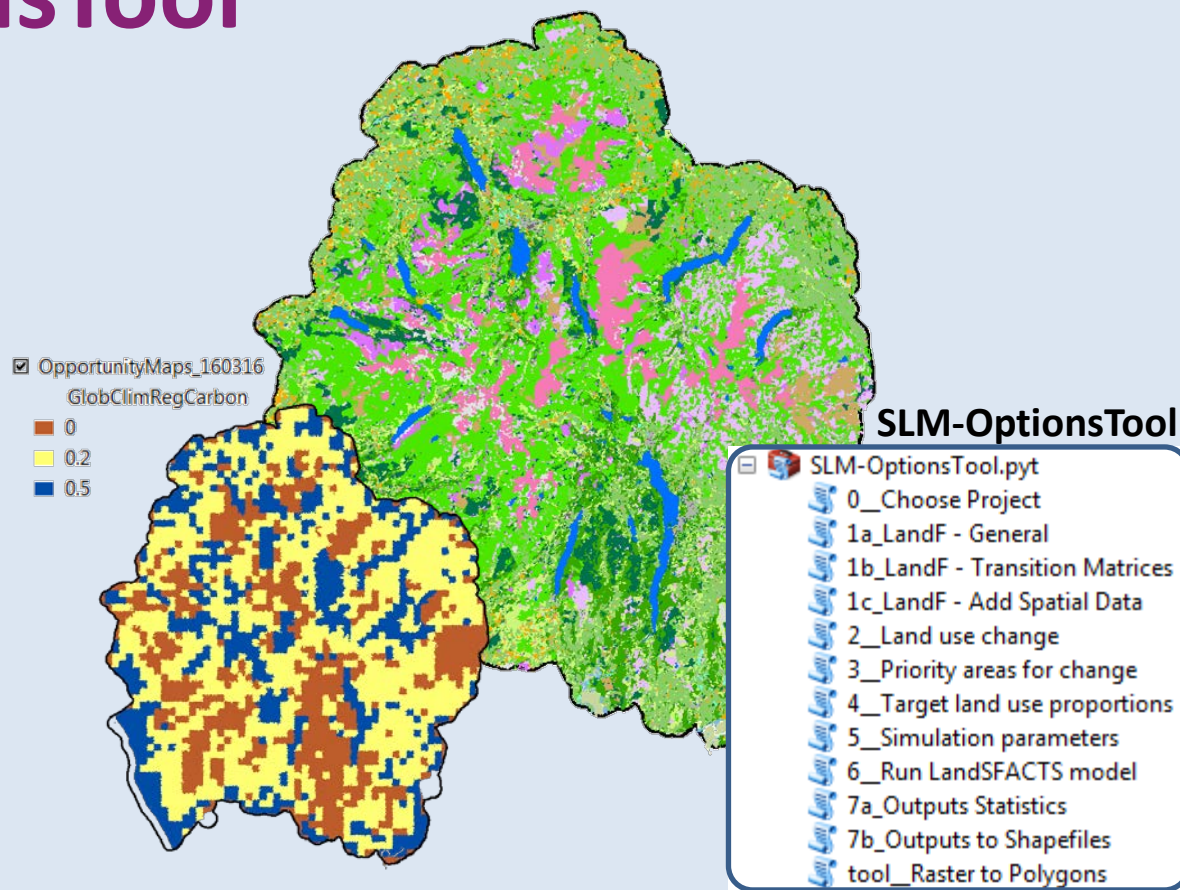


# Sustainable Land Management - OptionsTool



The James  
**Hutton**  
Institute



National  
Trust

Marie Castellazzi, Alessandro Gimona

Andrea Baggio, Justin Irvine, Laura Poggio, Andrew Coleman (NT)

ESCOM – 20<sup>th</sup> April 2016

# Sustainable Land Management - OptionsTool

## Talk topics



The James  
**Hutton**  
Institute



National  
Trust

- **Overview:** project & tool
- **SLM-OptionsTool components:**
  - **LandSFACTS model & developments**
  - **ArcGIS interface**
- **Example of scenarios**



- Designed for the National Trust in the Lake District National Park
- Main project focus was on mapping land functions
- Exploratory work: tool to help using those land functions maps for informed land use change

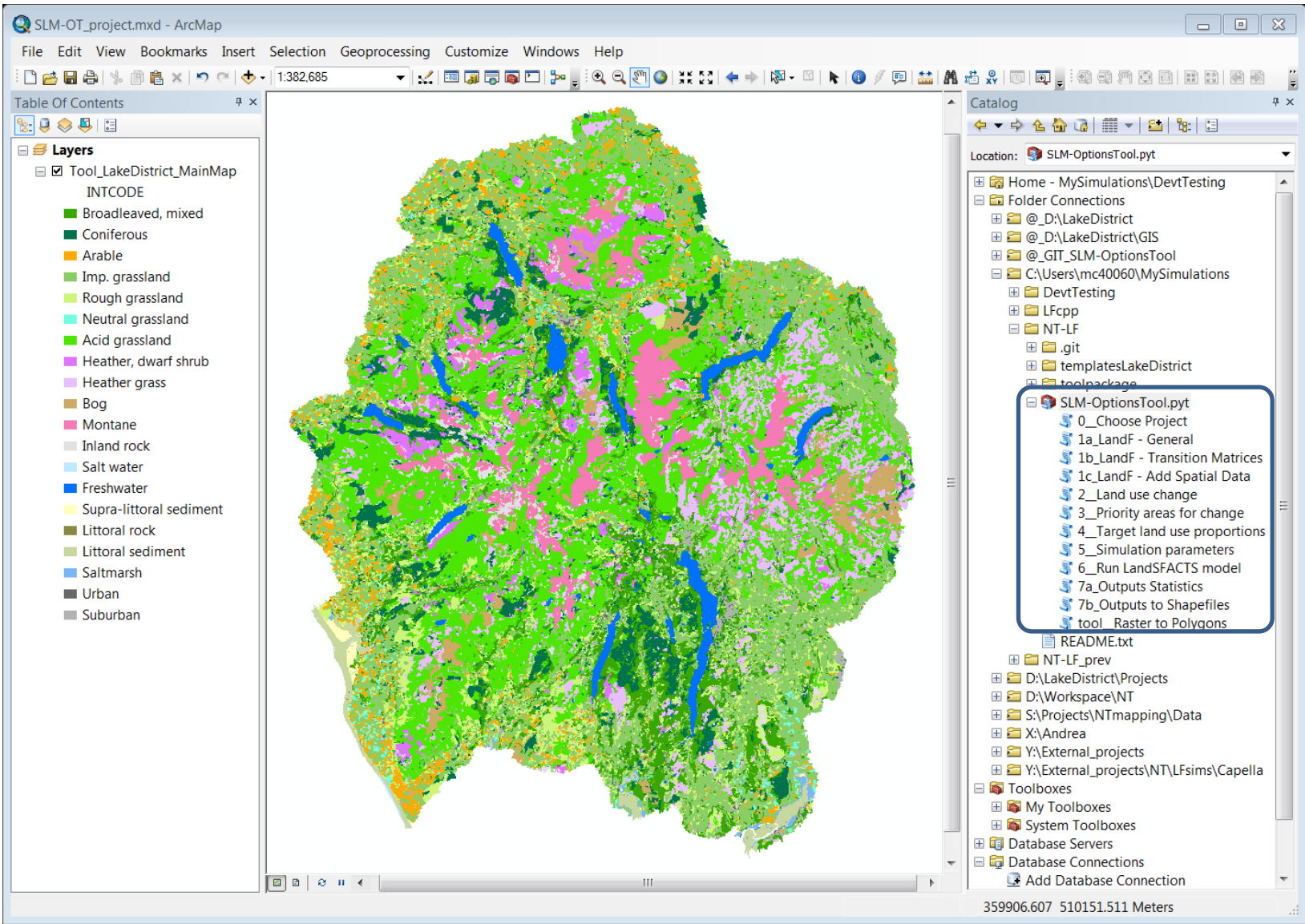


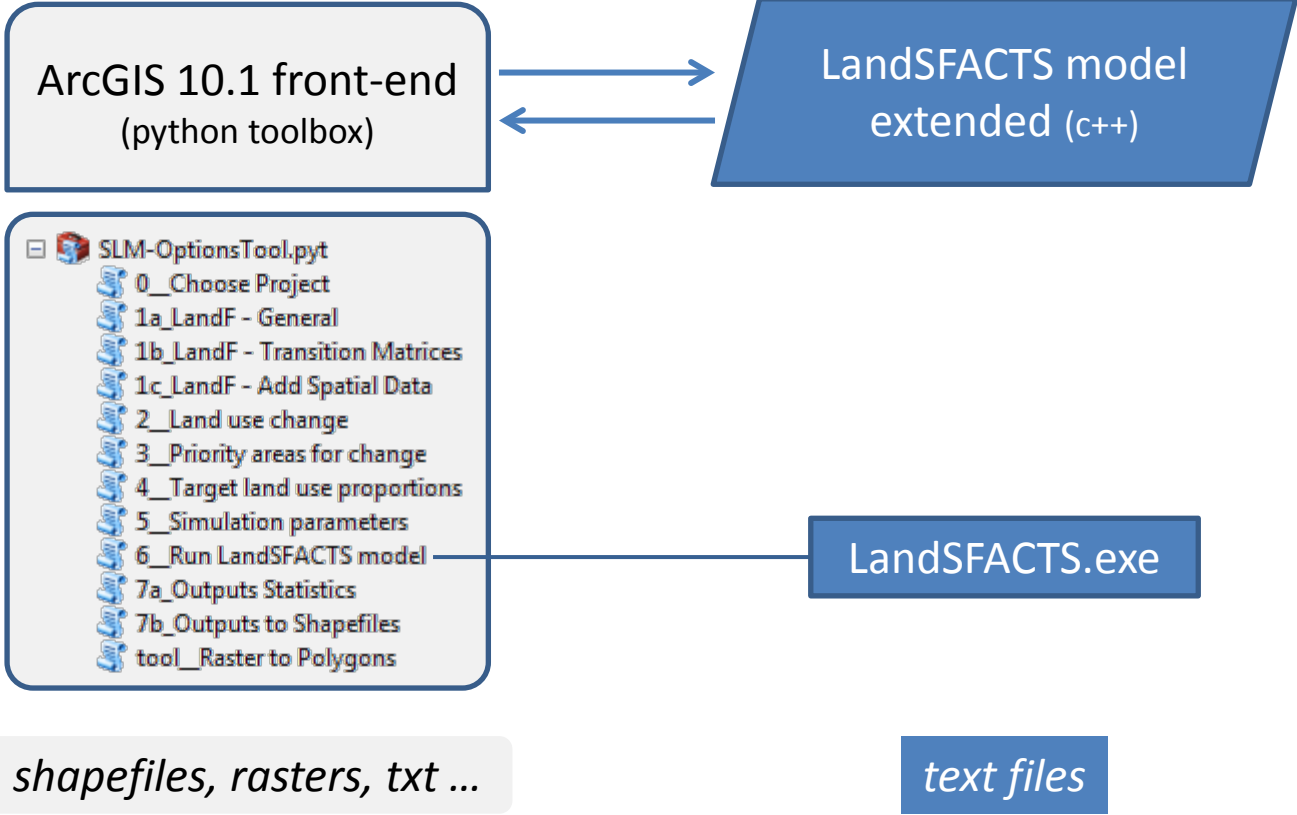
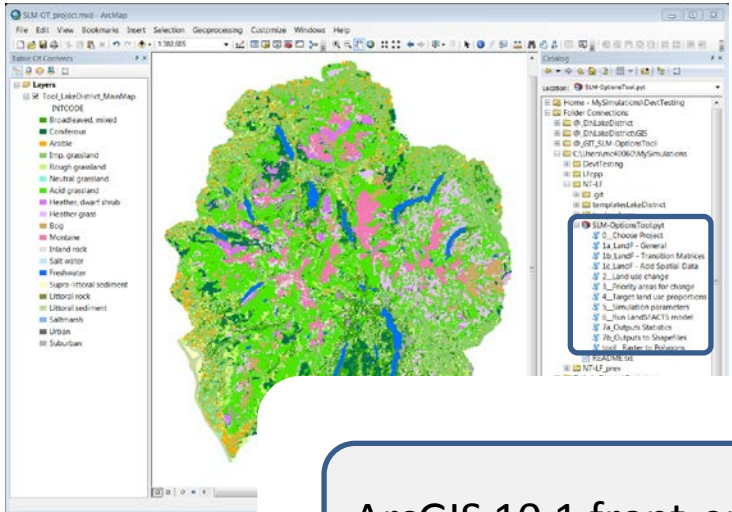
- Suggests potential land use changes meeting user-defined land management objectives
- Considers:
  - multiple land functions
  - other land management constraints
    - for specific areas (e.g. protected areas)
    - land uses (e.g. no arable decrease)
- Accessible through ArcGIS 10.1





