	ırface 🔀		Kriging		? 🔀
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ivianitol	a to choose the dest kriging	p	enormed using t	ne Geostatis	ticai vviza
model i	n every case.	t	OOI 🏾 🏶 Geostatistical <u>W</u> iz	^{ard} in the G	eostatistic
The Sa	ve error surface as option allows		Analyst extension	. This exter	nsion allow
saving	an error surface.	f	or more ad	lvanced o	eostatistic
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	auvii.	n	leighbors are	included	in th
ine da	masets must reside within the	ii I	nterpolation.		
Manifol	d project file.	• T	he datasets do	not have to	exist with
		t	he ArcMap proi	ect file. but	can resid
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Generate Contour Data from Points

Maria Vicenta Valdivia, Cornell University

This technical note compares the process for generating contour data from points using both ArcGIS and Manifold GIS. Elevation points corresponding to the Ithaca East Quadrangle are used to illustrate this example.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS (ArcMap)
Extensions: none	Extensions: Spatial Analyst
To perform the analysis, the laver	To perform the analysis, the elevation points
containing the elevation points must be	must be loaded into ArcMap.
loaded into Manifold.	
1. Onen the lower, and calent all elevation	1. Click the Spatial Analyst dropdown menu,
noints using Ctrl+A Copy the points	the interpolation method (Kriging will be
using Ctrl+C.	used in this example).
2. Click the dropdown menu of the Paste	· ,
tool tool in the project pane, and select	
Surface.	
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Contraction of the second seco	
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· · · · · · · · · · · · · · · · · · ·	2 Click the Z value field drandown arrow
Level Kalifan K Der Albert Kalifan Kalifan Berte Geschler under ander Berte Geschler under ander	and select the attribute you want to
3. Click the <i>Height</i> dropdown arrow, and	interpolate.
select the attribute you want to	3. Specify the desired parameters. Type a
interpolate.	name for the Output raster, and press
4. Click the <i>Method</i> dropdown arrow, and	OK.
will be used in this example)	
5. Specify the desired parameters, and	
press OK.	
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Paste As Si	urface (×
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<u>T</u> ype:	Floating-point (single)	
<u>P</u> ixel size:	425.00 x 425.00 Degree	
	✓ Same size in X and Y direction	
<u>M</u> ethod:	Kriging	~
<u>N</u> eighbors:	50 🗢 Model: Spherical 🗸	
	Use radius 1 Degree	
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71×100, 27.7	73 Kbytes OK Cancel	
Open under S	the interpolated surface Surface tools, select Contou	, , ,

nd



- 7. Click the Create dropdown arrow, and select lines.
- 8. Erase the default values in the Heights box. Click the Add Sequence 🐁 button, and type values for Offset and Step. Press OK.
- 9. Press OK on the Contours dialog box.

nput points:	elevationpts	- 🛎
Z value field.	Height	<u>.</u>
Criging method	🕫 Didnary 🦵 Un	iversal
Semivariogram model.	Spherical	٠
	Advanced	Parameters.
Search radius type:	Variable	
Search Radius Settings		
Number of points	50	
Maximum distance:		
Dutput cell size	120	
Create variance of prediction	damony	
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	OK L	Cancel
	OK	Cancel



4. Click the Spatial Analyst dropdown menu, and point to Surface Analysis - Contour.

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5. Specify the Contour interval and Base

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Contours		contour. Leave ∠ tactor as 1.
Name:	Elevationpts Drawing 2 Contours	6. Type a name in <i>Output features</i> for the
Description:		output layer. Press OK.
Create:	lines ✓ * *× ± ← ▼ ∓	Contour 😨 🛐
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	180.00	Contour definition
	200.00	Input height range: 2 mill: 173.5201067 2mail: 525
	220.00	Contout interval 10
	240.00	Base contour 0
		2 factor 1
Min height:	163.89802551269531	Output information based on input contour definition
Max height:	503.77053833007812	Minimum contour. 180
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Other Cons	siderations:	Other Considerations:
• Contain	a connet be concreted directly	· Contours connet be generated directly
	s cannot be generated directly	Contours cannot be generated directly from data points. An interpolated curfered
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surface	must be created first.	must be created first.
 Contour 	s for specific elevations in a	• Alternatively, contours can be created
surface	can be created clicking the Add	using the 3D Analyst extension, following
button 🕒	on the <i>Contours</i> dialog box.	the process described above.
 The data 	tasets must reside within the	Contours for specific locations in a
- Inc ua Manifolo	noiect file	surface can be created using the Create
ivialinoit		Contours tool 2 on the Orestal Archief
		Contours tool we on the Spatial Analyst
		and 3D Analyst toolbar.
		• Optionally, a <i>Z factor</i> different than 1 can
		be used if the z units of the surface are
		not the same as the x,y units.

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	• The datasets do not have to exist with the ArcMap project file, but can reselsewhere on the disk.
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Generate Contour Data from Raster

Maria Vicenta Valdivia, Cornell University

This technical note compares the process for generating contours from raster data using both ArcGIS and Manifold GIS. The data used in this example is the DEM (Digital Elevation Model) of the Ithaca East Quadrangle.

Manifold Process	ArcGIS process	
Software: Manifold GIS Extensions: Surface Tools	Software: ArcGIS (ArcMap) Extensions: Spatial Analyst	
To perform the analysis, the DEM must be loaded into Manifold.	To perform the analysis, the DEM must be loaded into ArcMap.	
1. Open the DEM, and under <i>Surface</i> tools, select <i>Contours</i> .	1. Click the Spatial Analyst dropdown menu, point to Surface Analysis - Contour.	
 Click the <i>Create</i> dropdown arrow, and select <i>lines</i>. Erase the default values in the <i>Heights</i> box. Click the <i>Add Sequence</i> button, and type values for <i>Offset</i> and <i>Step</i>. Press <i>OK</i>. 	 Specify the <i>Contour interval</i> and <i>Base contour</i>. Leave <i>Z factor</i> as 1. Type a name in <i>Output features</i> for the output layer, and press <i>OK</i>. 	
4. Press <i>OK</i> in the <i>Contours</i> dialog box.		
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Contours	Contour 🛛 🕅 🔯
Name: Ie_dem Contours Description: Create: Ines Image: Ine	Lontour Input reaface: Contour definition Input height range: Contour interval ID Base contour: ID Statue: ID Contour interval ID Base contour: ID Contour interval ID Base contour: ID Contour interval ID Base contour: ID Contour interval ID Maimum contour: ID Total number of contour values: ID ID
 Other Considerations: Contours for specific elevations in a surface can be created by clicking the <i>Add</i> button on the <i>Contours</i> dialog box. Processing time increases as more contour lines are generated. The datasets must reside within the Manifold project file. 	 Other Considerations: Alternatively, contours can be created using the <i>3D Analyst</i> extension, following the process described above. Contours for specific locations in a surface can be created using the <i>Create Contours</i> tool on the <i>Spatial Analyst</i> and <i>3D Analyst</i> toolbar. Optionally, a <i>Z factor</i> different than 1 car be used if the z units of the surface are not the same as the x,y units. The datasets do not have to exist within the ArcMap project file, but can reside elsewhere on the disk.

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Data Transformation Mathematical transformation of raster data

Zhilin Liu, Department of City and Regional Planning, and Elizabeth Goulet, Department of Entomology, Cornell University

This technical note compares the process of coordinate transformation for raster data using both ArcGIS and Manifold GIS. Spatial transformation is used to convert data from a digitized image or scanned map to real world coordinates. However, it can also be used to convert vector data from one coordinate system to another, or rubbersheet vector data to improve positional fit with other layers. The mathematical adjustment is based on the comparison of coordinates in a set of control points. The data used in this example includes the shapefile of road lines in the Ithaca East Quadrangle (RoadsI.shp) and a scanned map file (Sketch.jpg).

