U.S. Fish & Wildlife Service

Spatial Inventory and Monitoring on National Wildlife Refuges



Southwest Region National Wildlife Refuge System NWR Remote Sensing Lab, Division of Planning

TECHNICAL MANUAL

Vegetation/Habitat Mapping: Object Based Image Classification Using SPRING Software Draft 02/24/2006

Developed by:

U.S. Fish & Wildlife Service NWR Remote Sensing Laboratory Division of Planning Albuquerque, NM 87102

505.248.6432

Prepared by:

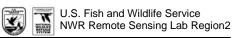
USFWS, NWR Remote Sensing Lab, Albuquerque, New Mexico, 87102, (505.248.6432)

David Lindsey, Remote Sensing Scientist – NWR Remote Sensing Lab Patrick Donnelly, Remote Sensing Scientist – Coordinator NWR Remote Sensing Lab



TABLE OF CONTENTS

1.0 IN		3
1.1	Purpose	3
1.2	Overview	4
2.0 S	PRING DEMO	5
2.1	Download and Install SPRING	5
2.2	Acquire and Install ERDAS ViewFinder	5
2.3	Reproject and Resample Imagery with ERDAS ViewFinder	5
2.4	Create Database, Project, Category, and Import Image	5
2.5	Create Segmentation	9
2.6	Create Classes for Classification Training Samples Collection	12
2.7	Run Training Sample Analysis, Classification, and Output Map	16
2.8	Create Vector	18
2.9	Export Thematic Map	20
2.10	Add Projection, Reproject, Load into GIS	21



1.1 Purpose

Spatial inventory and monitoring of vegetation, land cover and wildlife habitat on National Wildlife Refuges (NWR) plays an important roll in the management of our natural resources. Within the Southwest Region (R2) the NWR Remote Sensing Lab has been tasked with developing spatial habitat inventory and monitoring methods and producing these data for all NWRs throughout the region.

In addition to using eCognition, the NWR Remote Sensing Lab has begun recent research into utilizing SPRING software to complete the image segmentation and supervised classification steps in inventory and monitoring project processes.

Spring is an object oriented data model image/classification software similar to eCognition. The software takes advantage of innovative algorithms for spatial indexing, image segmentation, region-based classification by neural networks and TIN generation. Segmentation tests between SPRING and eCognition have shown no notable differences between the ability of the software packages to derive image objects within vegetation communities. SPRING reaches beyond eCognition in terms of classification algorithms, allowing users to apply far more than an object based nearest neighbor.

Because the software was developed by the Brazilian government, the help document and user guide is in Portuguese. This has made the learning curve a little bit steeper, but recently a tutorial was translated to English and ships with Version 4.2 of SPRING. This undoubtedly will help users new to SPRING to fully utilize the software. The **software is** <u>FREE</u> and can be downloaded at: <u>http://www.dpi.inpe.br/spring/english/index.html</u>. Before downloading, registration is required.

The Lab plans to continue the application and testing of this software. If successful it could greatly reduce the image processing steps required to generate vegetation/habitat inventories, further reducing the dependency on ERDAS Imagine and end use of eCognition.

The following is directly from the SPRING website:





What is SPRING?

SPRING is a state-of-the-art GIS and remote sensing image processing system with an object-oriented data model which provides for the integration of raster and vector data representations in a single environment. SPRING is a product of Brazil's National Institute for Space Research (INPE/DPI (Image Processing Division)) with assistance from:

- <u>EMBRAPA/CNPTIA</u> Brazil's Agricultural Research Agency.
- IBM Brasil
- <u>TECGRAF</u> Computer Graphics Technology Group.
- <u>PETROBRÁS</u> / CENPES

The SPRING project has received substantial support from CNPq (National Research and Development Agency) through its programs RHAE and <u>PROTEM/CC</u> (<u>GEOTEC</u> project).

SPRING main features

- An integrated GIS for environmental, socioeconomic and urban planning applications.
- A multi-platform system, including support for Windows95/98/NT, Linux and Solaris.
- A widely accessible freeware for the GIS community with a quick learning curve.
- To be a mechanism of diffusion of the knowledge developed for the INPE and its partners with the introduction of new algorithms and methodologies.

Scientific Citation of SPRING

For citation of SPRING in scientific reports, please use a reference to the paper: <u>"SPRING: Integrating</u> remote sensing and GIS by object-oriented data modelling" Camara G, Souza RCM, Freitas UM, Garrido J Computers & Graphics, 20: (3) 395-403, May-Jun 1996.

