CANADA LYNX – PHASE 2

Feature Source Data:

1. Montana Natural Heritage Program Suitability Habitat Model – covers approximately 75% of MT portion of Crown LCD project area; 4 suitability classes (including 'unsuitable') created using Maximum Entropy software (see http://mtnhp.org/models/).

R:\Base_Data\CROWN_LCD_Phase2\Feature_Layers_P2\CALY\CALY_MTNHP_HabSuitability.shp

2. Montana Natural Heritage Program Direct Observations

R:\Base_Data\CROWN_LCD\Features\CanadaLynx\MTNHP_ObsData_CALY.shp

3. Canada Lynx Range Shift - part of the data describing CALY climate response in the Gostout report "Implications of a shifting climate for lynx and wolverine in the Crown of the Continent" (Christian Gostout, 2019, Wilderness Society). This data doesn't not cover the full extent of AB on the LCD Project Area. Unless augmented with additional data it is not useful for AB.

C:\Users\SFinn\OneDrive - DOI\Documents\ArcGIS\Packages\Canadian Lynx Range Shift Model Agreement_238C0AD4-D3E7-4604-8DD4-E74988537409\commondata\raster_data\lyca

4. AB_Snow_layer – a snow retention layer provided by Danielle Pendelbury. Has been used by Alberta Parks as a proxy for lynx and wolverine distribution in AB.

D:\Base_Data\CROWN_LCD\Features\Wolverine\AB_Snow_layer\mosaic.tif

5. Remote camera observations from a data set provided by Anthony Clevenger

R:\Base_Data\CROWN_LCD\Features\CanadaLynx\Clevenger_Lynx_camera_detections2.shp

6. Canada Lynx Current – 'gridded' polygon data for AB

R:\Base_Data\CROWN_LCD\Features\SourceFeatureData\canada-lynx-current\CanadaLynx_current.gdb\ CanadaLynx_current

C:\Users\SFinn\OneDrive - DOI\Documents\ArcGIS\Packages\MIR_TS_C_180585_lynx_distrb_Lynx_ Distribution_USFS_308E28B0-781F-49F7-8A9D-E55DF946B6F6\commondata\raster_data\lynx_distrb.img

C:\Users\SFinn\OneDrive - DOI\Documents\ArcGIS\Packages\MIR_TS_C_180585_lynx_hab_mask_69B1AE81-3BE7-4F65-84D8-B19E26F78AF0\commondata\raster_data\lyn_hab_msk.img

Source	MT NHP	Score	MT_obs	Score	AB_Snow_layer	Score	CameraSta	Score
Data/Field	ClassDesc				Value			
	Optimal	10000	observed	10000	6.5 – 10.214	10000	observed	10000
	Moderate	5000			1.5 – 6.49	5000		
	Low	2000			0.5 – 1.49	2000		
	Unsuitable	0	Not	0	0 – 0.49	0	Not	0

Source 1:

<u>Add Field</u> (MTNHP_CALY; ShortInt); <u>Field Calculator</u> (while using select records) to assign values from Table to MTNHP_CALY field.

Step 1: MTNHP_CMP_Predicted_Habitat_Suitability_CALY: Clip MTNHP_CMP_Predicted_Habitat_Suitability_CALY to Crown_PA_MTonly2.shp to constrain data to Crown LCD Project Area (output =

MTNHP_CrownLCD_Predicted_Habitat_Suitability_CALY.shp); Use Union tool spatially union this layer with < Crown_PA_MTonly2.shp> (the Crown LCD project area clipped to Montana) to ensure entire MT portion of Crown is scored; assign a score of optimal suitability 10,000; moderate suitability 5,000; low suitability 2,000; unsuitable 0 (zero)

Output: The predicted suitability model from MT NHP extended to the full area of the Crown LCD Project Area scored to represent values for Marxan

Feature Source data alignment

Visual inspection of the three parallel Marxan outputs indicate inconsistent data interpretations. Scenario 5 is the first attempt to rectify & align data across the Project Area.

Dataset 1: Clevenger_CCoC_photo_data_14-16_complete2.xlsx – source data from Anthony Clevenger reports on camera station visits to a set of stations (x = xx) along the Rocky Mountain crest in CA. Source excel file has 2 worksheets: <wolverine detections by session> has site names and X Y location data for all cameras; <all species detection> lists detections by species and behaviors.

Created a point shapefile from XY data in Clevenger_CCoC_photo_data_14-16_complete2.xlsx/ wolverine detections by session called Clevenger_camera_stations_AB_BC.shp (in .../Features/Wolverine). Added Field in attribute table called CALY_obs (Short Integer) and populated with data from all species detection. If lynx detected at camera in 1 month only (regardless of the number of detections in that month) CALY_obs ranked '1'; if detected in 2 different months and detections > 10 days apart, CALY_obs ranked '2'; if detected in 3 different months, CALY_obs ranked '3'. Select by Attribute where CALY_obs >=1; Reproject the shapefile (using Project tool) to <

D:\Base_Data\CROWN_LCD\Features\CanadaLynx\Clevenger_Lynx_camera_detections2.shp> resulting in a point shapfile with only camera stations having lynx detections (n = 55).

To approximate lynx space use, I buffered Clevenger_Lynx_camera_detections2.shp twice using estimates of CALY home range size as reported by Koehler and Aubry (1994). The first buffer, using a 1871 m radius, approximates the lower home range estimate, 11 km2 (output: Clevenger_Lynx_camera_detections_1871m_buf.shp); the second buffer, using a 3970 m radius, approximates the larger home range estimate, 49.5 km2 (output: Clevenger_Lynx_camera_detections_3970m_buf.shp).

For both buffer shapefiles, Add Field 'score' (short integer). Use Field Calculator to populate score Field 4,000 in Clevenger_Lynx_camera_detections_1871m_buf.shp and 2,000 in Clevenger_Lynx_camera_detections_3970m_buf.shp, which indicates they lower estimate of a lynx home range surrounding a visited camera station is valuable for lynx; whereas the area within the high estimate for lynx home range is valuable, but less so.

Feature to Raster for both Clevenger_Lynx_camera_detections_1871m_buf.shp and Clevenger_Lynx_camera_detections_3970m_buf.shp producing clev_CL_1871 and clev_CL_3970.

		-
nput features	Output cell size	1
Clevenger_Lynx_camera_detections_1871m_buf	 interview (optional) 	
ield	The sell size for the set	
score	v The cell size for the out raster being created	put
lutput raster		
D:\Base_Data\CROWN_LCD\Features\CanadaLynx\dev_CL_1871	This parameter can be	
utput cell size (optional)	defined by a numeric va	lue
	esisting raste dilatest the cell are han the explicitly specified as its environment cell size is in used if specified, otherwise some addito rufers are used to calcul it from the other inputs. See the usage for more detail.	lf n ne ne ilue nal ate

Koehler, G. M. & Aubry, K. B. (1994). <u>"Lynx"</u>. In Zielinski, W. J. & Kucerala, T. E. (eds.). The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the western United States (General Technical Report RM-254) (Report). Rocky Mountain Forest and Range Experiment Station, <u>USDA Forest Service</u>. pp. 74–98. <u>ISBN 978-0-7881-3628-3</u>.

Dataset 2: ab_snow_alb (ESRI GRID format) derived from

D:\Base_Data\CROWN_LCD\Features\Wolverine\AB_Snow_layer\mosaic.tif – a snow retention layer provided by Danielle Pendelbury. Has been used by Alberta Parks as a proxy for lynx and wolverine distribution in AB. Cells are assigned values ranging from 0 – 17. According to metadata received and close inspection of the data 0 (zero) is no data (non-forest?); 17 is no persistent snow and 1-16 is the number of years with persistent spring snow cover – in reverse (i.e., low values indicate more regular snow). I reclassed these data as follows:

Original	Reclass
0	0
1-4	5,000
5-9	2,500
10-16	1,500
17	0

Output file: D:\Base_Data\CROWN_LCD\Features\CanadaLynx\absnow_recl

<u>Dataset 3:</u> C:\Users\SFinn\Documents\ArcGIS\Packages\Canadian Lynx Range Shift\lyca is part of the data describing CALY climate response in the Gostout report "Implications of a shifting climate for lynx and wolverine in the Crown of the Continent" (Christian Gostout, 2019, Wilderness Society). This data (in ESRI GRID format) doesn't not cover the full extent of AB on the LCD Project Area therefore it needs to be augmented with additional data for it to be useful for AB. It does extend across the BC portion of the Project Area. The source GRID has 6 classes:

Stable (Value = 42) indicates areas of the species' current range that are projected to remain climatically suitable by both GCMs (i.e. range is expected to remain "stable").

Contraction 2 (Value = 40) areas are projected to become less climatically suitable by both GCMs (i.e. range is expected to "contract").

Contraction 1 (Value = 41) areas are projected to become less suitable under one model but remain stable under the other.

Expansion 2 (Value = 22) areas are areas not within the species' current range that are projected to become climatically suitable by both GCMs (i.e. the range is expected to "expand").

Expansion 1 (Value = 21) areas are projected to become climatically suitable by one GCM, but not the other. No Presence (Value = 20)

Clip C:\Users\SFinn\Documents\ArcGIS\Packages\Canadian Lynx Range Shift\lyca to Project Area – output: D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CG_CALY_lcd.

Reproject D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CG_CALY_lcd to project projection, creating D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CG_CALY_alb.

Use Reclassify on <D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CG_CALY_alb> to create a raster output < D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CG_CALY_rcl> scored 5000 [stable and contraction 1] or 0 (zero).

Class	Original	Reclass
	Value	Value
No Presence	20	0
Expansion 1	21	0
Expansion 2	22	0
Contraction 2	40	0
Contraction 1	41	5,000
Stable	42	5,000

Output file: D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CG_CALY_rcl

The above processing results in four raster datasets:

clev_CL_1871 clev_CL_3970 absnow_recl CG_CALY_rcl

Use Mosaic to a New Raster tool to merge and sum values of the above 4 data rasters into output file D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CALY_AB_BC_Mo.

nput Rasters	Mosaic Operator
I 🖻	(optional)
	The method used to mosaic overlapping areas.
◆ cg_CALY_rd	 FIRST—The output cell value of the overlapping areas will be the value from the first raster dataset mosaicked
Dutput Location	I AST_The output
D: \Base_Data \CROWN_LCD \Features \CanadaLynx	cell value of the
Raster Dataset Name with Extension	overlapping areas
CALY_AB_BC_S5	from the last ractor
patial Reference for Raster (optional)	dataset mosaicked
North_America_Albers_Equal_Area_Conic_CM-112	into that location.
ixel Type (optional)	This is the default.
8_BIT_UNSIGNED V	 BLEND—The output
ellsize (optional)	cell value of the
800	overlapping areas
lumber of Bands	weighted calculation
1	of the values of the
osaic Operator (optional)	cells in the
losaic Colormap Mode (optional)	MEAN_The output
FIRST V	cell value of the

Reclass CALY_AB_BC_Mo such that the highest value is 10,000. The output file D:\Base_Data\CROWN_LCD\Features\CanadaLynx\CALY_AB_BC_S5, is then ready for zonal statistics.

Reclassify to max value = 10,000; new grid named: CALY_AB_BC_S5

Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the 2 "pulayer" files (pulayer_AB_2km_hex.shp, pulayer_BC_2km_hex.shp):

Input data: the pulayer_AB_2km_hex [pulayer_BC_2km_hex] Zone Field: PUID Input value raster: CALY_AB_BC_S5 Output table: zonalst_caly_s5ab [zonalst_caly_s5bc] Statistics type: ALL

Open zonalst_caly_s5ab Table; Table Options/Export Table –export as a text file named CALY_S5AB_SPEC.txt. Don't need to add table to map.