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: None	Extensions: None
I. Preparing for spatial adjustment To perform the analysis, both the shapefile and the scanned map must be imported into Manifold.	I. Preparing for spatial adjustment To perform the analysis, both the shapefile and the scanned map (JPEG file) must be added into ArcMap.
Notes:	To conversion the converse larger.
Both georegistration and spatial adjustment functions use Control Points	1. Under the View menu>Toolbars, select Georeferencing. On the Georeferencing
tools through the same process in	tool bar, click Add Control Points.
Manifold. It allows users to assign a	Georeferencing
coordinate system to an image or a	Georeterencing V Layer: sketch.jpg
scanned map, as well as transform	
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(the shapefile) window to activate it. Create a corresponding control point through the same process.



Repeat the above step to get a minimum of 30 pairs of control points to conduct the rubbersheeting function.

2. Under Control Points toolbar, click Register. Make sure the shapefile is activated. Choose the preferred method then click OK.





2. Set transformation method as rubbersheet: under Spatial Adjustment toolbar --> Adjustment Methods, click Rubbersheet.



3. Create displacement links: here we are adding 30 displacement links, i.e. 30 pairs of control points.



Notes: users may zoom in and out to make control points more precise without deactivating the Links tool.

4. Under Spatial Adjustment toolbar, click

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	Adjust. This will apply the rubbersheet transformation to Roads – the vector data in this example.
Other considerations: Three methods of adjustment are offered, including Affine, Numeric, and Similarity. The above example uses Numeric with 30 control points. Affine method requires a minimum of three control points, whereas similarity method requires only two.	Other considerations: 1. Rubbersheeting allows us to correct more chaotic and small-scale warping and shifting of spatial data. It requires many links to "rubbersheet" data through geometric transformation. Alternatively, users can choose Simple adjustment and polynomial adjustment through a similar process. 2. To conduct a simple adjustment, click Transformation-Similarity instead of rubbersheet in Step III-2. It requires a minimum of two displacement links. To conduct polynomial adjustment, users may choose the Tranformation-Affine method. This requires a minimum of three displacement links.

Projection definition and coordinate transformation

Elizabeth Goulet, Department of Entomology, and Zhilin Liu, Department of City and Regional Planning, Cornell University

This technical note compares the process for defining a map projection and performing a coordinate transformation using both ArcGIS and Manifold GIS. The map used in this example is a roads shapefile from the Ithaca East Quadrangle.

Manifold proce	ess	ArcGIS process
Extensions: N	one	Extensions: None
To perform this the map layer Select projection A Target Proj IMPORTANT! projection butto window appear	is process, right click on in the project window. ion. ection window will appear. Click on the current ton. A Current Projection ars.	To perform this process, Arc Toolbox is used. Open Arc Toolbox -> Data Management Tools -> Projections. Select Define Project Wizard for the appropriate map type. This example uses a shapefile.
Boolder Boolder Boolder Boolder Cone Cone	Affait (His dowing, Charging parameters with not charge the dowing data. Actual factor of the dowing data. Actual of the dowing data.	To um mage resolute solaries de galandes de las risco entre etc.
Current Projection	Sole constant 1.00 1.00 Pale eastinghorting 0.00 0.00 C.Adjust for units Preserve total values Suggest OK Cancel	In the Define Projection Wizard window, click on the selection folder and navigate to the map you want to project in the Add data window.
Scroll to the desired projection – in this case Universal Transverse Mercator - and select the appropriate zone. NOTE: Check to see if the datum and units are		The Define Projection Wizard prompts you to select a coordinate system. In the Spatial Reference Properties window, Select predefined coordinate system. In
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correct in the selection boxes below the projection <u>before selecting the zone</u>. Change if necessary. In this case we change to NAD 1927 mean conus.



Click OK in both the current projection and target projection windows.

the Browse for Coordinate System window, open Projected Coordinate Systems ->UTM, and the folder for the datum you want to use. Now select the UTM zone for your map.



The Spatial Reference Properties window now shows the coordinate system details for the selected projection.

	Spatial Reference Properties
	Coordinate System
	Name: NAD_1927_UTM_Zone_19N
	Details:
	Alae: Abbreviation: Renaida: Projection: Transverse_Metoator Paties_Exting_50000,000000 False_Exting_50000,000000 Cerival_Mender: 75,000000 Cerival_Mender: 75,000000 Latitude_01_Organ: 0,000000 Latitude_01_Organ: 0,000000 Grogophic Coordinate System: Name: GCS_North_Mendican_1327
	Select. Select a predefined coordinate system. Import Import Import domina from an existing geodataset (e.g., resture dataret, feature class, raiter). New Create a new coordinate system. Modily Edit the properties of the currently selected coordinate system. Clear Sets the coordinate system to Unknown. Save As Save the coordinate system to a file. OK Cancel Apply
	Click OK.
	The Define Projection Wizard will now appear with the coordinate information.
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	destination window, navigate to the
	output file and name your map.
	Interface former Interface
	Save the file, and click Next on the Project Wizard. The wizard will prompt the user to select a coordinate system. The selection process is the same as in Define Projection Wizard.
	For SPC, open Projected Coordinates-> State Plane, and select the datum.
	Browse for Coordinate System Image: Control of Coordinate System Look in: Image: Control of Coordinate System Image: Control of Coordinate System MAD 1903 StateFlane New York East FIPS 3100 (Feet).pri Image: Control of Coordinate System Image: Control of Coordinate System MAD 1903 StateFlane New York East FIPS 3100 (Feet).pri Image: Control of Coordinate FIPS 3100 (Feet).pri Image: Control of Coordinate FIPS 3100 (Feet).pri Image: Control of Coordinate FIPS 3100 (Feet).pri MAD 1903 StateFlane New York Long Island FIPS 3200 (Feet).pri Image: Control of Coordinate FIPS 3200 (Feet).pri Image: Control of Coordinate FIPS 3200 (Feet).pri Image: Control of Coordinate FIPS 3400 (Feet).pri MAD 1903 StateFlane North Dakots North FIPS 3400 (Feet).pri Image: Control of Coordinate FIPS 3400 (Feet).pri Image: Control of Coordinate FIPS 3400 (Feet).pri MAD 1903 StateFlane Ohio North FIPS 3400 (Feet).pri Image: Control of Coordinate FIPS 3400 (Feet).pri Image: Control of Coordinate FIPS 3400 (Feet).pri MAD 1903 StateFlane Ohio North FIPS 3400 (Feet).pri Image: Control of Coordinate FIPS 3400 (Feet).pri Image: Control of Coordinate FIPS 3400 (Feet).pri MAD 1903 StateFlane Ohio North FIPS 3400 (Feet).pri Image: Control of Control of Control of Control of FIPS 3100 (Feet).pri Image: Control of Contro
	For Ithaca East, use NAD1983 datum, and add State Plane New York Central projection. The Spatial Reference Properties window appears with the new coordinate information. The process now finishes the same as in defining a projection.
Other considerations:	Other considerations:
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The user can check current projection of any layer in its properties. Projection will be latitude/longitude on an undefined map.	The user can check current projection of any layer in the properties, under the source tab in the data source window.
ArcMap allows on-the-fly projections.	The Define Projection Wizard for coverages, grids and TINs allows you to define a coordinate system interactively, or to define the coordinate system for your data to match that of an existing data.
	ArcMap allows on-the-fly projections but will not have as much accuracy as using the projection wizard.

Vector Overlay Polygon in polygon overlay

Megan Y. Lew, Cornell University, Dept. of Natural Resources

This technical note compares the process for overlaying two polygon vector layers in both ArcGIS and Manifold GIS. This example overlays wetland polygons (14 polygons) and aquifer polygons (17 polygons) for the USGS Ithaca East quadrangle in Tompkins County, New York.

