USING SPATIAL INFORMATION TO SUPPORT DECISIONS ON SAFEGUARDS AND MULTIPLE BENEFITS FOR REDD+



STEP-BY-STEP TUTORIAL V1.1: EXTRACTING AND PROCESSING IUCN RED LIST SPECIES DATA USING A RASTER METHOD IN QGIS 2.8.2



The UN-REDD Programme is the United Nations Collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries. The Programme was launched in September 2008 to assist developing countries prepare and implement national REDD+ strategies, and builds on the convening power and expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP).

The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is the specialist biodiversity assessment centre of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organisation. The Centre has been in operation for over 30 years, combining scientific research with practical policy advice.

Prepared by Corinna Ravilious

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These training materials have been produced from materials generated for working sessions held in various countries to aid the production of multiple benefits maps to inform REDD+ planning and safeguards policies using open source GIS software.





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1. Introduction

REDD+ has the potential to deliver multiple benefits beyond carbon. For example, it can promote biodiversity conservation and secure ecosystem services from forests such as water regulation, erosion control and non-timber forest products. Some of the potential benefits from REDD+, such as biodiversity conservation, can be enhanced through identifying areas where REDD+ actions might have the greatest impact using spatial analysis.

Open Source GIS software can be used to undertake spatial analysis of datasets of relevance to multiple benefits and environmental safeguards for REDD+. Open-source software is released under a license that allows software to be freely used, modified, and shared (<u>http://opensource.org/licenses</u>). Open Source GIS software can be used to undertake spatial analysis of datasets of relevance to multiple benefits and environmental safeguards for REDD+. Therefore, using open source software has great potential in building sustainable capacity and critical mass of experts with limited financial resources.

This tutorial demonstrates how a species richness grid could be created using species range data from the IUCN Red List (IUCN, 2013). It provides full instructions of how to select and analyze and export information from the non-spatial species data on the IUCN Red List website and how to further analyze the information along- side the IUCN spatial data using QGIS, an open-source desktop GIS software.

2. Using IUCN Red List species data and generating species richness maps

2.1. Selecting and downloading species data from the IUCN Red List website

The IUCN Red List of Threatened Species website allows users to search for and extract tabular information (in comma separated values (CSV) file format) on the status of threatened species. The website provides a user friendly interface and gives the user flexibility to customize searches based on a range of criteria. Users must register with the website to save and export customized searches.

2.2. Searching for non-spatial data

Open a web browser and go to the IUCN Red List website at http://www.iucnredlist.org/.

Click on continue to the IUCN Red List



This search below is an EXAMPLE search for Mammals with threat status of Critically Endangered (CR) and Endangered (EN).



This search will result in a list of species within the AMPHIBIA, AVES and MAMMALIA taxonomic groups that have critically endangered, Endangered, Vulnerable, Lower Risk: Conservation Dependent, Near

Threatened, Data Deficient or Least Concern Red List status. The search will produce in a list of species containing additional attribute data, including the threat status of each of the species.

There are other criteria that you may want to include. For example, to limit the search to species dependent upon a particular habitat type you would click on Habitat, then expand and tick the relevant habitat type and send that across to the search criteria panel.

The IUCN Red List of Threatened Species 2014.2 Login | FAQ | Contact | Terms of use | IUCN.org Click a. t ::Initiatives ::News ::Photos ::Partners) REP Save/Export Search Enter Red List search term(s) OTHER SEARCH OPTIONS Discover more Home > Search > Search Results If already registered, b. Displaying species assessments 1 - 50 of 1241 in total Current search: 7 2 3 4 5 6 7 8 9 ... 24 25 Nexte/Ex fill in your email address alus spinosus Acanthia Status: 1 59% w taxa: Species 1 ver 3.1 and password and click 🗄 🔹 🏉 Login × Google The IUCN Red List of Threaten ad Sr 2011.1 login Thre ::Sp LR/cd, NT or Enter Red List search term(s) GO OTHER SEARCH OPTIONS If you have not yet C. Home » Login registered, you need Login to create an Login account You must log in to access advanced IUCN Red List function nality. Please enter your e-mail address and p (see box below) E-mail addres Password: Login An account is reate Account or Request New Password needed in order to If you do not have an IUCN Red List user account, or if y please enter your e-mail address below. A password wil ave forgotten your password, ent to the address you provide E-mail address: save and export stedsuc the search results. energy d. New users will be asked to fill out the details in the box below The first time new users export a search, they are required to fill out some information User Information about themselves and the intended use of We agree to respect your privacy. Please see our privacy policy the data First name Last name Mailing address: (optional) Phone number (optional) Click on Supply your Country of (Please select a country:) **information** and fill in the requested details (no permanent residence) Afghanistan Albania Algeria Ξ (Hint: On many browsers, press the first letter of your country name to jump in the list.) Click on Submit Affiliation (Please select a sector:) -Please indicate how you intend to use the exported IUCN Red List data:

2.3. Save the search and exporting to CSV format



j. Refresh the browser to see the status change to show the export is complete or if it is taking a long time log out and once the email has been received, log back in to the Red List website and click on the My Downloads Tab to get back to your saved searches.

0::	The IUCN Red List of Threatened Species [™] 2	014.2 My Downloads Ef Q Contact Terms of use IUCN org
C REP	about alnitiatives aNews aPhotos aPartners as	ponsors ::Resources
Guiding Conservation for 50 Years	Enter Red List search term(s) (OTHER SEARCH OPTION	Discover more

aved Searches	-				
wed searches are permanently stored in your user account. Once a search is saved, you ay also export the results for offline use, or provide a link for others to access your saved arch	1	k.	Click on the exported search e.g. NGA_AmpAveMam in this		
NGA_AmpAveMam Exported co-bo October 2014 Add your current search			example		
Load Search Loading this search will replace your current search. Please save your search if you may wish	<u> </u>	Scroll	down to the Export results		
to return to it later. Load this search Permalink To allow others to view your search results, you may copy and distribute the following link: http://www.jucnedlist.org/apos/redist/search/link/4eb90157-b44da2f0	m.	Click o and th	on Comma-Separated Values (CSV) he zip file will download		
Export Results Your search results have been exported. Please use the links below to download the export in your preferred format(s). Comma-Separated Values (CSV) Externation of the properties of the second seco	n.	If the or gener file to project	download has placed the file in a ral download folder move the zip a more suitable location e.g. in a rt folder		
Please note that the Red List data may change over time. The exported data is current as of 08 November 2011. To obtain the latest data, use the button below; your exported data will be replaced with the most current data. Refresh Exported Data Delete Search	0.	Renan e.g. No exam	ne the zip file to something sensible GA_AmpAveMam.zip in this ple		
This search is saved to your saved searches as "mam_cr_en". Delete search	p.	Right file	click on zip folder , extract the csv		

q. Rename the csv file e.g. NGA_AmpAveMam.csv in this example

2.4. Download the IUCN Red List spatial data layers

The next steps are for downloading spatial data. It is only possible to download the whole global dataset. It is not possible to filter by county prior to download. It is important to note that some of the spatial datasets are very large. If you have received the spatial data directly from IUCN you can skip this section.