Open zonalst_caly_s5bc Table; Table Options/Export Table –export as a text file named CALY_S5BC_SPEC.txt. Don't need to add table to map.

Step 7: Prepare Table for Marxan

Open D:\Base_Data\CROWN_LCD\CanadaLynx\CALY_S5AB_SPEC.txt in Excel. Delete all fields except PUID and Mean. Change "Mean" field name to "FEAT_3"; Save As: CALY_feats_S5AB.csv as a comma delimited file. Close file (keeping it in current format).

Open D:\Base_Data\CROWN_LCD\CanadaLynx\CALY_S5BC_SPEC.txt in Excel. Delete all fields except PUID and Mean. Change "Mean" field name to "FEAT_3"; Save As: CALY_feats_S5BC.csv as a comma delimited file. Close file (keeping it in current format).

Cost Source Data:

Crown Snowpack – LCD – 8/10/2022 This was developed for wolverine but is applicable for Lynx, although the reclassification might eventually need to look different...but maybe not.

Source data used:

Mosaic.tif (snow pack data compiled by Garth Mowat for snow density regarding Wolverines – see Readme_SnowCover.txt in D:/CMP/LCD/Spatial_Data/SnowCover_17yrGrid). 17 years of data showing number of years without spring snow.

Step 1 – Add field:

1A – add field called "GridCode" to mosaic.tif ; Short integer

Step 2 -Calculate:

"grid code" = "value"

Step 3 – raster to polygon:

Convert mosaic.tif to snowpack_mosaic.shp

Step 4 – Dissolve:

Dissolve on "gridcode"

Step 5 – Clip:

Input Features: snowpack_mosaic.shp; Clip Features: pulayer_crown_2km_hex_P2_basegrid.shp;

Output Feature Class: snowmosaic_pulayer.shp;

Environments/Output Coordinates: Same as Layer "pulayer_crown_2km_hex_P2_basegrid.shp" XY Tolerance: none

Step 6 – Identity:

Input Features: snowmosaic_pulayer.shp; Identity Features: pulayer_crown_2km_hex_P2_basegrid.shp; Output Feature Class: snowmosaic_pulayer_indent.shp

Did not need to run Identity as the snow data gets incorporated with the PU_Layer during the Zonal Stats step (below)

Symbology set to the following cutoffs (for visualization and validation): Natural Jenks: These are subjective and in need of further discussion to define the breaks better...

0-1 = very good 2-4 = good 5-9 = fair 10-17 = poor



Step 5: Reclassify

Add field: Condition Add field: ReclassVal

Years without Spring Snow:

Relative Condition	Source cutoffs	Reclass Value
Poor	10-17	4000
Fair	5-9	2000
Good	2-4	500
Very Good	0-1	0
NoData		0

Changed file name (in ArcCatalog) from snowmosaic_pulayer_indent.shp to: CMP/LCD/SpatialData/Wolverine/wolverine_springsnowdays.shp

Step 6: Convert to Raster Convert Roads\ wolverine_springsnowdays.shp to raster using Feature to Raster tool:

Input features: wolverine_springsnowdays.shp Field: Reclass Calue Output Raster: D:\CMP\LCD\SpatialData\Wolverine\wolv_snowdays **Output cell size: 350** Environments: Output coordinates - Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Input features		~	Output cell size	0
SNOW\New Group Layer\Wolverine_SnowDays	• 😆		(optional)	
Field				
ReclassVal	~		The cell size for the output restor dataset	
Dutput raster	-		Tabler Goldset.	
D:\CMP\LCD\SpadalData\Wolverine(wolv_anowdays	B		The default cell size is the	
Output cell size (optional)			shortest of the width or	
			output spatial reference, divided by 250.	
		\sim		
	>			~

NOTE: Output cell size: 350 (this matches the buffer used for point data; it approximates ¼ of the hexagon size)

Step 2 - Mosaic to New Raster mosaic the new raster with the Snap Grid (This step ensures that every raster we generate will have the exact same pixel alignment.)

Input Rasters: D:\CMP\LCD\SpatialData\Wolverine\Wolv_snowdays and P2_Snapgrid Output: D:\CMP\LCD\SpatialData\Lynx\ lynx_snowsnap

Cell Size = 300

Number of Bands = 1

Mosaic Operator = LAST



Step 3: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp

Zone Field: PUID

Input value raster: D:\CMP\LCD\SpatialData\Lynx\ lynx_snowsnap

Output table: D:\CMP\LCD\Metadata\CostLayers\Lynx\zonalst_lynx_snowsnap_p2cost Statistics type: ALL

🔨 Zonal Statistics as Table	- 🗆 ×
Input raster or feature zone data	Zonal Statistics as
P2_BASEGRID 🗾 🖻	Table
Zone field	
PUID ~	Summarizes the values of a
Input value raster	another dataset and reports
lynx_snowsnap 👱 🖻	the results to a table.
Output table	
D:\CMP\LCD\Metadata\CostLayers\Lynx\zonalst_lynx_snowsnap_p2cost	
Ignore NoData in calculations (optional) Statistics type (optional) ALL V	
<	~
OK Cancel Environments << Hide Help	Tool Help

Open ZonalSt_wolv_roads_p2cost; Table Options/Export Table –export as a text file named D:\CMP\LCD\Metadata\CostLayers\Lynx\Lynx_P2_S1_snowsnap.txt. Don't need to add table to map.

Lynx Habitat– Crown LCD – 8/19/2022

Step 1a – Reclassify

Reclassify LCD_DEM_100m These are the categories as giving in feet from the feature attribute table: 0 -4,100ft; > 6,560ft = 4000 4,101 - 4,260ft = 2000 4,261 - 5,900ft = 05,901-6,560ft = 500

These are the values to be reclassed in meters: 0 -1,250m; > 2,000m = 4000 1,250 - 1,300m = 2000 1,300 - 1,800m = 0 1,800-2,000m = 500

Output = lynx_demrec

Environments: output coordinates/processing extent: Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

nput raster				^	Output raster	1
LANDCOVER\lcd_dem_1	00m			≛ 🖻	The subschedule of the d	
teclass field					rastor	
VALUE				~	103(61.	
Reclassification					The output will always be of	
Old values	New values	<u> </u>			integer type	
611 - 1250	4000		Classify			
1250 - 1300	2000					
1300 - 1800	0		Unique			
1800 - 2000	500					
2000 - 3512	4000		Add Entry			
NoData	0		Aug chuy			
		D	elete Entries			
		~				
Land Caus	Deveree New Yold		Dessision			
Ludu Save	Reverse New Valu	ues	Precision			
Output raster						
D:\CMP\LCD\SpatialData\Lvr	v\1vnv_DEMrec					
b. (cmi (ccb (spadalbata (cyr	IX(CYIIX_DEMILEC					
Change missing values t	o NoData (optional)			~		
-						
L						

Step 3: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: lynx_demrec Output table: ZonalSt_Lynx_demrec_p2cost Statistics type: ALL

Zonal Statistics as Table			- 🗆	×
Input raster or feature zone data		_ ^	Output table	~
SNOW\New Group Layer\pulayer_crown_2km_hex_P2_I	BASEGRID	- 🖻		
Zone field			Output table that will contain	
PUID		~	the summary of the values	
Input value raster			in each zone.	
Lynx_DEMrec		- 🖻	The format of the table is	
Output table			determined by the output	
D:\CMP\LCD\SpatialData\Lynx\zonalst_lynx_demrec_p2cost		e*	location and path. If no	
☑ Ignore NoData in calculations (optional) Statistics type (optional) ALL		~	be an INFO table. If the location is in a geodatabase, the output table will be created in that particular type (for example, a file or ArcSDE geodatabase). If the name has a .dbf extension, the output will be in dBASE format.	
<		>		\sim
ОК	Cancel Environments	<< Hide Help	Tool Help	

Open ZonalSt_lynx_landcover_p2cost; Table Options/Export Table –export as a text file named Lynx_P2_S1_demcost.txt. Don't need to add table to map.

Step 1b – Spatial Analyst, slope tool: Source data used: LCD_DEM_100m

Output = LCD_Slope_100

Step 1C – Reclassify Reclassify slope in 2 categories; 0-30% and >30% Lynx prefer gentler slopes of 30% or less Reclass values: 0-30% = -30-100% = 4000 Output = Lynx_sloperec Environments: output coordinates/processing extent: Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Input raster				^	Output raster	~
LANDCOVER\LCD Slope	100			- 1	•	
Reclass field					The output reclassified	
Value				~	raster.	
Reclassification					The euterit will show a be of	
Old values	New values	<u> </u>			integer type	
0 - 30	0		Classify		integer (ype.	
30 - 70.309944	4000		11-1			
NoData	0		Unique			
			Add Entry			
			Delete Entries			
		~				
Load Savo	Powerce New Valu	100	Precision			
Coddini			11ccloid inter			
Output raster						
D:\CMP\LCD\SpatialData\Lyn	<\lynx_sloperec			2		
Change missing values to	NoData (optional)			~		
Change missing values in	(vobata (optional)					\sim
6				2		

Step 3: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: Lynx_sloperec Output table: ZonalSt_Lynx_sloperec_p2cost Statistics type: ALL

nput raster or feature zone data			Output table	1
SNOW/New Group Layer\pulayer_crown_2km, one field PUID put value raster LANDCOVER\lynx_sloperec Utput table D:\CMP\LCD\SpatialData\Lynx\zonalist_lynx_sloperec ☑]gnore NoData in calculations (optional) tatistics type (optional) ALL	hex_P2_BASEGRID		Output table that will contain the summary of the values in each zone. The format of the table is determined by the output location and path. If no extension is specified, it wi be an INPO table. If the location is in a geodatabase, the output table will be created in that particular type (for example a file or ArcSDE geodatabase). If the name has a .db for kensnion, the output will be in dBASE format.	ח ∥

Open ZonalSt_lynx_landcover_p2cost; Table Options/Export Table –export as a text file named Lynx_P2_S1_slopecost.txt. Don't need to add table to map.

CMP_LCD_Landcover2017; select LandCover = "Conifer" and "Mixed"

Export selected features to "LCD_Landcover2020_lynx.shp"

Dissolved "LCD_Landcover2020_lynx.shp" on landcover; output = LCD_Landcover2017_lynxdis.shp

Step 2b – Select Features:

CMP_LCD_Landcover2017; select LandCover = "Agricultural, Barren, Deciduous, Developed, Grassland, Ice/Snow, Schrub/shrub, Water, Wetland"

Export selected features to "LCD_Landcover2020_antilynx.shp"

Dissolved "LCD_Landcover2020_antilynx.shp" on landcover; output = LCD_Landcover2017_antilynxdis.shp

Step 2 – add field:

Add field "Value"; short integer

Step 3 – Calculate:

Mixed, conifer = 0; all else = 4000

Step 3 – Merge:

Inputs = LCD_Landcover2017_lynx.shp and LCD_Landcover2017_antilynxdis.shp;

output = D:\CMP\LCD\SpatialData\Lynx\LCD_Lynx_landcover2017.shp

Step 4: Convert to Raster Convert LCD_Lynx_landcover2017.shp to raster using Polygon to Raster tool:

Input features: LCD_Lynx_landcover2017.shp

Field: Value

Output Raster: D:\CMP\LCD\SpatialData\Lynx\Lynx_landcov

Output cell size: 350

Environments: Output coordinates - Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

hand Castown			Colleire (entional)
Input Heatures	22		Cellsize (optional)
Divide Bald	22		The cell size for the output
Value		×	raster dataset.
Output Raster Dataset			The defendence of the large
D:\CMP(LCD\SpatialData\Wolverine\wolv_landco	v	6	shortest of the width or
Cell assignment type (optional)		- Canad	height of the extent of the
CELL_CENTER		~	input feature dataset, in the
Priority field (optional)			divided by 250
NONE		~	
Cellsize (optional)			
250		8	
		<u>_</u>	

NOTE: Output cell size: 350 (this matches the buffer used for point data; it approximates ¼ of the hexagon size)

Rasters need to be integer for Zonal Stats. I suspect we want them signed to make sure we are not working with negative values. If you generate a raster that is floating point, just run the INT tool (Spatial Analyst – Math- INT).