Manifold GIS Process	ArcGIS Process	
Software: Manifold GIS Extensions: None	Software: ArcGIS 8.x Extensions: None	
To perform the analysis, load the wetland and aquifer polygon files into a new Project and a new Map.	To perform the analysis, load the wetland and aquifer polygon files into ArcMap.	
The overlay is completed by using the		
 Transfer rules must be specified for each attribute table field to be transferred between the two layers. Open both tables. Under the Table menu, select "Design." A dialogue box will open; specify rules for fields that you want to transfer. (this step may be avoided by setting all the transfer rules to a specific type under the <i>Tools</i> - ><i>Options</i> menu). 	 The overlay is completed using the GeoProcessing Wizard. Under the Tools menu, select "GeoProcessing Wizard". The GeoProcessing Wizard dialogue box will appear. Select "Union two layers", and click "Next". Select the wetland layer as the input layer. Select the aquifer layer to be the overlay. Give a name and location to the output shapefile. 	

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- 2. With the map activated, under the Drawing menu, select Topology Overlay.
- In the dialogue box that appears, input the source file (wetlands) and the target file (aquifers). Select "Union (areas-areas)" under Method. Click "OK". The overlay will be completed in the original target file or a new file will be created with the overlay, depending if the "Save results as new component" box is checked.





4. Click "Finish" and a new shapefile with the overlaid polygons will be created.



Other considerations:	Other considerations:
• Setting the transfer rules allows users	 The Union command in the
to select the columns they want	GeoProcessing Wizard transfers all
transferred in the overlay. Also,	table columns from one layer to the
transferred values from the table can	other. Also, values are copied; users
be copied, averaged, summed, etc.	cannot specify to take the average,
• The output of the overlay can be saved	sum, etc. of numeric values.
to a new file or completed in the	• The GeoProcessing Wizard creates a
original target file.	new file with the results of the overlay.

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Point in polygon overlay

Megan Y. Lew, Cornell University, Dept. of Natural Resources

This technical note compares the process for overlaying a point and vector polygon layer in both ArcGIS and Manifold GIS. This example uses soil samples (146 points) and a uniform rectangular polygon layer (6 polygons) for a land parcel in Freeville, New York.

Manifold GIS Process	ArcGIS Process
Software: Manifold GIS	Software: ArcGIS 8.x
Extensions: None	Extensions: None
To perform the analysis, load the point and polygon layers into a new project and a new map.	To perform the analysis, load the point and polygon layers into ArcMap.
Viria Labour parapose "relació Kolació"	
The overlay is completed by:	The overlay is completed in one step using a spatial join.
 Copy and paste one of the soil sample points into the polygon map. This will transfer the attribute table fields from one layer to the other. Delete the soil sample point from the polygon map when the table transfer has completed. Transfer rules must be specified for each attribute transferred between the two layers. Open both tables. Under 	 In the table of contents, right click with the mouse over the name of the polygon file. Click on "Joins and Relates", then "Join…" The "Join Data" Dialogue box appears. a. Select "Join data from another layer based on spatial location." b. In Question 1 select the soil

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the Table menu, select "Design". A sample point data as the input dialogue box will open; specify rules for layer to join to the file. c. In Question 2 select how the fields that you want to transfer. attribute data from the soil 3. Under the Drawing menu, select sample point layer will be "Spatial overlay". In the dialogue box transferred to the polygon layer. that appears, select the soil sample d. In Question 3 give a name to the points as the source and the polygon output file with the completed layer as the target. The method is overlay. "points to containing areas". Click e. Click "OK" and a new file with the "OK". The polygon drawing will yield overlay will be produced. the results of the spatial overlay. Join Data Join lets you append additional data to this layer's attribute table so you can, Spatial Overlays X e, symbolize the layer's features using this data What do you want to join to this layer? Source: [All Objects in Samples Drawing] ¥ n data from another layer based on s Target: [All Objects in Zone1a Drawing] ~ 1. Choose the layer to join to this layer, or load spatial data from disk: Method: Points to containing areas ~ - 🛎 samples 2. You are joining: Points to Polygons OK Cancel Fach polygon will be given a summary of the numeric attributes of the points that fall inside it, and a count field showing how many points fall inside it. How do you want the attributes to be summarized? Average
 Minimum
 Standard Deviation
 Sum
 Maximum
 Variance 0.000 ☐ Sum 二月月二日 李 田田田田田田 王 日日日 ⁶ Each polygon will be given all the attributes of the point that is closent to its boundary, and a distance field showing how close the point is (in map units). Note: A point falling inside a polygon is treated as being closest to the polygon, (i.e. a distance of 0). 3. The result of the join will be saved into a new layer. Specify output shapefile or feature class for this new laver M: Midtern_data\Join_Output.shp . About joining data... 0K Cancel And inches has been und • (133) Long Long Bula W acconder #101 tion in 0 · A · II F · · · · · · · · · · · · · · · · ·

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Other considerations:	Other considerations:
 Setting the transfer rules allows users to select the columns they want transferred in the overlay. Also, transferred values from the table can be copied, averaged, summed, etc. The spatial overlay is completed on the original file. The results of the overlay are not found in a new file. It is best to make a copy of the original file before beginning the overlay process. 	 All columns from the point file attribute data are transferred to the output file after the join. The join command creates a new file with the results of the overlay.

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Topological intersection

Megan Y. Lew, Cornell University, Dept. of Natural Resources

This technical note compares the process for intersecting two polygon vector layers in both ArcGIS and Manifold GIS. This example uses wetland polygons (14 polygons) and aquifer polygons (17 polygons) for the Ithaca East USGS quadrangle in Tompkins County, New York.

Manifold GIS Process	ArcGIS Process
Software: Manifold GIS 6.0	Software: ArcGIS 8.x
Extensions: None	Extensions: None
To perform the analysis wetlands and aquifers are loaded in Manifold.	To perform the analysis wetlands and aquifers are loaded in ArcMap.
Image: interversion interversion	Image: Internet to the internet
The intersection is completed by using the Topology Overlay command.	The intersection is completed in one step using the GeoProcessing Wizard.
 Transfer rules must be specified for each attribute table field to be transferred between the two layers (or just set the default to copy/copy). To set the transfer rules, open both tables, and under the Table menu, select "Design". A dialogue box will open, allowing you to specify the transfer rules for each of the fields. With map activated, under Drawing menu, select Topology Overlay. 	 Under the Tools menu, select "GeoProcessing Wizard". The GeoProcessing Wizard dialogue box will appear. Select "Intersect two layers", and click "Next".
3. In the dialogue box that appears, input	
How do I do that in Ar	cGIS/Manifold

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the source (wetlands) and target ieoProcessing Wizard (aquifer) files. Select the method About Intersect "Identity (areas, lines and points -Choose a GeoProcessing operation, then click the This operation cuts an input Next button to choose options layer with the features from areas)". Click "OK". The intersection an overlay layer to produce an output layer with features that have attribute data from C Dissolve features based on an attribute will be completed in the original target both layers Merge layers together file or a new file will be created with the Dip one layer based on another overlay, depending if the "Save results F Intersect two layers Overlay Output as new component" box is checked. Input Union Ivvo layers More about Intersect. × Topology Overlay Next > Cancel Target: [All Objects in Wetlands Drawing] v Source: [All Objects in Aquifer Drawing] ¥ Select the aquifer layer as the input 3. Method: Identity (areas, lines and points - areas) V layer. Select the wetland layer to be the overlay layer. Give a name and Save result as new component location to the output shapefile. OK Cancel eoProcessing Wizard 1. Select the input layer to intersect. About Intersect This operation cuts an input again . 1.0 laver with the features from an overlay layer to produce an output layer with features that have attribute data from Number of features: 17 3 4 8 2. Select a polygon gverlay layer. both layers. . weilands Number of features: 14 Overlay Output 3. Specify the output shapefile or feature class Input M: Midtern_dataUntersection_Dutput.shp More about Intersect <Back Finish Cancel Click "Finish" and a new shapefile with 4. the intersecting polygons will be created. 18 M 48 0.00 王 成本材 电电口口口 ● *** 师 N ● # 血 They we 37 Ð ٩, Digitar Statut party · k D · A · C Fin · · · · · · · · · · · · · · ·

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Other considerations:	Other considerations:
 Setting the transfer rules allows users to select the columns they want transferred in the overlay. Also, transferred values from the table can be copied, averaged, summed, etc. The output of the overlay can be saved to a new file or completed in the original target file. 	 The Intersect command in the GeoProcessing Wizard transfers all table columns from one layer to the other. Also, values are copied; users cannot specify to take the average, sum, etc of numeric values. The GeoProcessing Wizard creates a new file with the results of the intersection.