1.2 Overview

This document provides a demonstration in the use of SPRING. The methods described in this document may be applied to vegetation/landcover/habitat mapping, historical land use and change detection analysis. The steps outlined below have been applied by NWR Remote Sensing Lab for the delineation of image objects optimized to vegetative classes at the physiognomic level (NVCS Class level).



U.S. Fish and Wildlife Service NWR Remote Sensing Lab Region2 SPRING Demo Salt Plains NWR imagery subset

Goal: <u>To use SPRING to classify an image for final output as a shapefile for use in a GIS.</u>

2.1 Download and Install SPRING

- 1. Download SPRING Version 4.2 from: <u>http://www.dpi.inpe.br/spring/english/index.html</u>. You will need to register.
- 2. Install SPRING Version 4.2

2.2 Acquire and Install ERDAS ViewFinder

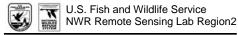
- 1. Acquire ERDAS ViewFinder. It was free at one time.
- **2.** Install ERDAS ViewFinder.

2.3 Reproject and Resample Imagery with ERDAS ViewFinder

- 1. Load project imagery into ERDAS ViewFinder.
- Select File | Save As.... Click on Output file options tab, click in checkbox for Change Output Pixel Size, increase Width: to <u>3</u> and Height: to <u>3</u>.
- Under File tab, navigate to appropriate directory (e.g. C:/SPRING_Demo_imagery), type in File name: (e.g. <u>sps3x</u>), change Files of type: to <u>TIFF</u>.
- Click on Change Output Projection checkbox. In Category: box, select <u>UTM WGS 84 North</u>. In Projection: box, select <u>UTM Zone 14 (Range 102W – 96W)</u>. Leave Resample Method: set to <u>Nearest Neighbor</u>.
- 5. Go back to File tab, make sure File name:, Files of type:, and Look in: (directory) are set correctly and click on OK. A blue progress bar should appear at bottom of window and a when processing is complete, a new window will open with the newly created file.
- 6. Close all ERDAS ViewFinder windows.

2.4 Create Database, Project, Category, and Import Image

- Using Windows tools, create a directory where the SPRING database will reside (e.g. C:\SPRING_Demo)
- 2. Start SPRING

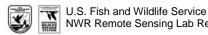




3. Create the SPRING database by selecting File | Database then click on the Directory button and navigate to the directory where the SPRING database will reside. In the Name: box type demo, pick a preferred database type in the DBMS: box pulldown such as Access (any of the provided databases can be used), then click on Create. After the database is created, click on Load. If a database already exists, select it and click on Load. You will be asked if you want to define a password for the database. Click on No unless you want one.

SPRING-4.2]
File Edit View Image Thematic	DTM Cadastral Network Analysis Execute Tools Help	
Database		
Data Model	Databases	
Import Import Table Import from SGI Import GRIB File Convert to ASCII SPRING Import TIFF/GeoTIFF	Directory c:\SPRING_Demo Databases	
Export Export SpringWeb Export to TerraLib	Name: demo	
Save As JPEG Image	DBMS: Access - Change Password	2
Print	,	
Image Registration	Create Load Delete Close Help	
Exit		r
Create or enable a Database		1

4. Create a Project by selecting File | Project. A Projects popup will appear. Type sps in the Name: box. Click on the Projection button. A Projections popup will appear. In the Systems box, highlight UTM. In the Earth Models box, highlight WGS84. Under the Origin section, type 14 in the **Zone:** box and <u>w 99 0.0.00</u> in the **Long:** (longitude) box. In the Projections popup, click on Apply and Close. Note: Under the Origin section, the value in the Long: box (w 99 0 0.00) is equal to the Central Meridian which can be found using ArcCatalog.



📓 SPRING-4.2 [demo]					
File Edit View Image Thematic	DTM Cadastral Network Analysis Execute Tools	Help			
Database					
Project					
	🗖 Projects 📃 🗖 🔀	🗖 Projections 📃 🗖 🗙			
Import	Projects				
Import Table		Systems Earth Models			
Import from SGI Import GRIB File		NO PROJECTION Hayford			
Convert to ASCII SPRING		MERCATOR Krasovsky			
Import TIFF/GeoTIFF	~	GAUSS - TM Airy LAMBERT MILLIC Everest			
Export					
Export SpringWeb	Name: sps				
Export to TerraLib	Projection UTM/WGS84	Hemisphere: 🔿 North 📀 Sou			
Save As JPEG Image		Origin			
Print	- Bounding Box	Lat n 0 0 0.00 Zury 14 CP			
	Coordinates: 💽 Geographic 🔿 Planes	Long: 0 99 0 0.00			
Image Registration	Long1: w 99 0 0.00 Long2: w 98 0 0.00	Long. 0 33 0 0.00			
Exit	Lat1: n 36 0 0.00 Lat2: n 37 0 0.00	ScaleFactor: 0.999600			
Create or enable a project	Hemisphere: ON @S ON @S				
	Hemisphere, C.N. 60.5 C.N. 60.5	Standard Parallel: Offset			
	Create Load Unload Change Delete	First.Lat: X: 500000.00			
		Seg.Lat: Y: 1000000.00			
	Close Help	Apply Close Help			