- ArcGIS toolbox

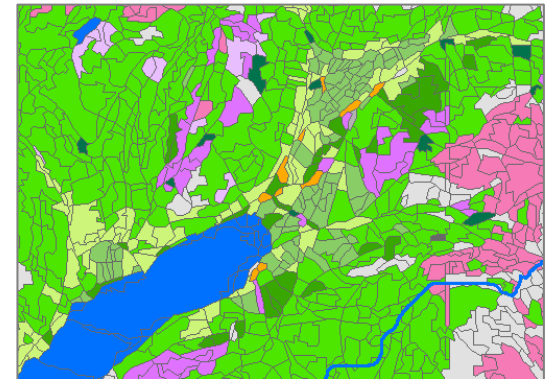




- **Previous developments**
  - landscape scale scenarios of cropping systems dealing with GM introduction in Europe (SIGMEA, EU FP7 project)
  - land use change scenarios in Scotland

- **Model's characteristics**

- **Stochastic model with rule based constraints**
- landscape spatial units as polygons (shapefile)
- spatial and temporal constraints on land use change
- targets of land use proportions
- output: 1 land use per polygon & year
- multi-runs → different output maps



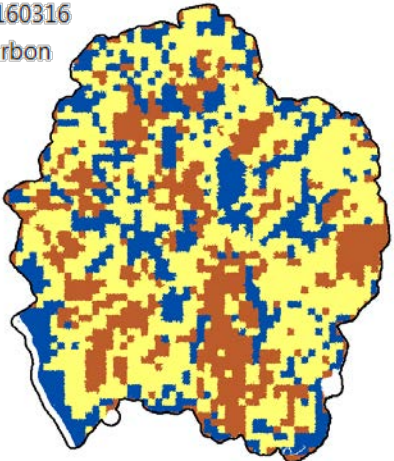
- For each land function in the tool: 3 components

An Opportunity map

- 0 : no land use change
- 0.2 : low probability of land use change
- 0.5 : high probability of land use change

☒ OpportunityMaps\_160316  
GlobClimRegCarbon

- 0
- 0.2
- 0.5



Land use transitions matrix using Scores

Glob.Clim.Reg.Carbon (scores)													
	Broadleaved, mixed	Coniferous	Arable	Imp. grassland	Rough grassland	Neutral grassland	Acid grassland	Heather, dwarf shrub	Heather grass	Bog	Montane		
	1	2	3	4	5	6	8	10	11	12	13		
Broadleaved, mixed	1	0	1	-5	-4	-1	-1	-3	-3	2	0		
Coniferous	2	-1	0	-6	-5	-2	-2	-4	-4	1	0		
Arable	3	5	6	0	1	4	4	2	2	7	0		
Imp. grassland	4	4	5	-1	0	3	3	1	1	6	0		
Rough grassland	5	1	2	-4	-3	0	0	0	-2	-2	3	0	
Neutral grassland	6	1	2	-4	-3	0	0	0	-2	-2	3	0	
Acid grassland	8	1	2	-4	-3	0	0	0	-2	-2	3	0	
Heather, dwarf shrub	10	3	4	-2	-1	2	2	2	0	0	5	0	
Heather grass	11	3	4	-2	-1	2	2	2	0	0	5	0	
Bog	12	-2	-1	-7	-6	-3	-3	-5	-5	0	0	0	
Montane	13	0	0	0	0	0	0	0	0	0	0	0	

Weight of this function  
in comparison to others  
(spatial or non-spatial)

Land functions in the tool	Weights
Glob.Clim.Reg.Carbon	0.1
Water cycling - Purification	0.1
Water cycling - Nutrient	0.1
Erosion Regulation	0.1
Woodland Connectivity	0.1
Production - Crops	0.1
Production - Fodder	0.1
Production - Timber	0.1
visual amenity and recreation	0.1
Landscape cultural heritage	0.1



CID	CIDname	Regulating services					Provisioning services			Cultural services	
		Glob. Clim. Reg. Carbon	Water cycling - Purification	Water cycling - Nutrient	Erosion Regulation	Woodland Connectivity	Production - Crops	Production - Fodder	Production - Timber	visual amenity and recreation	Landscape cultural heritage
1	Broadleaved, mixed	6	5	5	5	7	0	1	5	5	4
2	Coniferous	7	5	5	5	4	0	1	5	5	4
3	Arable	1	0	1	0	2	5	3	0	1	3
4	Imp. grassland	2	0	1	1	2	0	5	0	2	3
5	Rough grassland	5	3	4	5	2	0	2	0	4	3
6	Neutral grassland	5	3	4	5	2	0	2	0	4	3
8	Acid grassland	5	3	4	5	2	0	2	0	4	3
10	Heather, dwarf shrub	3	3	3	2	4	0	1	0	4	2
11	Heather grass	3	3	3	2	4	0	1	0	4	2
12	Bog	8	4	4	2	2	0	0	0	2	2
13	Montane	0	0	0	0	0	0	0	0	0	0
14	Inland rock	0	0	0	0	0	0	0	0	0	0
15	Salt water	0	0	0	0	0	0	0	0	0	0
16	Freshwater	0	0	0	0	0	0	0	0	0	0
18	Supra-littoral sediment	0	0	0	0	0	0	0	0	0	0
19	Littoral rock	0	0	0	0	0	0	0	0	0	0
20	Littoral sediment	0	0	0	0	0	0	0	0	0	0
21	Saltmarsh	0	0	0	0	0	0	0	0	0	0
22	Urban	0	0	0	0	0	0	0	0	0	0
23	Suburban	0	0	0	0	0	0	0	0	0	0

Exemplary ecosystem service potential matrix, after Burkhard et al. 2009 and 2012.

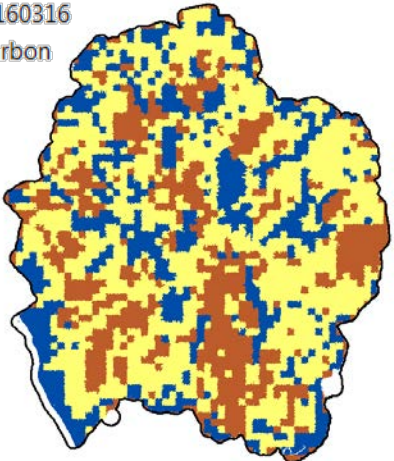
- For each land function in the tool: 3 components

An Opportunity map

- 0 : no land use change
- 0.2 : low probability of land use change
- 0.5 : high probability of land use change

☒ OpportunityMaps\_160316  
GlobClimRegCarbon

- 0
- 0.2
- 0.5



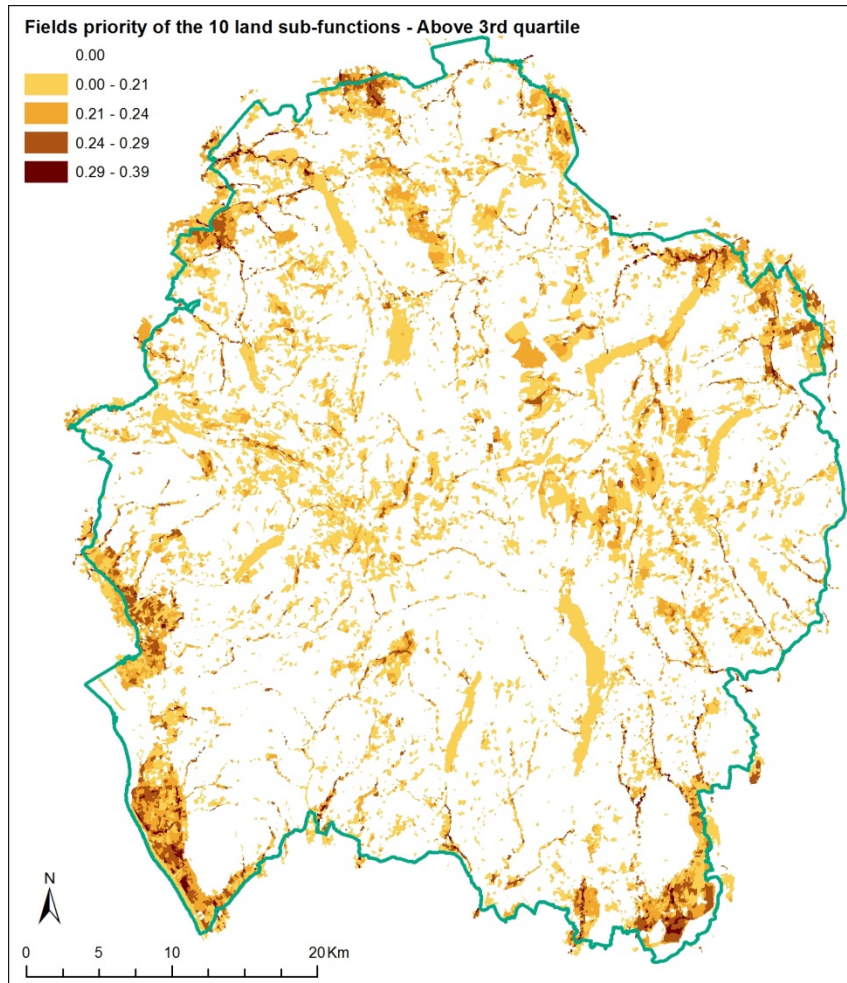
Land use transitions matrix using Scores

