Introduction to River Architect

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Lifespan Mapping

Davis, CA | November 21, 2019

Lifespan Mapping with River Architect

Lifespan Mapping with River Architect

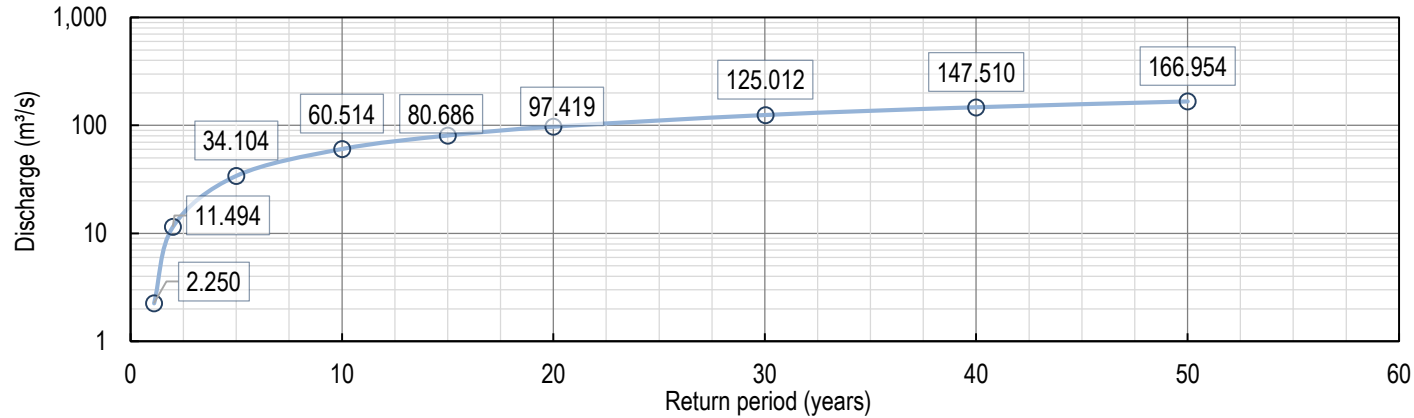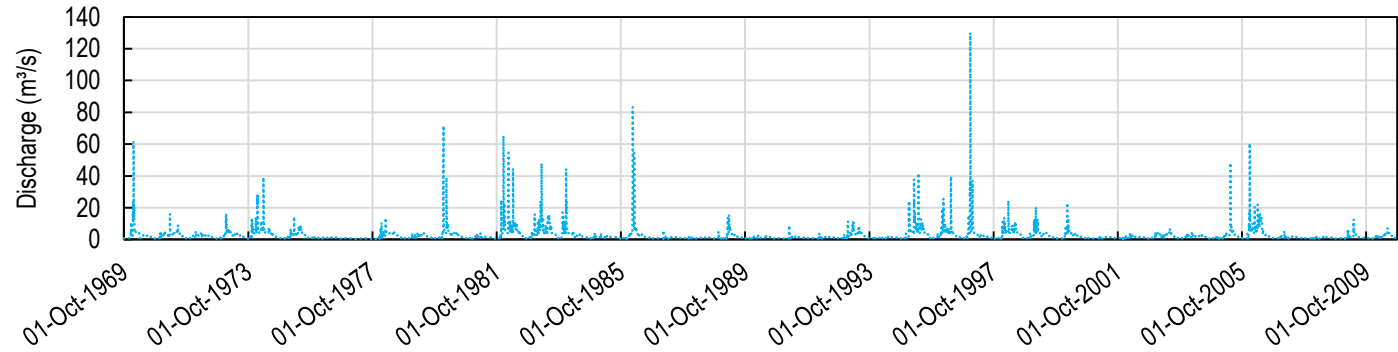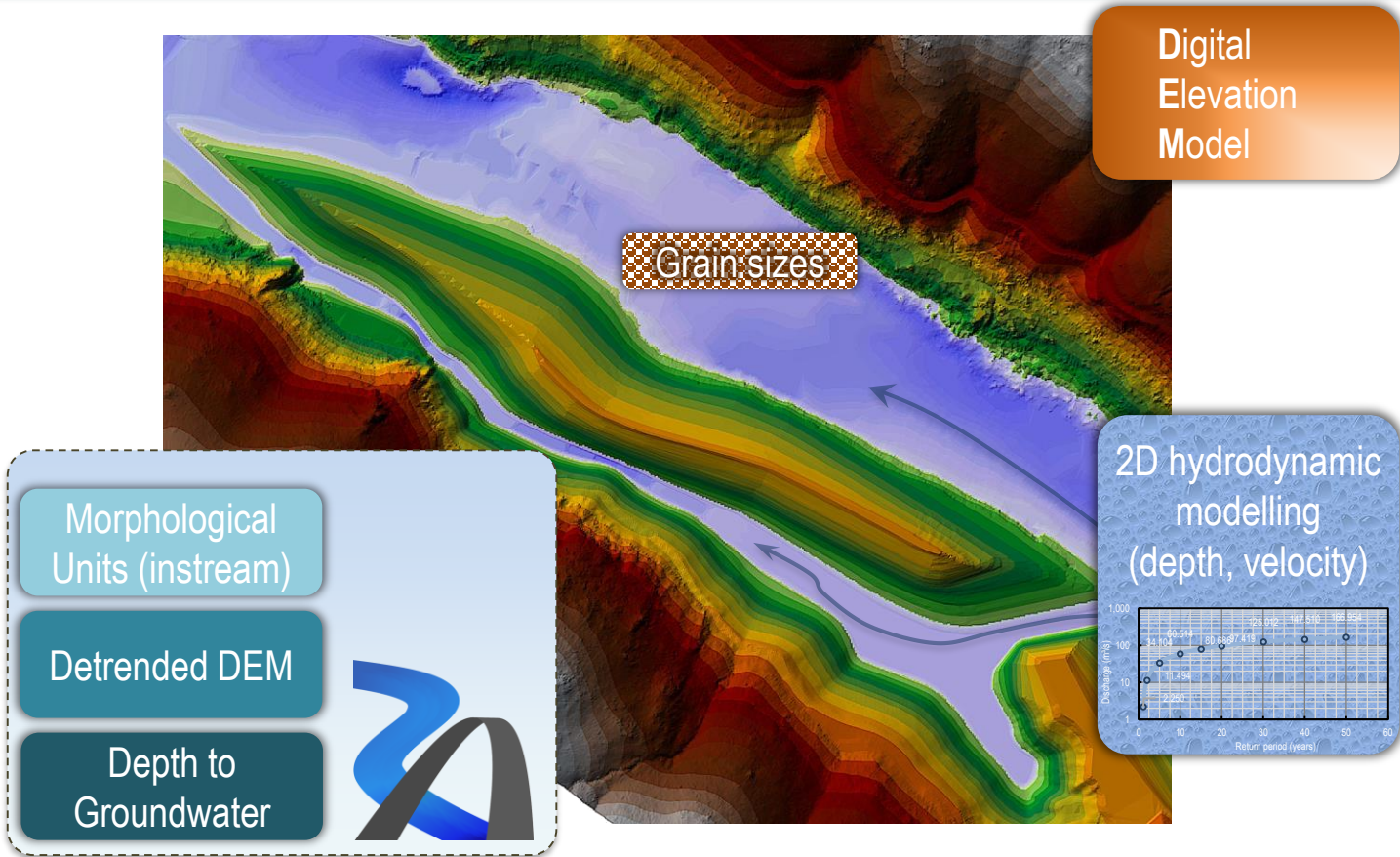Source: Schwindt, S., Pasternack G. B., Bratovich, P. M., Rabone, G., Simodynes, D. , 2019. Hydro-morphological parameters generate lifespan maps for stream restoration management. Journal of Environmental Management 232, 475-489. doi: 10.1016/j.jenvman.2018.11.010