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Line in polygon

Zachary M. Easton, Biological and Environmental Engineering, Cornell University

This technical note compares the process of line in polygon overlay in both ArcGIS and Manifold GIS. The data used in this example includes a watershed and road vector file for Ithaca, NY.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: Surface Tools	Extensions: Spatial Analyst
To perform this analysis we will need two vector files: one polygon (a watershed) and one line file (roadways). 1. In the transform toolbar select all objects in roads, clip with intersect and all objects in the watershed polygon. Hit apply.	To perform this analysis we will need two shape files: one polygon (a watershed) and one line shape file (roadways). Make them both active in the view. 1. Click the Tools menu and click GeoProcessing Wizard and select Clip one layer based on another. Click next.
Description Section 2010 Section 2010 </td <td>select a layer to clip—in this case, roads.</td>	select a layer to clip—in this case, roads.
Image: Transform Image: Transform Image: Image: Transform Image: Transfo	1. Series the space have in relation 2. Series the space have in relation 3. Series the space have in relation 3. Series of haven to 1 3. Series the snaped haven to interace relation 3. Series the snaped haven to interace relation
	3. Click the Polygon overlay layer you want to clip features with—in this case, the

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watershed. Click Finish.

4. Before overlay of a line in polygon can be accomplished, we must first make sure that both layers are of the same type (i.e. shapefiles). In Arc toolbox select create personal Geodatabase and create a new data base. Return to Arc Toolbox and select Export form shapefile> shapefile to coverage, and convert the watershed shapefile polygon to a coverage. Repeat this process for the clipped coverage containing the roads clipped to the extent of the watershed.



5. Add these new coverages to the project by selecting the correct file in the new personal geodatabase you have created (double click), and select the arc coverage files.

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in fem Theor Personal Geodet abuse milt When When Whene 13 Whene 18 Whene 18 Whene 18 Whene 18 Whene 18 Call 12 Call 12	Coll 4 Coll 4 Coll 2 Coll 2 Coll 4 Coll 4	El Cle , Oxford, eleg El de jourgo el el de jourgo el
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Raster Processing Mathematical operations on one raster Calculating Sine, Cosine, and Exponent

Jerry Brian, Dept of Applied Economics and Management Megan Molique, Dept of Crop & Soil Sciences Cornell University

This technical note compares the process for performing mathematical operations on one raster using both ArcGIS and Manifold GIS. The data used in this example includes the digital elevation model for the Six Mile Creek. <u>Note</u>: the data sets used may not reflect the most appropriate sources to apply these functions, and are only used to illustrate the methods for performing the functions.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: Surface Tools	Extensions: Spatial Analyst
To perform the analysis, one DFM must be	To perform the analysis, one DFM must be
loaded into Manifold.	loaded into ArcMap.
Calculating Sine, Cosine, and the Exponent	Calculating Sine, Cosine, and the Exponent
of one raster requires 4 steps:	of one raster requires 3 steps:
Transform.	Rester Calculator
	Lans Autoretic Topocnetic
Transform	
Scope: [All Pixels]	- 1 2 2 c - Xa Rue Mid Ter 41ar
Surraces:	
Formula: Sin((Nbi Image))	Sm(nbs) Set
	1002 1002 107
	About Building Expressions Cancel
Save result as <u>n</u> ew component	
OK Cancel	1. Under the Spatial Analyst toolbar,
2. In the Formula box, type in 'Sin' and	select the raster calculator, and click
opening parentheses. Then double-	the Advanced button.
click on one raster in the Surface box	
type in the closing parentheses	
Example: Sin([Nbi Image]). (To	2. Click on the trigonomic function 'Sin'
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و م Arthur I	5 Lembo Ir
S Altitul J.	Lembo, Ji.

calculate Cosine and the Exponent, replace 'Sin' with 'Cos' and 'Exp', respectively. Exp will also require you to enter an exponent.)

- 3. Put a check mark where it says 'Save result as new component' in order to create a new and separate map.
- 4. Then click OK. The calculation will automatically be entered in as a new layer, but you will need to double-click on it for it to be displayed. You may want to rename it to identify the new raster calculation properly.

and then double-click on a raster in the Layer box to enter it into the Formula box (to calculate cosine, or the exponent of a raster, click on the trigonomic function 'Cos' or the logarithm 'Exp', respectively).

3. Then click Evaluate. The calculation will automatically be entered in as a new layer. This calculation is currently in a temporary file. If you want to make it permanent, right click on it and select 'make permanent'. Follow the steps to save it where you like and rename it.

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Mathematical operations on two rasters Adding, Subtracting, Determining Maximum and Minimum

Jerry Brian, Dept of Applied Economics and Management Megan Molique, Dept of Crop & Soil Sciences Cornell University

This technical note compares the process for performing mathematical operations on two rasters using both ArcGIS and Manifold GIS. The data used in this example includes the digital elevation model for the Six Mile Creek. One should note that both systems allow the operations on even more than two rasters.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: Surface Tools	Extensions: Spatial Analyst
To perform the analysis, two DEM's representing the same are loaded into Manifold.	To perform the analysis, two DEM's representing the same are loaded into ArcMap.
Adding or subtracting or determining the min and max of two rasters requires 4 steps:	Adding or subtracting or determining the min and max of two rasters requires 3 steps:

- and max of two rasters requires 4 steps: 1. Under the Surface Menu, select Transform.
- 1. Under the Spatial Analyst toolbar, select the raster calculator.

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<u>F</u> ormula:	[Nbi Image] + [Nti Image]	< ×
	Save result as <u>n</u> ew component	

2. Double-click on one raster in the Surface box to enter it into the Formula box. To add, type in a + sign (to subtract, type in a - sign). Then double-click on the other raster.

- To determine Max and Min, in the Transform Dialog box, type in 'Max' and opening parentheses. Then double-click on one raster in the Surface box to enter it into the Formula box and type in the closing parentheses. Example: Max([Nbi Image],[Nti Image]). (To calculate Min, replace 'Max' with 'Min' in the formula.)
- Put a check mark where it says 'Save result as new component' in order to create a new and separate map.
- Then click OK. The calculation will automatically be entered in as a new layer, but you will need to double-click on it for it to be displayed. You may want to rename it to identify the new raster calculation properly.

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	1	0		1	1	Not

 Double-click on one raster in the Layer box to enter it into the Formula box. To add, type in a + sign (to subtract, type in a - sign). Then double-click on the other raster. To determine Max, * type in max=max(double click on one raster, type in a comma, and then double click on the other raster and close the parentheses. Example: max=max([nbi],[nti]). To determine Min, replace the word 'max' in the formula with 'min'.

* Note: max= indicates the name of the file that will be created with the calculation. So If you have more than one Max to determine, you may want to be more specific with the name, such as: maxsixmile= max([nbi],[nti]).