Glob.Clim.Reg.Carbon (scores)													
	Broadleaved, mixed	Coniferous	Arable	Imp. grassland	Rough grassland	Neutral grassland	Acid grassland	Heather, dwarf shrub	Heather grass	Bog	Montane		
	1	2	3	4	5	6	8	10	11	12	13		
Broadleaved, mixed	1	0	1	-5	-4	-1	-1	-3	-3	2	0		
Coniferous	2	-1	0	-6	-5	-2	-2	-4	-4	1	0		
Arable	3	5	6	0	1	4	4	2	2	7	0		
Imp. grassland	4	4	5	-1	0	3	3	1	1	6	0		
Rough grassland	5	1	2	-4	-3	0	0	0	-2	-2	3	0	
Neutral grassland	6	1	2	-4	-3	0	0	0	-2	-2	3	0	
Acid grassland	8	1	2	-4	-3	0	0	0	-2	-2	3	0	
Heather, dwarf shrub	10	3	4	-2	-1	2	2	2	0	0	5	0	
Heather grass	11	3	4	-2	-1	2	2	2	0	0	5	0	
Bog	12	-2	-1	-7	-6	-3	-3	-5	-5	0	0	0	
Montane	13	0	0	0	0	0	0	0	0	0	0	0	

Weight of this function  
in comparison to others  
(spatial or non-spatial)

Land functions in the tool	Weights
Glob.Clim.Reg.Carbon	0.1
Water cycling - Purification	0.1
Water cycling - Nutrient	0.1
Erosion Regulation	0.1
Woodland Connectivity	0.1
Production - Crops	0.1
Production - Fodder	0.1
Production - Timber	0.1
visual amenity and recreation	0.1
Landscape cultural heritage	0.1

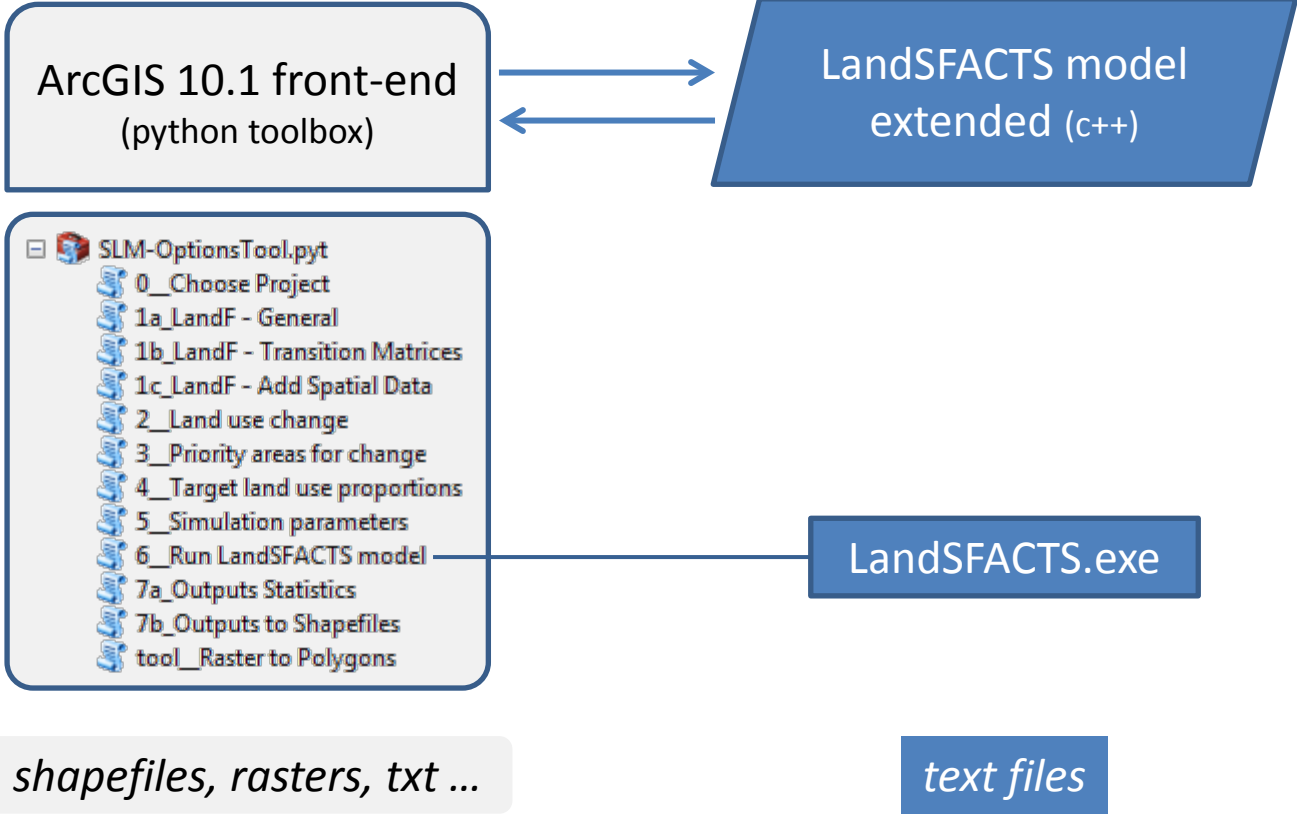
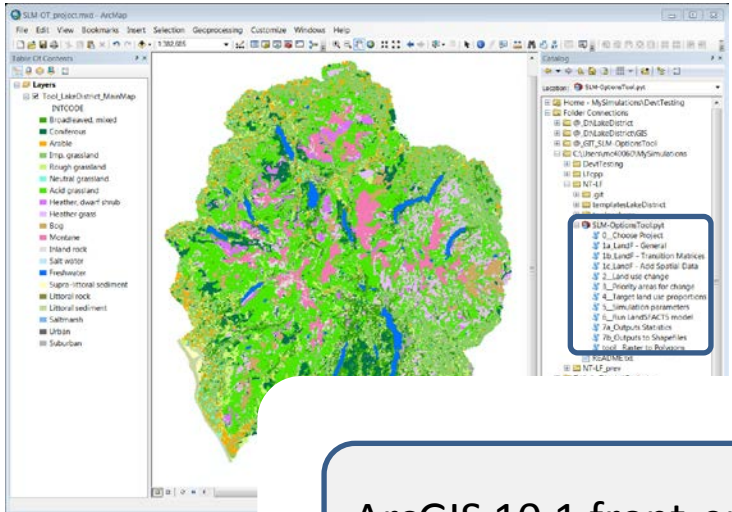
**Priority value for each polygon** = Sum of all land functions  
( Opportunity map × Weight )



3 maps with different thresholds:

- all
- above average
- above 3<sup>rd</sup> quartile

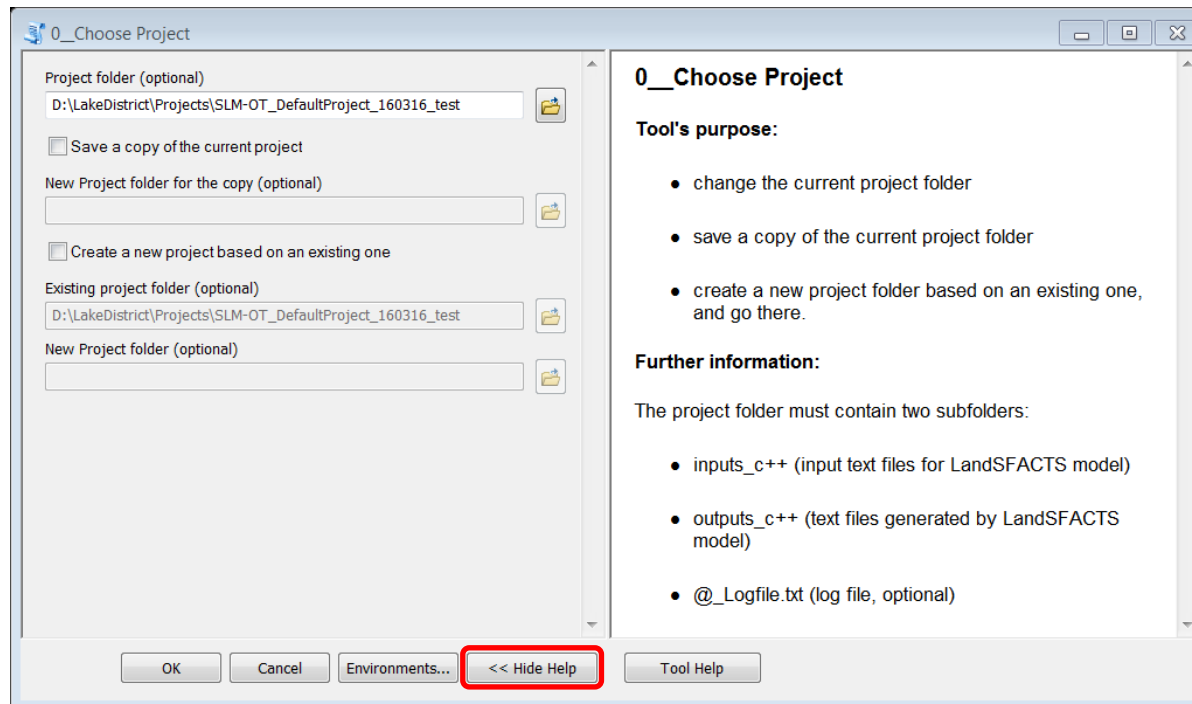
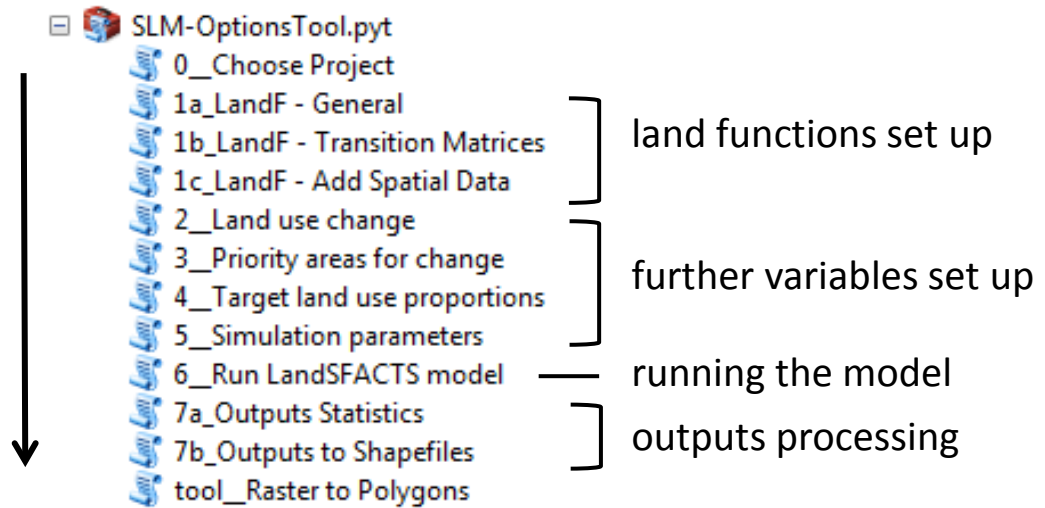
**High priority value  
→ high probability of  
land use change**



- SLM-OptionsTool.pyt
  - 0\_Chose Project
  - 1a\_LandF - General
  - 1b\_LandF - Transition Matrices
  - 1c\_LandF - Add Spatial Data
  - 2\_Land use change
  - 3\_Priority areas for change
  - 4\_Target land use proportions
  - 5\_Simulation parameters
  - 6\_Run LandSFACTS model
  - 7a\_Outputs Statistics
  - 7b\_Outputs to Shapefiles
  - tool\_Raster to Polygons