Lifespan Mapping with River Architect

Lifespan Mapping with River Architect

Digital **E**levation **M**odel

Grain sizes

2D hydrodynamic modelling (depth, velocity)

Morphological Units (instream)

Detrended DEM

Depth to Groundwater

Lifespan Mapping with River Architect

▶ River design feature groups

GROUP 1: Berm setback, calm water zones, grading, side channels, bank scalloping

GROUP 2.1: Vegetation plantings & GROUP 2.2: other (soil) bioengineering

GROUP 3 – Longitudinal connectivity: Sediment budget modification, flow regulation, lateral barrier removal (not yet fully considered in River Architect)

▶ Parametrization: Survival threshold values

Parameter (unit)	Depth to ground water (m)	Dim.less bed shear stress (--)	Froude number (--)	Flow depth (m)	Flow velocity (m/s)	TCD: Fill (m/year)	TCD: Erosion (m/year)
Grading	2 - 4	0.047	na	na	na	na	0.01
Etc.	…	…	…	…	…	…	…

Lifespan Mapping with River Architect

► Sustainability Criteria – Thresholds

Feature Name	VEGETATION PLANTINGS				BIOENGINEERING (OTHER)		
	Box Elder	Cottonwood	White Alder	Willow	Streamwood	Angular boulders	Soil stabilization
Critical dimensionless bed shear str	0.047		0.047	0.100		0.047	
Depth to groundwater (min)	3.0	5.0	1.0	1.0			
Depth to groundwater (max)	6.0	10.0	5.0	5.0			12.0
Detrended DEM (min)							
Detrended DEM (max)							
Flow depth	1.0	2.1		2.1	3.4		
Flow velocity		3.0					
Froude number					1.0		
Grain size							
Design map frequency threshold					10.0	20.0	
Safety factor						1.3	
Terrain slope							0.20
Topographic change: fill rate		3.36					
Topographic change: scour rate		1.68	3.00	1.68		3.00	

Source: https://github.com/RiverArchitect/program/blob/master/LifespanDesign/.templates/threshold_values.xlsx
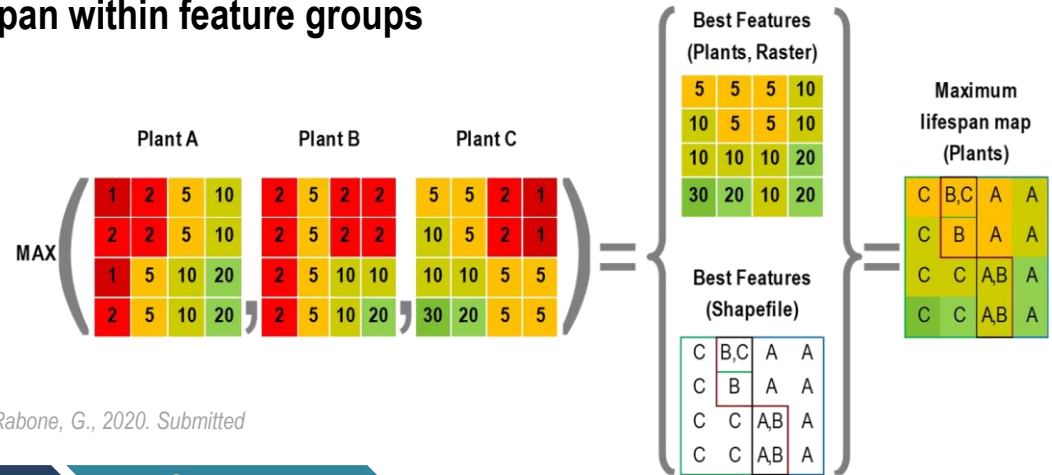
Lifespan Mapping   Input