- a. Open a web browser and go to the IUCN Red List website at http://www.iucnredlist.org/
- b. From the Resources tab, click on Spatial Data Download

The	UCN Red List of Threatened Species ^{**} 2014.2	My Downloads FAQ Co						
RED ::Ab	out #Initiatives #News #Photos #Partners #Sponsors	Resources						
Guiding Conservation for 50 Years	inter Red List search term(s) (OTHER SEARCH OPTIONS)	Key Documents Categories and Criteria Classification Schemes						
Home » Resource	25 » Spatial Data Download	Data C. tanization						
	Spatial Data Download	Intorum and Quality						
Resources		Assessment Process						
10001005	Red List Spatial Data	Red List Training						
Key Documents		References						
Categories and Criteria	The IUCN Red List of Threatened Species contains assessments for just ov	e Acknowledgements						
Classification Schemes	of which about two-thirds have spatial data. This spatial data provided below SIS News and Updates							
Data Organization	as those listed as Data Deficient are not mapped and subspecies are mapp	ed within the						
Spatial Data Download	parental species. The data is available as ESRI shapefiles format and conta range of each species. Ranges are depicted as polygons. DBF files accomm	ains the known panying contain						
Information Sources and Quality	taxonomic information, distribution status, sources and other details about t (see metadata document).	he maps						

c. Scroll down on the Spatial Data page to the Datasets table

	Spatial Data Dow	nload								
Resources	Red List Spatial	Data								
Key Documents										
Categories and Criteria	The IUCN Red List of Th	reatened Species contains assess	nents for just over 73,000 species,							
Classification Schemes	comprehensively assess	ed taxonomic groups. It is importan	t to note that some species such							
Data Organization	as those listed as Data D	eficient are not mapped and subsp	ecies are mapped within the							
Spatial Data Download	range of each species. The da	ta is available as ESRI shapefiles f langes are depicted as polygons. D	ormat and contains the known BF files accompanying contain							
Information Sources and Quality	(see metadata document).									
Assessment Process	Please note that the files	are large and download times cou	d be quite lengthy. The Taxonomy							
Red List Training	Table are full taxonomy	and Red List status tables providing	higher taxonomy and species							
References	the spatialdata due to Da	ata Deficient species not consistent	y mapped and subspecies							
Acknowledgements	beginning included within	n parental species polygons.								
SIS News and Updates	For ease of distribution a	nd downloading, the data is divided	I by taxonomic groups.							
	Use). For more informati <u>Process</u> . Please note the data in analyses or gene For all enquiries about s More information about s Note: A species richness	n on about the assessment process, at unfortunately we cannot provide t ral GIS support. Datial data, please contact the <u>IUCh</u> Spatial data resources here. page will be available shortly.	(see <u>Facilis as essentin</u> echnical support for use of the I <u>Red List GIS Unit</u> .							
	Main Dataset	Specific Group(s)	Descriptions and species lists							
		Marine Mammals	Includes mammal families for seals, sea lions and walrus, whales, dolphins and porpoises, manatees and dugongs.							
	Mammals ±	Terrestrial Mammals	Excludes mammal families for seals, sea lions and walrus, whales, dolphins and porpoises, manatees and dugongs.							
		Taxonomy Table	Species list from website							
		Tailless Amphibians	Species from the order Anura as a shapefile.							
		Tailed Amphibians	Species from the order Caudata as a shapefile.							
	Amphibians ±	Caecilian Amphibians	Species from the order Gymnophiona shapefile.							
		Taxonomy Table	Species list from website							
	Birds		BirdLife International is the IUCN Red Listing Authority for birds and maintains the most up to date information on global bird distributions. To request a copy of the shapefiles of species range maps for threatened birds, please visit the BirdLife Data Zone <u>here</u> .							

- d. Click the links to navigate to each dataset and download the following global datasets:
 - Mammals
 - > Amphibians
 - Birds (via the link to the BirdLife Data Zone). Please note that BirdLife international requires to request permission to download this data.

(Leave Reptiles for now as assessment is not yet complete for all species)

These files are all stored in geographic coordinate system (EPSG: 4326). Be aware the files are very large and will take some time to download.

Note: If you have received the spatial data directly from IUCN they may have delivered as a single geodatabase containing all taxa in a single feature class rather than as separate files.

2.5. Format species CSV file in preparation for joining to the spatial data

a. Open the 'exported search' results csv file (that was downloaded in section 2.3 step m) e.g.
 NGA_AmpAveMam.CSV in this example. Open the file Excel (or if using completely open source software in Gnumeric or Libre Office Calc) (The Screengrab examples below use Excel).

NGA_AmpAveMam.csv	08/10/2014 12:46 Micros	oft Office E	225 KB
NGA_AmpAveMam.csv.zip	Open Print Edit	ed (zipp	55 KB
	Convert to Adobe PDF Convert to Adobe PDF and EMail		
	Scan for viruses Move to Quarantine		
1	Open with	Microsoft	Office Exce