To be followed in order,  
some can be skipped



Help window  
for every tool

tool\_\_Raster to Polygons

Project folder  
C:\Users\mc40060\MySimulations\DevTesting\SLM-OT\_DefaultProject\_120416\_allfunctions\_wood10000\_Water\_FPab3Q\_PH

Original shapefile  
C:\Users\mc40060\MySimulations\NT-LF\templatesLakeDistrict\Tool\_LakeDistrict\_MainMap.shp

From shapefile: unique polygon ID (e.g. PlgID)  
PlgID

From shapefile: Area (e.g. CalcArea)  
CalcArea

To fill table: select input Raster (optional)  
D:\LakeDistrict\GIS\MAP4LUC\LUC\_carbon.tif

To fill table: new column name in the output shapefile (optional)  
carbon

List of rasters to process (automatically filled up)

Raster	NewColName
D:\LakeDistrict\GIS\MAP4LUC\LUC_arable.tif	arable
D:\LakeDistrict\GIS\MAP4LUC\LUC_timber.tif	timber
D:\LakeDistrict\GIS\MAP4LUC\LUC_grassland.tif	fodder

Output shapefile name  
NewShapefile.shp

OK Cancel Environments... Show Help >>

1a\_LandF - General

Project folder

D:\LakeDistrict\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000

Land Functions status

ConditionID	Name	Activated (true/false)	Non-Spatial weight	Spatial weight	Opportunity map	Transition matrice
10	Glob.Clim.Reg.Carbon	true	0.1	not present	present	valid
11	Water cycling - Purification	true	0.1	not present	present	valid
12	Water cycling - Nutrient	true	0.1	not present	present	valid
13	Erosion Regulation	true	0.1	not present	present	valid
14	Woodland Connectivity	true	0.1	not present	present	valid
15	Production - Crops	true	0.1	not present	present	valid
16	Production - Fodder	true	0.1	not present	present	valid
17	Production - Timber	true	0.1	not present	present	valid

Information: Detailed information on why a given transition matrice is 'not valid' (optional)

OK

Cancel

Environments...

Show Help >>

17	Production - Timber	true	0.1	not present	present	valid
18	Landscape Cultural Heritage	true	0.1	not present	present	valid
19	Visual Amenity and Recreation	true	0.1	not present	present	valid

ArcGIS toolbox

SLM-OptionsTool.pyt

0\_Chose Project

1a\_LandF - General

1b\_LandF - Transition Matrices

1c\_LandF - Add Spatial Data

2\_Land use change

Land functions – Add TM & Spatial Data

1b\_LandF - Transition Matrices

Project folder

C:\Users\mc40060\MySimulations\DevTesting\SLM-OT\_DefaultProject\_120416\_allfunctions\_wood10000\_Water\_FPa

Select a land function to display

10 - 'Glob.Clim.Reg.Carbon'

1c\_LandF - Add Spatial Data

Project folder

C:\Users\mc40060\MySimulations\DevTesting\SLM-OT\_DefaultProject\_120416\_allfunctions\_wood10000\_Water\_FPa

From current project, select land function and spatial data (optional)

From the log file, latest import is (optional)

2016-03-16 11:24:27 - updated for 11-Watercycling-Purification\_\_Opportunity with attribute WATERPUR from C:\Users\mc4

Shapefile with spatial data to import (optional)

C:\Users\mc40060\MySimulations\NT-LF\templatesLakeDistrict\OpportunityMaps\OpportunityMaps\_160316.shp

From shapefile, select unique polygon ID column, e.g. PlgID (optional)

PlgID

From shapefile, select column with land function to import (optional)

Automatically filled up: list of all data to import

Shapefile	PlgID	Field to import	ConditionID-Name-O/SW
C:\\Users\\mc40060\\...	PlgID	CARBON	10-Glob.Clim.Reg.Carbon...
C:\\Users\\mc40060\\...	PlgID	WATERPUR	11-Watercycling-Purificat...

James  
tton  
stitute





3\_Priority areas for change

Project folder  
C:\Users\mc40060\MySimulations\DevTesting\SLM-OT\_DefaultProject\_120416\_allfunctions\_wood10000\_FPabove3rd

☒ Priority ranking of polygons: Use for all activated land functions, their Opportunity map x non-spatial weight

☐ Priority ranking of polygons: Import directly from a single shapefile (0: no land use change authorised, >0 <= 1: probabil

Shapefile with spatial data to import (optional)  
C:\Users\mc40060\MySimulations\NT-LF\templatesLakeDistrict\Non-changeableAreasMaps\NonChangeableAreas\_11

From shapefile, select unique polygon ID column, e.g. PlgID (optional)  
PlgID

From shapefile, select column defining the priority ranking (continuum for changeable = 0 to non-changeable = 1) (optional)

☒ Impose an exclusion zone: areas without any land use change

Shapefile with spatial data to import (optional)  
C:\Users\mc40060\MySimulations\NT-LF\templatesLakeDistrict\LakeDistrict\_PriorityAreasForchange\_120416.shp

From shapefile, select unique polygon ID column, e.g. PlgID (optional)  
PlgID

From shapefile, select column defining non-changeable areas (binary data only with changeable = 0; non-changeable = 1) ...  
PRIOR\_HAB

Select a threshold to be applied to priority values  
Above 3rd quartile

From the log file, latest import for (Non)changeable areas (optional)  
2016-04-14 12:34:20 - (Non)changeable Areas, Opportunity\*weights :: 'Opport' used 10 land functions (10; 11; 12; 13; 14;

OK Cancel Environments... Show Help >>

Land functions are selected

Protected habitats are excluded from land use change (*just an example*)

Only values above 3<sup>rd</sup> quartile are kept

- Target land use areas (ha) in the landscape are driving the land use changes, e.g. all woodlands (Broadleaved + Coniferous) must increase by 10,000ha

**4\_Target land use proportions**

Project folder  
D:\LakeDistrict\FORUSB\SLM-OptionsTool\_package\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000

Target land use proportions (wait 1-2s for updates) (optional)

ConditionID	Name	Land use group	Current area (ha)	Percentage of landscape	Minimum (ha)	Maximum (ha)
5	allwood_+10,000ha	30-All woods	39328.709	15.63	49328.709	50000

To add a new line to the table, select a land use name or group (optional)

For info: Landscape Area (ha) (optional)  
2516556233.7386

**a\_View a land use group**  
select a land use group to display (optional)  
30-All woods

All land uses in the above group (optional)  
1-Broadleaved, mixed; 2-Coniferous

**b\_Add a land use group**

OK Cancel Environments... Show Help >>

5\_Simulation parameters

Project folder  
D:\LakeDistrict\ForUSB\SLM-OptionsTool\_package\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000

Activating/Disactivating conditions in the project

ConditionID	Condition type	Name	Activated (true/false)
5	target land use proportions	allwood_+10,000ha	true
10	land Functions	Glob.Clim.Reg.Carbon	true
11	land Functions	Water cycling - Purification	true
12	land Functions	Water cycling - Nutrient	true
13	land Functions	Erosion Regulation	true
14	land Functions	Woodland Connectivity	true
15	land Functions	Production - Crops	true
16	land Functions	Production - Fodder	true

Frozen land uses (not subject to land use change)

CID	Land uses	Frozen (true 1 /false 0)
1	Broadleaved, mixed	false
2	Coniferous	false
3	Arable	true
4	Imp. grassland	false
5	Rough grassland	false
6	Neutral grassland	false
8	Acid grassland	false
10	Heather, dwarf shrub	false

Number of simulations to be run as a Batch (maximum 10)

1

Advanced parameters

Very advanced parameters

OK Cancel Environments... Show Help >>

All land functions & target land use proportions can be activated/disactivated.

Land uses can be frozen,  
e.g. here Arable land is protected from change.

Number of simulations (no maximum in reality)



6\_Run LandSFACTS model

Project folder  
D:\LakeDistrict\ForUSB\SLM-OptionsTool\_package\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000

LandSFACTS .exe  
C:\Users\mc40060\MySimulations\NT-LF\NoConsoleExe\_x64\_5383a51.exe

Simulation name  
AllFunctions\_wood10000

☒ Create shapefile and display

Original shapefile (optional)  
C:\Users\mc40060\MySimulations\NT-LF\templatesLakeDistrict\Tool\_LakeDistrict\_MainMap.shp

Unique polygon ID (e.g. PlgID) (optional)  
PlgID

Name of output shapefile (optional)  
D:\LakeDistrict\ForUSB\SLM-OptionsTool\_package\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000\res

☒ Create Land use change shapefile and display

Name of output land use change shapefile (optional)  
D:\LakeDistrict\ForUSB\SLM-OptionsTool\_package\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000\LU

☐ Create statistic files

Name of output statistics file (.txt) (optional)  
D:\LakeDistrict\ForUSB\SLM-OptionsTool\_package\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000\St