Right click on properties – source to double check

Step 5 - Reclassify

make sure 'NoData' is reclassed as a zero before running Zonal Stats

input = Lynx_landcov

reclass field = Value

Output Raster = D:\CMP\LCD\SpatialData\Lynx\Lynx_landcvcr

The Reclassify	- 🗆 X
Input raster	Output raster
LANDCOVER\Lynx_landcov	The output reclassified
VALUE	raster.
Reclassification	The output will always be of
Old values New values 0 0 4000 4000 NoData NoData Add Entry Delete Entries Load Save	integer type.
Output raster	
D:\CMP\LCD\SpatialData\Lynx\lynx_landcvrc	
Change missing values to NoData (optional)	
X	\sim
OK Cancel Environments << Hide Help	Tool Help

Step 2 - Mosaic to New Raster mosaic the new raster with the Snap Grid (This step ensures that every raster we generate will have the exact same pixel alignment.)

Input Rasters: D:\CMP\LCD\SpatialData\Lynx\Lynx_landcvcr and P2_Snapgrid

Output: D:\CMP\LCD\SpatialData\Lynx\ Lynx_habsnapb

Cell Size = 300

Number of Bands = 1

Mosaic Operator = FIRST (LAST did n0t work properly, although First did not work properly for the LCDfirerasteb...)

Input Rosters	^	Mosaic Operator
	· 🖻	(optional)
♦ lync_landoric	+	The method used to mosaic
♦ p2_snapprd		overlapping areas.
	<u>^</u>	
	1	 FIRST — The output cell value of the
		overlapping areas will
	·	be the value from the
		mosaicked into that
A second s		location.
Output catcoon		 LAST — The output
Andre Antonia Marca and Antonia		cvertapping areas will
tync,habenap		be the value from the
Spatial Reference for Raster (optional)		last raster dataset
North_America_Albers_Equal_Area_Conic_ON-112	8	location. This is the
Poel Type (optional)		default.
8_BIT_UN\$30x60	×	BLEND — The output
Celisze (optional)		overlapping areas will
		be a horizontally
Martinet of Barries	1	of the values of the
Mosaic Operator (optional)		cells in the
LAST	×	overlapping area.
Mosaic Colormap Mode (optional)		 MEAN — The output cell value of the
PRST	0]	overlapping areas will
		be the average value
		cels.
		 MINIMUM —The
		output cell value of
		will be the minimum
		value of the
		overlapping cells.
		 moduluom — me output cell value of
		the overlapping areas
		will be the maximum waken of the
		overlapping cells.
	×	 SUM —The output
<	>	cell value of the

Step 3: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: **D:\CMP\LCD\SpatialData\Lynx\ Lynx_habsnapb** Output table: ZonalSt_Lynx_landsnap_p2cost Statistics type: ALL

🔨 Zonal Statistics as Table	×
Input raster or feature zone data	Output table
P2_BASEGRID 🗾 🖆	
Zone field	Output table that will contain
PUID	the summary of the values in
Input value raster	each zone.
Lynx_habsnapb 🗾 🖻	The format of the table is
Output table	determined by the output
D:\CMP\LCD\Metadata\CostLayers\Lynx\ZonalSt_Lynx_landsnap_p2cost	location and path. If no
☐ Ignore NoData in calculations (optional)	be an INFO table. If the location is in a geodatabase.
Statistics type (optional)	the output table will be
ALL	created in that particular
	type (for example, a file or ArcSDE geodatabase). If the name has a. dbf extension, the output will be
	in dBASE format.
X	
OK Cancel Environments << Hide He	lp Tool Help

Open ZonalSt_Lynx_landsnap_p2cost; Table Options/Export Table –export as a text file named Lynx_P2_S1_landsnapcost.txt. Don't need to add table to map.

Step 3 – raster to polygon:

Convert mosaic.tif to snowpack_mosaic.shp

Step 4 – Dissolve:

Dissolve on "gridcode"

Step 5 – Clip:

Input Features: snowpack_mosaic.shp; Clip Features: pulayer_crown_2km_hex_P2_basegrid.shp;

Output Feature Class: snowmosaic_pulayer.shp;

Environments/Output Coordinates: Same as Layer "pulayer_crown_2km_hex_P2_basegrid.shp" XY Tolerance: none

Step 6 – Identity:

Input Features: snowmosaic_pulayer.shp; Identity Features: pulayer_crown_2km_hex_P2_basegrid.shp; Output Feature Class: snowmosaic_pulayer_indent.shp

Did not need to run Identity as the snow data gets incorporated with the PU_Layer during the Zonal Stats step (below)

Symbology set to the following cutoffs (for visualization and validation): Natural Jenks: These are subjective and in need of further discussion to define the breaks better...

0-1 = very good 2-4 = good 5-9 = fair 10-17 = poor



Add field: Condition Add field: ReclassVal

Spring Days without Snow:

Relative Condition	Source cutoffs	Reclass Value
Poor	10-17	4000
Fair	5-9	2000
Good	2-4	500
Very Good	0-1	0
NoData		0

Changed file name (in ArcCatalog) from snowmosaic_pulayer_indent.shp to: CMP/LCD/SpatialData/Wolverine/wolverine_springsnowdays.shp

Step 6: Convert to Raster

Convert Roads\ wolverine_springsnowdays.shp to raster using Feature to Raster tool:

Input features: wolverine_springsnowdays.shp Field: Reclass Calue Output Raster: D:\CMP\LCD\SpatialData\Wolverine\wolv_snowdays **Output cell size: 350** Environments: Output coordinates - Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Seature to Raster	- D	×
Input features	Output cell size	~
SNOW\New Group Layer\Wolverine_SnowDays 👱 🖆	(optional)	
Field		
ReclassVal v	The cell size for the output	
Output raster	rasior dataset.	
D:\CMPILCD\SpatialData\Wolverine\wolv_snowdays	The default cell size is the	
Output cell size (optional)	shortest of the width or	
30 🗃	height of the extent of the	
		~
(
OK Cancel Environments << Hide Help	Tool Help	
MIDTI MINI IN IN INVESTIGAT		-

NOTE: Output cell size: 350 (this matches the buffer used for point data; it approximates ¼ of the hexagon size)

Step 3: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: wolv_snowdays Output table: ZonalSt_wolv_snow_p2cost Statistics type: ALL

Input raster or feature zone data	Output table	
SNOW\New Group Layer\pulayer_crown_2km_h	- 🖻	
Zone field	Output table that will conta	n
PUID	in each zone.	
Input value raster		
wolv_snowdays	The format of the table is	
Dutput table	determined by the output	
D:\CMP\LCD\SpatialData\Wolverine\zonalst_wolv_snov	extension is specified, it w	ill
☑ Ignore NoData in calculations (optional) Statistics type (optional)	be an INFO table. If the location is in a geodatabase, the output	
ALL	 table will be created in that 	
	particular type (for exampl a file or ArcSDE geodatabase). If the name has a dth extension, the output will be in dBASE format.	θ,
r	>	

Open ZonalSt_wolv_roads_p2cost; Table Options/Export Table –export as a text file named Wolv_P2_S1_snowcost.txt. Don't need to add table to map.

Fire (Lynx) – Crown LCD – 8/2022

Source Data: InteragencyFirePerimeterHistory.shp (US) NFDB_Poly_202110707 (CAN)

Step 1 - Clip Clip InteragencyFirePerimeterHistory.shp Clip feature: Crown_LCD_Boundary2020_AEA.shp Output: LCD_US_Fires2020.shp Environments: Output Coordinates = Same as "pulayer_crown_2km_hex_P2_basegrid.shp" Clip NFDB_Poly_202110707.shp Clip feature: Crown_LCD_Boundary2020_AEA.shp Output: LCD_CAN_Fires2020.shp Environments: Output Coordinates = Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Selected 4 fires along the US/CAN boarder and erased them from either shapefile...

Step 2 - Union Features Input Features = LCD_CAN_Fire2020.shp Update Features = LCD_USA_Fire2020.shp Output Feature Class = LCD_Fires2020.shp Gaps allowed checked Environments: Output Coordinates = Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

🔨 Union				- 🗆 ×
Input Features			• •	gaps in the output, set this option to NO_GAPS, and a feature will be created in
Features CD_USA_Fire2020 LCD_CAN_Fire2020		Ranks	+ ×	these areas. To select these features, query the output feature class based on all the input feature's FID values being equal to -1.
<			•	 Checked—No feature will be created for areas in the output that are completely enclosed
Output Feature Class D:\CMP\LCD\SpatialData\Fire\LCD_Fires2020.shp			e 1	by polygons. This is the default.
JoinAttributes (optional) ALL XY Tolerance (optional)		Meters	~	 Unchecked—A feature will be created for the areas in the output that are
Gaps Allowed (optional)		meters	>	completely enclosed by polygons. This feature will have blank attributes.
	OK Cancel	Environments <	< Hide Help	Tool Help

Step 2 – add field:

Add field "Value"; short integer

Step 3 – Calculate:

(lynx avoid recent burns (<10 years); lynx are positively associated with landscapes that were clearcut 15 to 35 years previously (Hoving et al. 2004, p. 291; Simons-Legaard et al. 2013b, pp. 573–574), some of which were also treated with herbicides to promote conifer regeneration (Scott 2009, p. 7). Lynx avoided mature stands (>40 years old) and short (3.4–4.3 m [11–14 ft]) regenerating clear-cut or partial harvested stands <10 years post-harvest (Fuller et al. 2007). Surface

fires, avalanches, insects, and forest pathogens have also been important agents of disturbance, creating more structural diversity at a smaller scale. Disturbance < 10 years = 4000 mature stands >40 years old = 2000 Disturbance 10-15years = 500 Disturbance 15 - 35 years old = 0

Step 3 – Polygon to Raster

Convert LCD_Lynx_landcover2017.shp to raster using Polygon to Raster tool:

Input features: LCD_Fires2020.shp

Field: Year

Output Raster: D:\CMP\LCD\SpatialData\Fire\LCD_fire

Output cell size: 100

Environments: Output coordinates - Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Nolygon to Raster	- 🗆 X
Popy on to haster Popy on the haster	Cellsize (optional) The cell size for the output raster dataset. The default cell size is the shortest of the width or height of the extent of the input feature dataset, in the output spatial reference, dwided by 250.
Celleze (optional) 5 Celleze (optional) 6 Celleze (optional) 7 Celleze (Тоо! Нер

Step 1a – Reclassify lynx avoid recent burns (<10 years)

Reclassify LCD_Fires2020.shp Reclass Values: Fire Year 2007-1987 = 0 Fire Year 2013- 2008; 1986 - 1982 = 500 Fire Year < 1981 = 2000 Fire Year 2020 - 2012 = 4000