0) 🖬 🤊 -	(~ ~) ⇒							100	_	NGA	_AmpAve	/lam.cs	w - Microso	oft Excel		-		-	-	-			- 0	x
19	Home	Insert	Page La	iyout l	Formulas	Data	Revie	ew Vie	ew Add-	Ins Ac	robat													0 - 0	×
Pas	Cut		Calibri	- 1: 11 - 1 (555	1 * A		• = =	≫ ~	📑 Wrap	lext	General		-	Condition	al Format	Normal	B	ad		Insert Dele	te Format	Σ AutoSur Fill *	n * Azz	Find &	
-	Forma	at Painter		• (c.					- merge	or center	-3	0 2 1.00	· ->.0	Formatting	→ as Table →	0000				· ·	-	2 Clear *	Filter *	Select *	
	Clipboard	19		Font		19		Align	ment		• Ni	Imber	19			Style	S			Cel	5		Editing		
	A1	•	0	∫ _≭ Sp	ecies_ID																				×
	Α	В	С	D	E	F	G	н	1	J	K	L		М	N	0	Р	Q	R	S	Т	U	V	W	
1	Species_ID	Kingdon	n Phylun	n Class	Order	Family	Genus	Species	Authority	Inf_rank	Inf_name	Inf_aut	h Stk	_subpop	Synonyms	Com_eng	com_fre	com_spa	rl_status	rl_criteria	rl_version	year_ass	poptrend	Petitione	d 🖃
2	56055	ANIMAL	IA CHORE	A AMPHI	ANURA	HYPERO	Acanthi	spinosus	(Buchholz	& Peters,	1875)								LC		3.1	2013	unknown	N	- 1
3	22695490	ANIMAL	IA CHORE	A AVES	ACCIPIT	ACCIPITI	Accipite	badius	(Gmelin, 1	788)						Shikra	Epervier	shikra	LC		3.1	2013	stable	N	- 11
4	22695486	ANIMAL	ACHORE	A AVES	ACCIPIT	ACCIPITI	Accipite	castanili	Bonaparte	, 1853						Chestnut-	Autour à	flancs rou:	LC		3.1	2012	decreasi	N	- 11
5	22695576	ANIMAL	IA CHORE	A AVES	ACCIPIT	ACCIPITI	Accipite	erythrop	(Hartlaub,	1855)						Red-legge	Epervier	de Hartlau	LC		3.1	2012	decreasin	N	- 11
6	22695673	ANIMAL	IA CHORE	AVES	ACCIPIT	ACCIPITI	Accipite	melanol	Smith, 183	0						Black Spar	Autour n	bir	LC		3.1	2012	decreasi	n N	- 11
7	22695619	ANIMAL	IA CHORE	A AVES	ACCIPIT	ACCIPITI	Accipite	ovampe	Gurney, 18	75						Ovambo S	Epervier	de l'Ovam	LC		3.1	2012	increasin	e N	- 11
8	22727705	ANIMAL	IA CHORE	A AVES	ACCIPIT	ACCIPITI	Accipite	toussen	(Verreaux	& Verrea	ux, 1855)					Red-chest	ed Gosha	wk .	LC		3.1	2014	decreasi	n N	- 1
9	219	ANIMAL	IA CHORE		CARNIV	FELIDAE	Acinon	jubatus	(Schreber,	1775)						Cheetah, I	Guépard	Chita, Gu	VU	A2acd; C1	3.1	2008	decreasi	n N	- 11
10	44938	ANIMAL	IA CHORE		RODEN'	MURIDA.	Acomys	johannis	Thomas, 1	912						Johan's Sp	iny Mous	e, Johan's !	LC		3.1	2008	stable	N	- 11
11	22714745	ANIMAL	IA CHORE	A AVES	PASSER	SYLVIIDA.	Acrocer	arundina	(Temmind	< & Schleg	gel, 1847)					Great Ree	Roussero	lle turdoid	LC		3.1	2012	decreasi	n N	- 11
12	22714859	ANIMAL	IA CHORE	A AVES	PASSER	SYLVIDA	Acrocer	graciliro	(Hartlaub,	1864)						Lesser Swa	Roussero	lle des ma	LC		3.1	2012	stable	N	- 11
13	22714846	ANIMAL	IA CHORE	A AVES	PASSER	SYLVIIDA	Acrocer	rufescer	(Sharpe &	Bouvier,	1876)					Greater Sv	Roussero	lle des car	LC		3.1	2012	stable	N	- 11
14	22714700	ANIMAL	IA CHORE	A AVES	PASSER	SYLVIID/	Acrocet	schoeno	(Linnaeus,	1758)						Sedge Wa	Phragmit	e des jonc	LC		3.1	2014	stable	N	_
15	22714722	ANIMAL	IA CHORE	A AVES	PASSER	SYLVIIDA	Acrocer	scirpace	(Hermann,	1804)						Eurasian R	Roussero	lle effarva	LC		3.1	2014	stable	N	- 11
16	22693264	ANIMAL	IA CHORE	A AVES	CHARAI	SCOLOP.	Actitis	hypoleu	Linnaeus,	1758					Tringa hyp	Common	Chevalie	rguignette	LC		3.1	2012	decreasi	n N	- 11
17	22693528	ANIMAL	IA CHORE	A AVES	CHARAI	JACANIE	Actophi	africanu	(Gmelin, 1	789)						African Jac	Jacana à j	poitrine do	LC		3.1	2012	stable	N	_
18	575	ANIMAL	IA CHORE		RODEN'	MURIDA	Aethor	stannari	(Thomas, 1	.913)						Tinfields F	Rock Rat		DD		3.1	2008	unknown	N	_
19	56060	ANIMAL	IA CHORE	A AMPHI	ANURA	HYPERO	Afrixalı	dorsalis	(Peters, 18	75)					Hyperolius	Brown Bar	nana Frog,	Cameroor	LC		3.1	2013	increasin	g N	_
20	56071	ANIMAL	IA CHORE	A AMPHI	ANURA	HYPERO	Afrixalu	nigerien	Schiøtz, 19	63					Afrixalus c	Nigeria Ba	nana Frog		NT		3.1	L 2009	stable	N	
21	56074	ANIMAL	IA CHORE	A AMPHI	ANURA	HYPERO	Afrixalı	paradors	Perret, 196	0									LC		3.1	2013	unknown	Ν	

b. Scroll along the **column headings** of the table. Some will need to be changed as GIS software such as QGIS will not accept them. **Change the ones listed below in red**

OLD Field Name		New Field Name
Species ID	=	Species_ID
Kingdom	=	` Kingdom
Phylum	=	Phylum
Class	=	Class
Order	=	Order
Family	=	Family
Genus	=	Genus
Species	=	Species
Binomial	=	Binomial
Authority	=	Authority
Infraspecific rank	=	Inf_rank
Infraspecific name	=	Inf_name
Infraspecific authority	=	inf_auth
Stock/subpopulation	=	stk_subpop
Synonyms	=	Synonyms
Common names (Eng)	=	com_eng
Common names (Fre)	=	com_fre
Common names (Spa)	=	com_spa
Red List status	=	rl_status
Red List criteria	=	rl_criteria
Red List criteria version	=	rl_version
Year assessed	=	year_ass
Population trend	=	poptrend
Petitioned	=	Petitioned

c. Click File>>Save to save the file (keeping the file format as csv). If it asks if you want to keep the file in this format click yes

Keep the CSV file open as it will be used in section 2.6 where we will use the 'species_id' column to prepare an SQL query to be used in QGIS.

d. Open a text editor and create a new file empty csv file and add the following text to correspond to the data types of each of the columns in the .csv file. e.g. the Species_ID column should contain integer values

"integer", "string", "stri



These are the data types for each of the fields in the species csv file.

e. Save the file with the same name and in the same folder as the species csv file but with the a .csvt ending e.g. NGA_AmpAveMam.csvt in this example

This will ensure that when the file is opened later in QGIS that the numeric (Integer) fields are read with the correct data type, otherwise QGIS will default to making all the fields text (string).

2.6. Prepare SQL query for selecting species of interest

The next steps will prepare an SQL query which will be used in QGIS to select out the polygons from the large spatial dataset which are in the species list. This method is being used rather than using a 'join' to join the species list to the spatial data because the join function often fails or causes errors on this very large spatial dataset.

Go back to the 'species list csv file. e.g. NGA_AmpAveMam.CSV
 Then copy and paste the Species_ID column into column B to a new excel worksheet

	А	В	С	D	E	F	G	Н	I.	J
1		Species_ID								
2		56055								
3		22695490								

- b. In row 2 of column A type "id_no" = (make sure you put a space after the equals sign as this is important for the SQL syntax we are creating
- c. In row2 of column C type a OR (this time make sure you put a space before the OR as this is important for the SQL syntax we are creating)
- d. In row 2 of column D type =A2&B2&C2
- e. Next fill Columns A, B, C and D by double clicking on the bottom right hand corner of each cell in row 2
- f. Delete the entire first row so that the file now looks similar to the illustration below

	D2	- (f _x	=A2&B2&C2	
	Α	В	С		D	E
1		Species_ID				
2	"id_no" =	56055	OR	"ic	_no" = 56055 OR	
3		22695490				
4		22695486				
5		22695576				
6		22695673				
7		22695619				

	D1	- (<u> </u>	<i>f</i> _≪ =A1&B1&C1	
	Α	В	С	D	E
1	"id_no" =	56055	OR	"id_no" = 56055 OR	
2	"id_no" =	22695490	OR	"id_no" = 22695490 OR	
3	"id_no" =	22695486	OR	"id_no" = 22695486 OR	
4	"id_no" =	22695576	OR	"id_no" = 22695576 OR	
5	"id_no" =	22695673	OR	"id_no" = 22695673 OR	
6	"id_no" =	22695619	OR	"id_no" = 22695619 OR	
7	"id_no" =	22727705	OR	"id_no" = 22727705 OR	
8	"id_no" =	219	OR	"id_no" = 219 OR	

g. Save the worksheet for later to a new file e.g. in this example called formatted_for_SQL_query.xlsx and close

2.7. Use SQL query to select species of interest from spatial dataset

The next section prepares the spatial data ready for analysis. The IUCN spatial dataset is a complex dataset as it contains many overlapping polygons for each species for the entire world. Even subsetting the dataset for your area of interest can be problematic so these set of instructions are important steps to make sure the analysis runs as smoothly as possible and to reduce the risk of errors in processing.