OK Cancel Environments... Show Help >>

— Name of the simulation

Create and display  
land use maps and  
land use change maps

6\_Run LandSFACTS model

Completed

Close

<< Details

☐ Close this dialog when completed successfully

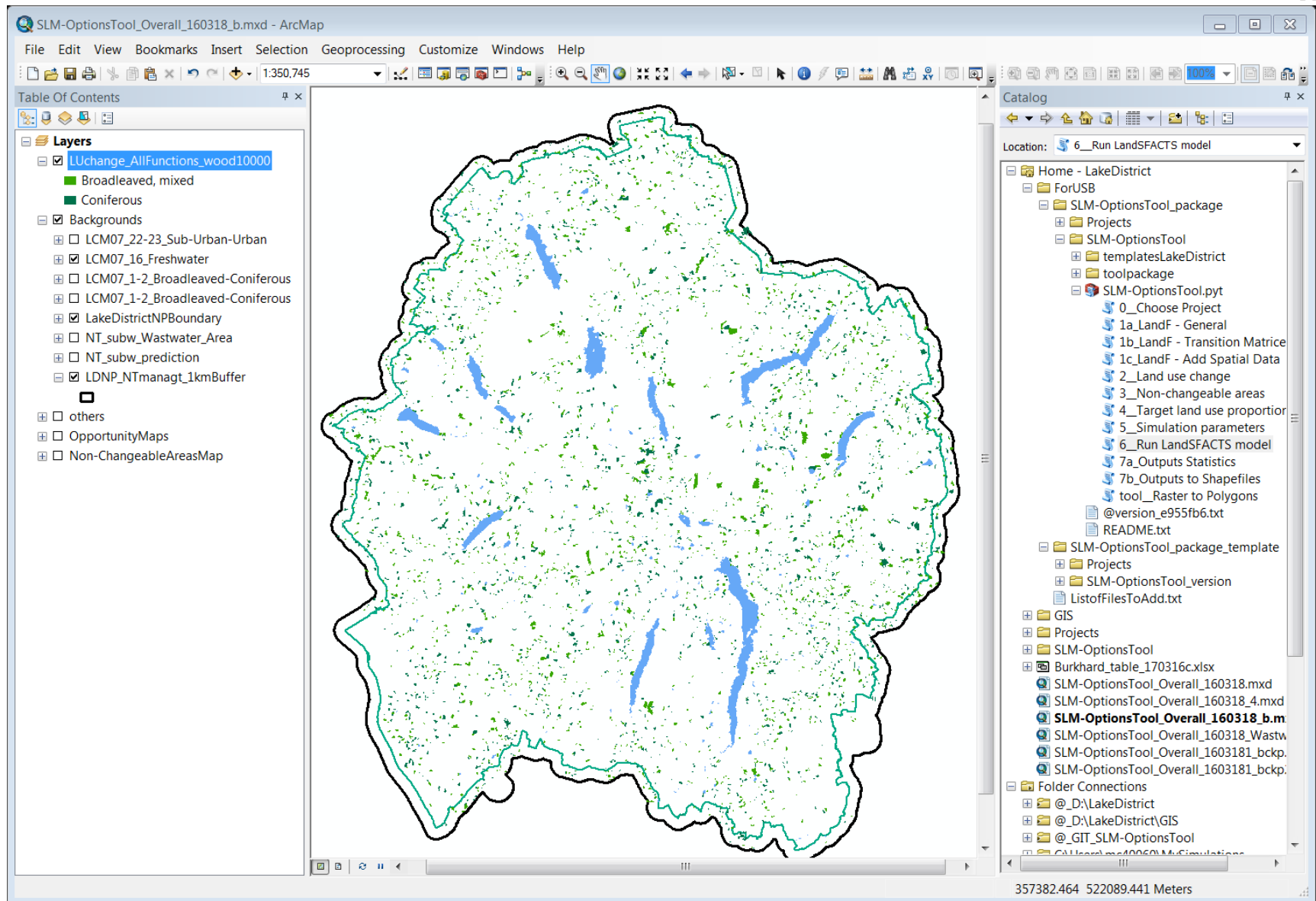
```
Executing: RunLF C:\Users\mc40060\MySimulations\DevTesting\SLM-OT_150416_allLF_wood10000
_FPopAb3rdQ_exclPH C:\Users\mc40060\MySimulations\NT-LF\NoConsoleExe_x64_539bebb.exe LF10Ab3rdQexcPH
true C:\Users\mc40060\MySimulations\NT-LF\templatesLakeDistrict\Tool_LakeDistrict_MainMap.shp PlgID C:
\Users\mc40060\MySimulations\DevTesting\SLM-OT_150416_allLF_wood10000_FPopAb3rdQ_exclPH
\result_LF10Ab3rdQexcPH.shp true C:\Users\mc40060\MySimulations\DevTesting\SLM-OT_150416
_allLF_wood10000_FPopAb3rdQ_exclPH\LUchange_LF10Ab3rdQexcPH.shp false C:\Users\mc40060\MySimulations
\DevTesting\SLM-OT_150416_allLF_wood10000_FPopAb3rdQ_exclPH\Stats\stats_LF10Ab3rdQexcPH.txt
Start Time: Fri Apr 15 17:50:45 2016
Running script RunLF...
Emptying outputs_c++ folder...
LandSFACTS is running...
LandSFACTS ran without error.

Summary of the simulation run:
-----
- simulation 0 was successful.
-----

Output shapefile is being created...
newShpName : C:\Users\mc40060\MySimulations\DevTesting\SLM-OT_150416_allLF_wood10000_FPopAb3rdQ_exclPH
\result_LF10Ab3rdQexcPH.shp
Output Land Use Change shapefile is being created...
Shp2Name: LUchange_LF10Ab3rdQexcPH.shp
No output statistic file created.
Completed script RunLF...
Succeeded at Fri Apr 15 17:54:25 2016 (Elapsed Time: 3 minutes 40 seconds)
```



- Land use map with only changed land uses



7a\_Outputs Statistics

Project folder

D:\LakeDistrict\ForUSB\SLM-OptionsTool\_package\Projects\SLM-OT\_DefaultProject\_160316\_allfunctions\_wood10000

Select a result file to display its statistics

log\_FinalCropAllocID\_0.txt

Select a statistics set (wait 1-2s for display in the box and table)

Per Land uses

Statistics (table to view only) (optional)

Land uses	Stat1	Stat2	Stat3	Stat4	Stat5
LandUse	Gain-Loss Area	Initial Area	Final Area	Initial Perc	Final Perc
1-Broadleave...	20.33	250317316	301219150	9.95	11.97
2-Coniferous	34.34	142969774	192070322	5.68	7.63
3-Arable	0	95802139	95802139	3.81	3.81
4-Imp. grassl...	-6.12	564658434	530019103	22.44	21.06
5-Rough gras...	-6.43	171898771	160827309	6.83	6.39
6-Neutral gra...	-4.75	13705080	13052455	0.54	0.52
8-Acid grassl...	-5.70	651802728	612082214	25.0	24.4

Select a statistics set (wait 1-2s for display in the box and table)

Per Land use change

Statistics (table to view only) (optional)

Land uses	Stat1	Stat2	Stat3	S
LandUse change	Area	Perc in Landscape	Number of poly...	
1-Broadleaved, mixed => 1-Broadleaved, mixed	250317316	9.95	13800	
2-Coniferous => 2-Coniferous	142969774	5.68	6290	
3-Arable => 3-Arable	95802139	3.81	4858	
4-Imp. grassland => 1-Broadleaved, mixed	16642997	0.66	800	
4-Imp. grassland => 2-Coniferous	17996333	0.72	823	
4-Imp. grassland => 4-Imp. grassland	530019103	21.06	24564	
5-Rough grassland => 1-Broadleaved, mixed	5205202	0.21	207	

OK

Cancel

Environments...

Show Help >>



## 2 scenarios based on woodland expansion:

### a) Enhancing water cycling

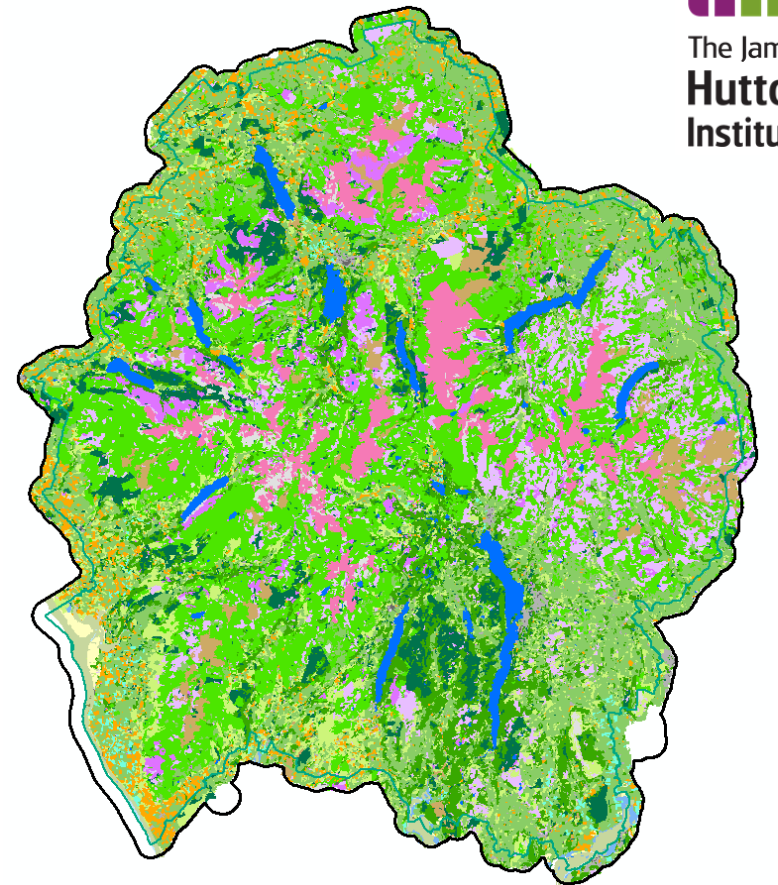
- 3 land functions:
  - water cycling – purification
  - water cycling – nutrient
  - erosion regulation
- 2 sub-scenarios

### b) Enhancing all 10 land functions

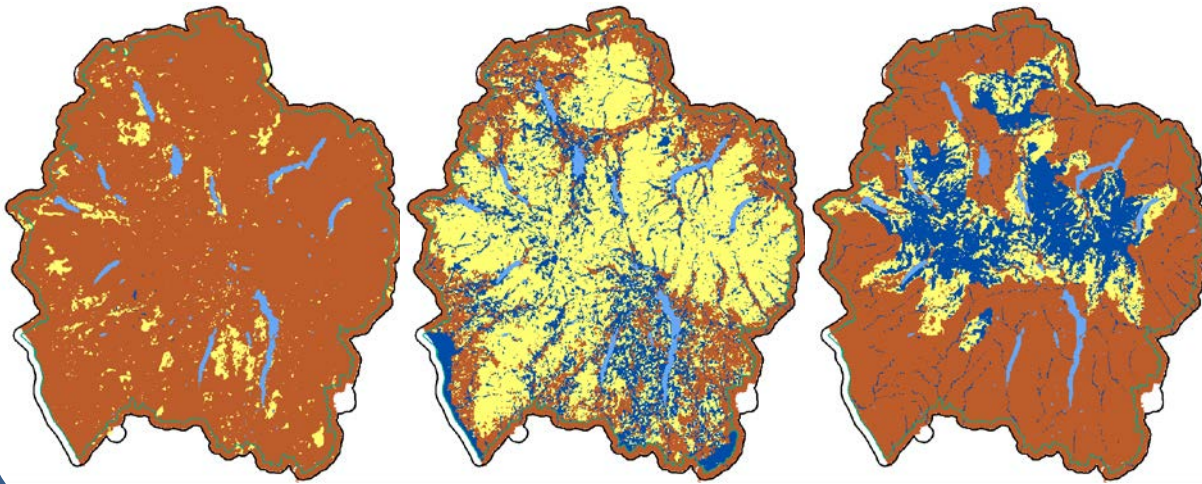
- Highlight complexity  
& output variability



- LCM2007 (vector)
- Woodland expansion (10,000ha)
- No arable decrease
- 3 land functions with equal weights
  - water cycling – purification
  - water cycling – nutrient
  - erosion regulation



- 0 : no land use change
- 0.2 : low probability of land use change
- 0.5 : high probability of land use change



Land functions in the tool	Weights
Glob.Clim.Reg.Carbon	0.34
Water cycling - Purification	0.34
Water cycling - Nutrient	0.33
Erosion Regulation	0.33
Woodland Connectivity	0.33
Production - Crops	0.33
Production - Fodder	0.33
Production - Timber	0.33
Visual amenity and recreation	0.33
Landscape cultural heritage	0.33

[illegible][illegible][illegible]