5. In the Projects popup, under the Bounding Box section, set the Coordinates: checkbox to <u>Geographic</u>, then enter Long1: <u>w 99 0 0.00</u>, Long2: <u>w 98 0 0.00</u>, Lat1: <u>n 36 0 0.00</u>, and Lat2: <u>n 37 0 0.00</u>. Click on Create. In the Projects box of the Projects popup <u>sps</u> will appear and will be highlighted. Click on Load. The Control Panel popup should appear. Minimize the Control Panel popup.

SPRING-4.2 [demo][sps]		
File Edit View Image Thematic DT	M Cadastral Network Analysis Execute	Tools Help
🖲 📷 🗲 🗾 🔝 Auto 🔽 1	Disabled V	+ 💠 0 😒 🖊 🕱 🖉 🗢 🔊 📘
🗖 Control Panel 🛛 🗖 🔀	1	<u></u>
Categories		
Infolayers		
		V
		No current infolayer
Select Query DISPLAY CONTROL Enable: • 1		



6. Create a place for images to reside in SPRING by selecting File | Data Model. Select the Image checkbox. In the Name: box type <u>imagery</u> then click on Create, Apply, and Close. It will appear as though nothing has happened but a place for images has been created and will appear in the Control Panel as soon as the first image is imported.

SPRING-4.2 [demo	alisosi							
File Edit View Image		Network	Analysis E	xecute Tools	Help			
9 12 5 / 10	Auto 💌 1/	Disabled	- 18) + 4	0	2 3 8	2 00	?
Data Model								1
- Categories	Visual Attributes							
Name: imagery	Table:							
 Image DTM 	C Cadastral							
C Thematic C Object	C Non-Spatial							
Create Cha	nge Delete							
- Thematic Classes	Visual	J.				No curren	t infolayer	
	Attributes							
	Data							
Name:	Table: CR							
CreateCha	nge Delete							
Apply Clo	ise Help							

7. Import the image by selecting File | Import TIFF/GeoTIFF.... The Import TIFF/GeoTIFF popup should appear. Click on the File... button and navigate to sps3x.tif. In the bottom section of the Import TIFF/GeoTIFF popup, leave Image selected in the Entity: box. Click on the Category: button and with imagery highlighted, click on Apply. In the Infolayer: box type sps3x then click on Apply. The image should import 3 bands for this demo. To the root name of the image, an _1 will be applied to band 1, an _2 to band 2, and an _3 to band 4. Images with more than 3 bands also can be processed. When processing is complete, clickon Close.

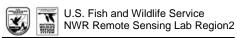


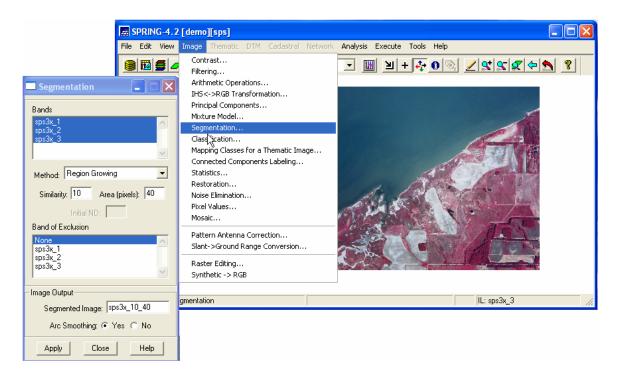
SPRING-4.2 [demo][sps]		
File Edit View Image Thematic	DTM Cadastral Network Analysis Execute Tools	Help
Database Project Data Model	🗖 Import TIFF/GeoTIFF 📃 🗖 🗙	
Import Import Table Import from SGI Import GRIB File Convert to ASCII SPRING Import TIFF/GeoTIFF	Data File C:\SPRING_Demo_im CR Projection UTM/wGS84 Bounding Box Properties Resolution: X: 3.0000 Y: 3.0000	Open File ?X Look in: SPRING_Demo_imagery v (E 🕆 🖽 v
Export Export SpringWeb Export to TerraLib Save As JPEG Image Print	Histogram Band 1 2 3 Waximum: CR CR Graphic	File name: sps3x.tif Open
Image Registration	Conversion to 8 Bits Algorithm No. Deviations Convert: 2%	Files: *.tif Cancel
Import TIFF or GeoTIFF	Histogram	No current infolayer
Categories List	SPRING Entity: Image Project: sps Category jimagery Infolayer: sps3x Mosaic Apply Close Help	