Output = LCD_FireRec

Environments: output coordinates/processing extent: Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Input rester	ssify						×
LCD_Free2020 Image: Comparison of the	ter				^	Output raster	
tectss field The output reclassified rasker. VALUE rasker. cectssoftation The output will always be of integer type. 1970 - 1981 2000 1986 - 5000 Unique 2007 - 2012 - 5000 Add Entry Delete Entrues Delete Entrues Load Swe Reverse New Values Frecision Dubput raster D:(CMPL/CDISpatialbataLlymt/hmc_firerec Change missing values to NoData (optional) V	re2020			- 🖻			
VALUE values val	ield					The output reclassified	
eclassfication Old values New values The output will always be of integer type. 11910 - 1998 1 2000 Image 11910 - 1998 1 2000 Image 2007 - 2012 500 Image 2007 - 2012 4000 Add Entry Delete Entrues Delete Entrues Load Save Reverse New Values Precision Delete Entrues D:CMPLCD/SpatialDataLtynxlynx_frerec Image Change missing values to NoData (optional) V				~		raster.	
Old values New values 1910 - 1991 2000 1911 - 1991 2000 1915 - 1991 2000 1915 - 1991 0 1916 - 1991 0 1916 - 1991 0 2007 - 2012 - 500 0 2012 - 2022 - 4000 Add Entry Delete Entrest 0 Load Seve Reverse New Values Precision udput raster 0 Dr(CMPLCD/Gspatialbate/Lymk/mrc_frerec Change missing values to NoData (optional)	ication						
Old values New values Classify 11910 - 1996 2000 Classify Integer type. 1986 - 2007 0 Unique Add Entry 2017 - 2012 500 Add Entry Delete Entries Load Save Reverse New Values Precision utput raster D://CMP/LCD/Spatialbabil.jmx/t/mx, firerec Classify Classify						The output will always be of	
1910 - 1961 2000 1981 - 1965 500 1966 - 5007 0 2007 - 2012 500 2012 - 2022 4000 Add Entry Delete Entries Load Save Reverse New Values Precision utput raster ::CMPLCD/Spetialbabilymx/frerec Change missing values to NoData (optional)	Old values	New values	Classify			integer type.	
1396:2000 0 1396:2001 0 2007:2012 500 2012:2022 4000 Add Entry Data 0 Delete Entries Load Save Reverse New Values Precision dput raster (VMPLCD)SpatialDataLymx/jmx,frerec Change missing values to NoData (optional)	1910 - 1981	2000	clussity				
2007 : 2012 500 2012 : 2022 4000 Add Entry Delete Entries Lood Save Reverse New Values Precision aput raster r:(CMFLCD(SpetialData(Lymx)/ymx,firerec Change missing values to NoData (optional)	1901 - 1900	500	Unique				
2012 - 2022 4000 Add Entry NoData 0 Ocleta Entries Load Save Reverse New Values Precision Aput raster (AMFLCD/SpatialDataLymx)/mc,frerec Change missing values to NoData (optional)	2007 - 2012	500					
NoData 0 Add Entry Delete Entries Load Seve Reverse New Values Precision Precision Adjut raster Precision Pr(MPILCD)SpatialData Lymx)/mx, firerec Precision Change missing values to NoData (optional) V	2012 - 2022	4000					
Delete Entries Load Seve Reverse New Values Precision utput raster VCMPLCD/Spatalobats(ymx/ymx,firerec Change missing values to NoData (optional)	NoData	0	Add Entry				
Load Save Reverse New Values Precision utput raster 2):(CMPL/LD):SpotalData Lymx\/ymx,firerec Change missing values to NoData (optional)	·		Dalata Datata				
Load Save Reverse New Values Precision uppt raster >:(CMPLCD(SpatialData\Lymx\/mx.frerec Change missing values to NoData (optional)			V Delete Entries				
Load Save Reverse New Values Precision utput raster D:(CM/LCD/SpatialData/Lymx/lymx/frerec Change missing values to NoData (optional)							
utput raster D:(CMP(LCD)SpatialData(Lymx)/ymx,firerec Change missing values to NoData (optional)	Save	Reverse New Value	ues Precision				
utput raser Updut							
CMM/LCD/spatialbate/Lymx/tyms/trerec Change missing values to NoData (optional)	ister						
Change missing values to NoData (optional)	(LCD\SpatialData\Lynx\ly	/nx_firerec					
Invisition in such and a final contracts	ago missing values to N	(oData (ontional)			V		
> >	ige missing values to iv	opata (optiolial)					
				>			
OV Constal Environmente de Unio Textuluio			OV Canad	and an annual second	-	Teal Hala	

Step 2 - Mosaic to New Raster mosaic the new raster with the Snap Grid (This step ensures that every raster we generate will have the exact same pixel alignment.)

Input Rasters: Lynx_FireRec and P2_Snapgrid

Output: D:\CMP\LCD\SpatialData\Fire\LCDFireRasteb

Cell Size = 300

Number of Bands = 1

Mosaic	Operator	= LAST
S Morair To New Parter		

put Rasters		a ^	Mosaic Operator (optional)
	- 1	-	(optional)
FIRE)/ync_firerec		+	The method used to mosair
▶ p2_snepgrid			overlapping areas.
		×	
			• FIRST The output
		Ť	cell value of the
			overlapping areas w
		ŧ	be the value from th
			first raster dataset
			mosaicked into that
			location.
put tecesion			 LAST — The output
\CMP/LCD/SpatialData/Fire		6	cell value of the
ter Dataset Name with Extension			overlapping areas w
Dfireraster			be the value from th
tial Reference for Raster (optional)			last raster dataset
30 - 7		~	mosaicked mo mai
		-	default
el Type (optional)			- PLEND The even
BIT_UNSIGNED			 BLEND — The output colluption of the
(size (optional)			centrate of the
		100	be a horizontally
mber of Bands			weighted calculation
		1	of the values of the
raic Deerator (ontional)			cells in the
		~	overlapping area.
rair Colorman Mode (articoal)		_	 MEAN —The output
and continue model (optional) Ref		-	cell value of the
			overlapping areas w
			be the average value
			of the overlapping
			cells.
			 MINIMUM —The
			output cell value of
			the overlapping are
			will be the minimum
			value of the
			overlapping cells.
			 MAXIMUM — The
			ouput cell value of
			une overlapping area
			will be the maximum
			value of the
		- U	over appling cells.
			Sum — The output
		>	Cen value of the

Step 3: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp

Zone Field: PUID

Input value raster: D:\CMP\LCD\SpatialData\Fire\LCDFireRasteb

Output table: D:\CMP\LCD\Metadata\CostLayers\Lynx\ZonalStat_Lynx_Firesnap_P2Cost Statistics type: ALL

Input raster or feature zone data		~	Output table
P2_BASEGRID		- 2	
one field			Output table that will contain
PUID		~	each zone
input value raster			Cubit Long.
LCDfirerasteb		. ≥	The format of the table is
Output table			determined by the output
D:\CMP\LCD\Metadata\CostLayers\Lynx\ZonalStat_Lyn	<_Firesnap_P2Cost	e 🔁	extension is specified it will
Ignore NoData in calculations (optional)			be an INFO table. If the location is in a geodatabase,
Statistics type (optional)			the output table will be
ALL		~	created in mat particular type (for example, a file or ArcSDE geodatabase). If the name has a .dbf extension, the output will be in dBASE format.
		>	

Open D:\CMP\LCD\Metadata\CostLayers\Lynx\ZonalStat_Lynx_Firesnap_P2Cost; Table Options/Export Table –export as a text file named D:\CMP\LCD\Metadata\CostLayers\Lynx\Lynx_P2_S1_firesnap.txt. Don't need to add table to map.

Industry (Wolverine)

Step 1 – Select by Attributes (Wells)

GWIC_Wells_LCD_Clip.ship, selected industrial types of wells (petroleum, gas, mines, etc); output = GWIC_Wells_LCD_Clip_industry.shp

Step 2 – Erase (Wells)

Erased GWIC_Wells_LCD_Clip_industry.shp from Wells_CCE_50kmBuffer_UTM11 (due to redundancy); output = GWIC_Wells_LCD_Clip_industry_CCEWells_erased.shp

Step 3 – Merge (Wells)

Merged Wells_CCE_50kmBuffer_UTM11.shp with GWIC_Wells_LCD_Clip_industry_CCEWells_erased.shp; output CMP/LCD/SpatialData/Wells/CCE_LCDGWIC_Wells.shp

Step 4 – New Field (Wells)

Add new field = Type

Calc type = [SRC_Status] and [status]

(Could take out wells that are abandoned, but haven't done so yet)

Step 5 – Merge

a) Merge; Industrial Points

Merged Crown_LCD_OilandGas2020.shp, Crown_LCD_ProducingMines2020.shp, and CCE_LCDGWIC_Wells.shp;

```
output = LCD_Industry_Points
```

(to be used for competitor access into remote areas)

b) Merge; Industrial Lines

Merged All_Roads_Crown_LCD.shp, CMP_LCD_Railroads.shp, and Crown_LCD_Pipelines2020;

Output = LCD_Industry_Lines.shp

(to be used for competitor access into remote areas)

- bb) Merge; Industrial Lines (No Roads)
- Merged All_Roads_Crown_LCD.shp, CMP_LCD_Railroads.shp, and Crown_LCD_Pipelines2020;
- Output = LCD_Industry_LinesB.shp

(to be used for competitor access into remote areas)

a) Merge; Industry Polygons

Merged Recreation_Areas_All.shp and LCD_BC_Coalmines.shp;

output = LCD_Industry_Polygons.shp

(to be used for competitor access into remote areas)

Step 6a– Buffer (the 3 industry layers need to buffer these so show how far the competitor can spread - 32km) coyotes can travel about 20 miles a day according to <u>How Far Do Coyotes Travel In A Day? - [Answer] 2022 - The Classic</u> <u>Wanderer</u>

Buffer – input "LCD_Industry_Points.shp"

Buffer distance 5 km 32 km

Output = LCD_Industry_Points_5kmbuffer.shp

After running the buffer, the well coverage was crazy busy so I decided to drop the buffer down to 5km...

Also, these points contain abandoned wells. Should these be removed as they no longer pose a threat of disturbance?

Step 6b- Buffer (the 3 industry layers need to buffer these so show how far the competitor can spread - 5km)

Buffer – input "LCD_Industry_linesB.shp"

Buffer distance 5km

Output = LCD_Industry_LinesB_5kmbuffer.shp

These lines contain roads from the All_Roads_Layer.shp. Should these be taken out because we will be using road density as a cost layer? I created LCD_Industry_linesB.shp without the roads layer...

Step 6c– Buffer (the 3 industry layers need to buffer these so show how far the competitor can spread - 5km)

Buffer – input "LCD_Industry_polygons.shp"

Buffer distance 5km

Output = LCD_Industry_Polygons_5kmbuffer.shp

Step 7 - Add field

Add field called "Value" to each of the 3 industry layers

Calc Field – Each industry value was scored 4,000 to reflect the potential for competitor introduction into remote areas.

Step 8a - Dissolve

Input = LCD_Industry_LinesB_5kmbuffer.shp Dissolve on Value Output = LCD_Industry_LinesB_5kmbufdis.shp

Step 8a - Dissolve Input = LCD_Industry_Polygons_5kmbuffer.shp Dissolve on Value Output = LCD_Industry_Polygons_5kmbufdis.shp

Step 8b – clip

Input = LCD_Industry_Polygons_5kmbufdis.shp Clip feature = pulayer_crown_2km_hex_P2_basegrid.shp Output = LCD_Industry_Polygons_5kmbufdisclip.shp

Step 9a: Convert to Raster

Convert LCD_Industry_Points_5kmbuffer.shp to raster using Feature to Raster tool:

Input features: LCD_Industry_Points_5kmbuffer.shp Field: Value Output Raster: D:\CMP\LCD\SpatialData\Wolverine\wolv_indpts **Output cell size: 350** Environments: Output coordinates - Same as "pulayer crown 2km hex P2 basegrid.shp"

Input features			Output cell size	1
INDUSTRY\LCD_Industry_Polygons_Skmbuffer	·	8	(optional)	
Field				
Value		~	raster dataset	
Dutput raster				
Drichmicch/spaceback/wowennetwow_natpolys			The default cell size is the	
Dutput cell size (optional)			shortest of the extent of the	
		~	divided by 250.	