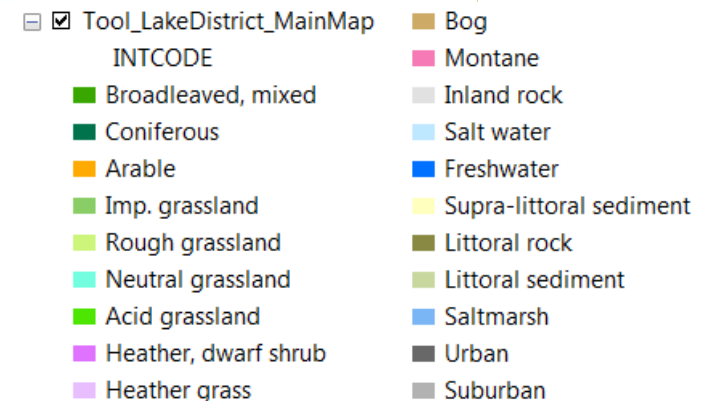
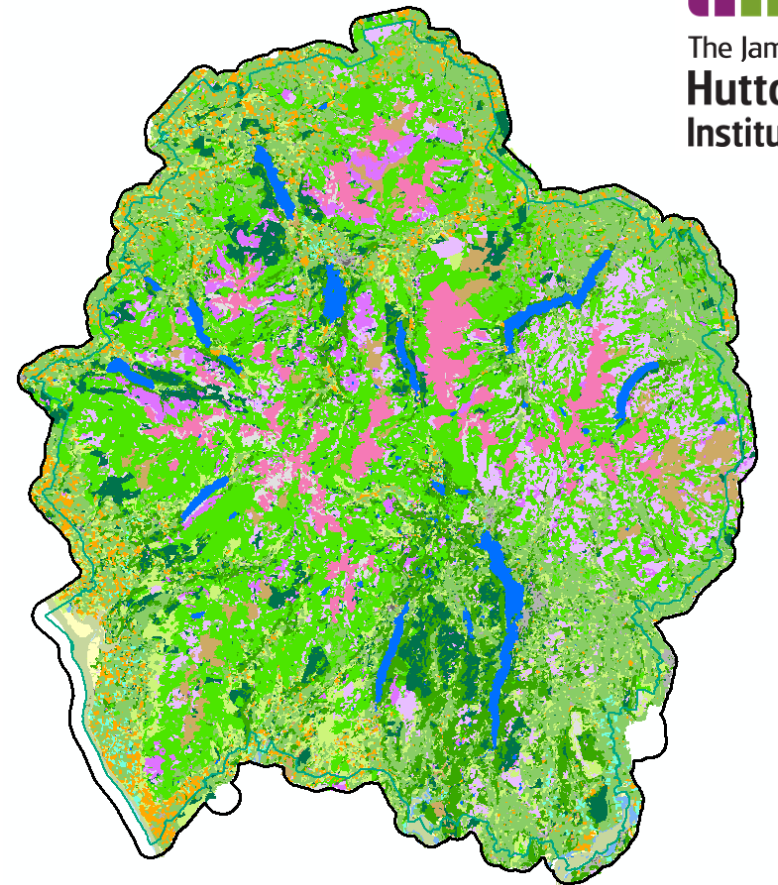
- LCM2007 (vector)
- Woodland expansion (10,000ha)
- No arable decrease
- 3 land functions with equal weights
  - water cycling – purification
  - water cycling – nutrient
  - erosion regulation
- **Priority areas for LU change, 2 sub-scenarios :**

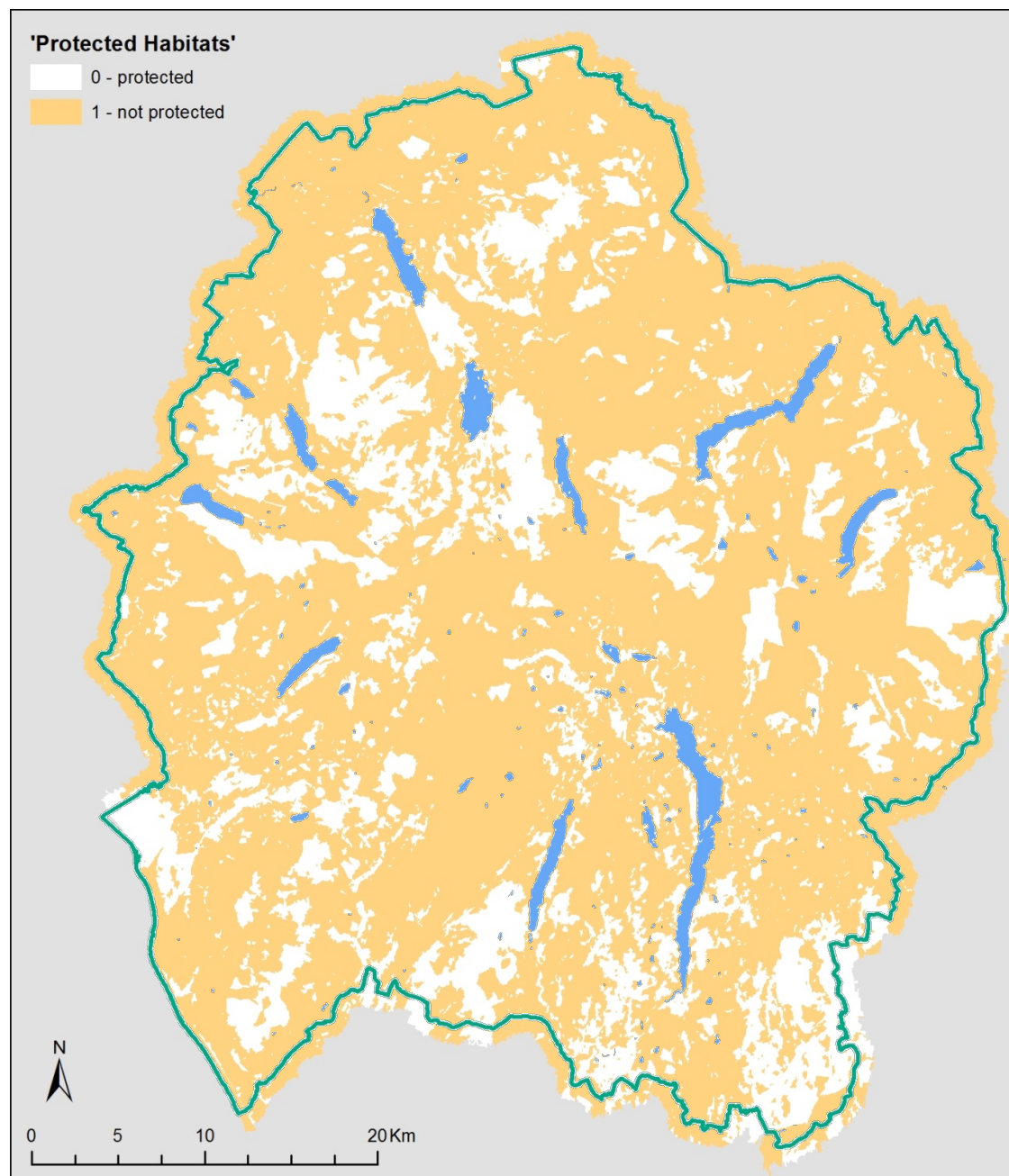
**a<sub>1</sub>) 'Protected Habitats' with no LU change**

**a<sub>2</sub>) Protected Habitats' with no LU change**

**+ Priority areas for LU change**

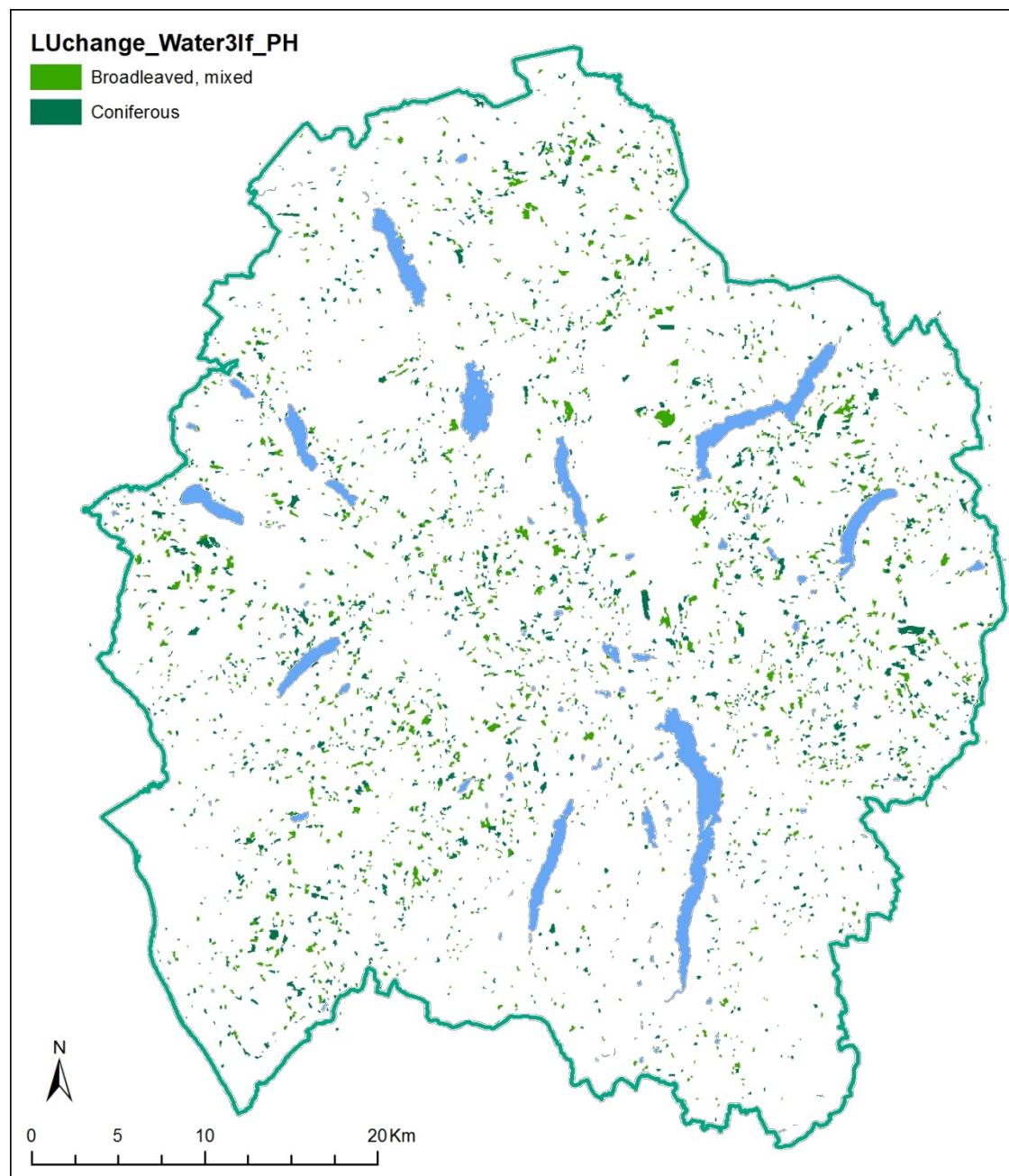
- 3 land functions
- values above 3<sup>rd</sup> quartile only
- excludes priority habitats