8. Open the Control Panel and turn each of the bands on: <u>sps3x_1</u> as R(ed), <u>sps3x_2</u> as G(reen), and <u>sps3x_3</u> as B(lue) then click on Draw. The image should appear in the main display. To zoom in, click on the Zoom Cursor , click on opposite corners of the image, then click on the zoom in button . To pan, use the Roaming Cursor .

2.5 Create Segmentation

To create a segmentation, select **Image | Segmentation**. In the **Bands** box highlight all 3 bands. In the **Method:** box select <u>Region Growing</u>. Set the **Similarity:** box to <u>10</u> and the **Area(pixels):** box to <u>40</u>. In the **Segmented image:** box type in a name such as <u>sps3x 10 40</u>. Set the **Arc Smoothing:** to <u>Yes</u> and then click on **Apply**. The segmentation should begin. On large, high resolution images you should let this run overnight. Use names that help you remember how the images were created.

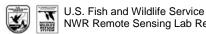


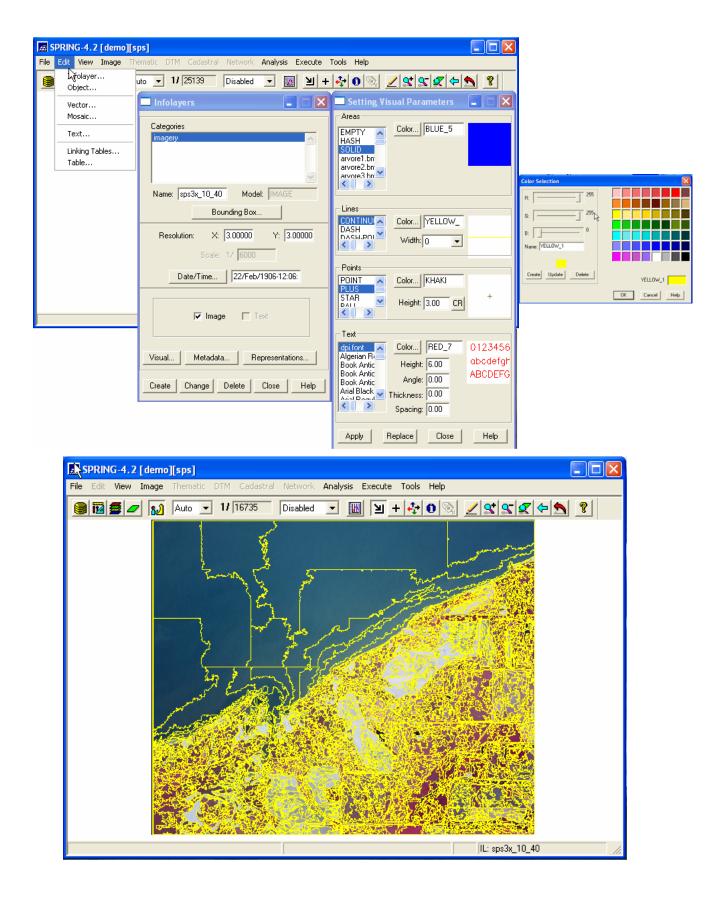


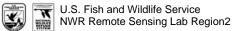
When the segmentation is complete, the following notice will appear:



Click on **OK** to close the notice. If you want to inspect the segmentation, highlight the segmentation infolayer in the Control Panel, click on the Labeled checkbox, and click on Draw. Use the SPRING Roaming Cursor (pan) and zoom tools to inspect the segmentation. If you want to change the color of the segmentation lines, select Edit | Infolayer.... The Infolayers popup should appear. In the lower section of the Infolayers popup, select the Image checkbox. Click the Visual... button. The Setting Visual Parameters popup should appear. In the Setting Visual Parameters popup, in the Lines section, click on the Color... button. The Color Selection popup should appear. Select yellow then click on OK. In the Setting Visual Parameters popup, click Apply then Close. In the Infolayers popup, click on Change then Close. When you turn the lines on again, they should now be yellow.