Lifespan Mapping with River Architect

► **Lifespan Calculation (Raster overlay)**
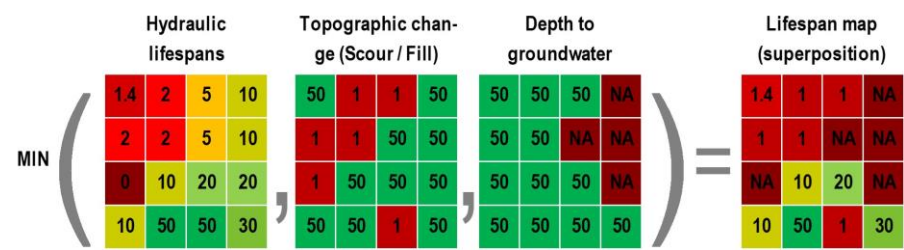
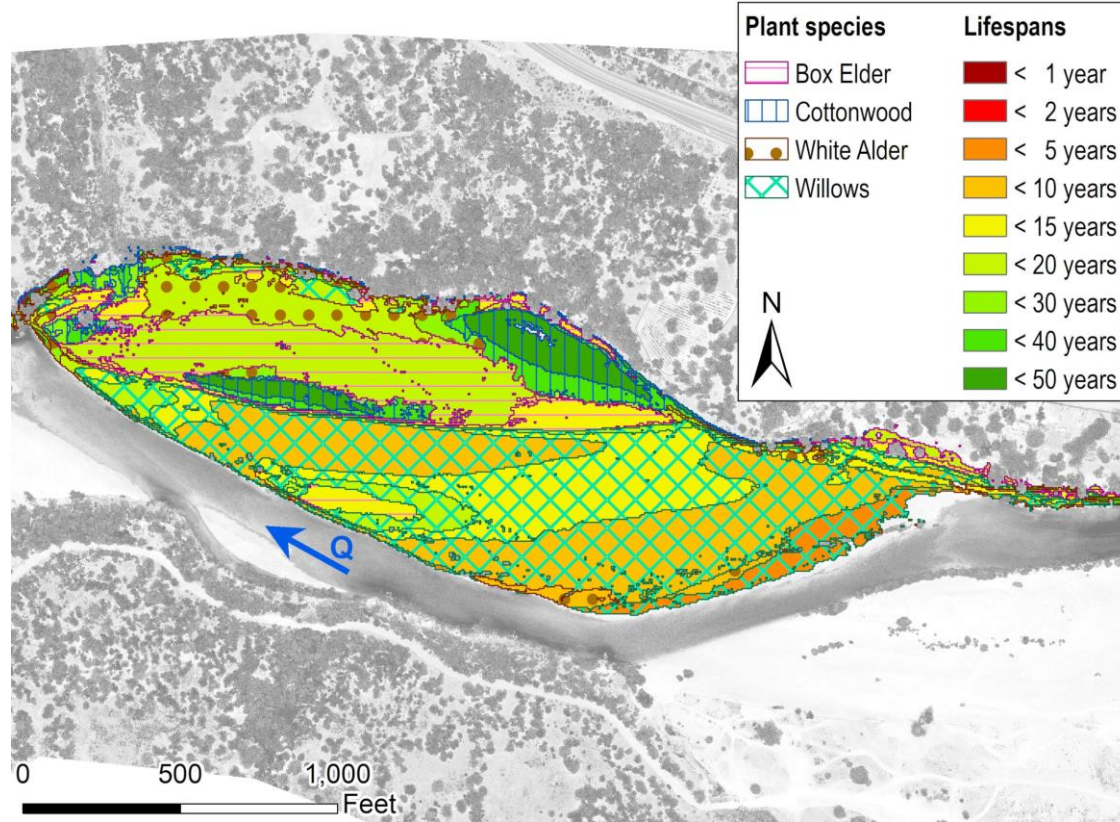► **Identify best lifespan within feature groups**

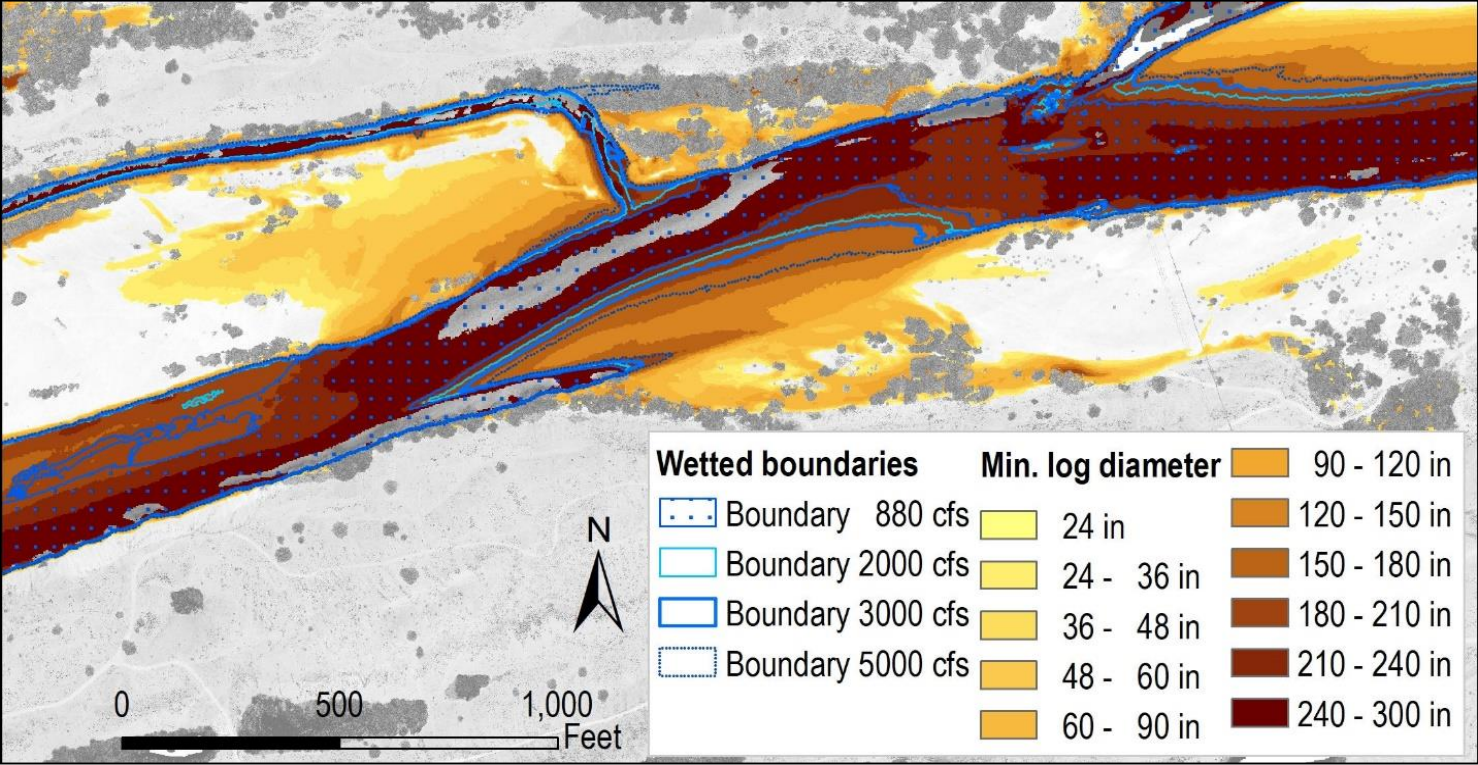*Source: Schwindt, S., Pasternack G. B., Rabone, G., 2020. Submitted*

