**Introduction:**

The process for developing the Habitat Cores layer is based on the case study found in Appendix A of the New York practitioner’s guide 2014. Since this guidebook was developed some methods for calculating the core ranks have evolved. The process followed in these scripts might not match exactly the practitioners guide however it should still be consulted.

1. In the guidebook all attributes were calculated from the Habitat Interior. This process uses the Core Interior to calculate geometry score only. All other values are calculated using the entire Habitat Core (including edge area)
2. Some field names have changed slightly for clarity.
3. Soils were added to the Diversity rank.
4. This toolbox used the values given in the guidebook for categorizing the scores and ranks. Another way to categorize these values is by using quintiles or natural breaks.
   * The Score and Rank calculations are setup in the model as variables and can be changed as necessary.
   * Using the model builder will make changing any inputs easier. Most of the models don’t require any key field. If one is necessary, it is noted in the metadata.

**How to use the toolbox:**

The toolbox: **“Building the Ulster Cores and their Ranks”** has 5 key toolsets. Inside each toolset are sub-toolsets containing the models necessary to calculate each field in the Core’s attribute table.

* *00\_Process – Helpers (Do not run – for reference.)*
* 01\_Building the Cores and Geometry Scores
* 02\_Water Quality and Quantity Scores
* 03\_Diversity Scores
* 04\_Overall Rank

**General Guidelines**

1. The Helper toolset if for reference. No need to run these unless processing new data. The outputs of these models are in the inputs folder – they will be used in the rest of the models.
2. Once the scripts in toolset **01\_Building the Cores and Geometry Scores have been run** – the rest can be run in any order as long as the Process script is run before the Calculate script.
3. All fields in the final Habitat Core Dataset have two models used to calculate the final values; **1) called “Process”** and the other **2) “Calculate”.**
   1. The **Process** script will create and calculate a field from the intersect/summary statistics process - which the rank or score will be based on. (Rank 1 – 5) 1 = best.
   2. **Calculate** script will then break those values up by categories defined in the practitioner’s guide. The user can substitute the breaks by editing the code block given as a variable.
4. The scripts are set up so that they begin at the point of having prepared inputs. If an input required processing to get it formatted properly the process was performed in the Toolset called 00\_Process – Helpers. This was done to save time on testing and rerunning the main toolsets. For example, waterbodies was converted to a raster.
5. There is only one expected “hiccup”! When creating the cores using the high resolution landcover a few linear features were identified (visually) that might be best used to split a core but do not otherwise fit the selection criteria. (Mainly this feature was a powerline)
   1. In model **011\_Cores\_Interior**. The wildcard variable is used in case there are features on the landscape known that might not be included in the Landcover dataset. For example: Powerlines or Small roads/trails... This variable allows the user to add those features into the process.

* \*\* This shapefile must be included in the analysis even if no features are necessary to break up the core
* The shapefile must include one feature in the AOI. The work around for this is to include a very small line over top of an existing non-natural feature or use an existing road layer if scale matches the landcover layer used to select core features.
* Remember: The dummy line must be included in the AOI. (If you are running a small test area make sure there is a small line present over a non-natural feature in the wildcard shapefile)

1. The models should be kept in the folder structure given. Depending on user settings (in ArcMap) they will overwrite existing intermediate data. If a problem occurs with schema locks the scratch folder’s contents can be cleared.

**Description of models**

The models are similar to each other;

* 1. the basic idea is that they perform an intersection of the cores and data layer containing given theme
  2. then do a Summary Statistics.
  3. values are calculated in the summary statistics table
  4. then joined to the cores layer

It might be noticed for the polygon themes the cores have been pre-processed (into a raster). This is because the summary statistics command will do it anyway and since it’s used multiple times was better to do this only once.

Following is a simple description of the models. By using the model builder for this toolbox every effort was made to keep the models easy to follow. Where meta notes might be necessary they are given. Otherwise hopefully the process are easy to follow.

In order to understand the model running a test area is recommended. In the AOI folder (within Inputs folder) there are several sample site AOI’s. Remember to make sure to use a simple line feature mentioned above for the Wildcard layer. Then run from within model and explore outputs. The Cores layer will remain constant and be given values for the scores. All other data created are intermediate.

1. **00\_Process – Helpers**

These models are numbered to match the model their output will be used in. These “helpers” are used to get the data from their source format/structure to the format that will most easily be used in model builder. They do not need to be run unless new data will be used. The outputs of these models are in the inputs folder as they are inputs to the model processes used to calculate the core attributes.