NOTE: Output cell size: 350 (this matches the buffer used for point data; it approximates ¼ of the hexagon size)

Step 9b: Convert to Raster

Convert LCD_Industry_LinesB_5kmbufdis.shp to raster using Poly to Raster tool:

Input features: LCD_Industry_LinesBB_5kmbufdis.shp

Field: Value

Output Raster: D:\CMP\LCD\SpatialData\Wolverine\wolv_indline (or wv_linbuf for lines layer without roads) Output cell size: 350

Environments: Output coordinates - Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Step 9c: Convert to Raster

Convert LCD_Industry_Polygons_5kmbuffer.shp to raster using Poly to Raster tool:

Input features: LCD_Industry_Polygons_5kmbufdisclip.shp.shp Field: Value Output Raster: D:\CMP\LCD\SpatialData\Wolverine\wv_indpolgon **Output cell size: 350** Environments: Output coordinates/Processing Extent - Same as "pulayer_crown_2km_hex_P2_basegrid.shp"

Step 10a : extract by mask

Input raster = wolv_indpts input feature = R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp Output = wolv_indptscp Step 10b : extract by mask
Input raster = wolv_indlineB
input feature =
R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp
Output = wolv_indlincp
Output = wolv_indlinbc

Step 10c : extract by mask
Input raster = wolv_indpolys input feature =
R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp
Output = wolv_indpolcp wv_polbufcp

Step 10a - Reclassify

make sure 'NoData' is reclassed as a zero before running Zonal Stats

input = wolv_indptscp
reclass field = Value
Output Raster = D:\CMP\LCD\SpatialData\Wolverine\wolv_indptrc

Step 10b - Reclassify

make sure 'NoData' is reclassed as a zero before running Zonal Stats
input = wv_linbuf
reclass field = Value
Output Raster = D:\CMP\LCD\SpatialData\Wolverine\ wv_linbufrec

Step 10c - Reclassify

make sure 'NoData' is reclassed as a zero before running Zonal Stats

input = wv_indpolgon
reclass field = Value
Output Raster = D:\CMP\LCD\SpatialData\Wolverine\wv_indpolrec

The Reclassify	- 🗆 ×
Input raster	Output raster
Reclass field VALUE V	The output reclassified raster.
Old values New values 4000 4000 NoData 0 Unique Add Entry Delete Entries Load Save	The output will always be of integer type.
Output raster	
D:\CMP\LCD\SpatialData\Wolverine\wolv_indptrc	
Change missing values to NoData (optional)	
< >>	×
OK Cancel Environments << Hide Help	Tool Help

Step 11a – **Mosaic to New Raster mosaic the new raster with the Snap Grid (**This step ensures that every raster we generate will have the exact same pixel alignment.)

Input Rasters: D:\CMP\LCD\SpatialData\Wolverine\ wv_indptrcb and P2_Snapgrid

Output: D:\CMP\LCD\SpatialData\Wolverine\ WvIndptssnap

Cell Size = 300 Pixel Type = 8 bit unsigned Number of Bands = 1 Mosaic Operator = First

🔨 Mosaic To New Raster					- 🗆 X
Input Rasters				· 🖻	Mosaic Operator (optional)
◆wolv_indptrcb ◆p2_snapgrid				+ × †	The method used to mosaic overlapping areas. • FIRST —The output cell value of the overlapping areas will be the value from the first raster dataset mosaicked into that
Output Location D:\CMP\LCD\SpatialData\Wolverine Raster Dataset Name with Extension WvIndptssnap Spatial Reference for Raster (optional) North_America_Albers_Equal_Area_Conic_CM-112					 LAST — The output cell value of the overlapping areas will be the value from the last raster dataset mosaicked into that location. This is the
Pixel Type (optional) 8_BIT_UNSIGNED Cellsize (optional) Number of Bands Mosaic Operator (optional) FIRST				300 1 ~	 default. BLEND —The output cell value of the overlapping areas will be a horizontally weighted calculation of the values of the cells in the overlapping area. MEAN —The output
-	ОК	Cancel	Environments	<< Hide Help	Tool Help

Step 11b – Mosaic to New Raster mosaic the new raster with the Snap Grid (This step ensures that every raster we generate will have the exact same pixel alignment.)

Input Rasters: D:\CMP\LCD\SpatialData\Wolverine\ wv_linbufrec and P2_Snapgrid Output: D:\CMP\LCD\SpatialData\Wolverine\ WvIndlinsnap

Cell Size = 12 (to get as close to the roads layer as possible) 300 is too chunky

Pixel Type = 8 bit unsigned

Number of Bands = 1

Mosaic Operator = First

Nosaic To New Raster		- 🗆 X
	- 🖻 🔨	(optional)
♦ wv_linbufrec	+	The method wood to more in
	×	overlapping areas.
	1	• FIRST — The output
	►	cell value of the overlapping areas will be the value from the first raster dataset
		mosaicked into that
Output Location		LAST —The output
D. /CMP/LCD/Spatialbata/Wolvernie		cell value of the
Raster Dataset Name with Extension		overlapping areas will
wvindiinshap		be the value from the
Spatial Reference for Raster (optional)		last raster dataset
North_America_Albers_Equal_Area_Conic_CM-112		location This is the
Pixel Type (optional)		default.
8_BIT_UNSIGNED	~	BLEND —The output
Cellsize (optional)		cell value of the
	12	overlapping areas will
Number of Bands		be a horizontally
	1	weighted calculation
Mosaic Operator (optional)		of the values of the
FIRST	~	overlapping area
Mosaic Colormap Mode (optional)	\checkmark	MEAN —The output
	ž	cell value of the
OK Cancel Environments	<< Hide Help	Tool Help

Step 11C – Mosaic to New Raster mosaic the new raster with the Snap Grid (This step ensures that every raster we generate will have the exact same pixel alignment.)

Input Rasters: D:\CMP\LCD\SpatialData\Wolverine\ wv_indpolrec and P2_Snapgrid Output: D:\CMP\LCD\SpatialData\Wolverine\ WvIndpolsnap

Cell Size = 300 Pixel Type = 8 bit unsigned Number of Bands = 1 Mosaic Operator = First

🔨 Mosaic To New Raster	-					_		×
Input Rasters					^	Input Raste	rs	~
				- 🖻		The input raste	r datasets.	
wv_indpolrec				+				
p2_snapgrid								
				×				
				▲				
				↓				
Output Location								
D:\CMP\LCD\SpatialData\Wolverine				2				
Raster Dataset Name with Extension								
WvIndpolsnap								
Spatial Reference for Raster (optional)								
North_America_Albers_Equal_Area_Conic_CM-112				e 19 19 19 19 19 19 19 19 19 19 19 19 19				
Pixel Type (optional)								
8_BIT_UNSIGNED				\sim				
Cellsize (optional)								
				300				
Number of Bands								
				1				
Mosaic Operator (optional)					\mathbf{v}			
FIRST								\sim
]			
	ОК	Cancel	Environments	<< Hide Hel	р	Tool Help		

Step 10a: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: WvIndptsSnap Output table: D:\CMP\LCD\Metadata\CostLayers\Wolverine\ZonalSt_wolv_indpts_snapp2cost Statistics type: ALL

Zonal Statistics as Table				-	- 🗆	×
Input raster or feature zone data			^	Output tal	ole	~
P2_BASEGRID			- 🖻			
Zone field				Output table t	hat will contain	
PUID			\sim	each zone	or the values in	
Input value raster			_			
WvIndptssnap			<u> </u>	The format of	the table is	
Output table				determined b	y the output	
D:\CMP\LCD\Metadata\CostLayers\Wolverine\zonalst_wolv_in	ndptss_snapp2cost		2	extension is s	path. It no specified it will	
Ignore NoData in calculations (optional)				be an INFO ta	able. If the	
in the second and the second second (optional)				location is in	a geodatabase	э,
Statistics type (optional)			_	the output tab	le will be	
				type (for exar ArcSDE geod the name has extension, the in dBASE for	nple, a file or latabase). If a .dbf output will be mat.	
			\sim			
<			>			\sim
	OK Cancel	Environments <<	Hide Help	Tool Help		

Open ZonalSt_wolv_indpts_snapp2cost; Table Options/Export Table –export as a text file named D:\CMP\LCD\Metadata\CostLayers\Lynx\Wolv_P2_S1_indptssnapcost.txt. Don't need to add table to map.

Step 10b: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: WvIndlinsnap wolv_indlines (or wv_linbufrec for no roads) Output table: D:\CMP\LCD\Metadata\CostLayers\Wolverine\ZonalSt_wolv_indlin_snapp2cost ZonalSt_wolv_indlines_p2cost (or ZonalSt_wv_linbufrec_p2cost for no roads in the line layer) Statistics type: ALL

Tonal Statistics as Table	- 🗆 X
Input raster or feature zone data P2_BASEGRID Zone field PUD Input value raster WvIndlinsnap Output table D:\CMP\LCD\Metadata\CostLayers\Wolverine\zonalst_wolv_indlin_snapp2cost Ignore NoData in calculations (optional) Statistics type (optional) ALL	Output table Output table that will contain the summary of the values in each zone. The format of the table is determined by the output location and path. If no extension is specified, it will be an INFO table. If the location is in a geodatabase, the output table will be created in that particular type (for example, a file or ArcSDE geodatabase). If the name has a .dbf extension, the output will be in dBASE format.
	~
OK Cancei Environments << Hide Help	тоогнер

Open ZonalSt_wolv_indlin_snapp2cost; Table Options/Export Table –export as a text file named D:\CMP\LCD\Metadata\CostLayers\Lynx\Wolv_P2_S1_indlinsnapcost.txt Wolv_P2_S1_industlinesCost.txt (or Wolv_P2_S1_industlinesBcost.txt for no roads). Don't need to add table to map.

Step 10c: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: wv_indpolree WvIndpolSnap Output table: D:\CMP\LCD\Metadata\CostLayers\Wolverine\ZonalSt_wolv_indpols_snapp2cost ZonalSt_wolv_indpolys_p2cost (or ZonalSt_wv_indpolys_p2cost for no roads) Statistics type: ALL

input raster or feature zone data			\sim	Output table
P2_BASEGRID		- 🖻		
Zone field				Output table that will contain
PUID		~		each zone
input value raster				5000 L000
WvIndpolsnap		- 🖻		The format of the table is
Dutput table				determined by the output
D:\CMP\LCD\Metadata\CostLayers\Wolverine\ZonalSt_wolv_indpts_	_snapp2cost	6		extension is specified it will
Ignore NoData in calculations (optional)				be an INFO table. If the
Statistics type (optional)				the output table will be
			~	ArcSDE geodalabase). If ArcSDE geodalabase). If the name has a dbf extension, the output will be in dBASE format.
		>		

Open ZonalSt_wolv_indpts_snapp2cost; Table Options/Export Table –export as a text file named D:\CMP\LCD\Metadata\CostLayers\Lynx\Wolv_P2_S1_indpolysnapcost.txt. Don't need to add table to map.

Traffic Volume – this data was from Mule Deer (Sean). Need to get this data from him for the lynx analysis...