- a. Open QGIS
- Add in the IUCN Species spatial dataset(s) (the data are in geographic coordinate system (i.e. EPSG:4326)
- Untick the dataset in the table of contents to stop it drawing

🌠 Add vec	tor layer			? ×
-Source ty	ре			
O File	 Directory 	 Database 	O Protoco	bl
Encoding	System			•
-Source-				
Туре	ESRI FileGDB			-
Dataset	C:\NGA_SpeciesRichn	ess\iucn_rl_species_20	14_2.gdb	Browse
		Open	Cancel	Help

- **d.** Add in a polygon dataset of the area of interest (e.g. country boundary). e.g. in this example **nga_border_dd.shp.** Make sure the dataset is in geographic coordinate system (i.e. EPSG:4326) to match the coordinate system of the IUCN spatial data
- e. Click on the IUCN spatial dataset in the table of contents to make it the active layer e.g. in this example iucn_rl_species_2014_2_no_sens



f. Right click on the IUCN spatial dataset and Click Filter

	lucii_ii_specie	s_2014_2_no_s	ens			
ields				Values		
id_no						
binomial						
presence						
subpop				8		
data_sens						
sens_comm				8		
legend						
seasonal						
owner						
ecosystem					Samala	A II
areakm2					Sample	All
taxonid			_	🗌 🗌 lise u	nfiltered laver	
SUDDOD ID						
	<	×	LIKE	%		
	>=	ļ=	ILIKE	AND	OR NOT	
<=						
<=	ilter expressior	I				_
<= Provider specific f "id_no" = 22720	ilter expressior 012 OR]				
<= Provider specific f "id_no" = 22720 "id_no" = 58167	ilter expressior 012 OR OR	1				
<= Provider specific f "id_no" = 22720 "id_no" = 58167 "id_no" = 23144	ilter expression 012 OR OR OR]				•
<= Provider specific f "id_no" = 22720 "id_no" = 58167 "id_no" = 23144 "id_no" = 22692	ilter expression 012 OR OR OR 643 OR					•
<= Provider specific 1 "id_no" = 22720 "id_no" = 28167 "id_no" = 22692 "id_no" = 22692	ilter expression 012 OR OR 0R 643 OR 663 OR					[
<pre><= Provider specific 1 "id_no" = 22720 "id_no" = 23144 "id_no" = 22692 "id_no" = 22692 "id_no" = 229211</pre>	ilter expression OR OR 643 OR 663 OR OR					-
<= rovider specific f "id_no" = 22720 "id_no" = 58167 "id_no" = 23144 "id_no" = 22692 "id_no" = 22692 "id_no" = 22208 "id_no" = 22218	ilter expression OR OR 643 OR 663 OR OR OR 420 OR					
<= Provider specific f "id_no" = 22720 "id_no" = 28167 "id_no" = 23144 "id_no" = 22692 "id_no" = 22321 "id_no" = 22708 "id_no" = 22708 "id_no" = 22708	ilter expression OR OR 643 OR 663 OR OR 420 OR 420 OR					
<= Provider specific f "id_no" = 22720 "id_no" = 58167 "id_no" = 23144 "id_no" = 22692 "id_no" = 23211 "id_no" = 22708 "id_no" = 22713	ilter expression OR OR 643 OR 663 OR OR 720 OR 934	1				

- **g.** A Query window appears. **Copy and paste** into the Query window **the SQL query** that you created earlier. This will select out only those species present in the exported species list
- Remove the OR from the last row and click Test to check you got the syntax correct. This may take 5 10 minutes or longer depending on how many records are being selected. If correct it should return the number of rows selected



Note: This number does not equate to the number of species but to the number of polygons so you cannot use this to check that the number of species it has selected is correct.

- i. Click OK to close the Query Result window
- **j. Click OK** to apply the filter to the IUCN spatial dataset and close the Query Builder window.
- k. To see that the dataset now only shows the filtered records right click on the IUCN spatial dataset and click on Open Attribute table



K A	ttribute table - iucr	_rl_species_2014_2	no_sers :: Features	total: 4379. iltere	d: 4379, selected: 0	-				
	/ 🗐 🖫 💁 🖀 😻 🇭 🗐 🔚 🖽									
	id_no 🗸	binomial	presence	origin	compiler	year				
0	219	Acinonyx jubatus	1	1	IUCN	2				
1	219	Acinonyx jubatus	1	1	IUCN	2				
2	219	Acinonyx jubatus	1	1	IUCN	2				
3	219	Acinonyx jubatus	1	1	IUCN	2				
4	219	Acinonyx jubatus	1	1	IUCN	2				
5	219	Acinonyx jubatus	1	1	IUCN	2				

Note the attribute table shows only the records filtered by the SQL query.



o. Right click and Remove the IUCN spatial dataset in the table of contents e.g. in this example remove iucn_rl_species_2014_2_no_sens



2.8. From the previous selection select out the current native species range

a. Right click on the newly added subset species layer e.g. nga_iucn_selection.shp in this example and click Filter



b. To only include categories as advised by IUCN Presence - 1 (extant); 2 (probably extant); 6 (presence uncertain) Origin - 1 (native); 2 (reintroduced); 5

(origin uncertain)

Put the following expression into the Query Builder window:-("presence" = 1 OR "presence" = 2 OR "presence" = 6) AND ("origin" = 1 OR "origin" = 2 OR "origin" = 5)

- c. Click Test d. Click OK to close the
- Query Result window





е.

Click **OK** to close the Query Builder window

- g. Right click on the subset IUCN spatial dataset e.g nga_iucn_selection.shp in this example and Click Save as ~
- h. Save the file with a new name. e.g. nga_iucn_selection_PO.shp in this example



- ormat	ESRI Shapefile		-
Save as	C:/NGA_SpeciesRichness/nga_iu	cn_selection_PO_shp Browse	•
CRS	Layer CRS		Ŧ
	WGS 84	Browse	•
Encoding	g	System 🔻	
Save	e only selected features		
Skip	attribute creation saved file to map		
Symbolo	ogy export	No symbology 💌	
Scale		1:50000	
ooulo			١,

i. Click OK -

2.9. From the previous selection select out terrestrial species ranges

- a. Right click on the newly added subset species layer e.g.
 nga_iucn_selection_PO.shp in this example and and Click Filter
- b. To only include species which are terrestrial put the following expression into the Query Builder window:
 "biome_terr" = 't'
- Layers ð× v É-🔎 Zoom to Layer Show in overview iucn_selection Remove **P** ė... 🗌 nga_border_dd [Duplicate Set Layer Scale Visibility Po Set Layer CRS Set Project CRS from Layer Open Attribute Table
- c. Click Test
 d. Click OK to close the Query Result window



e. Click OK to close the Query Builder window

Query Builder	n nga_iucn_selection_l	20			? ×
rields id_no binomial presence origin compiler year citation source dist_comm island			Sample	r	All
perators		> LK	E %	N	NOT IN
4.1		!= ILK	E AND	OR	NOT
Provider specific	filter expression				

f. Right click on the subset IUCN spatial dataset e.g nga_iucn_selection_PO.shp in this example and Click Save as



g. Save the file with a new name. e.g. nga_iucn_selection_PO_T.shp in this example