1. **01\_Building the Cores and Geometry Scores**
   * **011\_Process --> Cores\_Interior**
     + This model starts with the high resolution landcover dataset given to GIC by client. It is expected the field values will remain the same, however inputs can be changed in the select variable if necessary.
     + The Practitioners Guide describes the process of creating the Core Interior as a “buffer in” 100 meters using natural features. The process used for this model however is the opposite. The process used here selects the NON-Natural features and performs a buffer out 100 meters from those NON-Natural features using spatial analysis Euclidean distance. A reclass reverses the values and the Core Interior’s are born.
       1. This allows for the wildcard to be added. See note 4 in general guidelines above.
       2. Query used: **NOT ("Class" = 'Emergent Wetland' OR "Class" = 'Tree Canopy' OR "Class" = 'Water')** The features above will be the features included inside the core.
   * **012\_Calculate --> Cores**
     + The practitioners quidebook uses the core interiors only. However since this publication it has been decided the “edge area” (area buffered back out) should be included in ranking the cores.
     + This model uses a Euclidean Allocation command to buffer the area back out without crossing a large river.

More details can be found in table below and in the individual model meta-notes that appear to left of command window on a double click. User should be able to explore the model to understand process.

1. **02\_Water Quality and Quantity Scores**

These models calculate the individual Water Quality Scores and WQQ Rank.

1. **03\_Diversity Scores**

The process used for the diversity scores are similar to the Water Quality and Quantity models.

1. **04\_Overall Rank**

These models sum the above three ranks and categorizes them based on criteria from practitioner’s guide.

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| Toolset: 01\_Building the Cores and Geometry Scores. | | | |
| FIELD NAME | SOURCE | DESCRIPTION | Script |
| 1. InteriorAC (interi­or acreage) 2. SizeScore | Cores interior layer | Interior habitat cover begins 100 meters inward from the edge (Bulluck et al, 2007) of habitat. This field shows the amount of interior acreage in each core. Some habitat features have no interior acreage; these fragments can be removed.  This value categorizes cores based on interior acreage size. It is based on Natural Landscape Blocks values used in the VANLA (Bulluck et al, 2007). Fragments of less than 10 acres can be retained to aid in connect­ing patches. | geometry in US Acres.  [InteriorAC] <10 then SizeScore = 0  [InteriorAC]<100 then SizeScore = 4  [InteriorAC] < 1000 then SizeScore = 3  [InteriorAC]<10000 then SizeScore = 2  [InteriorAC]>=10000 then SizeScore = 1 |
| * InPerimM | Cores interior layer | Total perimeter in meters. | perimeter in meters. |
| 1. P\_A\_Ratio (perim­eter to area ratio) 2. P\_A\_Score | Cores interior layer | This calculation shows fragmentation within a core. Lower values show less frag­mented cores with better interior habitat (Bulluck et al, 2007). | Field calculate, [InPerimM]/[InteriorAC].  [P\_A\_Ratio] <10 then PAScore = 1  [P\_A\_Ratio] <25 then PAScore = 2  [P\_A\_Ratio] <50 then PAScore = 3  [P\_A\_Ratio] <100 then PAScore = 4  [P\_A\_Ratio] =>100 then PAScore = 5 |
| * GeoRank | Cores interior layer | Calculates GeoRank from PA and Size Score. | ([P\_A\_Score] + [SizeScore])/2  Note: this field might have decimal places. |