2.6 Create Classes for Classification Training Samples Collection

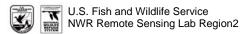
- 1. In the **Control Panel**, highlight one of the image bands that was used in the segmentation.
- Select Image | Classification. Under the Context box, click on the Create button. The Context Creation popup should appear. In the Name: box, type a name such as <u>sps3x 10 40 class</u>. For the Analysis Type: select the Regions checkbox. Highlight all three bands in the Bands box, select appropriate segmentation in Segmented Images box such as <u>sps3x 10 40</u> and click on Apply.
- **3.** Before you can begin collection training samples, you need to click on **Region Extraction** in the **Classification** popup. On a large image, this will take a few minutes.

SPRING-4.	2 [demo][sps]	
File Edit View	Image Thematic DTM Cadastral Network	Analysis Execute Tools Help
Classification	Contrast Filtering	
Directory c:\SPRING_Demo\demo\ CR	Arithmetic Operations IHS <->RGB Transformation Principal Components	Context Creation
sps3x_20_40	Mixture Model Segmentation	Name: sps3x_20_40 Analysis Type: C Pixel © Regions
	Classification apping Classes for a Thematic Image Connected Components Labeling	Bands sps3x_1 sps3x_2
Bands	Statistics Restoration	sps3x_3
sps3x_1 sps3x_2 sps3x_3	Noise Elimination Pixel Values Mosaic	Segmented Images sps3x_10_40
Segmented Image: sps3x_10_40	Pattern Antenna Correction Slant->Ground Range Conversion	
Region Extraction	Raster Editing Synthetic -> RGB	Apply Close Help
Training Classification Post-Classification Mapping	ges Classifiers	IL: sps3x_3
Close Help		

4. When **Region Extraction** is complete, click on the **Training** button. A small window should pop up telling you to "Acquire sample(s)!". Click on OK.

NOTICE	
1	Acquire sample(s)!
	ок

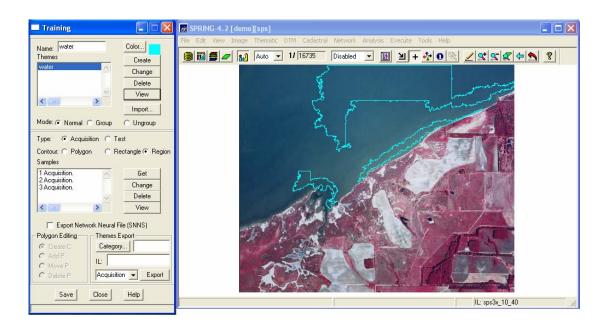
5. At this point you may want to minimize the **Control Panel** and **Classification** popups and reposition/resize the main display window and move your **Training** popup to the side.



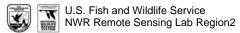
6. In the Training popup, enter a theme (physiognomic or vegetation class) name into the Name: box such as <u>water</u>, click on the Color button, select <u>Blue</u>, OK, and Create. The name <u>water</u> should appear in the Themes box. Make sure the Type: <u>Acquisition</u> and Contour: <u>Region</u>

checkboxes are selected. Then using the **Cross Cursor**, select a sample, then click on **Get**, **Save**, and the top **View** button. Repeat for each <u>water</u> sample.

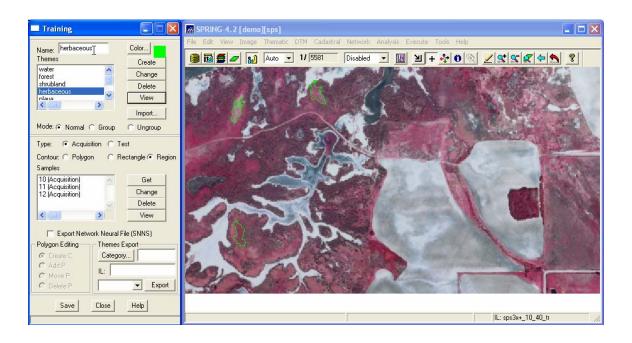
🗖 Training 📃 🔳 🔀	📓 SPRING-4.2 [demo][sps]
Name: water Color	File Edit View Image Thematic DTM Cadastral Network Analysis Execute Tools Help Image Thematic DTM Cadastral Network Analysis Execute Tools Help Image Thematic DTM Cadastral Network Analysis Execute Tools Help Image Tools Image Tools Image Tools </th
Water Change Delete View View Import	Color Selection
Mode: Normal C Group C Ungroup	G: 255
Type: Acquisition C Test Contour: Polygon C Rectangle Region Samples	B: 255
Get Change Delete View	Create Update Delete CYAN_1
Export Network Neural File (SNNS) Polygon Editing Themes Export	DK Cancel Help
Create C Cadegory C Add P C Delete P Acquisition <u>Export</u> Save Close Help	
	IL: sps3x_10_40