Format	ESRI Shapefile		
Save as	C:/NGA_SpeciesRichness/nga_iu	cn_selection_PO_T.shp	Browse
CRS	Layer CRS		
	WGS 84		Browse
Encoding	J	System	•
Save	only selected features		
Skin	attribute creation		
Auu	saved life to map		

2.10. Split the final subset IUCN dataset into separate files by species

2	From the Vector menu >> Data	Ve	ctor Raster	Database	W	eb L	ifemapp	er Pro	ocessin	g Help
a.		i 🗌	Buffer by Perc	entage	F	া য় য			\bigcirc	0
	management tools >> Split vector		Coordinate Ca	pture	×	1	Y	Þ	∕⊲	⊁⊠ i
	laver		Dxf2Shp		F	aho	abri	abe	ahe	abe
			GPS		F			(interest		9
			Group Stats		F					
	$\langle \rangle$		OpenStreetMa	р	F					
			Road graph		F					
			Spatial Query		×					
			Split Layers By	y Field	×					
			Table Manager		F					
			Topology Chec	ker:	F					
	\backslash	1	Analysis Tools	i	×					
		J.	Research Tool	s	×					
		Ø	Geoprocessin	g Tools	×					
	\setminus	-	Geometry Tool	s	×					
	*		Data Managem	ent Tools	۶.	Q , D	efine cu	urrent p	orojecti	on
				ŝ		ilian de	oin attri	butes b	y locat	ion
						v∕≨ s	plit vect	tor laye	r	
						D N	1erge sł	napefile	es to on	e
						C	reate sp	oatial in	ndex	

Using open source GIS software to support REDD+ planning

- Under input vector layer choose the name of the species range file you want to split. e.g. in this example nga_iucn_selection_PO_T.shp
- c. Under unique ID field choose the / field to base the split on. Select
 id_no, this contains a unique ID for each species.

	🥂 Split vector layer	? ×
	Input vector layer	
1	Inga_iucn_selection_PO_T	•
	id_no	-
/	Output folder GA SpeciesRichness/nga jucn selection PO T splits	Browse
	1	
		Close

d. Select an output folder for the split species range files. e.g. in this example
 C:\NGA_SpeciesRichness\nga_iucn_selection_PO_T_splits

e. Click OK —

2.11. Create Raster for Area of interest with all pixels having value of 1

a.	Right click the interest e.g. r example and	e Vector lay nga_border open Attrik	er of the ar _ dd.shp in oute table `	rea of this	V: #. @.		nga_iucn_sel nga_iucn_sel nga_iucn_sel	Layers 000000000 ection_PO_T ection_PO ection	ð
b.	Click on the to attribute tabl	oggle editir e window	ng button in	a the			nga border	 Zoom to Layer Show in overvies Remove Duplicate Set Layer Scale V Set Layer CRS Set Project CRS f Open Attribute Toggle Editing Save As Save As Layer De Filter Show Feature Co Properties Rename Copy Style 	w isibility irom Layer able finition File
	Attribute table - r	nga_border_dd :: Fe E	atures total: 4, filte	red: 4, selected: 0		1		21	1
	OBJECTID	ISO3 CODF	STATUS	CAPITAL	Ter	ND	Terr Name	Color Code	Shape Leng
	0 187	NGA	Member State	Abuja		179	Nigeria	NGA	48.0857211107
	1 187	NGA	Member State	Abuja		179	Nigeria	NGA	48.0857211107
	2 187	NGA	Member State	Abuja		179	Nigeria	NGA	48.0857211107
	3 187	NGA	Member State	Abuja		179	Nigeria	NGA	48.0857211107
	1								

c. The calculator button becomes active. Click on the Calculator button

Create a new field called ID (in this example) of type integer and calculate all the values in that field as 1

🤾 Field calculator
Qily update 0 selected features
Update existing field
Output field type Whole number (integer) OBJECTID
Output field width 10 🜩 Precision 0 🚖
Function list
Search ⊕ Operators ⊕ Conditionals ⊕ Math ⊕ Conversions ⊕ Date and Time ⊕ String ▼ Operators = 1 + - / * ^ () Expression
Output preview: 1 OK Cancel Help

e. An ID field is added to the table. Click the toggle editing button to stop editing

	Attribute table - nga_border_dd :: Featurer table -; mitered: 4, selected: 0										
											odate Al
Π	OBJECTID	ISO3_CODE	STATUS	CAPITAL	Terr_ID	Terr_Name	Color_Code	Shape_Leng	Shape_Area	ID	∇
0	187	NGA	Member State	Abuja	179	Nigeria	NGA	48.08572111070	75.03683338530		1
1	187	NGA	Member State	Abuja	179	Nigeria	NGA	48.08572111070	75.03683338530		1
2	187	NGA	Member State	Abuja	179	Nigeria	NGA	48.08572111070	75.03683338530		1
3	187	NGA	Member State	Abuja	179	Nigeria	NGA	48.08572111070	75.03683338530		1
	Show All Features	\$ _									

f. Click Save to save the edits



g. In the Processing Toolbox, search for the SAGA - shapes to Grid tool

h.	Double click on the	Processing Toolbox	
	Shaped to grid tool	shapes to	<
		🖻 🖷 🎸 SAGA [228 geoalgorithms]	
		Grid Bridding	
		Shapes to gild	

- i. Set the Shapes to the Area of Interest shapefile
- j. Set the attribute to use for the grid values as ID (i.e. all the grid values will be 1)
- k. Set the Preferred Targer Grid Type to Integer (1 byte)
- I. Set the cellsize in decimal degrees e.g. in this example 0.008333 (equivalent to 1km)

1 Shares to avid		X
to snapes to grid		
Parameters Log Help		
Shapes		
nga_border_dd [EPSG:4326]	- 2	
Attribute		
	•	
Method for Multiple Values		
[0] first	-	
Method for Lines		
[0] thin	-	
Preferred Target Grid Type		
[0] Integer (1 byte)	•	
Output extent(xmin, xmax, ymin, ymax)		
[Leave blank to use min covering extent]		
Cellsize		
0.008333	.	
Grid		
C:/NGA_SpeciesRichness/NGA_GRID_values1.tif		
Ppen output file atter running algorithm		
0%		
	Run Clos	se

- m. Give the output Grid a new name and save in .tif format e.g. in this example
 C:\NGA_SpeciesRichness\NGA_GRID_values1.tif
- n. Once run click Close to close the dialogue box. It appears as Grid in the table of contents.
 All values are 1 and no data is value 0
- o. Right click on Grid and rename it AOI (for area of interest)



2.12. Batch clip Area of Interest Raster with Each Species Range

a. In the Processing Toolbox search for the SAGA tool Clip grid with polygon



b. Right click on the Clip grid with polygon tool and Execute as batch process

Input	Polygons	Output	Load in QGI	s
			Yes	
	Select from open layers	<u> </u>	Yes	
	Select from filesystem		Yes	
			1	

- c. Click on the ... in the first row of the input column and select from open layers
- d. Select AOI (i.e. the grid of the area of
 interest where all cells contain the value of 1)
 e. Click OK



- f. Click on the ... in the first row of the Polygons column and select from file system