'Protected  
Habitats'  
with no LU change



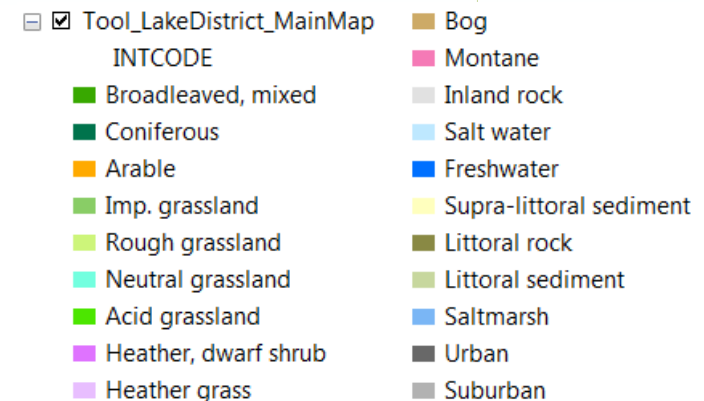
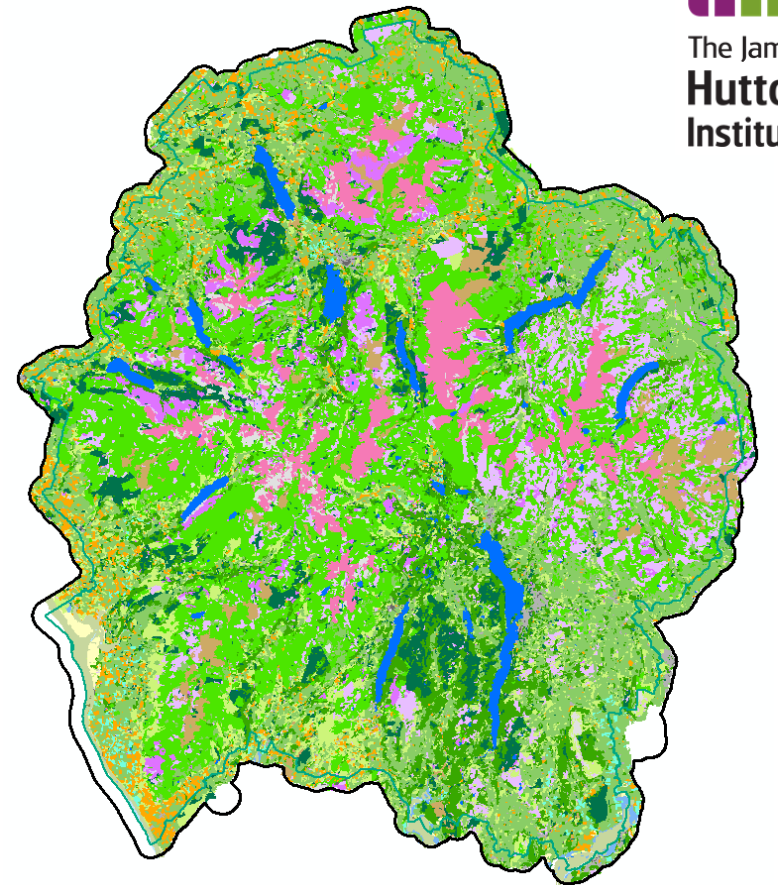


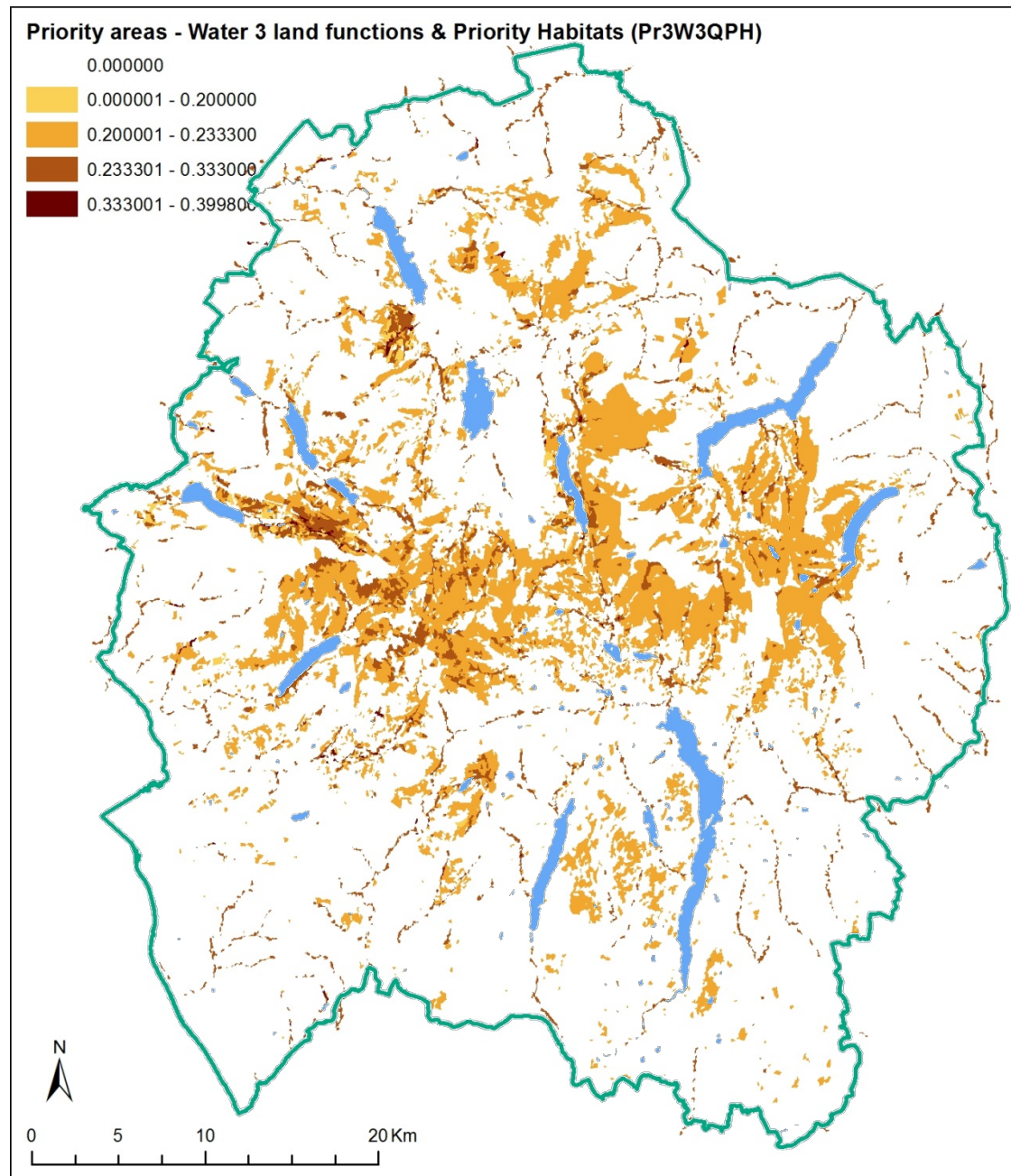
- LCM2007 (vector)
- Woodland expansion (10,000ha)
- No arable decrease
- 3 land functions with equal weights
  - water cycling – purification
  - water cycling – nutrient
  - erosion regulation
- **Priority areas for LU change, 2 sub-scenarios :**
  - a<sub>1</sub>) 'Protected Habitats' with no LU change

**a<sub>2</sub>) 'Protected Habitats' with no LU change**

+ Priority areas for LU change

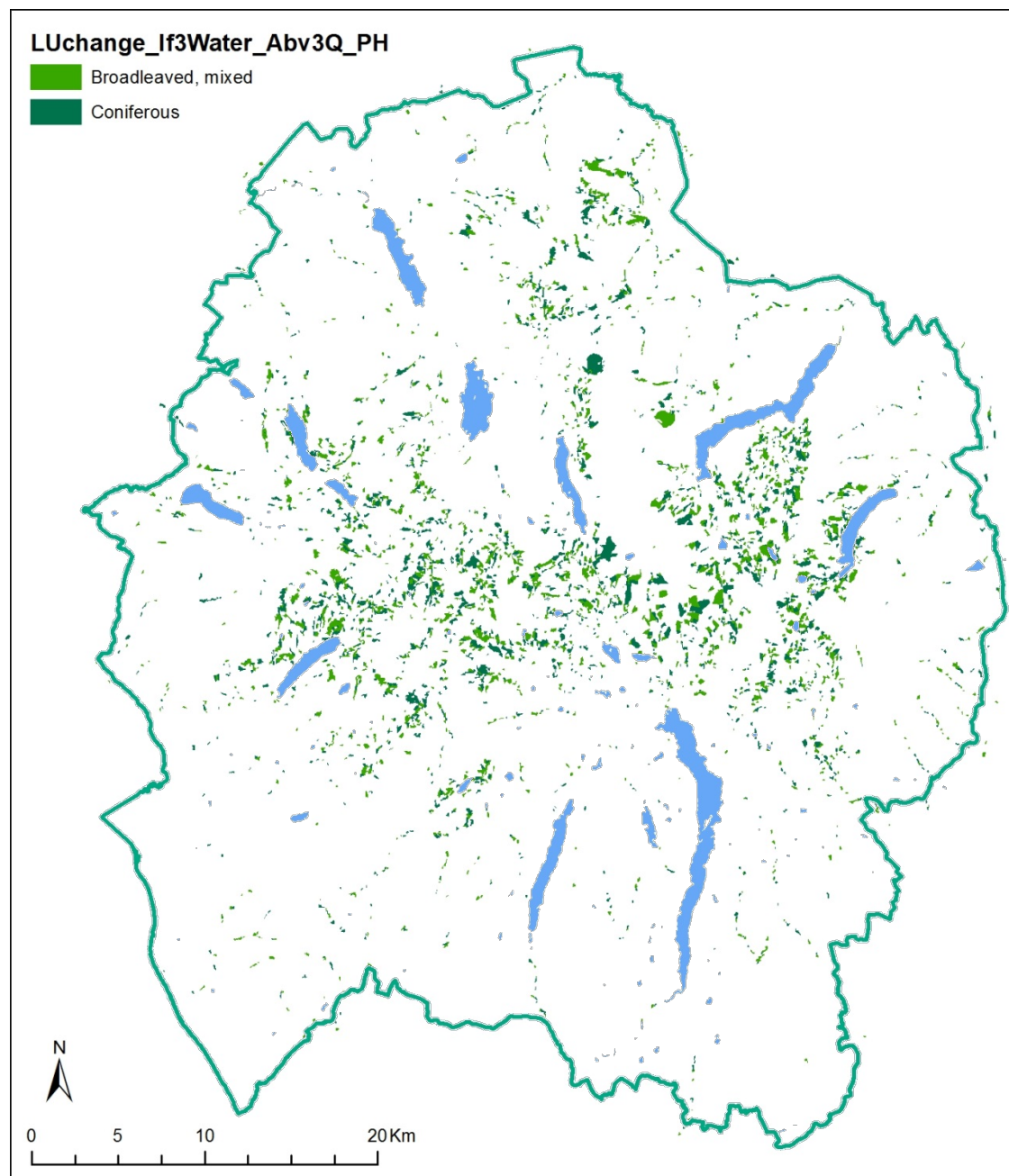
- 3 land functions
- values above 3<sup>rd</sup> quartile only
- excludes priority habitats