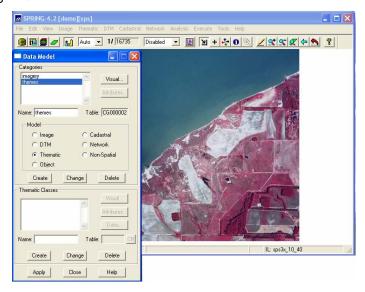
7. Repeat this training sample collection process for forest, shrubland, herbaceous, playa, and ag. As you collect samples, try to capture as much of the variation in signatures for each class from



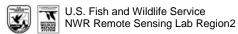
all over the imagery.



8. At some point you may want to save an image of your samples. To do this you will need to create a Category to hold thematic data. Select File | Data Model. In the Name: box type themes, select the Thematic checkbox, click on Create, then Apply. It will appear that nothing has happened but the newly created Category will appear in the Control Panel as soon as you put something in it.

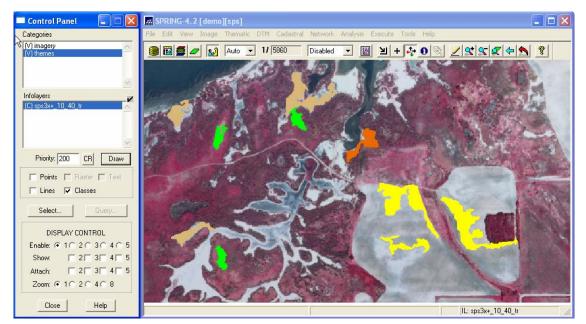


 Returning to the Training popup, near the bottom of the popup, under Themes Export, click on Category.... A Categories List popup should appear. Select the <u>themes</u> category you just

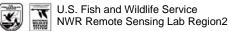


created and click on **Apply**. Back in the **Training** popup, in the **IL**: box type <u>sps3x 10 40 tr</u>, making sure <u>Acquisition</u> appears in the window just below **IL**:, then click on the **Export** button. Maximize the **Control Panel** popup, highlight the <u>themes</u> **Category**, in the **Infolayers** window highlight the IL you just exported, click in the **Classes** checkbox, then click on **Draw**. All of your samples should appear.





10. As you select, Get, Save, and View your samples, you may want to occasionally export them, overwriting your <u>themes</u> Category. If something should go wrong, you can import the training



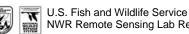
samples by clicking on the **Import** button in the upper section of the **Training** popup, selecting the appropriate IL, then Apply.

2.7 Run Training Sample Analysis, Classification, and Output Map

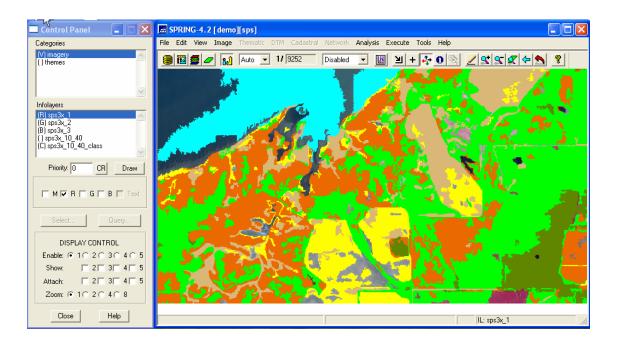
1. To make sure that your samples do not overlap, maximize the **Classification** popup, click on Classification, in the Name: box type sps3x 10 40 class, click on Create, in the Classifier: select <u>Bhattacharya</u>, Acceptance-Threshold: <u>99.9%</u>, then click on the Sample Analysis button. A Sample Analysis popup should appear and will provide you with an accuracy assessment. If there are any questionable samples, you can easily find them by noting the theme, the sample number, returning to the **Training** popup, selecting the appropriate **Theme** and searching through the sample numbers. Highlight the suspect sample, click on View in the Samples section and locate, zoom to, and inspect the suspect sample. You can delete it and select, Get, Save, and View more samples.