🏑 Batch Process	sing - Clip grid with poly	gon	- 9 A	9 8	100	x
Parameters	Log Help					ad in 0.015
	input	Hivgons	Output			ad in QGIS
AOI		Sel	ect from open layers		Yes	
		Sel	ect from filesystem		Yes	
					Yes	-
			0%			
			R	un A	dd row Dele	ete row Close

g. Navigate to the folder containing the split up shapefiles, change the type shp and hold down the shift key and select all the species files. e.g. in the folder
C:\NGA_SpeciesRichness\nga_iucn_selection_PO_T_splits in this example

🤾 Open file	-				
@ .	↓ Computer ↓ Local Disk (C:) ↓ NGA_S	peciesRichness 🕨 ng	a_iucn_selection_P	°O_T_splits → 🐓	Search ng i_iucn_selection_PO 🔎
Organize	✓ New folder				i 🕶 🕶 📵
	Name	Date modified	Туре	Size	^
	nga_iucn_selection_PO_id_no_45953631	14/10/2014 09:15	SHP File	1,112 KB	
	nga_iucn_selection_PO_id_no_61612961	14/10/2014 09:15	SHP File	96 KB	
	nga_iucn_selection_PO_id_no61612971	14/10/2014 09:15	SHP File	46 KB	
	nga_iucn_selection_PO_id_no_61627052	14/10/2014 09:16	SHP File	185 KB	
	nga_iucn_selection_PO_id_no61650582	14/10/2014 09:16	SHP File	765 KB	
	nga_iucn_selection_PO_id_no_61741660	14/10/2014 09:17	SHP File	267 KB	
	nga_iucn_selection_PO_id_no_61781834	14/10/2014 09:17	SHP File	104 KB	
	nga_iucn_selection_PO_id_no61914670	14/10/2014 09:17	SHP File	500 KB	
	nga_iucn_selection_PO_id_no_62026481	14/10/2014 09:18	SHP File	4,244 KB	
	nga_iucn_selection_PO_id_no_62120190	14/10/2014 09:18	SHP File	7,346 KB	
	nga_iucn_selection_PO_id_no_62774969	14/10/2014 09:19	SHP File	6,916 KB	↓
	File <u>n</u> ame:			¢	SHP files(*.shp)
					Open Cancel

A single row per species file is added for the batch process

Batch Processing -	Clip grid wit	h polygon		 1 - C - C - C - C - C - C - C - C - C -	
Parameters Log	Help				
Input		Polygons	Output	Load in QGIS	
AOI		² O_id_no219.0.shp		 Yes	-
		² O_id_no575.0.shp		 Yes	-
		PO_id_no811.0.shp		 Yes	-
		D_id_no1550.0.shp		 Yes	-
		D_id_no1793.0.shp		 Yes	-
		D_id_no2054.0.shp		 Yes	•
		D_id_no2147.0.shp		 Yes	-
		D_id_no3744.0.shp		 Yes	-

h. Double click on the Input heading to auto populate the AOI down the input column

Parameters Log	Help					
Input		Polygons		Output	Load in QGIS	
A0I		³ O_id_no219.0.shp]		 Yes	-
AOI		³ O_id_no575.0.shp			 Yes	-
AOI		PO_id_no811.0.shp			 Yes	-
A0I		0_id_no1550.0.shp]		 Yes	-
A0I		D_id_no1793.0.shp			 Yes	-
AOI		0_id_no2054.0.shp			 Yes	-
A0I		J_id_no2147.0.shp			 Yes	-
AOI		D id no 374 .0.shp			 Yes	-

i. Click on the ... in the first row of the **Output** column and **select from file system**

🏑 Save file		×
😋 🗢 🛡 📕 « NO	GA_SpeciesRichness > nga_iucn_selection_PO_T_splits_grids - 4; Search nga_iucn_s	selection_PO 🔎
Organize 🔻 Ne	w folder	- • •
E ^	No items match your search.	
File <u>n</u> ame:	tif	•
Save as <u>t</u> ype:	TIF files(*.tif)	•
Alide Folders	Save	Cancel

- j. Create a new folder to put the output species rasters e.g. in this exampleC:\NGA_SpeciesRichness\nga_iucn_selection_PO_T_splits_grids
- **k.** In the file name box put **.tif**
- I. In the Save as type box pick Tif files(.tif)
- m. Click Save
- n. In the Autofill mode box that appears pick Fill with parameter values and for the Parameter to use pick polygons



A single row per species file is added for the batch process with an output name the same as the input name but with a .tif ending.

Input	Polygons		Output	Load in (QGIS
AOI	 ² O_id_no219.0.shp		_PO_id_no219.0.tif	 Yes	
AOI	 ² O_id_no575.0.shp	6 77	_PO_id_no575.0.tif	 Yes	
AOI	 PO_id_no811.0.shp		_PO_id_no811.0.tif	 Yes	•
			0%		

- o. Click on the ... in the first row of the Load in QGIS column and change to No
- p. Double click on the Load in QGIS column title to auto-change every row to No

Parameters Log	Help					
Input		Polygons	Output	Lo	ad in QGIS	
AOI		² O_id_no219.0.shp	 _PO_id_no219.0.tif	 No		•
AOI		PO_id_no575.0.shp	 _PO_id_no575.0.tif	 No		-
AOI		² O_id_no811.0.shp	 _PO_id_no811.0.tif	 No		-
			 0%			

- q. Click Run to run the batch process
- **r.** In a windows explorer window navigate to the output folder to see the new species raster's being created

Once the process is complete there should be a .tif file for each species which contains values of 1 where present and no data (0). The extent of the file does not cover the whole of the area of interest (AOI) file only the extent of the individual species.

2.13. Extend extent in species raster to Area of Interest Raster

In order to sum the individual species raster's it is important that they all cover the same extent (i.e. that of the AOI).

a. Use the Area of Interest raster to combine with the individual species raster to ensure they all have the full extent of the area of interest. In the **Processing Toolbox** search for the **GDAL** tool **Clip raster by extent**

Processing Toolbox	0 🗙
clip raster	\boxtimes
Recently used algorithms GIp raster by mask layer GIp raster by extent GDAL/OGR [45 geoalgorithms] GDAL] Extraction	
Clip raster by extent	Execute Execute as batch process Edit rendering styles for outputs

b. Right click on the Clip raster by extent tool and Execute as batch process

c. Click on the ... in the first row of the input column and select from filesystem.

1 Patch Descention Office and a build and		
Parameters Log Help		
 Input layer	Nodata value, leave blank to take the nodata value from input	Clipping extent Add
	Select from open layers	Leave blank to use
Î	Select from filesystem	Leave blank to use

d. Select the species ranges raster tif files created in the previous step, by navigating to the folder containing the clipped species ranges, change the type to tif and hold down the shift key and select all the species files in the folder.

✓ Open file ♥ ● ● ≪ xavierd (\\v	c-data-01.internal.wcmc\home) (U:) → Mongolia_Manual2 → Clips	-	Search Clip	95	× Q
Organize 👻 New folder					
🔆 Favorites	Name Date modified	Туре	Size		
📃 Recent Places	mng_iucn_selection_PO_CRENVU_id_no_5953.0 05/01/2016 11:23	TIFF image	4,783 KB		
) 5 7 Cote d'Ivoire	mng_iucn_selection_PO_CRENVU_id_no_7951.0 05/01/2016 11:23	TIFF image	1,179 KB		
🛞 iCloud Photos	mng_iucn_selection_PO_CRENVU_id_no_8976.0 05/01/2016 11:23	TIFF image	3,415 KB		
	mng_iucn_selection_PO_CRENVU_id_no_12832.0 05/01/2016 11:23	TIFF image	3,833 KB		
🧊 Libraries	mng_iucn_selection_PO_CRENVU_id_no_13897.0 05/01/2016 11:23	TIFF image	4,575 KB		
Documents	Solution_selection_PO_CRENVU_id_no_19832.0 05/01/2016 11:23	TIFF image	93 KB		=
👌 Music	mng_iucn_selection_PO_CRENVU_id_no_22732.0 05/01/2016 11:23	TIFF image	2,514 KB		
Pictures	Reference in the interval of t	TIFF image	3.675 KB		

e. Click OK

f. Click on the ... in the first row of the Clipping extent column and use layer/canvas extent.