4. Then click Evaluate. The calculation will automatically be entered in as a new layer. This calculation is currently in a temporary file. If you want to make it permanent, right click on it and select 'make permanent'. Follow the steps to save it where you like and rename it.

Neighborhood Functions Calculating Average, Minimum, Maximum and Most Frequent

Jerry Brian, Dept of Applied Economics and Management Megan Molique, Dept of Crop & Soil Sciences Cornell University

This technical note compares the process for performing mathematical operations on one raster using both ArcGIS and Manifold GIS. The data used in this example includes the digital elevation model for the Six Mile Creek.

Manifold Process	ArcGIS process	
Software: Manifold GIS Extensions: Surface Tools (only for Max value)	Software: ArcGIS Extensions: Spatial Analyst	
To perform the analysis, one DEM is loaded into Manifold. Copy, paste and rename DEM for analysis. Calculating Average, requires 3 steps: 1. Under the Surface Menu, go to Effects and select Filter.	 To perform the analysis, one DEM is loaded into ArcMap. Calculating Average, Minimum, Maximum, and Most Frequent requires 1 step: Under the Spatial Analyst toolbar, select the Neighborhood Statistics. For input data: browse for a DEM you want to analyze. For the Field, select <value>, then choose the statistical type you want to determine: Mean, Minimum, Maximum or most frequent.</value> Select preferred neighborhood shape, and set the neighborhood setting accordingly. Choose output cell size and name output raster to preferred file location. 	
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2. Select 'Low Pass1' to calculate the mean. Click 'Apply' to update the matrix values.

Filter 🔀					
Low Pass 1					
0	0	0	0	0	
0	1	1	1	0	
0	1	1	1	0	
0	1	1	1	0	
0	0	0	0	0	
Offset 0 Scale 9					
Previe	ew [ОК		ancel	

3. The new layer will reflect new DEM with mean values.



Selecting the minimum or maximum value requires the creation of a formula in the Surface -> Transform dialog as follows:

Input deta: ni view Field: Values Statistic type: Mean Neighborhood Retrings Height: 3 Width: 3 Units: © Cell © Map Output cell nice: 30 Output cell nice: 30 Output saster: M:MidTem/withribhdmean OK Cancel	Neighborhood S	tatistics	? 🛛	4	
Field: Statistic type: Mean Neighborhood: Rectangle Neighborhood Settings Height: 3 Width: 3 Units: © Cell Output cell size: 30 Output sater: M: Midf em/Nhirbbhdmean OK Cancel	Input data:	nti	• 🖻		
Statistic type: Mean Neighborhood: Rectangle Neighborhood Settings Height: 3 Woth: 3 Units: © Cell © Map Output cell size: 30 Output saster: MEMidTem/Iniribhd-mean OK Cancel	Field	<value></value>	•		
Neighborhood Settings Height: Height: Height: Unit: Cell Map Dutput cell size: 0K Cancel	Statistic type:	Mean	•		
Neighborhood Settings Height: 3 Width: 3 Units: © Cell Output cell size: 30 Output saster: M:MidTem/Iniribhd-mean OK Cancel	Neighborhood:	Rectangle	*		
Height: 3 Width: 3 Units: © Cell C Map Output cell size: 30 Output cell size: 30 Output taster: M:WidTem/Iniribhd-mean E OK Cancel	Neighborhood S	ettings			
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	✓ Save result as new component	
	OK Cancel	

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Statistical Function Calculating Areas, Perimeters and Lengths

John Taber, Applied Economics and Management, Cornell University

This technical note compares the process for calculating areas, perimeters, and lengths of objects using both ArcGIS and Manifold GIS.

Manifold Process	ArcGIS Process
Software: Manifold GIS	Software: ArcGIS
Extensions: None	Extensions: None
Load the feature to be updated into	For this example, the area and perimeter
Manifold.	fields will be re-created for the Wetlands feature.
1. Create an area column (if none	
exists) in the feature attribute table.	 Open the Attribute Table Select (or add) the Area column
2. Using the Transform toolbar,	3. Right click on the column and choose
assign the new column with the	calculate values
Intrinsic value for area.	4. In the field calculator, click on
and down	advanced, and enter this code into the
AREA V Fil with V 2000 V Apply	Pre-Logic VBA Script Code:
	Dim dblArea as double
Updating the perimeter in a feature	Dim pArea as IArea
follows the same process.	Set pArea = [shape]
Length(ID)	dblArea = pArea.area
Transform	· · · · · · · · · · · · · · · · · · ·
PERIMETER V Fil with V Length [] V Apply	 Under AREA= (or "your area column" =) enter dblArea.
	The Field calculator should now look like this:

Other Considerations:	Field Calculator
	Fields Type Functions
	PARCELS AREA CLASS FID ID PERIMETER POLY_ACRES → C Number → Number → Number → Number → Ahs() Ahn() Cos() Exp() Fix() Int() Log() String → String → Date → String → String → Date → String →
	Pre-Logic VBA Script Code
	Dim dblArea as double * / & Dim pArea as lArea Set pArea = [shape] + = dblArea = pArea.area OK Cancel
	6) Hit "OK", and the column will be filled with the corresponding area value.
	with the corresponding area vales.
	Adding Perimeter values works much the same way, with the following VBA Script Code:
	Dim dblPerimeter as double Dim pCurve as ICurve Set pCurve = [shape] dblPerimeter = pCurve.Length
	Under "Perimeter =" enter "dblPerimeter"
	The code for length is very similar:
	Dim dblLength as double Dim pCurve as ICurve Set pCurve=[shape] dblLength = pCurve.Length
	Under "Length =" enter "dblLength"

Cross Tabulation of Two Data Categories

John Taber, Applied Economics and Management, Cornell University

This technical note compares the process for creating a cross-tabulation matrix from two vector files using both ArcGIS and Manifold GIS. The data used in this example include two landcover files, one from 1968 and one from 1995.

Manifold Process	ArcGIS Process
Software: Manifold	Software: ArcGIS
Extensions: None	Extensions: Spatial Analyst
Performing Cross-tabulation in	To perform a cross tabulation, the user must
Manifold requires loading the two	download and register the tabulatearea.dll.
relevant features into a map.	The instructions, provided by ESRI to
1. Start the Topology Overlay tool	perform this task are as follows:
under "Drawing."	4 Deviator DI L frame ArcMan
2. Select one feature as the target	1. Register DLL from Arciviap:
and another as the source, set the	CIICK I OOI/CUSTOMIZE, CIICK
and click "Save result as now	Customize dialog, povigete te
component"	the file Tabulate Area dll and
This will create a new feature	click OK button. Click
which is the union of the two	Commands tab in Customize
features to be cross-tabulated.	dialog find "SA Sample Tools"
	category, and then drag the
Topology Overlay	TabulateArea command to a
Target: [All Objects in Luse68f Drawing]	toolbar.
Source: [All Objects in Land 2]	2. Add the required layers into
Method: Union (areas - areas)	ArcMap, fill the parameters,
Save result as new component	then it is ready to run.
OK Cancel	
	The tabulate area command requires that
3. Create a query as follows:	the themes are in raster format.
	Therefore, under the Spatial Analyst
<pre>transform sum([Area(I)])</pre>	extension, select Convert -> Features to
select [Field1] from	Raster, to create a raster dataset for both
[Union feature] group by	of the data sets.
[Field1] pivot [Field2]	
In this case, Field is luce, gen	
and Field? is to the columns	
describing land use for the two	
features in the final merged	
feature.	
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? × Features to Raster This counts the area involved in each possible grouping of land Ê • landcov Input features: use and creates a confusion Field: AREA ▼ matrix. 🔲 Tabulate * 16.398 Output cell size: luse_gen D A
 Non-gen
 A
 O
 F
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 Agriculture
 55389139...300171....7887.54...
 10894939...16465.7...