Lifespan Mapping with River Architect

► **Maximum / Best Lifespan Map: Identify most suitable vegetation plantings**
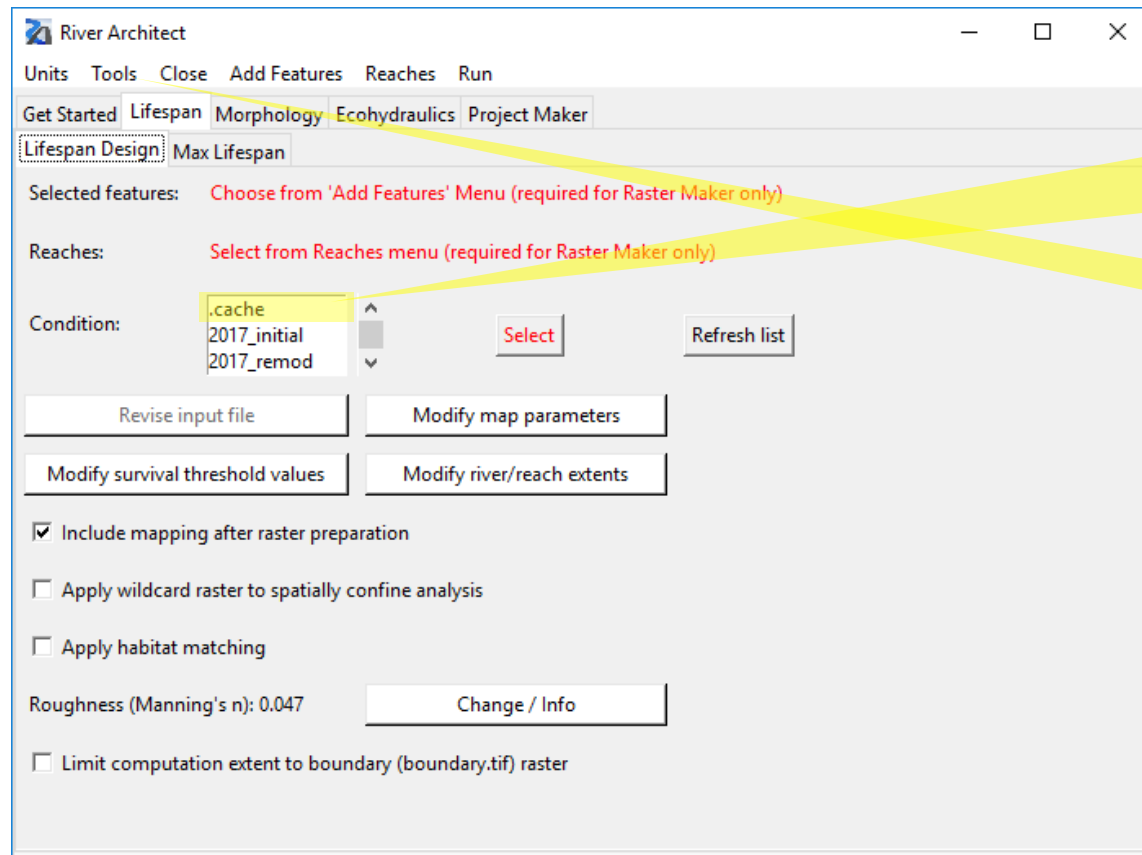
Lifespan Mapping with River Architect