			
Nodata value, leave blank to take the nodata value from input	Clipping extent		Additional creation parameters
	[Leave blank to use		
	[Leave blank to use		Use layer/canvas extent
	[Leave blank to use		Use min covering extent from input lavers
	[Leave blank to use		
	[Leave blank to use		
	[Leave blank to use		
	[Leave blank to use		
	[Leave blank to use		
	Nodata value, leave blank to take the nodata value from input	Nodata value, leave blank to take the nodata value from input Clipping extent [Leave blank to use [Leave blank to use	Nodata value, leave blank to take the nodata value from input Clipping extent [Leave blank to use [Leave blank to use

g. Click on the ... in the first row of the Clipping extent column and use layer/canvas extent and select AOI.

4	8 Batch Processing - Clip raster by extent			
	Parameters Log Help			
	Input layer	Nodata value, leave blank to take the nodata value from input	Clipping extent	4
	al2\Clips\mng_iucn_selection_PO_CRENVU_id_no5953.0.tif		[Leave blank to use	[
	al2\Clips\mng_iucn_selection_PO_CRENVU_id_no7951.0.tif	 🕺 Select extent	[Leave blank to use]	[
	al2\Clips\mng_iucn_selection_PO_CRENVU_id_no8976.0.tif	 Use extent from	[Leave blank to use]	[
	2\Clips\mng_iucn_selection_PO_CRENVU_id_no12832.0.tif	 Use canvas extent 🗸	[Leave blank to use]	[
	2\Clips\mng_iucn_selection_PO_CRENVU_id_no13897.0.tif	 Use canvas extent	[Leave blank to use]	[
	2\Clips\mng_iucn_selection_PO_CRENVU_id_no19832.0.tif	 AOI	[Leave blank to use]	[
	2\Clips\mng_iucn_selection_PO_CRENVU_id_no22732.0.tif		[Leave blank to use]	
	2) Clips/mpg jucp selection PO CRENVIL id po 20680.0 tif	í I	Diagva blank to usa	

h. Double click on the Clipping Extent heading to auto populate the AOI down the input column.

						and the second second	S X
					$\overline{\ }$		
value from input	Clipping extent		Additional creation parameters		Clipped (extent)		Load ii 📥
	5468755,52.152712755						Yes
	5468755,52.152712755						Yes
	5468755,52.152712755						Yes
	5468755,52.152712755						Yes
	5468755,52.152712755						Yes
	μ.	_	NC I I I I I I I I I I I I I I I I I I I	1			

i. Click on the ... in the first row of the Clipped (extent) column

j. Create a **new folder** to put some **temporary** output species raster's e.g. in this example C:\NGA_SpeciesRichness\tmpgrids

🌠 Save file							×
Sector Secto	_SpeciesRichness 🕨 tmpg	grids	•	\$ 9	Search tmpgrids	_	٩
Organize 🔻 New	folder						?
Name	*	No items	Date modified	ch.	Туре	Size	
			-				
	~			_			•
File <u>n</u> ame: .t	if						-
Save as <u>t</u> ype: T	IF files(*.tif)						•
Alide Folders					Save	Cance	
C							
j. In the	file name box pu	ut .tif					
k. Click S	ave						
I. Chang	ge the Autofill mo	ode to	Fill with nu	mbe	ers.		
		\square	_		ର	57	1
Autofill setting	s				8	~~	
Autofill mode	Fill with numbers						
Addiminiouc							
Parameter to use	Input layer					\$	
				ок	Car	ncel	
(1

xtent	Additional creation parameters	Clipped (extent)		Loa	d in QGIS
12755		U:/Mongolia_Manual2/Tempgrid/1.tif		No	\$
12755		U:/Mongolia_Manual2/Tempgrid/2.tif		No	\$
12755		U:/Mongolia_Manual2/Tempgrid/3.tif		No	\$
12755		U:/Mongolia_Manual2/Tempgrid/4.tif		No	+
12755		U:/Mongolia_Manual2/Tempgrid/5.tif		No	†
12755		U:/Mongolia_Manual2/Tempgrid/6.tif		No	†
12755		U:/Mongolia_Manual2/Tempgrid/7.tif		No	†
	 ,	i	10	Ϋ́	

- m. Click on the ... in the first row of the Load in QGIS column and change to No

- o. Click **Run** to run the batch process
- p. In a windows explorer window navigate to the temporary output folder to see the new species raster's being created e.g. C:\NGA_SpeciesRichness\tmpgrids in this example.

🧭 Batch	processing							
Batch processing successfully completed!								
	ОК							

If the process is successful this box will appear once the batch process is complete.

2.14. Batch Reclassify No data values to 0

Because the Raster calculator does not recognize NoData values, it is necessary to convert NoData values to 0 in order to create later the species richness raster.

a. Use the searching tool in the processing toolbox and search for SAGA's Reclassify Grid Values.

Processing Toolbox	0 🗙
reclassify	\mathbf{X}
Recently used algorithms Reclassify Grid Values Reclassify Grid Values Grid PWCMC_custom_toolbox] Grid PWCMC_custom_toolbox] Grid SAGA (2.1.2) [235 geoalgorithms] Grid - Tools Grid - Tools Grid Saga Saga Saga Saga Saga Saga Saga Sag	

b. Right click on the tool and click on Execute as batch process.

c. Click on the ... in the first row of the input column and select from filesystem.

K	Batch Processing - Reclassify grid values				/	
	Parameters Log Help			/		
	Grid		Method		old value (for single value change)	new va
			Select from open aver	÷	0.0	1.0
			Select from filesystem	ŧ	0.0	1.0
		 43	[0] single	÷	0.0	1.0

d. Select the **tif files** created in the previous step, by navigating to the folder containing the species ranges adjusted to the extent of the Area of Interest. Hold down the **shift key** and **select all the** files in the folder

Organize 🔻 New fold	ler					/		0
쑦 Favorites	^	Name	^	Date modified	Туре	Size		-
🗐 Recent Places	=	I		05/01/2016 12:55	5 TIF	4,788 KB		
퉬 57 Cote d'Ivoire		2		05/01/2016 12:55	5 TIFF image	4,788 KB		Ξ
🜸 iCloud Photos		3		05/01/2016 12:55	5 TIFF image	4,788 KB		
		4		05/01/2016 12:55	5 TIFF image	4,788 KB		
ز Libraries		5		05/01/2016 12:55	5 TIFF image	4,788 KB		
Documents		6		05/01/2016 12:55	5 TIFF image	4,788 KB		
🁌 Music		🛃 7		05/01/2016 12:55	5 TIFF image	4,788 KB		
Pictures		8		05/01/2016 12:55	5 TIFF image	4,788 KB		
📑 Videos		9		05/01/2016 12:55	5 TIFF image	4,788 KB		
		🛃 10		05/01/2016 12:55	5 TIFF image	4,788 KB		

e. Click OK

f. In the Method column select [0] single.