Step 5: Reclass All_Roads_Crown_LCD.shp (field = RDSURFACE) to estimate relative use from heavy (e.g., CITY) to light (e.g., minor rural); based on source data – elected to generate 3 classes of road: Paved, Unpaved and Unknown Surface. I also recognized and withdrew a few roads where RDSURFACE = decommissioned or overgrown – these were not classified as roads but removed from further analysis

Geoprocessing/Environments: Set Output Coordinates and Processing Extent to "Same as: Crown_LCD_PlanningUnit_Mask.shp"

Add Data: All_Roads_Crown_LCD.shp

Select by Attribute where RDSURFACE = ASPHALT, CONCRETE, paved, Paved or PAVED

Select By At	tributes			×
Layer:	All_Ro	ads_Crown_LCD	s in this list	•
Method:	Create a ne	ew selection		~
"FID" "ROADTYI "SURFACE "Road_Cla "RDSURFA	PE" ETYP" %" 4CE"			Î
= < > > < < _% (> Like = And = Or) Not	"PAVED" 'rough' 'seasonal' 'UNDETERMIN 'unknown' 'Unpaved'	ED'	^
ls ir	Null	Get Unique Val	Go To:	
"RDSURFA OR "RDSURFA	CE" = 'ASPH RFACE" = 'pa CE" = 'PAVE	ALT OR "RDSUP wed OR "RDSUP D1	FACE" = 'CONG	CRETE' ^
Clear	Verfy	Help	Load	Save
		OK	Apply	Close

67019 of 281231 features selected.

Add New Data (Paved_Roads_Crown_LCD.shp) & Clear selection

Select by Attribute where RDSURFACE = Aggregate, bladed, dirt, graded, gravel, loose, native material (all), natural, rough, seasonal or unpaved

Select By /	Attributes			×
Layer:	All_Ro	ads_Crown_LCD		-
	Only sho	w selectable layers	a in this list	
Method:	Create a ne	w selection		~
"FID"				A .
"ROADT	PE"			
"SURFAC	ETYP"			
"Road_Cl	ass"			
"RDSUR	ACE"			~
-	Like	'Paved'		^
		'PAVED'		
>	- And	'rough'		
< .	:= Or	'seasonal'		
		UNDETERMIN	ED.	
- %	() Not	unknown		~
ls	In Null	Get Unique Valu	Jes Go To:	
ELECT	ROM AI_Roa	ds_Crown_LCD W	HERE:	
OR "RDSU "RDSURF - NATIVE I OR "RDSU "NATURAL 'seasonal]	IRFACE" = 'D ACE" = 'GRAV MATERIAL' OF IRFACE" = 'N ' OR "RDSUF	RT'OR "RDSURF EL'OR = 1009e'O R "RDSURFACE" ATIVE MATERIAL FACE" = 'rough'O	ACE" = 'GRADI R "RDSURFAC = 'NATIIVE MAT 'OR "RDSURF/ R "RDSURFAC	ED'OR E" = 'NAT 'ERIAL' ACE" = E" =
Clear	Verify	Help	Load	Save
		OK	Apply	Class

131751 of 281231 features selected

Data/Export; Output Feature Class:

R:\Base_Data\CROWN_LCD_Phase2\Cost_Layers_P2\Roads\Unpaved_Roads_Crown_LCD.shp

Select by Attribute where RDSURFACE = Undetermined, unknown or <no value>

Select By	Attributes			×
Layer:	Only s	Roads_Crown_LC	D ers in this list	•
Method:	Create a	new selection		~
"FID" "ROADT "SURFA "Road_C "RDSUB	YPE" CETYP" Jass"			
NUSUR	TACE	-		¥
>	<> Like			
<	< = 0r			
_ %	() Not			
ls	In Null	Get Unique V	alues Go To:	
SELECT * "RDSURF 'unknown'	FROM AI_R ACE" = 'UN 'OR "RDSU	oads_Crown_LCD DETERMINED' OF RFACE'' = ' '	WHERE: R "RDSURFACE"	= ^
Clear	Vert	y Help	Load	Save

73279 of 281231 features selected

Data/Export; Output Feature Class: R:\Base_Data\CROWN_LCD_Phase2\Cost_Layers_P2\Roads\Unknown_Surface_Roads_Crown_LCD.shp

Add New Data (Unknown_Surface_Roads_Crown_LCD.shp) & Clear selection

Also selected where RDSURFACE = decommissioned or overgrown (9182 records) to cross check selection numbers but no further attributes or processes added to these records

Select By At	tributes			×
Layer:	All_Ro	ads_Crown_LCD w selectable layers	in this list	•
Method:	Create a ne	w selection		~
"FID" "ROADTYF "SURFACE "Road_Class "RDSURFA	2E" TYP" 38" 4CE"			*
= <:	> Like			
> >	= And			
< <	= Or			
_ % ()	Not			
ls In	Null	Get Unique Value	es Go To:	
SELECT * FF	OM AI_Roa	ds_Crown_LCD WH	IERE:	
"RDSURFAG	CE'' = 'decom	missioned' OR "RD	SURFACE" =	~ ~
Clear	Verify	Help	Load	Save
		OK	Apply	Close

Step 5 resulted in 3 shapefiles based on road surface type. To more accurately characterize the spatial footprint of the traffic and the disturbance it represents, the three road types were buffered at different widths.

Step 6: Buffer

Selection output file	Number of Buffer B		Buffer Output File
	Records	Width	
Paved_Roads_Crown_LCD.shp	67019	12.2 m	Paved_Roads_Crown_LCD_buffer12.2.shp
Unpaved_Roads_Crown_LCD.shp	131751	6.1 m	Unpaved_Roads_Crown_LCD_buffer6.1.shp
Unknown_Surface_Roads_Crown_LCD.shp	73279	8.2 m	Unknown_Surface_Roads_Crown_LCD_
			buffer8.2.shp
<pre>< decommissioned or overgrown></pre>	9182	-none-	
Total	281231		

Buffering:

Input Peakures		_ ^	Distance [value or	
Paved_Roads_Crown_LCD	*	6	field]	
Output Peakure Class		_		
R/Base Data/CROWN LCD Phase2/Cost Lavers P2/Roads/Paved Roads Cro	wn LCD buf12.2.shp	e 👘	The distance around the	
Datance (value or field) ① Linear unit			buffered. Distances can be provided as either a value	
12.2	Meters	~	representing a linear	
Field			the input features that	
		× 1	contains the distance to	
Side Type (optional)			buffer each feature.	h
PULL		~		
End Type (optional)			If linear units are not	
ROUND		~	specified or are entered as	
Method (optional)			Unknown, the linear unit of	
PLANAR		~	the input features' spatial	
Dasolve Type (optional)			reterence is used.	
AL		~		
Dissolve Pield(s) (optionel)				
E FID				
LI ROADTYPE				
USURFACETYP				
Road_Class				
DAVIDADA				
		- V		

Click error and warning icons for more information	×	Disaster Terra
Irou & Easturar	^	(optional)
liesand Roads Course LCD		
forgan contract of the		Specifies the type of
Dutters Debut Control	The heat of the second	dissolve to be performed t
In pase paraloxonin (co) materiologica (capes (crans provide) materiologica)	n Jone rae	remove butter overlap.
Distance (value or field)		
(e) Linear unt		 NONE—An
6.1 Meter	s 🗸	individual outer for
○ Field		maintained
		repardless of
Side Type (optional)		overlap. This is the
PuL	~	default.
End Type (optional)		 ALL—AI buffers a
ROUND		dissolved together
Method (optional)		into a single featur
PUNAR		removing any
Dissolve Type (optional)		overlap.
ALL .	~	sharing attribute
Dissolve Field(s) (optional)		values in the listed
C ro		fields (carried over
ROADTYPE		from the input
SURFACETYP		features) are
Road_Class		dissolved.
L RDSURFACE		
ROADOLASS		
C LON TOX	~	

Input Features		^	Dissolve Type
Unknown_Surface_Roads_Crown_LCD		· 🖻 👘	(optional)
Output Feature Class			
R: (\$ese_Data)(RDWN_LCD_Phase2(Cost_Layers_P2(Roads)Unknown_Su	face_Roads_Crown_LC	D) 🔁	Specifies the type of
Distance [value or field]			remove buffer overlap.
	1.2 Meters	~	 NONE—An
OReld			individual buffer for
			each feature is
Side Type (optional)			maintained,
FUL			regardless of
End Type (optional)			default.
ROUND			 ALL—All buffers are
Hethod (optional)			dissolved together
PLANAR		~	into a single feature,
Dissolve Type (optional)			removing any
ST.		~	overlap.
Dissolve Field(s) (optional)			 USI—Any butters
E FID			values in the listed
ROADTYPE			fields (carried over
U SURFACETYP			from the input
Road_Class			features) are
DOURPACE			dissolved.
E FFAT IPN			
		~	

Step 7: Scoring and completing traffic volume cost input

We don't currently have reliable data that estimates relative threat levels based on traffic volume but, again we can hypothesize that higher traffic volumes represent a more intense threat to mude. The following score estimates those relative threat levels:

Buffer Output File	Score
Paved_Roads_Crown_LCD_buffer12.2.shp	4000
Unpaved_Roads_Crown_LCD_buffer6.1.shp	1000
Unknown_Surface_Roads_Crown_LCD_ buffer8.2.shp	2500

For each of the above 3 files:

Open Attribute Table/Table Options/Add Field ("mude_score"; short intiger; precision = 0). Right click on the header of the new field (mude_score), select Field Calculator (say 'yes' to edit outside of editor function). In the Field calculator enter the appropriate score (see table, above) in the box under mude_score. Click OK.

Table Image: Second	Image: Second		
	Pred Calculator Parace ©\18 Script Pred Fild Shape Id mude_score Shave Codeblock mude_score = 4000	Type: Functions: © Number Abs () Osting Exc () Exc () Exc () String String	
	About calculating fields	Clear Load Save	

Merge: Paved_Roads_Crown_LCD_buffer12.2.shp, Unpaved_Roads_Crown_LCD_buffer6.1.shp, Unknown_Surface_Roads_Crown_LCD_ buffer8.2.shp to create Road_Use_Proxy_Crown_LCD.shp <R:\Base_Data\CROWN_LCD_Phase2\Cost_Layers_P2\Roads\Road_Use_Proxy_Crown_LCD.shp>

Convert Roads\Road_Use_Proxy_Crown_LCD.shp to raster using Feature to Raster tool:

Input features: Road_Use_Proxy_Crown_LCD.shp Field: mude score Output Raster: R:\Base Data\CROWN LCD Phase2\Cost Layers P2\Roads\traffic vol Output cell size: 5

Environments: Output coordinates - Same as "Crown LCD PlanningUnit Mask"

Input features				Output ce	II size	
Road_Use_Proxy2_Crown_LCD			- 2	(optional)		
Field						
mude_score			~	The cell size	for the output	
Output raster				raster being	created.	
R:\Base_Data\CROWN_LCD_Phase2\Co	ost_Layers_P2\Roads\traffic_v	ol	6	This parame	ter can be	
Output cell size (optional)				defined by a	numeric value	
8				existing rast the cell size explicitly sp parameter v environment is used if sp otherwise sc rules are use it from the of See the usa detail.	tion an er dataset. If hasn't been scified as the lue, then the cell size value collection and collection d to calculate her inputs. ge for more	

NOTE: the cell size for this analysis is small – 5 meters. That is so we can capture with detail the relative traffic volumes on the narrowest roads (6.1 m). In subsequent steps pay attention to the variation in cell size (aka resolution) to ensure we capture the data at this scale while characterizing and scoring planning units.

Step 2 - Mosaic to New Raster mosaic the new raster with the Snap Grid (This step ensures that every raster we generate will have the exact same pixel alignment.)