► **Design Map: Stable log diameters for streamwood placement**

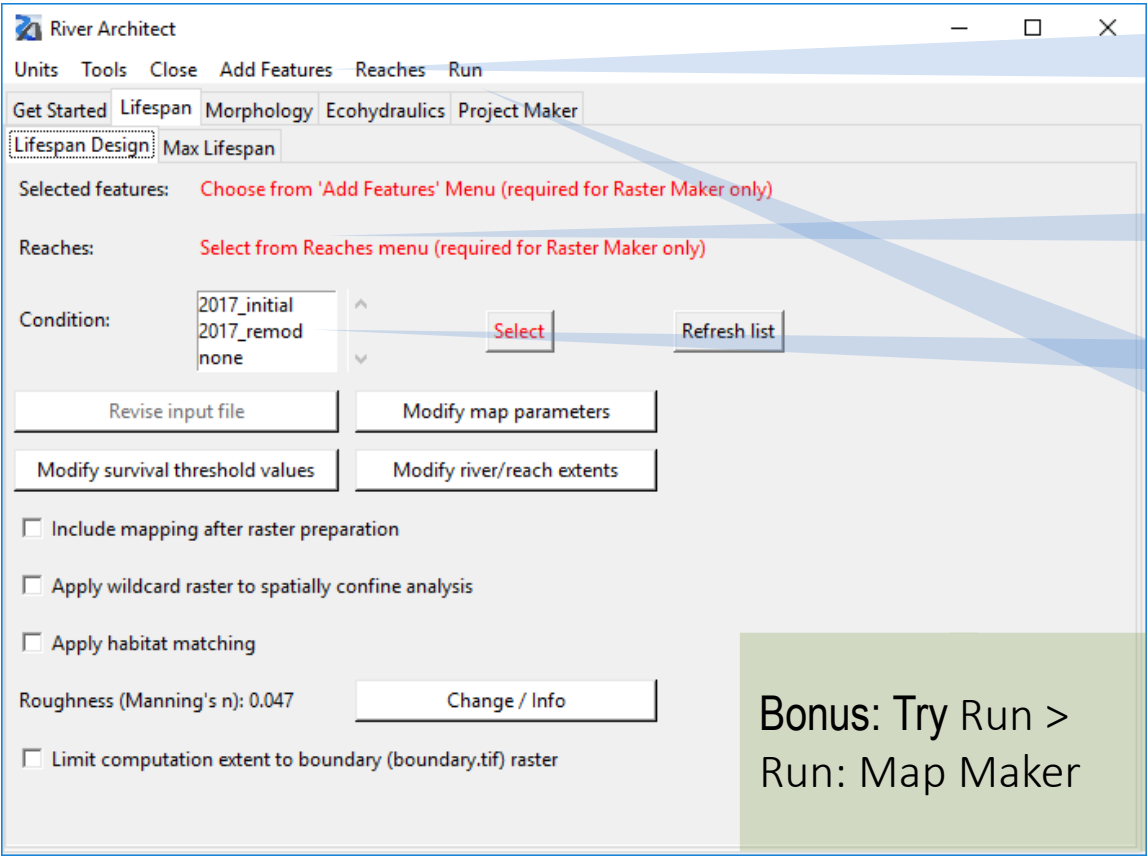⚒ **Create Lifespan Maps for Vegetation Plantings**

Create Lifespan Maps

.cache folder deletion sometimes fails – in this case use

Tools > Delete .cache folders

Useful because .cache folders may contains large useless files.
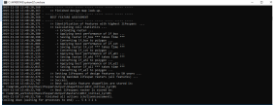
Create Lifespan Maps

1) Add Features > Group layer: Plantings

2) Reaches > IGNORE (...)