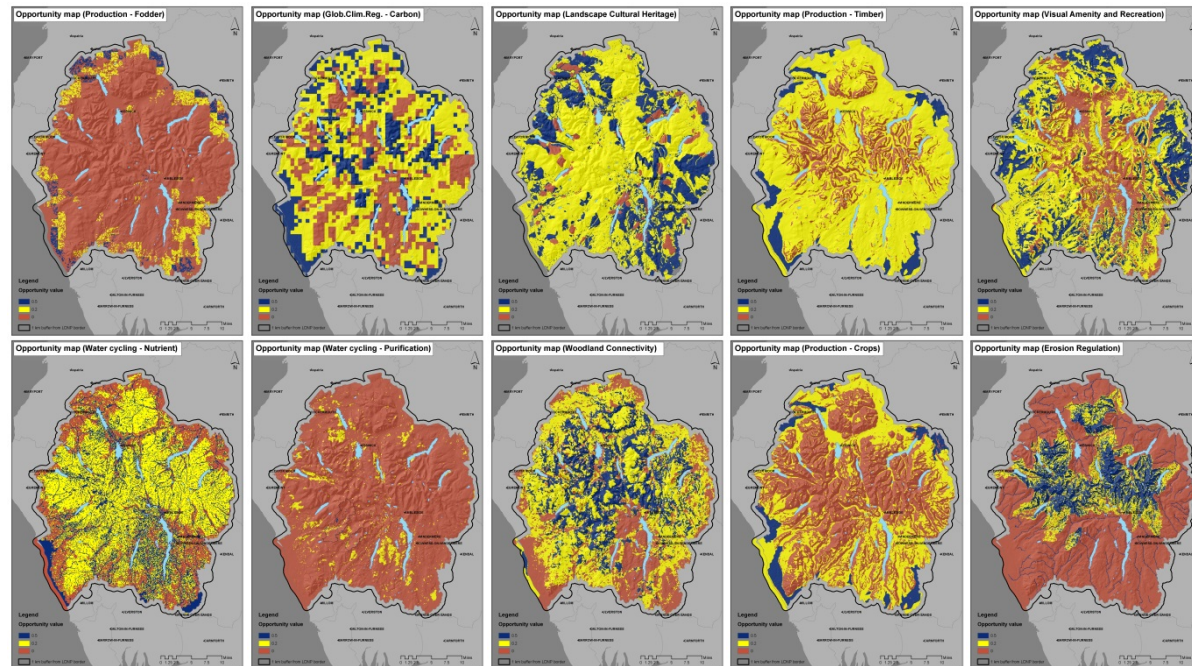


combines 3 land  
function  
opportunity maps  
+ only above 3<sup>rd</sup>  
quartile  
+ 'Protected  
Habitats'  
with no LU change



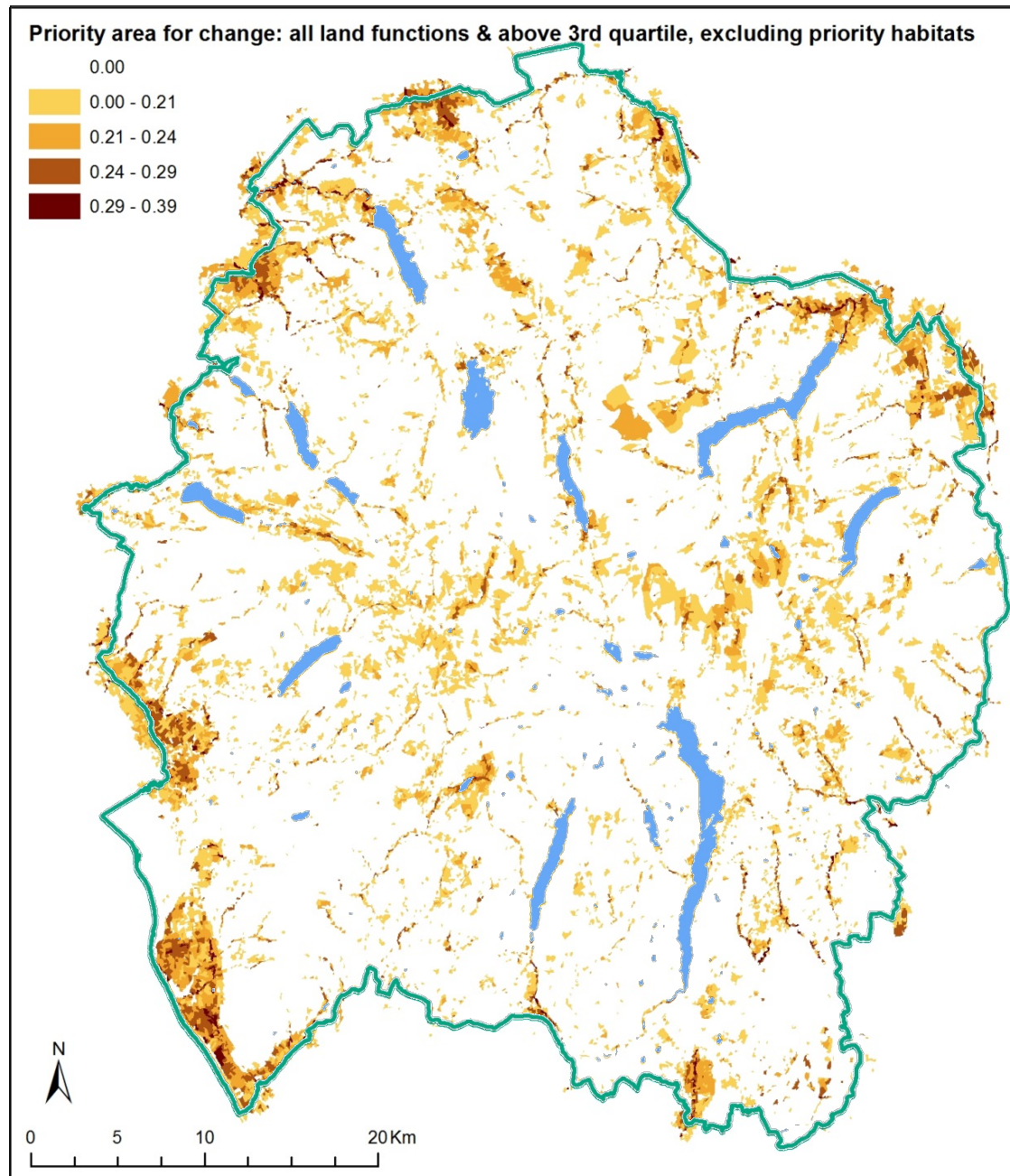


- LCM07 (vector)
- Woodland expansion (10,000ha)
- No arable decrease
- Considers 10 land functions (opportunity & matrices), equal weight



- Priority areas for LU change:
  - 10 land functions
  - values above 3<sup>rd</sup> quartile only
  - excludes priority habitats

## b) 10 land functions scenario, priority areas

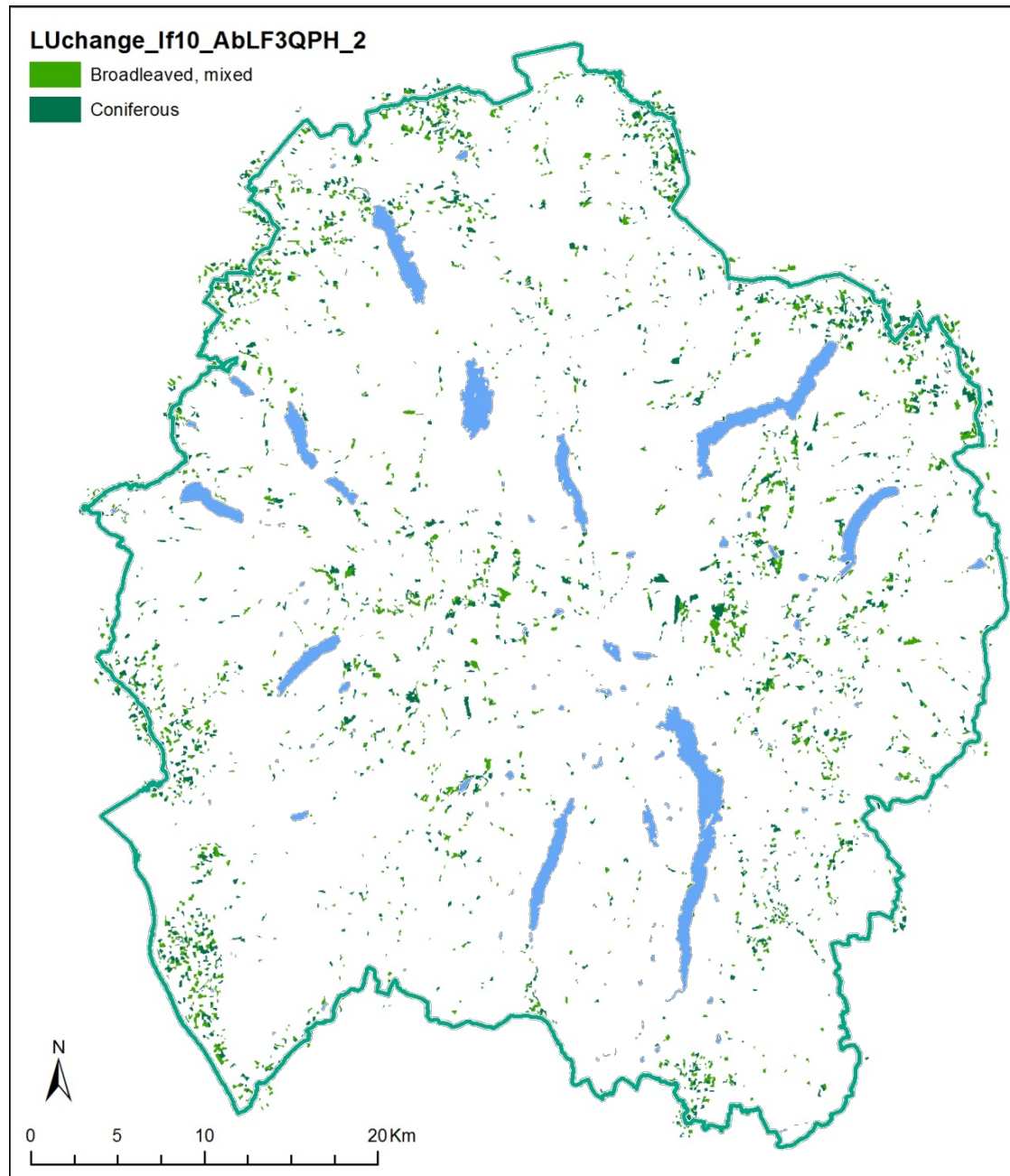


10 land function  
opportunity maps

+ only above 3<sup>rd</sup>  
quartile

+ 'Protected  
Habitats'  
with no LU change





**Spatial variability of the whole model set up, including:**  
land functions  
transition matrices

**more complex models could include:**  
land capability,  
regional/cooperative targets of land uses, regional preferences on land use transitions...

- **for ArcGIS front-end tool**
  - further output interpretation tools
    - assessment of land function status of new landscape (relative)
    - if multiple runs: summary map over all new landscapes
    - export for GoogleEarth
  - interface enhancements beyond NT project
    - allow new base map (i.e. outside of Lake District)
    - allow new land use classes (e.g. to include land management)
    - multi-years scenarios...
- **Potential new projects**
  - its implementation in Scotland for scenario development and analyses
- **Let us know if further ideas or funding**



Many Thanks for your  
Attention !

Contact:

[alessandro.gimona@hutton.ac.uk](mailto:alessandro.gimona@hutton.ac.uk)

[marie.castellazzi@hutton.ac.uk](mailto:marie.castellazzi@hutton.ac.uk)



The James  
**Hutton**  
Institute



National  
Trust