 Development land
 145723....519204....
 342422...

 Extractive land
 530.406...45943.4...
 114266....24519.6...

 Forest lands
 1335199...1515137...
 114266.....1178574...

 Water/welland
 21387.9....9190.48...
 127093....
 C:\DOCUME~1\ajI53\LOCALS 2 Output raster: OK. Cancel Under the tabulate Area button, enter both feature datasets: 😂 Tabulate Area Zone dataset LANDCOV3 -Zone field Value -Value raster • LUSE68F2 Value field Value -OK. Cancel The two raster datasets are compared, and a resultant cross tabulation table is created. VALUE_1 VALUE_2 VALUE_3 VALUE_4 VALUE_5 VALUE OID. 361098.348 184867.241 45003.024 615324.54 070030 403 11334 526 1331314 015 1619.275 5345766.877 11,2529.62 19971 06 1030764 379 11,269614,965 11604,805 124684.183 278245.439 109840.829 Record He 4 1 + H Shore AT Pacords (al 5) Optora +

General Specify distance buffers

Elizabeth Goulet, Department of Entomology, and John Taber, Department of Applied Economics and Mangement, Cornell University

This technical note compares the process of creating distance buffers around objects in Manifold GIS and ArcGIS. In this example, 500 foot buffers are created around the water features. The data used include water and parcel polygons in Ithaca, New York.





Other considerations:	Other Considerations:
A buffer can be created around a single object by selecting it in the layer. Shift + left click allows the user to add more objects. Choosing the (selected objects) option for the layer on the transform toolbar will buffer only the user's selected	It is possible to only buffer selected features of a layer by clicking the "Use only the selected features" option in the first pane of the Buffer Wizard dialogue box.
objects.	In addition, features in the layer could be buffered different distances depending on
The transform toolbar provides three other buffer zone options.	a value in the data table for each feature.
1. Inner buffer to the inside of features.	Other options for buffering include multiple buffers, saving all buffer boundaries, and creating buffers inside, outside or on both
2. Border buffer to both inside and outside by the chosen distance.	sides of boundaries. The object can also be included with the boundary.
3. Common buffer transform creates one buffer zone around all of the objects selected.	
To change the units of measure, first re- project the drawing into a projection type that has the desired units.	

Polygons within distance of selected features

John Taber, Department of Applied Economics and Mangement, and Elizabeth Goulet, Department of Entomology, Cornell University

This technical note compares the process of selecting polygons within a specified distance of other objects in Manifold GIS and ArcGIS. The data used are water and parcel polygons in Ithaca, New York.

Manifold Process	ArcGIS process
Software: Manifold GIS	Software: ArcGIS
Extensions: None	Extensions: None
A query is used to select polygon features (parcels) in one layer within or beyond a certain distance, or between distances, of features within another layer. The most basic method is to create an SQL query as:	To select the features of a layer within a certain distance of another layer, use the Select by Location tool, under "Selection". In this example, the features from parcels that are within 500 feet of the water feature are selected. Note that if a 500 foot buffer for the water feature already existed, that buffered feature could be used instead of including the buffering in the selection.
Another option is to select the parcels between 100 and 800 feet of the water feature. within distance * viewer distance (water water where distance(water.id,parcels.id) Load the parcels shapefile into Manifold to see the selected parcels. The image below shows the selected parcels along with the query, the query table, and the water layer.	Select By Location Lets you select features from one or more layers based on where they are located in relation to the features in another layer. I want to: select features from the following layers: parcels wetlands aquifer that: intersect Use selected features (0 features selected) Apply a buffer to the features in water of: Freeview The red features represent the features in water. The highlighted cyan features are selected because they intersect the red features.
	Points Lines Polygons Apply Close
How do I do that i	n ArcGIS/Manifold

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Find nearest features

Elizabeth Goulet, Department of Entomology, and John Taber, Department of Applied Economics and Mangement, Cornell University

This technical note compares the process of finding the nearest features in one vector file to the features in a second vector file using Manifold GIS and ArcGIS. The data used are roads and wetlands in Ithaca, New York.

Manifold Process	ArcGIS Process
Software: Manifold GIS	Software: ArcGIS, ArcToolBox
Extensions: None	Extensions: None
Manifold uses query functions to find the	ArcGIS uses the <i>JoinData</i> function to find the
nearest feature of one feature class to a	closest feature in one file to another file. To
feature in another class.	open the dialog, right click on a theme in the
	table of contents and select <i>Join</i> .
Create a new query in the project window	
of Manifold.	In the Join Data dialog, select Join data from
	another layer based on spatial location.
I ne first query determines the distance of	vvnen using polygons and lines, the user can
all features from one class (roads) to all	select the option to compute the distance
teatures in another class (wetlands).	from features in one file with features in a
	second file. A new column is added to the
	distance to the percent feature in the other
alloistances X select wetlands wetla as wetland, roads tlid.	distance to the hearest reature in the other
distance(wetlands.id,roads.id) as dist into alldist	ineme.
order by wetid, dist;	Join Data
	Join lets you append additional data to this layer's attribute table so you can, for example, webbilise the lawer's features using this data.
	What do you want to join to this layer?
	Join data from another layer based on spatial location
The second query selects the nearest road	Ohoose the layer to join to this layer, or load spatial data from disk: Insetti
to each wetland.	2. You are joining: Polylines to Polygons
	C Each polygon will be given a summary of the numeric attributes of the lines that intersect it, and a count field showing how many intersect the summary.
	How do you want the attributes to be summaized?
📾 nearest *	E Avetage E Minimum E Standard Deviation
select wetland, first(tlid), min(dist)	Each polygon will be given all the attributes of the line that is closest to its boundary, and a distance field showing how close the line is for example.
from alldist	Note: A line falling inside a polygon is beated as being closest to the polygon, is a <i>a distance</i> of 0.
group by wetland;	3. The result of the join will be saved into a new laper.
	Specify output shapefile or feature class for this new layer: W/1css520/widemdata/Loin Output sho
	About joining data OK Cancel
1	1

How do I do that in ArcGIS/Manifold 100 © Arthur J. Lembo, Jr. The highlighted wetland, TA-5, is highlighted on both the query table and map below. The closest road ID is in column 1 and the distance is in column 2.



The road table can be opened and the road number selected to identify the closest road to this wetland on the map.

Other considerations: Queries can be used to find the distance between any two feature classes in Manifold. Also, the query may be adapted to include <i>farthest feature</i> , or <i>symmetric</i> <i>feature</i> .	Other Considerations:

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3D Analysis Generating Slope and Aspect

Ya-Wen Lu and Michael Sinkevich Jr., Cornell University

This technical note compares the process for generating slope and aspect of sections of a raster data set using both ArcGIS and Manifold GIS. This example also creates a 3D visualization of the data. The data used in this example includes the digital elevation model for the Ithaca East Quadrangle.



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slope"[[U27etu]])	<
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Save result as new component	
	[All Povels] ▲U27eku ▲aspect slope[[U27eku]) Save result as new component.

The slope (as defined by percent slope) is now generated, and a terrain map is automatically created with it.



A similar procedure can be used to find the aspect of the DEM. Once the DEM is loaded, the aspect can be obtained in three steps:

- 1. Select the DEM
- 2. Under Surface -> Transform
- 3. In the formula section type

"aspect," click on the DEM name, and the hit OK.

user can also select the output as either percent or degree slope.

ie_dem 💌 🚅
Degree C Percent
5
10
M:\\slope_5

The slope is now generated.