Input Rasters: D:\CMP\LCD\SpatialData\Roads\LCD_TrafficVolume\ traffic_vol and P2_Snapgrid Output: D:\CMP\LCD\SpatialData\Roads\Roads_volsnapK

Cell Size = 300 (changed this to 12 to get as close to the 5m mimicking the traffic volume raster Sean Made above) Pixel Type = 16 bit unsigned

Number of Bands = 1

Mosaic Operator = First

Mosaic To New Raster		- 1 *	`
	· · ·	Mosaic Operator	~
♦ traffic_vol	+	(optional)	
	-	(optional)	
	×	The method used to mosaic overlapping areas.	
	ł	 FIRST —The output cell value of the overlapping areas will be the value from the first detect to be the value of the value	
Output Location		TIFST FASTER DATASET	
D:\CMP\LCD\SpatialData\Roads	6	location.	
Raster Dataset Name with Extension		 LAST —The output 	
Roda_volsnapG		cell value of the	
Spatial Reference for Raster (optional)		overlapping areas will	
North_America_Albers_Equal_Area_Conic_CM-112	<u> </u>	be the value from the last raster dataset	
Pixel Type (optional)		mosaicked into that	
16_BIT_UNSIGNED	~	location. This is the	
Cellsize (optional)		default.	
	25	 BLEND —The output 	
Number of Bands		cell value of the	
	1	be a horizontally	
Mosaic Operator (optional)		weighted calculation	
FIRST	~	of the values of the	
Mosaic Colormap Mode (optional)		cells in the	
FIRST	 ~ *	overlapping area.	
	>	 MEAN — The output 	

Step 3: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case R:\Base_Data\CROWN_LCD_Phase2\Crown_Marxan_Database_P2\pulayer_crown_2km_hex_P2_BASEGRID.shp):

Input data: pulayer_crown_2km_hex_P2_BASEGRID.shp Zone Field: PUID Input value raster: D:\CMP\LCD\SpatialData\Roads\Roads_volsnapK Output table: ZonalSt_Lynx_volsnap_p2cost Statistics type: ALL

Szonal Statistics as Table				- 0	×
Input raster or feature zone data			~	Output table	~
P2_BASEGRID			- 🖻	· ·	
Zone field				Output table that will contain the summer of the voluce	1
PUID			~	each zone.	
Input value raster					
Road_VolSnapK			- 🖻	The format of the table is	
Output table				determined by the output	
D:\CMP\LCD\Metadata\CostLayers\Lynx\zonalst_lynx_volsnap	p_p2cost		e 🔁	extension is specified, it wi	
Ignore NoData in calculations (ontional)				be an INFO table. If the	
				location is in a geodatabas	е,
Statistics type (optional)				the output table will be	
				ArcSDE geodatabase). If the name has a .dbf extension, the output will be in dBASE format.	
<			>		
	OK Cancel	Environments	<< Hide Help	Tool Help	

Open ZonalSt_Lynx_volsnap_p2cost; Table Options/Export Table –export as a text file named Lynx_P2_S1_trafvolsnapcost.txt. Don't need to add table to map.

End Phase 2

Other Canada Lynx

Canada Lynx Connectivity Summer Corridors

Squires et al. 2013. Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery

https://www.sciencebase.gov/catalog/item/54b037e1e4b0a211ade11f28

CanadaLynx_SummerCorridors.zip

Canada Lynx Connectivity Winter Corridors

Squires et al. 2013. Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery

https://www.sciencebase.gov/catalog/item/54b05a0ee4b078c4c44376df

CanadaLynx_WinterCorridors.zip

This layer provides information on putative winter corridors facilitating dispersal from northern populations to patches capable of supporting Canada lynx in the Northern Rocky Mountains. These results combine resource selection, step selection, and least-cost path models to define movement corridors for lynx in the Northern Rocky Mountains.

D:\Base_Data\CROWN_LCD\Features\SourceFeatureData\GOUSTAT\GOUSTAT\Spatial_Data\Lynx\Climate_niche

MIR_TS_C_180585_lynx_distrb_Lynx_ Distribution_USFS.lyr - lynx diatribution southern crown -- GYE -- Winds and Bighorns

(C:\Users\SFinn\Documents\ArcGIS\Packages\\MIR_TS_C_180585_lynx_distrb_Lynx_ Distribution_USFS_308E28B0-781F-49F7-8A9D-E55DF946B6F6\commondata\raster_data\lynx_distrb.img)

MIR_TS_C_180585_lynx_hab_mask.lyr - 'blurred boundary of above

(C:\Users\SFinn\Documents\ArcGIS\Packages\MIR_TS_C_180585_lynx_hab_mask_69B1AE81-3BE7-4F65-84D8-B19E26F78AF0\commondata\raster_data\lyn_hab_msk.img)

Canada Lynx Climatic Niche Model

(C:\Users\SFinn\Documents\ArcGIS\Packages\Canadian Lynx Range Shift\Model Agreement_238C0AD4-D3E7-4604-8DD4-E74988537409\commondata\raster_data\lyca)

Phase 1:

Canada Lynx Data Sources, Data Selection and Process Steps

Montana – Scenario #1

Source data with comments

MTNHP_Predicted_Habitat_Suitability_CALY.shp – covers approximately 75% of MT portion of Crown LCD project area; 4 suitability classes (including 'unsuitable') created using Maximum Entropy software (see http://mtnhp.org/models/).

Lynx_CH.shp – USFWS Critical Habitat designations for Canada Lynx. The source layer identifies several units of the United States (will need to clip to Unit #3 Northern Rockies, Montana). Critical Habitat (including exclusions) span about 40-50% of the MY portion of the Crown LCD study area.

Step 1: MTNHP_CMP_Predicted_Habitat_Suitability_CALY: Clip MTNHP_CMP_Predicted_Habitat_Suitability_CALY to Crown_PA_MTonly2.shp to constrain data to Crown LCD Project Area (output =

MTNHP_CrownLCD_Predicted_Habitat_Suitability_CALY.shp); Use Union tool spatially union this layer with < Crown_PA_MTonly2.shp> (the Crown LCD project area clipped to Montana) to ensure entire MT portion of Crown is scored; assign a score of optimal suitability 10,000; moderate suitability 5,000; low suitability 2,000; unsuitable 0 (zero)

Output: The predicted suitability model from MT NHP extended to the full area of the Crown LCD Project Area scored to represent values for Marxan

Step 2: Lynx_CH.shp: Select all records where Unit = 3 to pull out critical habitat in the Crown LCD project area < FWS_Unit3_CriticalHabitat_CALY.shp>; Use Union tool spatially union FWS_Unit3_CriticalHabitat_CALY.shp with < Crown_PA_MTonly2.shp> (the Crown LCD project area clipped to Montana) to ensure entire MT portion of Crown is scored; assign a score of 1,500 to all designated critical habitat (including exclusions).

Output: Canada Lynx critical habitat in the Crown LCD project area identified with a "bonus" of 1,500 to differentiate critical habitat from non-designated.

Data processing described above results in 2 vector layers:

MTNHP_CMP_Predicted_Habitat_Suitability_CALY.shp FWS_CrownLCD_CriticalHabitat_CALY2.shp

Step 3: Use Spatial Join tool join the 2 vector files while retaining all feature attribute data:

Having 'issues' with Spatial join, I used Dissolve tool on MTNHP_CMP_Predicted_Habitat_Suitability_CALY.shp to create MTNHP_CMP_Predicted_Habitat_Suitability_dissolve_CALY.shp

Spatial Join: Target Feature: FWS_CrownLCD_CriticalHabitat_CALY.shp Join Feature: MTNHP_CMP_Predicted_Habitat_Suitability_dissolve_CALY.shp Output Feature Class: Suitability_plus_CriticalHabitat_CrownLCD_CALY.shp Join Operation: JOIN_ONE_TO_ONE Match Option: Intersect

Step 4: Sum up scores from MTNHP_CMP_Predicted_Habitat_Suitability_dissolve_CALY.shp and FWS_CrownLCD_CriticalHabitat_CALY.shp. These two layers which were just spatially joined each have an attribute field called 'score'. Inspect the joined layer layer <Suitability_plus_CriticalHabitat_CrownLCD_CALY.shp> and notice a field called 'score' (with values of 0 or 1500 – this field originated from FWS_CrownLCD_CriticalHabitat_CALY.shp) and another field called 'score_1' (with values of 0, 2000, 5000 or 10000 – this field originated from MTNHP_CMP_Predicted_Habitat_Suitability_dissolve_CALY.shp). We need to add these field and then cap the maximum value at 10,000. Open the Suitability_plus_CriticalHabitat_CrownLCD_CALY.shp attribute table; Table Options/Add Field, name it Sum_score, Type = short integer; Right click on the Sum_score field name/Field Calculator; create a formula: score + score_1 and calculate; select all records where Sum_score > 10000 and again Right click on the Sum_score field name/Field Calculator; enter 10000 in formula box and calculate.

Using ArcCatalog, copy Suitability_plus_CriticalHabitat_CrownLCD_CALY.shp and rename the copy MT_CALY_for_Marxan_Scenario1.shp

At this point inspect MT_CALY_for_Marxan_Scenario1.shp to make sure it's accurate. Use Properties/Symbology, Show: Categories/Unique Values; Value Field = Score (Add All Values). Click OK and inspect map to ensure scoring looks right. Check the attribute table, particularly the "score" field.

Step 4: Feature to Raster tool

To simplify the process of formatting the data for Marxan entry, the next step is to convert the vector feature data to a grid or raster.

Input Features: MT_CALY_for_Marxan_Scenario1.shp Field: Sum_score Output Raster: D:\Base_Data\CROWN_LCD\Features\CanadaLynx\MT_CALY_S1 (Note: the raster file name must be 13 characters or less) Output cell size: 350 (this matches the buffer used for point data; it approximates ¼ of the hexagon size)

Step 6: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case pulayer_MT_2km_hex.shp):

Input data: the pulayer_MT_2km_hex Zone Field: PUID Input value raster: MT_CALY_S1 Output table: ZonalSt_CALY_S1 Statistics type: ALL

Open ZonalSt_GRBE_S1 Table; Table Options/Export Table –export as a text file named CALY_S1_SPEC.txt. Don't need to add table to map.

Step 7: Prepare Table for Marxan

Open D:\Base_Data\CROWN_LCD\CanadaLynx\CALY_S1_SPEC.txt in Excel. Delete all fields except PUID and Mean. Change "Mean" field name to "FEAT_3"; Save As: CALY_feats.csv as a comma delimited file. Close file (keeping it in current format).

DONE with Canada lynx Data! Move to next species ©

NOTE: These instructions are for a single feature (feat) ... will need to do a little more prep work for multiple features. See Section 3.3.5 (page 14) in Marxan handbook.

Back in ArcMap, right click on pulayer_MTcrown_15km_hex; select Joins and Relates/Remove Joins to make sure there is nothing Joined. Then Joins and Relates/Join... Join Attributes from a Table; base join on PUID field; choose the table to join conservationfeats.csv using PUID field (image below is not exact)

Join Data	×
Join lets you append additional data to this layer's attribute table so for example, symbolize the layer's features using this data.	you can,
What do you want to join to this layer?	
Join attributes from a table	~
 Choose the field in this layer that the join will be based on: PUID 	~
2. Choose the table to join to this layer, or load the table from di	isk:
pulayer_MTcrown_15km_conservationfeats Show the attribute tables of layers in this list	• 🖻
3. Choose the field in the table to base the join on:	
r CAI_1	Ť
Join Options	
 Neep air records All records in the target table are shown in the resulting ta Unmatched records will contain null values for all fields bein appended into the target table from the join table. 	ble. Ig
○ Keep only matching records	
If a record in the target table doesn't have a match in the table, that record is removed from the resulting target tab	join Ie.
Validate Join	1
About joining data OK	Cancel

Open the attribute table of pulayer_MTcrown_15km_conservationfeats.shp and inspect. Review the fileds, number of records; use symbology to visualize the data and make sure it look accurate.