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| --- | --- | --- | --- |
| Toolset: 02\_Water Quality and Quantity Scores | | | |
| FIELD NAME | SOURCE | DESCRIPTION | Script |
| 021 Stream Score | | | |
| 1. Stream (core stream length) 2. StrmScor | National Hydrography Dataset (NHD) – Flowline at 1:24,000 resolution. Selected FType of StreamRiver, Connector or Arti­ficial Path. | Total length of streams, rivers & linear water fea­tures within a core.  Only Shape is used. | Length of stream that intersect in km.  [Stream] < 5 then SrtmScor = 5  [Stream] < 10 then SrtmScor = 4  [Stream] < 20then SrtmScor = 3  [Stream] < 50 then SrtmScor = 2  [Stream] >= 50 then SrtmScor = 1 |
| 022\_Surface Water Score | | | |
| 1. Srfwater (core sur­face water area) 2. SrfwtScore | NHD – waterbody at 1:24,000 resolution. | Total acreage of water­body features within a core.  Only Shape is used. | Area of waterbodies that intersect in Acres.  [Srfwtr] < 10 then SrfwtScore = 5  [Srfwtr] < 25 then SrfwtScore = 4  [Srfwtr] < 50 then SrfwtScore = 3  [Srfwtr] < 150 then SrfwtScore = 2  [Srfwtr] >=150 then SrfwtScore = 1 |
| 023\_Wetland Score | | | |
| 1. Wetland (wetlands area) 2. WtlndScore | NHD, NWI wetlands & NYSDEC wetlands 2009. | Total acreage of wetland features within a core.  Only Shape is used. | Area of wetlands that intersect in acres.  [Wetland] < 25 then WtlndScore = 5  [Wetland] < 50 then WtlndScore = 4  [Wetland] < 100 then WtlndScore = 3  [Wetland]< 200 then WtlndScore = 2  [Wetland] >=200 then WtlndScore = 1 |
| 024\_Trout Stream Score | | | |
| 1. TrStr (trout stream length) 2. TrtStrmScore | NYSDEC – Trout and Trout Spawning (T&TS) streams. For more information see NYSDEC Water Classifications informa­tion at the end of this appendix. | Total length of T&TS streams within a core.  Only Shape is used. | Length of trout stream that intersect in km.  [TrtStream] <= 5 then TrtSrtmSco = 5  [TrtStream] <= 10 then TrtSrtmSco = 4  [TrtStream] <= 20 then TrtSrtmSco = 3  [TrtStream] <= 50 then TrtSrtmSco = 2  [TrtStream] > 50 then TrtSrtmSco = 1 |
| 025\_Trout Surface Water Score | | | |
| 1. TrSurf (trout surface water area) 2. TrtSrfScore | NYSDEC – Trout and Trout Spawning ponds, lakes & reser­voirs. For more information see NYSDEC Water Classifications information at the end of this appendix. | Total area of T&TS ponds, lakes & reservoirs within a core.  Only Shape is used. | Area of Trout waterbody that intersect in Acres.  [TrtSurf] < 3 then TrtSrfScor = 5  [TrtSurf] < 10 then TrtSrfScor = 4  [TrtSurf] < 100 then TrtSrfScor = 3  [TrtSurf] < 150 then TrtSrfScor = 2  [TrtSurf] >=150 then TrtSrfScor = 1 |
| 026\_NYSDEC Stream Categories Score | | | |
| 1. DECCalc (NYSDEC water quality class X stream length) 2. DECScore | NYSDEC Water Quality Class Line – each category of water quality (AA, A, B, C, D, and empty/unkown) was selected & processed separately. For more information see NYSDEC Water Classifications information at the end of this appendix. | Total length of X quality streams as determined by NYSDEC.  Must include field with WQ Class (called Classifica in source data). If other data is used any new values must be included in select/calculate “TimesBy” field. | Weighted length in km of stream quality class that intersects core.  [CLASSIFICA]= "A" then TimesBy = 3  [CLASSIFICA]= "AA" then TimesBy = 3  [CLASSIFICA]= "B" then TimesBy = 2  Else TimesBy = 1  [TimesBy] \* ( [SUM\_Shape\_Length]/1000)  [DECCalc] < 5 then DECScore = 5  [DECCalc] < 15 then DECScore = 4  [DECCalc] < 25 then DECScore = 3  [DECCalc] < 50 then DECScore = 2  [DECCalc] >= 50 then DECScore = 1 |
| 027\_Mussel Richness Score | | | |
| 1. MusselRch 2. PrdMusScore | Predicted Mussel Richness | Number of Mussel species in rivers that intersect core.  Field called “rich” that includes number of species. | Number of Mussel species in river that intersects core.  [MusselRch] <= 0 then PrdMusScor = 5  [MusselRch] <=2 then PrdMusScor = 4  [MusselRch] <=4 then PrdMusScor = 3  [MusselRch] <=7 then PrdMusScor = 2  [MusselRch] > 7 then PrdMusScor = 1 |
| 028\_Final WQQ Rank | | | |
| 1. H20Calc 2. H2ORank | Above scores. | Sum of scores | [SrtmScor] + [SrfwtScore] + [WtlndScore] + [TrtSrtmSco] + [TrtSrfScor] + [DECScore] + [PrdMusScor]  [H20Calc] <=15 then H20Rank = 1  [H20Calc] <= 20 then H20Rank = 2  [H20Calc] <= 25 then H20Rank = 3  [H20Calc] <= 30 then H20Rank = 4  [H20Calc] > 30 then H20Rank = 5 |