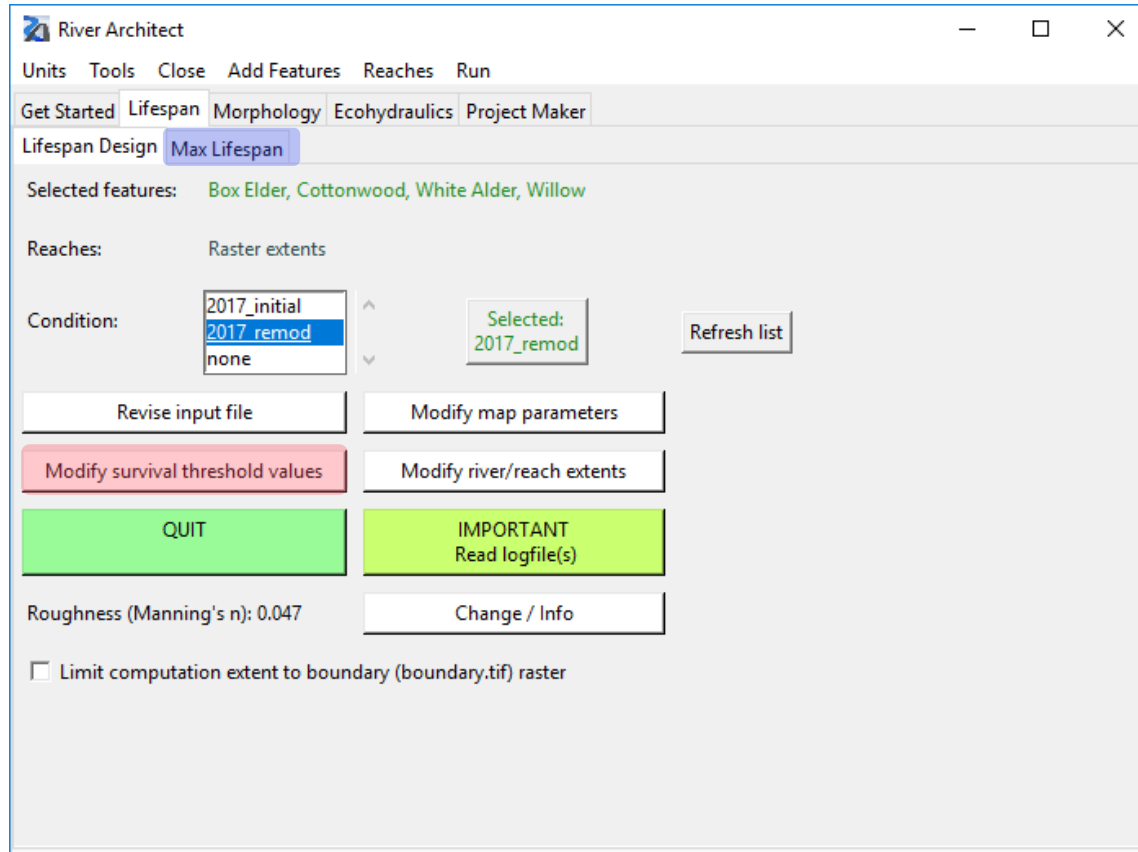3) Highlight & select remod condition

4) Run > Run: Raster Maker

5) Check results (rasters) in /LifespanDesign/Output/Rasters/

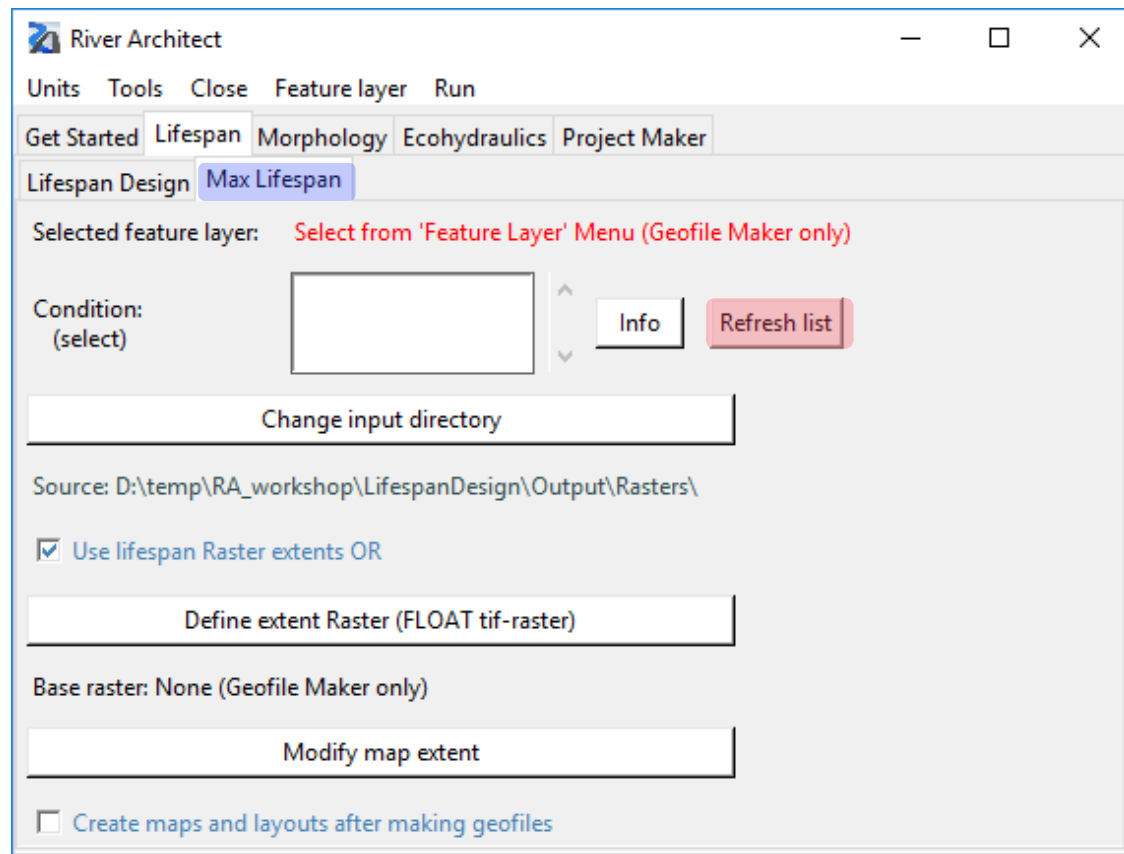Bonus: Try Run > Run: Map Maker

Create Lifespan Maps

Lifespan maps exist now for individual plant species (Box Elder, Cottonwood, White Alder, Willow).

Click on the Modify survival threshold values button to see/change criteria feature properties (threshold_values.xlsx).

What plant species performs best at a given pixel?
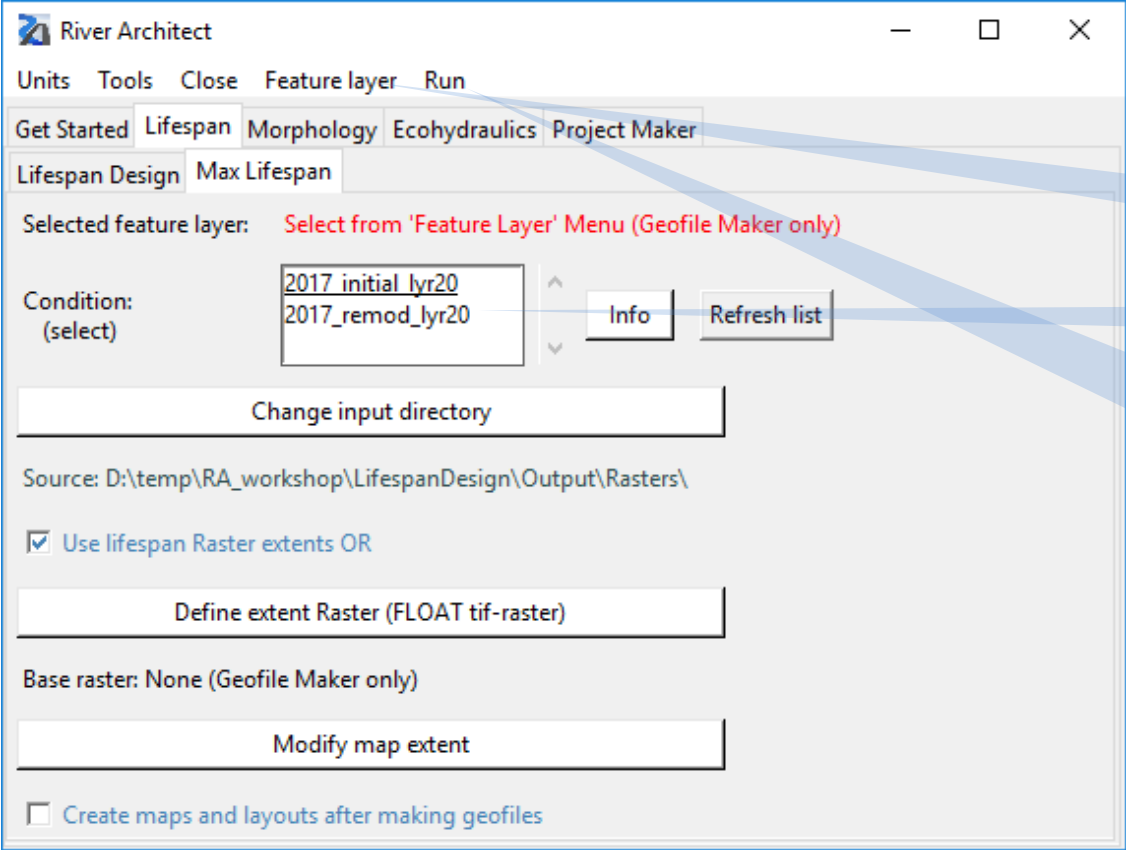→ Go to the Max Lifespan tab.