Classification	SPRING-4.2 [demo][sps]			
Directory c:\SPRING_Demo\demo\ CR	File Edit View Image Thematic DTM Cadastral Network Analysis Execute Tools Help			
Contexts	🖲 🔯 💆 🖉 🔬 Auto 💌 1/ 58	60 Disabled 🔽 🔟 💾 🕂 🗘 🛈		
sps3x_20_40	Image Classification 📃 🗖 🔀	🗖 Sample Analysis 📃 🗖 🔀		
	Classified Images	Sample Analysis: 📀 Acquisition 🤉 Test		
Create Delete	sps3x_10_40_class	Classif. Accuracy: 100.00 %	A REAL PROPERTY AND	
Bands		Omission Errors: 0.00 %	A CAR WAR	
sps3x_1	Name: sps3x_10_40_class	Comission Errors: 0.00 %	A ANTA	
sps3x_3	Create	Themes Theme Confusion Matrix water 🔊 water 100.00 %		
Segmented Image: sps3x_10_40		forest forest 0.00 %		
Region Extraction	Classifier: Bhattacharya 💌	herbaceous 0.00 % playa playa 0.00 % aq ag 0.00 %	1355 42 518	
Training Classification	Acceptance-Threshold: 99.9% 💌	Rejection 0.00 %	and and a state of the state of	
Post-Classification	Texture File	Samples Sample Confusion Matrix Sample1 water 100.00 %		
	Sample Analysis	Sample2 forest 0.00 % Sample3 shrubland 0.00 %		
<u>Close</u> Help		herbaceous 0.00 % playa 0.00 % ag 0.00 %		
	Classify Close Help	Ag 0.00%	·	
		Save Close Help	IL: sps3x_1	

2. When you have gathered a few samples and tested for accuracy, run a classification. Maximize the Image Classification popup, highlight the classified image name you have been using to run the Sample Analysis or create a new one, under the Sample Analysis button, which you have been using, click on **Classify**. The classification should begin to run and will take up to a few hours on a large image. Once the classification has completed, a **Notice** will popup telling you exactly how long the classification took. This may prove handy in predicting how long various images will take to process for planning and scheduling purposes. Click on OK to close the Notice popup. Minimize the **Classification** popup. Minimize the **Training** popup. Minimize any other popups that may be in the way. Maximize the **Control Panel** popup. In the imagery

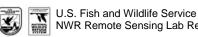


Category, highlight the classification you just created (i.e., sps3 10 40 class), click in the Classified checkbox, then Draw.



You can turn on and off other infolayers as you require. After inspecting the classification, you may notice some areas that were not classified and so you may want to collect more samples and rerun the Sample Analysis and then another Classification.

3. When you are satisfied with you classification, maximize the **Classification** popup, and click on the **Mapping** button. The **Class Mapping** popup should appear. In the upper left window of the popup, highlight the classified image in the **Classified Images** box. In the upper right window, in the Categories box, highlight the Thematic Category where you want the final map to reside. In the lower left window of the popup, highlight a theme (class) in the **Themes** box. In the lower right window, in the **Classes** box, select the matching **Class**. In the lower left select the next Theme and match it to the corresponding Class in the lower right window. Continue until all Themes and Classes have been matched. Click on Apply, then Close. You can minimize or close the Classification popup.

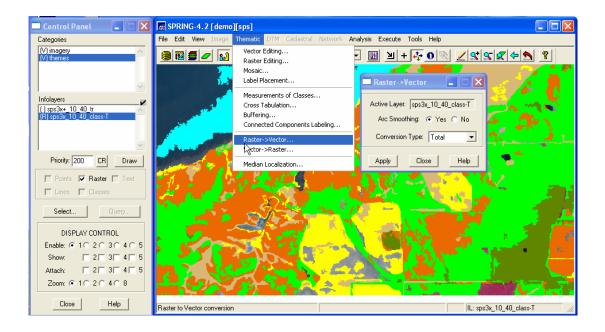


SPRING-4.2 [demo]	[sps]				_ 🗆 🔀
File Edit View Image	Thematic DTM Cadastra	Network Analysis	Execute Tools He		
Class Mapping		Disabled 💌 [🔟 뇓 + 💠 🖸	2222	· 🗢 💁 🙎
Classified Images sps3x_10_40_class	Categories themes		٤R		
Themes				ALL Y	
water -> water forest -> forest shrubland -> shruble herbaceous playa ag	None water forest shrubland herbaceous playa		23 - S		E.F.
Apply Clo	se Help		CON-		
	4				
				IL: sps3x_1	

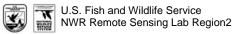
2.8 Create Vector

- 1. With the goal of exporting the Infolayer from SPRING to a shapefile, you must now create a vector component in the thematic Infolayer. To do this, open or maximize the Control Panel, select the Thematic Category that you just sent the map to and highlight the Infolayer just created. SPRING automatically attaches -T as a suffix to the thematic Infolayer. In this case, sps3x_10_40_class-T.
- 2. Select Thematic | Raster->Vector.... The highlighted thematic Infolayer by default will appear in the Active Layer: window. Set Arc Smoothing: to Yes and Conversion Type: to Total then Apply.