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| Toolset: 03\_Diversity Scores | | | |
| FIELD NAME | SOURCE | DESCRIPTION | PROCESS |
| 031\_Elevation Score | | | |
| 1. ElevSD 2. ElevScore | Elevation Model (DEM) | Standard Deviation in elevation.  Raster elevation value is necessary | Average Standard Deviation of elevation that intersects core.  [ElevSD] < 25 then ElevScore = 5  [ElevSD] < 75 then ElevScore = 4  [ElevSD] < 125 then ElevScore = 3  [ElevSD] < 175 then ElevScore = 2  [ElevSD] >=175 then ElevScore = 1 |
| 032\_Heritage Natural Communities (note: the process models are run individually but the final calculate model runs all three together.) | | | |
| 1. GSRank 2. GSScore | Natural Heritage Communities | Sum of G and S rank communities  Must include field with G and S rank. | [SRankCnt] + [GRankCnt]  [GSRank] < 5 then GSScore = 5  [GSRank] < 10 then GSScore = 4  [GSRank] < 15 then GSScore = 3  [GSRank] < 20 then GSScore = 2  [GSRank] >= 20 then GSScore = 1 |
| 1. EORCalc 2. EORScore | Natural Heritage Communities | Weighted calculation of categorized communities.  Must include field with Natural Community Rank (called EORank in source data). If other data is used any new values must be included in select/calculate “TimesBy” field. | [EO\_RANK] = "A" then TimesBy = 3  [EO\_RANK]= "B" then TimesBy = 2  else TimesBy = 1  [TimesBy] \* ( [SUM\_Shape\_area] /43560)  [EORCalc] >= 5000 then EORScore = 1  [EORCalc] >1000 then EORScore = 2  [EORCalc] > 100 then EORScore = 3  [EORCalc] > 10 then EORScore = 4  [EORCalc] <= 10 then EORScore = 5 |
| 1. EOCount 2. EOAddscore | NHP EO Layer | Total number of different rare species and significant natural community types within a core. | Count of Element occurances  [EOCount] >= 10 then EOAddScore = 1  [EOCount] >= 8 then EOAddScore = 2  [EOCount] >= 6 then EOAddScore = 3  [EOCount] >= 3 then EOAddScore = 4  [EOCount] < 3 then EOAddScore = 5 |
| 033\_BAP Score | | | |
| 1. PBAP\_Calc (Predict­ed BAP score of X stream length) 2. PBAP\_Score | NY Natural Heritage Program (NYNHP) – New York State Freshwater Conservation Blueprint Project. Predicted Biological Assessment Profile Model. This model represents an amalgamation of scores for predicted biodiversity. The higher the score, the better the water quality. Note, that this is a model and does not reflect exact conditions on the ground. | Total length of X Predicted BAP for streams as deter­mined by NYNHP  Must include field with PBAP predicted score (called BAPpredmap in source data). If other data is used any new values must be included in select/calculate “TimesBy” field.. | Weighted length of stream that intersects core.  [BAPpredmap] >=8 then Timesby = 3  [BAPpredmap] >=5 then Timesby = 2  [BAPpredmap] < 5 then Timesby = 1  [PBAPCalc] >=100 then PBAPScore = 1  [PBAPCalc] >=25 then PBAPScore = 2  [PBAPCalc] >=5 then PBAPScore = 3  [PBAPCalc] > 0 then PBAPScore = 4  [PBAPCalc] <=0 then PBAPScore = 5 |
| 034\_Soil Diversity | | | |
| 1. SoilsVar 2. SoilScore | Soil Survey Geographic (SSURGO) Database NRCS | Soil variability score.  Soil type attribute needs to be included. Script will count number of different types. | Number of Soil types that intersect core.  [SoilsVar] < 8 then SoilScore = 5  [SoilsVar]<18 then SoilScore = 4  [SoilsVar] < 36 then SoilScore = 3  [SoilsVar] < 75 then SoilScore = 2  [SoilsVar] >= 75 then SoilScore = 1 |
| 035\_Final Diversity Score | | | |
| 1. DivCalc 2. DivRank | Above scores | Core’s diversity Rank | [ElevScore] + [EORScore] + [EOAddScore] + [GSScore] + [PBAPScore] + [SoilScore]  [DivCalc] <= 14 then DivRank = 1  [DivCalc] <= 19 then DivRank = 2  [DivCalc] <= 22 then DivRank = 3  [DivCalc] <= 24 then DivRank = 4  [DivCalc] > 24 then DivRank = 5 |

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| --- | --- | --- | --- |
| Toolset: 04\_Overall Rank | | | |
| 1. CoreCalc 2. CoreRank | Sum of all ranks | Total Core Rank | [GeoRank] + [H20Rank] + [DivRank]  [CoreCalc] <=6 then CoreRank = 1  [CoreCalc] <=8 then CoreRank = 2  [CoreCalc] <=10 then CoreRank = 3  [CoreCalc] <=12 then CoreRank = 4  Else CoreRank = 5 |