Create Lifespan Maps

Click on the Refresh list button to show newly created Conditions

Create Lifespan Maps

Click on the Refresh list button to show newly created Conditions

1) Feature layer > Group layer: Plantings

2) Highlight remod … _lyr20

3) Run > Run: Geofile Maker

4) Run > Run: Map Maker

ERROR ?
https://riverarchitect.github.io/RA_wiki/Troubleshooting

Create Lifespan Maps

- ERROR: Failed to save PDF map assembly.
    - *Cause:* The `make_pdf_maps(self, ...)` function of the `Mapper()` class (`.site_packages/riverpy/cMapper.py`) raises this error when the map assembly is corrupted.
    - *Remedy:*
        - PDF map export of Lifespan maps has troubles at the moment. We recommend to open the automatically created project `RiverArchitect/02_Maps/CONDITION/maps_CONDITION_lyrXY.aprx` and to export PDF maps in *ArcGIS Pro*: (1) Go to desired layout tab; (2) Ensure map layout fits desired export; (3) Go to the `Share` ribbon and click on the green arrow `Layout` (export layout).
        - Ensure that no other program accesses the `LifespanDesign/.cache/`, `MaxLifespan/.cache/`, `ModifyTerrain/.cache/`, `LifespanDesign/Output/`, `MaxLifespan/Output/`, or `ModifyTerrain/Output/` directories or their contents (close *ArcGIS Pro* and verify read/write rights for `RiverArchitect/02_Maps/CONDITION/`).

Map maker function (PDF export) has troubles with PDF Export → Manual export:

1) Open RiverArchitect/02_Maps/CONDITION_lyr20/maps_CONDITION_lyr20[...].aprx

2) Go to the layout_mlf_plants tab

3) Verify layer geofile links: Table of Contents > Layers Map Frame > layer_mlf_plants > Best Lifespans (double-click) > Source > Set Data Source > Select MaxLifespan\Output\Rasters\CONDITION_lyr20\max_lf_plants (Similar for all other layers… Shapefiles folder … background from 01_Conditions)