Batch Processing - Reclassify grid values			
Parameters Log Help			
Grid	Method	d value (for single value change)	new value (for single value change)
U:\Mongolia_Manual2\Clips_extent\1.tif	 [0] single	9	1.0
U:\Mongolia_Manual2\Clips_extent\2.tif	 Uj single	0.0	1.0
U:\Mongolia_Manual2\Clips_extent\3.tif	 [0] single	0.0	1.0
U:\Mongolia_Manual2\Clips_extent\4.tif	 [0] single 🛛 🖨	0.0	1.0

g. In the **Old Value** column enter **1.0** and double click on column title to auto-change every row to 1.0.

ų	Batch Processing - Reclassify grid values			
ſ	Parameters Log Help			
	Grid	Method	old value (for single value change)	new value (for single value change)
	U:\Mongolia_Manual2\Clips_extent\1.tif	 [0] single 🔷 🖨	1.0	1.0
	U:\Mongolia_Manual2\Clips_extent\2.tif	 [0] single 🗘	1.0	1.0
	U:\Mongolia_Manual2\Clips_extent\3.tif	 [0] single 🗘	1.0	1.0
	U:\/Mongolia_Manual2\/Clips_extent\4.tif	 [0] single 🗘	1.0	1.0
	U:\Mongolia_Manual2\Clips_extent\5.tif	 [0] single 🗘	1.0	1.0

Ensure that the Replace no data values column is marked as Yes and the new value for no data values column is 0.0.

Parameters Log Help				
		4		
operator (for table)	replace no data values	new value for no data values	replace other values	new value for other valu
[0] min <= value < max 🗧	Yes 🗘	0.0	Yes 🗘	0.0
[0] min <= value < max 🛛 🖨	Yes 🗘	0.0	Yes	0.0
[0] min <= value < max 🛛 🖨	Yes 🔷 🖨	0.0	Yes 🗧	0.0
[0] min <= value < max 🛛 🖨	Yes 🗧 🖨	0.0	HES 🗧	0.0
[0] min <= value < max 🛛 🗘	Yes 😫	0.0	Yes 🔷 🖨	0.0

- i. Also ensure that the **Replace other values** column is marked as **Yes** and the **new value for other data values** is **0**.
- j. Then, click on the ... in the first row of the Reclassified Grid column

g - Reclassify grid values				
.og Help				
new value for no data values	replace other values	new value for other values	Reclassified Grid	
0.0	Yes 🗘	0.0		
0.0	Yes 🗘	0.0		
0.0	Yes 🗘	0.0		
0.0	Yes 🗘	0.0		

k. Create a **new folder** to put some **new reclassified species range files** e.g. in this example binarygrids

1 Save file						
🚱 🕞 🗣 📕 🖌 Computer 🔸 System (C:) 🔸 NGA_SpeciesRichness 🔸 binarygrids 💿 🗸 🍫 Search binarygrids						
Organize 🔻 New folder						0
	Name	Date modified	Туре	Size		
System (C:)		No items match your se	arch.			
🚽 library (\\wcmc-data-03.inte						
🚽 I_Drive (\\wcmc-gis-01) (I:)						
🚽 data (\\wcmc-gis-01) (J:)						
🖵 Programs (\\wcmc-data-03.	\searrow					
🖵 Public (\\wcmc-data-03.inte						
雬 xavierd (\\wcmc-data-01.int						
🖵 raster_data_storage (\\wcmc 🗸						
File name: .tif						•
Save as type: SDAT 1 as(*.sdat)						•
Hide Folders				Save	Cance	
	\mathbf{i}					

- I. In the file name box put .tif
- m. Click Save

n. Click Save



- o. Change the Autofill mode to Fill with number values
- **p.** Change the Load in QGIS to No (as this can use too much memory and cause the function to fail half way through when processing many files).

This will create new species range maps in which 1 represents presence of the species and 0 absence. We are using number rather than the names from the input as the next step requires the file names to be very short.

2.15. Create Species Richness Raster

Now that all the individual species raster files have a value of 1 for present and 0 for absent, the final step is to sum them together to make a richness grid.

- a. Load all the rasters from the previous step into QGIS e.g. C:\NGA_SpeciesRichness\ nga_iucn_selection_PO_T_splits_grids_final_1_0 in this example.
- b. Press Ctrl+Shft+H to turn the layers off i.e. to stop them drawing
- c. From the main menu pick Raster>>Raster Calculator



- d. Open Excel
- e. In row 1 of column A type 1
- f. In row 1 of column B type "
- g. In row 1 of column C type =B1&A1&"@1"&B1&" + "
- **h.** Auto increment the number in Column A so it matches the number of species you have in the final species rasters folder. e.g. 1206 in this example

 Fill the rest of the columns so it looks similar to the image right

		C1	- (0	f_{x}	=B1&A1&"	@1"&B1&'	'+"	
	Α	В	С	D	E	F	G	Н
1	1	0	"1@1" +					
2	2		"2@1" +					
3	3		"3@1" +					
4	4		"4@1" +					
5	5	0	"5@1" +					
6	6		"6@1" +					
7	7		"7@1" +					
8	8		"8@1" +					
9	9		"9@1" +					
10	10		"10@1" +					
11	11		"11@1" +					
12	12		"12@1" +					

j. Copy and paste the contents of column C into the raster calculator window in QGIS

🔏 Raster calculator	? ×				
Raster bands	tesult layer				
"10@1" "11@1" ▲ C	Dutput layer MAM_AMP_BIRD_richness_PO_T.tif				
"1@1" "12@1"	Current layer extent				
"13@1" "14@1" "501"	K min 2.66843 🗘 XMax 14.67628 🗘				
"15@1" "16@1" "17@1"	Y min 4.27714 Y max 13.90176				
"18@1" C	Columns 1441 - Rows 1155				
"20@1" "21@1"	Dutput format GeoTIFF				
▼ Operators					
+ * sqrt sin	acos (
- / cos asin	tan atan)				
< > = <=	>= AND OR				
Raster calculator expression					
"1202@1" + "1203@1" +					
"1204@1" + "1205@1" +					
"1206@1"					
Expression valid					
	OK Cancel				

k. Click on the ..., navigate to the folder to place the output and give it a new name. e.g.
 C:/NGA_SpeciesRichness/MAM_AMP_BIRD_richness_PO_T.tif in this example.

This is the final species richness dataset

The dataset can then be symbolized and placed in a map layout as in the example below

Example Map



Methods and data sources: Endemic species distribution (amphibians, mammals and birds): Young, BE, Beck S, Córdova J, Embert D, Franke I, Hernandez P, Herzog S, Pacheco V, Timaná M, Tovar C, and Vargas J. 2007. Digital distribution maps of species endemic to the east slope of the Andes in Peru and Bolivia. NatureServe, Arlington, Virginia, USA. Data provided by NatureServe in collaboration with the Centro de Datos para la Conservación (CDC) of the Universidad Nacional Agraria La Molina, the Museo de Historia Natural de la Universidad Mayor de San Marcos, and many participating natural history museums and herbaria. See: http://www.natureserve.org/conservation-tools/data-maps-tools/modeled-distribution-maps-species-endemic-east-slope-andes-peru