A similar procedure can be used to find the aspect of the DEM. Once the DEM is loaded, the aspect can be obtained in two steps:

- Using the Spatial Analyst, open Spatial Analyst -> Surface Analysis
 -> Aspect
- 2. Select the DEM as the input surface, select the appropriate cell size and output location, and then click OK.

Input surface:	midtermaspect	- 🖻
Output cell size:	10	
Output raster:	<temporary></temporary>	-

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Transform	The aspect is now generated.
Scope: (Al Provis)	
Surfaces:	Distance () (out (book)) (0.000) (0.000) (0.000) Distance () (0.000) Distance () (0.000) Distance () (0.000) Distance () (0.000)
Formula: aspect([U27ek])	Image: Section 1 Image: Section 2
Save result as new component	
The aspect is now generated, and a terrain map is automatically created with it.	to and the second sec
Other Considerations:	Other Considerations:
Manifold can also compute slope and aspect of a dataset without the use of Surface Tools, using the <i>Edit -> Save Mask/Channel</i> menu. Simply select slope or aspect as the feature to save.	A separate program called ArcScene can show the terrain of the data. ArcScene is loaded from the 3D analyst toolbar. Make sure 3D Analyst is activated under Tools -> Extensions.
The user can easily view and analyze the terrain maps. By pressing the 'W' or 'S' keys, it is possible to move forward and backward, respectively, along the surface. Also, vector layers may be draped over the terrain for more impressive looking visualizations.	3D Analyst - Layer: 모양 중 아 초 죠 죠 는 @
	Select the ArcScene button from the far right of the toolbar to open the program.
	Once ArcScene is open, the terrain map can be opened by clicking add data. The user can navigate throughout the dataset using the pan and zoom buttons.

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The terrain can also by rotated by using the arrow keys.





To see the 3D view, right click on the layer, then go to Properties -> Base Heights. Under Height choose *Obtain heights for layer from surface*. Also, you may change the Z Unit Conversion from 1 to 10 for better height distinction.

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Now a new terrain is created. Also, vector layers may be draped over the terrain for more impressive looking visualizations.



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Identifying Watersheds

Ya-Wen Lu and Michael Sinkevich Jr., Cornell University

This technical note compares the process for identifying watershed boundaries in a raster data set using ArcGIS. The data used in this example includes the digital elevation model for the Ithaca East Quadrangle.

Manifold Process	ArcGIS Process
Software: Manifold GIS Extensions: n/a	Software: ArcGIS Extensions: Spatial Analyst
Manifold does not have the functions to perform this type of analysis.	To perform the analysis, the "filled" DEM, free from gores and spikes, is loaded into ArcMap.
	The spatial analyst toolbar must be added under View -> Toolbars. The spatial analysis must also be activated under Tools -> Extensions.
	Spatial Analyst Lever
	Under the Spatial Analyst, open the Raster Calculator. Using the FlowDirection command and selecting the DEM, an output grid of flow patterns over the landscape is created.





Right click the basin layer and choose Properties -> Symbology. Change from Classified to Unique Values.



This results in a map with unique values for each watershed.



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Network Functions Choosing the optimal path through a network

Kathy Mills, Department of Natural Resources, Cornell University

This technical note compares the process for defining an optimal path through a network using both Manifold GIS and ArcGIS. This example specifies an optimal driving path through a road network in the Ithaca East quadrangle.

Manifold Process	ArcGIS Process
Software: Manifold GIS	Software: ArcGIS
Extensions: Business Tools	Extensions: Network Analyst
To perform the analysis, a drawing	To perform this analysis, a file must be
window or drawing layer in a map	contained in a geodatabase and
window must be open. This drawing	converted to a geometric network within
must contain lines and at least two	ArcGIS. (See help files:
points should be chosen between	'geodatabases'>'creating' and 'network
which a route can be selected. Fields	feature class > creating .)
length and speed of travel for each	Open the network in ArcMap, Right click
line in the road network.	on the main menu and select "Utility
	Network Analyst" to open the toolbar
	associated with this extension. Using
	the flag/barrier selector tool, designate
	as the endpoints of a route.
The second states	
	Distant in any lots 5.90 In lat up parts plant plant part plant D all Up 1 and
A STATION	
2 The	
Teach and Rear all Teacher and Second and Se	
To gonorate an entimel route, chases	
"Drawing" from the main toolbar and	A MALL TO
select "Optimal Route." In the	PA CR.
command window, fill in fields and	
units for road length and speed.	And a second sec
	On the Utility Network Analyst tealbar
	select "Find path" as the Trace Task and

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click the solve icon.



The optimal route program selects the fastest route between the two points and highlights this path on the map.



By clicking "Save Report" in the command window, a report with driving directions is generated.





A path between the two points is highlighted on the map.

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Other considerations:	Other considerations:
Manifold also allows the user to choose a visual interface for selecting points between which optimal routes are needed. In the main toolbar, select "Drawing"-> "Optimal Route (Visual)"	To find the shortest path, weights can be assigned to the junctions of the geometric network. For example, if roads have different speed limits, a speed field could be used to assign weights for determining the shortest path.
<complex-block></complex-block>	The Utility Network Analysis extension in ArcGIS does not provide an option for producing a report with driving directions between the two points.
optimal path should be determined.	

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Defining a drive-time zone

Kathy Mills, Department of Natural Resources, Cornell University

This technical note compares the process for defining a drive-time zone using both Manifold GIS and ArcGIS. This example selects drive-time zones from one location in the Ithaca East quadrangle.

Manifold Process	ArcGIS Process
Software: Manifold GIS	Software: ArcView
Extensions: Business Tools	Extensions: Network Analyst
To perform the analysis, a drawing	To perform this analysis, a project
window or drawing layer in a map	containing two shapefiles, one of
window must be open. I his drawing	which contains a network and one of
must contain lines and at least one	which contains a point to denote the
the zone to be defined. Fields in the	opened
drawing table should specify the length	opened.
and speed of travel for each line in the	- Andrea(d)11 Ne 18, One Jones Jones Jones Data
road network.	
	and had the
& MILE	
Ten Barrow Republic Contract R	Enable the Network Analyst
	Extension, and activate the theme
To generate a zone around the center	containing the network shapefile. To
point that can be reached within a	create a drive time zone about the
specified driving time, choose	the main menu and select "Find
"Drawing" from the main toolbar and	Service Area "
select "Drive-Time Zones." In the	
for road longth and spood. Also	
choose a method for determining the	
drive-time zone (buffer, hull, or zone).	
and type in the amount of driving time	
each zone should encompass. Multiple	
drive-time zones may be generated at	
How do I do that in	a ArcGIS/Manifold

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Geocoding addresses

Kathy Mills, Department of Natural Resources, Cornell University

This technical note compares the process for geocoding addresses using both Manifold GIS and ArcGIS. This example uses an attribute table for roads in the Ithaca East quadrangle as the basis for deriving addresses.