4) Export: Go to the Ribbon Share > Layout

Lifespans   Activity
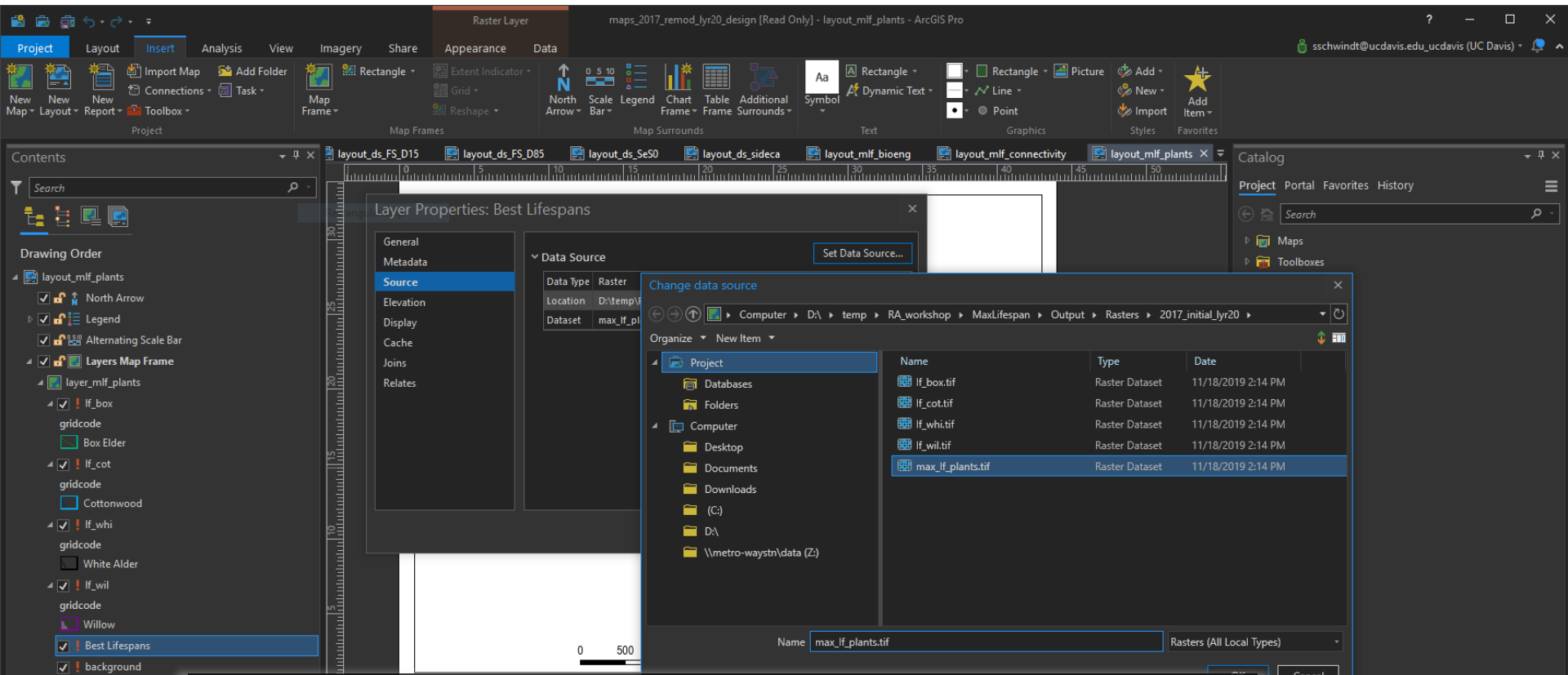
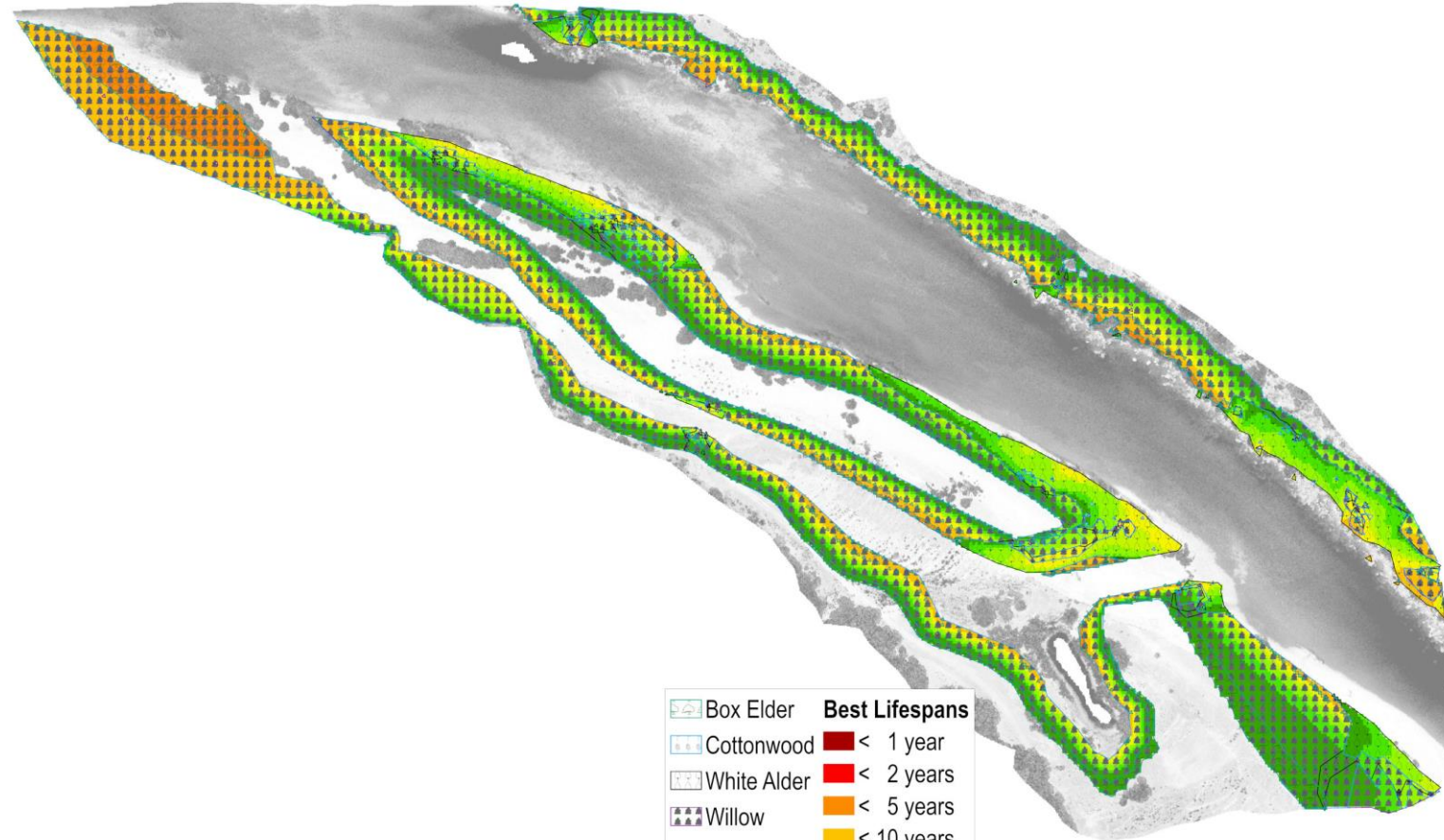Best Lifespans: MaxLifespan\Output\Rasters\CONDITION_lyr20\max_lf_plants.tif
Background: 01_Conditions\CONDITION\back.tif
lf_[PLANT]:   MaxLifespan\Output\Shapefiles\CONDITION_lyr20\lf_[PLANT].shp

	Box Elder	**Best Lifespans**	
	Cottonwood		< 1 year
	White Alder		< 2 years
	Willow		< 5 years
			< 10 years
			< 15 years
			< 20 years
			< 30 years
			< 40 years
			< 50 years

N

0   200   400 Feet

Detailed documentation & reading for this chapter
https://riverarchitect.github.io/RA_wiki/LifespanDesign