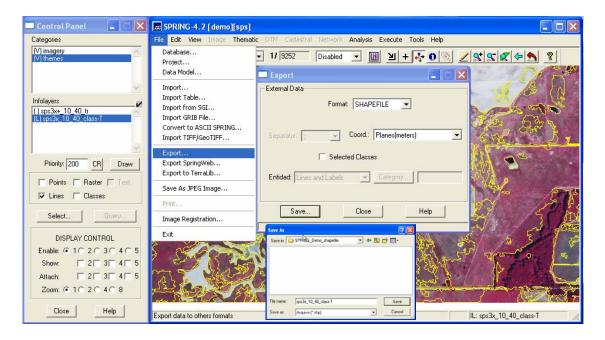
You should see a series of blue progress bars flash across the bottom of the main viewer. Close the **Raster->Vector** popup when processing is complete. You will notice that in the **Control Panel** the **Points**, **Lines**, and **Classes** checkboxes and associated text are no longer grayed out. Uncheck the **Raster** checkbox and check on the **Lines** checkbox. Go to **Category** <u>imagery</u> and turn the image bands back on and **Draw**. If you want to see the lines better, go back and highlight the thematic **Infolayer**, then **Edit | Infolayer...**, click on the **Vector** checkbox, click the **Visual** button. The **Setting Visual Parameters** popup should appear. In the **Lines** area of the popup, click on the **Color...** button, select yellow, **OK**, **Apply**, and **Close**. In the **Infolayers** popup, click on **Change**, **Close**, and then **Draw**. The lines should now be yellow and much easier to see. This procedure for changing line color of the **Vector** output is the same procedure used previously to change the color of the **Segmentation** lines.

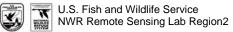


🗖 Control Panel 📃 🗖 🗙	SPRING-4.2 [demo][s]		
Categories	File Edit View Image The	ematic DTM Cadastral Network Analysis Execute	Tools Help
(V) imagery (V) themes	Infolayer	to 🔹 1/ 9252 Disabled 💌 🔣 +	<u>∻0 ⊗ ∠ss⊊¢ \$</u>
	Vector Mosaic	🗖 Infolayers 📃 🗖 🗙	Setting Visual Parameters
Infolayers	Text	Categories imagery	EMPTY Color BLUE_5
(L) sps3x_10_40_class-T	Linking Tables Table	themes	SOLID arvore1.brr arvore2.brr
	Low of	Name: sps3x_10_40_ Model: THEMATIC	
Priority: 200 CR Draw	10 - 10 - 10 V	Bounding Box	
Lines Classes	220	Resolution: X: 3.00000 Y: 3.00000	DASH DASH, POI Vidth: 0
Select Query	1	Scale: 1/ 6000 Date/Time 23/Feb/1906-08:29:	Points
DISPLAY CONTROL Enable: • 10 20 30 40 5	· Shi		POINT Color KHAKI
Show: 2 3 4 5		🗖 Image 🔽 Vector 🔲 Text	BAAI SAAI
Attach: □ 2 □ 3 □ 4 □ 5 Zoom: ● 1 C 2 C 4 C 8	B Ag St		dpi.font Color RED_7 0123456
Close Help	Edit Infolayer	Visual Metadata Representations	Algerian R Book Antic Book Antic Book Antic
	Lakiniolayer	Create Change Delete Close Help	Book Antic Angle: 0.00 ADCDEPG
			Spacing: 0.00
			Apply Replace Close Help

2.9 Export Thematic Map

 With the thematic Infolayer highlighted, select File | Export. In the External Data popup, select SHAPEFILE in the Format: box, then click on Save..., navigate to the directory where you want to save the shapefile. Use the default name or enter a new file name in the File name: box such as <u>sps3x_10_40_class-T</u> (.shp will be added by SPRING), then click on Save and then Close.





2. Minimize or exit SPRING.

2.10 Add Projection, Reproject, Load into GIS

SPRING does not add the projection to the shapefile so you will need to add it using ArcCatalog. Remember it is UTM Zone 14, WGS84, in this case. You may need to then reproject to UTM Zone 14, GRS80. Then use the shapefile as is or convert it to a personal geodatabase and load it into and work with it in your favorite GIS.