Using Table Options, Add a Field called 'species' Type Short integer. Use Field Calculator to assign species the value "1".

Export the table as a text file naming it puvsp.txt. Don't add table to current map

Open puvssp.txt in Excel. Set up fields as follows 'species' | 'pu' | 'amount' where amount is the data from FEAT_1. Delete all other fields. Save as puvsp.dat.

In windows explorer, remove the ".txt" from puvsp.dat (ignore the warning). Move puvssp.dat to the input folder.

Alberta – Scenario #3

Source data with comments

C:\Users\SFinn\Documents\ArcGIS\Packages\Canadian Lynx Range Shift is part of the data describing CALY climate response in the Gostout report "Implications of a shifting climate for lynx and wolverine in the Crown of the Continent" (Christian Gostout, 2019, Wilderness Society). This data doesn't not cover the full extent of AB on the LCD Project Area. Unless augmented with additional data it is not useful for AB.

D:\Base_Data\CROWN_LCD\Features\Wolverine\AB_Snow_layer\mosaic.tif – a snow retention layer provided by Danielle Pendelbury. Has been used by Alberta Parks as a proxy for lynx and wolverine distribution in AB.

Clevenger_CCoC_photo_data_14-16_complete2.xlsx

Step 1: Use Reclassify on < C:\Users\SFinn\Documents\ArcGIS\Packages\Canadian Lynx Range Shift> to create a raster output < D:\Base_Data\CROWN_LCD\Features\CanadaLynx\Gost_CALY_rcl> scored 4000 [contraction (2 models), contraction (1 model) and stable] or 0 (zero). Reproject Gost_CALY_rcl to project projection, creating Gost_CALY_alb. Repair: used Reclassify to reclass the 4000 values to 8000; (Gost_CALY5_ab) **Step 2:** Created a point shapefile from XY data in Clevenger_CCoC_photo_data_14-16_complete2.xlsx/ wolverine detections by session called Clevenger_camera_stations_AB_BC.shp. Added Field in attribute table called CALY_obs (Short Integer) and populated with data from all species detection. If lynx detected at camera in 1 month only (regardless of the number of detections in that month) CALY_obs ranked '1'; if detected in 2 different months and detections > 10 days apart, CALY_obs ranked '2'; if detected in 3 different months, CALY_obs ranked '3'. Select by Attribute where CALY_obs >=1; Reproject the shapefile (using Project tool) to <

D:\Base_Data\CROWN_LCD\Features\CanadaLynx\Clevenger_Lynx_camera_detections2.shp> resulting in a point shapfile with only camera stations having lynx detections. Buffer Clevenger_Lynx_camera_detections2.shp by 800 m radius to indicate CALY use a larger area than the single-point camera station: output

Clevenger_Lynx_camera_detections_800m_buf.shp; Add field: score (short integer); using Select by Attribute and Field Calculator, score CALY_obs values of 1 = 3,000, CALY_obs values of 2 = 5,500, and CALY_obs values of 3 = 8,000. Repair: using Select by Attribute and Field Calculator, score CALY_obs values of 1 = 6,000, CALY_obs values of 2 = 8,000, and CALY_obs values of 3 = 10,000. (Clev_CALY5_al)

Step 3: Reprojected D:\Base_Data\CROWN_LCD\Features\Wolverine\AB_Snow_layer\mosaic.tif to project projection: D:\Base_Data\CROWN_LCD\Features\Wolverine\AB_Snow_layer\AB_snow_alb; used Reclass by Ascii to reclass the 17 values as follows: 0-5 = 5000; 6-10 = 3000; 11-14 = 1000; 15-17 = 0 and create D:\Base_Data\CROWN_LCD\Features\Wolverine\AB_Snow_layer\AB_snow_rcl Repair: used Reclass by Ascii to reclass the 17 values as follows: 0-5 = 8000; 6-10 = 5000; 11-16 = 3000; 17 = 0 (ab_snow_rc2).

Data processing described above results in 1 vector layers and 2 raster layer:

Clevenger_Lynx_camera_detections_800m_buf.shp gost_caly_alb AB snow rcl

Step 4: Feature to Raster tool

Convert Clevenger_Lynx_camera_detections_800m_buf.shp to a raster layer in prep for Marxan input.

Be sure to clear all selections.

Input Features: Clevenger_Lynx_camera_detections_800m_buf.shp

Field: score

Output Raster: D:\Base_Data\CROWN_LCD\Features\CanadaLynx\clev_caly_alb (Note: the raster file name must be 13 characters or less)

Output cell size: 800 (this matches the gost_caly_alb raster)

Also: Click on 'Environments...' at bottom of Feature to Raster dialog box. Select Processing extent.

Set Extent to 'Same as layer Clevenger_Lynx_camera_detections_350m_buf.shp' and Snap Raster to gost_caly_alb

Step 5: Mosaic to a New Raster tool

Merges gost_caly_alb, clev_caly_alb and AB_snow_rcl, and sums values of both rasters. Create output: AB_CALY_S3 which it then ready for zonal statistics.

Input Rasters	. 🛋 (Mosaic To New
J		
♦ gost_caly_alb	+	Merges multiple raster
dev_caly_alb	-	datasets into a new raster
ab_snow_rd	×	dataset.
	T	
Output Location		
D:\Base_Data\CROWN_LCD\Features\CanadaLynx	2	
Raster Dataset Name with Extension		
AB_CALY_S3		
Spatial Reference for Raster (optional)	_	
North_America_Albers_Equal_Area_Conic_CM-112	*	
Pixel Type (optional)		
8_BIT_UNSIGNED	~	
Cellsize (optional)		
	800	
Number of Bands		
	1	
Mosaic Operator (optional)		
SUM	~	
Mosaic Colormap Mode (optional)		
FIRST	~ `	~

Step 6: Reclassify to max value = 10,000; new grid named: Repair: AB_CALY_S3a Mosaic to New Raster output AB_CALY_S5 and Reclassify output AB_CALY_S5a

Step 6: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case pulayer_AB_2km_hex.shp):

Input data: the pulayer_AB_2km_hex_Scenario3_BASEGRID Zone Field: PUID Input value raster: AB_CL_S3a Output table: ZonalSt_CALY_S3 Statistics type: ALL

Open ZonalSt_ CALY_S3 Table; Table Options/Export Table –export as a text file named CALY_S3_SPEC.txt. Don't need to add table to map.

Step 7: Prepare Table for Marxan

Open D:\Base_Data\CROWN_LCD\CanadaLynx\ CALY_S4_SPEC.txt in Excel. Delete all fields except PUID and Mean. Change "Mean" field name to "FEAT_3"; Save As: CALY_feats_s4.csv as a comma delimited file. Close file (keeping it in current format).

British Columbia – Scenario #4

Source data with comments

C:\Users\SFinn\Documents\ArcGIS\Packages\Canadian Lynx Range Shift is part of the data describing CALY climate response in the Gostout report "Implications of a shifting climate for lynx and wolverine in the Crown of the Continent" (Christian Gostout, 2019, Wilderness Society). This source data (grid) describes 6 classes (no presence, expansion (1 model), expansion (2 models), contraction (2 models), contraction (1 model), and stable) for BC portion of Crown and some of MT and AB. Since the coverage of this grid spans all of the BC jurisdiction; we will use it as a coarse range map and score all of contraction (2 models), contraction (1 model) and stable as 2000.

Clevenger_CCoC_photo_data_14-16_complete2.xlsx: Camera site info for T. Clevenger. Source excel file has 2 worksheets: <wolverine detections by session> has site names and X Y location data for all cameras; <all species detection> lists detections by species and behaviors.

Step 1: Use Reclassify on < C:\Users\SFinn\Documents\ArcGIS\Packages\Canadian Lynx Range Shift> to create a raster output < D:\Base_Data\CROWN_LCD\Features\CanadaLynx\Gost_CALY_rcl> scored 4000 [contraction (2 models), contraction (1 model) and stable] or 0 (zero). Reproject Gost_CALY_rcl to project projection, creating Gost_CALY_alb.

Step 2: Created a point shapefile from XY data in Clevenger_CCoC_photo_data_14-16_complete2.xlsx/ wolverine detections by session called Clevenger_camera_stations_AB_BC.shp. Added Field in attribute table called CALY_obs (Short Integer) and populated with data from all species detection. If lynx detected at camera in 1 month only (regardless of the number of detections in that month) CALY_obs ranked '1'; if detected in 2 different months and detections > 10 days apart, CALY_obs ranked '2'; if detected in 3 different months, CALY_obs ranked '3'. Select by Attribute where CALY_obs >=1; Reproject the shapefile (using Project tool) to <

D:\Base_Data\CROWN_LCD\Features\CanadaLynx\Clevenger_Lynx_camera_detections2.shp> resulting in a point shapfile with only camera stations having lynx detections. Buffer Clevenger_Lynx_camera_detections2.shp by 800 m radius to indicate CALY use a larger area than the single-point camera station: output

Clevenger_Lynx_camera_detections_800m_buf.shp; Add field: score (short integer); using Select by Attribute and Field Calculator, score CALY_obs values of 1 = 3,000, CALY_obs values of 2 = 5,500, and CALY_obs values of 3 = 8,000.

Data processing described above results in 1 vector layers and 1 raster layer:

Clevenger_Lynx_camera_detections_800m_buf.shp

gost_caly_alb

Step 3: Feature to Raster tool

Convert Clevenger_Lynx_camera_detections_800m_buf.shp to a raster layer in prep for Marxan input.

Be sure to clear all selections.

Input Features: Clevenger_Lynx_camera_detections_800m_buf.shp

Field: score

Output Raster: D:\Base_Data\CROWN_LCD\Features\CanadaLynx\clev_caly_alb (Note: the raster file name must be 13 characters or less)

Output cell size: 800 (this matches the gost_caly_alb raster)

Also: Click on 'Environments...' at bottom of Feature to Raster dialog box. Select Processing extent.

Set Extent to 'Same as layer Clevenger_Lynx_camera_detections_350m_buf.shp' and Snap Raster to gost_caly_alb

Step 4: Mosaic to a New Raster tool

Merges gost_caly_alb and clev_caly_alb and sums values of both rasters. Create output: BC_LC_S3 which it then ready for zonal statistics.

Input Rasters	Number of Bands
	The number of bands that the output raster will have.
Output Location	
D:\Base_Data\CROWN_LCD\Features\CanadaLynx	
Raster Dataset Name with Extension BC_CL_S3	
Spatial Reference for Raster (optional)	
North_America_Albers_Equal_Area_Conic_CM-112	
Pixel Type (optional) 8 BIT UNSIGNED	
Cellsize (optional)	
800	
Number of Bands	
Mosaic Operator (optional)	
SUM V	
Mosaic Colormap Mode (optional)	
FIRST V	

Step 5: Reclassify to max value = 10,000; new grid named: BC_CL_S3a

Step 6: Zonal Statistics as a Table & Export Table

Use Zonal Statistics as a Table to generate output data specifically linked to the "pulayer" file (in this case pulayer_BC_2km_hex.shp):

Input data: the pulayer_BC_2km_hex Zone Field: PUID Input value raster: BC_CL_S3a Output table: ZonalSt_CALY_S4 Statistics type: ALL

Open ZonalSt_ CALY_S4 Table; Table Options/Export Table –export as a text file named CALY_S4_SPEC.txt. Don't need to add table to map.

Step 7: Prepare Table for Marxan

Open D:\Base_Data\CROWN_LCD\CanadaLynx\ CALY_S4_SPEC.txt in Excel. Delete all fields except PUID and Mean. Change "Mean" field name to "FEAT_3"; Save As: CALY_feats_s4.csv as a comma delimited file. Close file (keeping it in current format).