Manifold Process	ArcGIS Process
Software: Manifold GIS	Software: ArcGIS
Extensions: Geocoding database	Extensions: none
, v	
Addresses stored in a table may be	ArcGIS provides numerous addressing
geocoded as long as 4 primary fields	schemes. This example chooses a
are available: address, city, state, zip.	simple scheme called "US One Address".
Under Tables -> Address -> Geocode,	Within ArcCatalog,
a user can select the appropriate fields,	1) Double click on "Geocoding
and information they want returned:	Services."
	2) Double click on "Create new
Geocode Addresses	geocoding service."
Longtude: [New Column] V Address: v	3) In the new geocoding service
Latitude: [New Column] V City	Window, scroll down and select "US
Status: [New Column] V State: state V	One Address (GDB).
Match type: (New Column) V Zp: zp V	Second International Contractor and Second
Cogreny: address	Carles and Access
Eal on: unknown street name, no similar names	Informed and a second and a second
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OK Cancel	C Alger C
	Coll and
An error dialog box will come up to	Constant de
assist the user in identifying errors	The second
within the addresses	All and All an
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Unmatched Records (1 of 1)	Constraint former Constraints Constraints Constraints Constraints Constraints Constraints
geoord: 16 bush lane, use Accept	
Asthese: Balancian (José Up)	
unknown.zp	4) Direct the geocoding service to the
Equina: Its Control International Annual Internationa Annual International Annual International Annual Internation	reference file containing the streets
16 BUSH U6, CREAK SPRINKS, 11, 62922, URITED STATES 16 BUSH U8, BLIZABETHFOWN, KY, 42701, UNITED STATES 16 BUSH U8, BWC CONCORD, XY, 42006, UNITED STATES	for geocoding. The user can then
16 BUSHUN, RUSH, KY, 41168, UNITED STATES 16 BUSHUN, PURVES, MS, 39475, UNITED STATES 16 BUSHUN, MARMAN NO. COMO, UNITED STATES	specify the columns of the reference
16 RUSHUK, THACA, NY, 14000, UNITED STATES 16 RUSHUK, RENSELARVILLE, NY, 12147, UNITED STATES	table that define the address
	information (i.e. street name, city,
User must separately purchase either	etc.).
MapPoint 2004 or the Manifold	

How do I do that in ArcGIS/Manifold 115 © Arthur J. Lembo, Jr. geocoding database. Currently, no facilities exist to geocode user supplied centerlines.



Other Considerations:	4. Right clicking on an address also enables the user to zoom to the address and flash the location, add a graphic marker to the map at the location, or set a spatial bookmark for the location.
Other Considerations:	ArcGIS includes many options for geocoding, that are too numerous to mention in this note. Therefore, this note only illustrates one of the simplest methods for geocoding addresses using ArcGIS.

Data Display and Presentation

Data display functions provide the ability to generate both two-dimensional orthographic and three-dimensional perspective displays; symbolize point, line and area features and annotate maps for display on a terminal or hardcopy device.

Page 30, The Process for Selecting Geographic Information Systems.

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Map and Map feature annotation

Virginia Collins, Cornell University, Spring 2004

This technical note compares the processes for displaying and presenting data sets using both ArcGIS and Manifold GIS. The data display and presentation processes include thematically shading polygons, creating map titles, legends, scale bars and north arrows, and creating, moving and editing annotations and labels. Land parcels in Ithaca, New York, are used to illustrate this example.

Manifold Process	ArcGIS Process
Software: Manifold GIS Extensions: None	Software: ArcGIS Extensions: None
Thematically Shade Polygons – selecting polygons based on certain attributes (i.e. parcel size, area, land use, etc.)	Thematically Shade Polygons - selecting polygons based on certain attributes (i.e. parcel size, area, land use, etc.)
To perform this analysis, the parcel data set was loaded into Manifold.	To perform this analysis, parcel layer must be loaded into ArcMap.
 Thematically shading polygons requires 2 steps: 1. Select Area/Polygon Background button. Can designate either one color for all the polygons, or select theme to specify an attribute for polygon shading. Select Thema 	Thematically shading polygons requires 3 steps: 1. Double click on the layer of interest in the Table of Contents pane. The layer properties window will open. Select symbology tab.
Imported. Imported.	2. Specify in the field option which attribute for analysis. Also select a color
(palette) for the attribute of interest in the	scheme, classifications, and label

How do I do that in ArcGIS/Manifold 119 © Arthur J. Lembo, Jr. format box. Select OK button, and polygons should be shaded based on selected properties. requirements.

3. Select Enter and polygons should be shaded according to attribute selected.



Facility for creating map titles, legends, scale bars, etc

To perform the analysis, load parcels map into Manifold

Creating map titles, legends and scale bars requires 3 steps:

1. Create a layout of either a surface or a map. Select the layout in the project pane.



2. In create button options above project pane, select "create legend", "insert textbox", "insert scale" or "insert north arrow". Can also add legend, title, north arrow or scale bar from the view drop down menu.

Facility for creating map titles, legends, scale bars, etc

To perform the analysis, load parcels map into ArcMAP

Creating map titles, legends and scale bars requires 3 steps:

1. Under the view drop down menu, select Layout view. (In order to go back to the data view while working on your layout, select data view from the View pull down menu).

2. Under the Insert drop down menu, select legend, scale bar, north arrow, title, etc.



3. Follow the appropriate prompts for

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Manifold System - [midterm *] - [ParcelsMap *]	
Zoom In Chi+Plus Zoom Qut Chi+Minus	
Q Zoom To FR Zoom To	
Grabogie Grid	
North Arrow	
Projection	
Eul Screen F11	
Refresh Data Alt+FS Refresh View FS	
Broperties Ak+Enter	
 3. To specify options for legend (ie color scheme, number of points, etc), select the dataset from which the layout was created from. Follow the steps outlined in thematically shading polygons from above. Other Considerations: To delete the legend, scale bar, title or north arrow, right click in the layout view, and select delete from the options. 	
Add and move annotations – In Manifold, annotations are labels.	A
Adding and moving annotations/labels can be completed in 3 steps:	A e o
1. Select File – Create –> Labels under drop	m w

the item you wish you to create in your layout:

 Legends – select attributes you would like

displayed, enter legend title, border, font

size, border color, shadow color, etc.

- North Arrow select desired north arrow.
- Title enter the title in the text box

displayed on the layout.

• Scale – select desired scale bar.

Add and move annotations

ArcMAP annotation is editable and easily supports adding individual pieces of text that are not associated with any map feature. This means that if you want to create a few new pieces text

How do I do that in ArcGIS/Manifold 121 © Arthur J. Lembo, Jr. down menu, or create- labels from project pane options.



2. Select the data layer and attributes for labeling. Specify text as desired.

Create Lab	els 🛛 🛛
<u>N</u> ame:	Labels 7
<u>P</u> arent:	Aquifers Acuifers Bevalon Points Parcels Rads Water Weterdads
	Create labels for <u>existing</u> objects Create labels for new objects as necessary Align labels to lines
<u>C</u> olumns:	PROPCLASS PRIORPRCLA Type (I)
<u>T</u> ext:	Area: [AREA] Property Class: [PROPCLASS]
	OK Cancel

3. Drag and drop the label created under data layer (in project pane) into the map (not in a drawing or surface).

and place them where you like on and around your map, then you should use annotation.

Adding and moving annotations can be completed in 5 steps:

1. Right click on a layer in the table of contents pane. Select Properties and labels tab.

et Laberal II	e historic the care may	•		
natures will be to	deled using the splices specifie	d.		
ed Seing bel Einlit 🔳			Equation .	
net Symbol				
	Automata	Ţ	Depei	
ter Options		Pre-defined L	abel Style	

2. Select the attribute/field that you would like displayed. Click on OK.

3. Can label each point or place on map individually. Make sure the Draw Toolbar is turned on.



4. Select the new text, new splined text button, callout button, or label button located on the draw toolbar.

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5. Use the mouse to click the location where the text, line, callout box or label will be located. Type in the text string. Hit enter when complete

Other Considerations:

To Create Labels, can also call function under the new button found in the project pane.

To specify what zoom level the annotations/labels become visible, select view – properties, and specify zoom to the desired level.

Font color, size, angle and style can all be edited by changing the selections in font options above the surface screen.

Other Considerations:

To edit annotation text for a point, double click on the text and dialogue box will pop up. To move text, click and hold on the text and drag to new location. Store your text in the geodatabase if you want to use the same text in different maps. Store your text in the map document if you only want to use your text on that particular map

As you zoom in and out on your map, the size of your labels will not change. If you want label text size to scale with the map, right-click the data frames and click Set Reference Scale. Font color, size, angle and style can all be edited by changing the selections drawing toolbar.

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