Methodology for Developing Spatial Features

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NatureServe

Table of Contents

Tables and Figures

Background

The NatureServe concept of Element Occurrences as observed locations of "elements" of biodiversity was developed with the intent of defining practical units for conservation action. Element Occurrences (EOs) typically represent populations and ecosystems that, if conserved, may contribute to the survival or persistence of the element through continued presence and/or regular recurrence. As derived features with estimated viability and ecological integrity, occurrences have served as NatureServe's core feature for the last quarter century, enabling more effective environmental assessment and conservation planning than raw observation data, which frequently represent ephemeral events. Almost a million EOs – representing several million observations or specimens – have been collected and managed by the NatureServe network of natural heritage programs.

Because valid aggregation and comparison of occurrences require spatial data that are consistent and accurate, a rich and comprehensive methodology for mapping and managing spatial data was developed in the mid-1990s for use throughout the NatureServe network. This spatial model defined a detailed method by which observations data was processed through a number of steps, each characterized by a different feature. Some of these features were only conceptualized and others digitized, some buffered and others not – based on the size of the underlying observations compared with map scale and the Locational Uncertainty (LU) associated with the data. Source Features (SFs) resulting from this process were then combined using separation distance guidelines to create EOs. While the precepts of this spatial model are well-founded, implementation over the past decade has provided information on improvements that could be made to the process for developing features.

Updated Spatial Methodology

In the spring of 2010, a team comprising NatureServe central and network staff[1] began work on updating the spatial model based on potential improvements identified with the existing feature development process through implementation. Specific objectives identified for the team were to:

- Improve the process and work flow of the spatial methodology, and provide flexibility in implementation through identifying different feature stages that produce consistent spatial data; and
- Integrate observations into the spatial model, defining the relationships between observation data and other features in the methodology, specifically SFs and EOs.

The team produced a proposed set of changes to the spatial model, which were subjected to an iterative review process by both NatureServe central staff and two separate teams of network staff[2] before broader review by the entire NatureServe network. The outcome is a set of recommended updates to the methodology which:

1. Streamline spatial methodology workflow
2. Provide flexibility in implementation
3. Integrate observations data

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[1] Members of the Spatial Methodology team included Rob Solomon, Whitney Weber, Don Faber-Langendoen, and Jennifer Nichols of NatureServe central; Jay Cordeiro, formerly of NatureServe; Larry Master, retired from NatureServe; and Tim Howard of the New York Natural Heritage Program.

[2] Participants on Network Team 1: Cullen Hanks – TXWDP; Dave Clark – PC; Jim Morefield – NVNHP; Karen (Walker) Coleman – MTNHP; Pete Sorrill – ONNHIC; Ross Geredien – formerly of MDNHP; Sabra Schwartz – AZHDMS.
Participants on Network Team 2: Amy Lavender – CONHP; Gretchen Fowles – NJNHP; Jason Bulluck – VVANHP; Kierstin Carlson and Susan Klugman – PANHP; Andy Teucher, Marta Donovan, Meherzad Romer, and Katrina Stipec – BCCDC.

1. **Streamline spatial methodology workflow** by simplifying the processes for creating and managing spatial data, accomplished through automation of several steps in the spatial feature development processes. This automation provides users with the ability to process the output data from a particular stage to the next higher stage in a consistent fashion with relatively small effort, subject to user acceptance. Processes that are automated in the updated spatial methodology include:
    - Automatic generation of SFs from mapped Observation Features, depending on associated Locational Uncertainty Type (LU Type)
    - Automated application of user-specified Separation Distance to SFs, if desired
    - Autogenerated new Element Occurrences, or modified existing occurrences, for user evaluation
    - Automatic clipping of unsuitable habitat from SFs, if user opts to define associated Unsuitable Habitat Features

2. **Provide flexibility in implementation** by providing three feature output stages within the updated spatial model that allow all member programs to advance their data to a stage that best meets the needs of their clients and staff. The initial Observation Feature stage is optional; although SFs (stage 2) are always developed from observations data, a mapped feature representing the raw observation is not required for implementing the spatial model. However, an EO (stage 3) can only be developed from one or more SFs developed in the preceding stage.

Table 1. High-level description of stages in the spatial model.

STAGE	OUTPUT	DESCRIPTION	SYSTEM UTILIZED	SPATIAL FEATURE RELATIONSHIPS
1	OBSERVATION FEATURE	• Created to represent raw observations data (optional) • Locational Uncertainty is **not** included in the mapped features	Kestrel[3]	OBSERVATION FEATURE
2	SOURCE FEATURE	• Developed from one or more observations • Locational Uncertainty is always included, ensuring that the location of the underlying observation(s) is captured within the feature	Biotics	SOURCE FEATURE
3	ELEMENT OCCURRENCE	• Developed from one or more Source Features • Consistency is achieved using standard criteria and rules of separation • Developed to define potentially viable conservation units	Biotics	ELEMENT OCCURRENCE

[3] Observation data managed in other databases and applications can also be utilized in the spatial feature development process.

3. **Integrate observations data** as an optionally managed standard component of the spatial model. [4] Reasons for incorporating raw Observation Features (i.e., mapped as-is, unmodified by inclusion of LU) in the methodology include:
    - Enabling programs to meet client requests for the mapped observations that underlie the NatureServe value-added features (i.e., SFs and EOs);
    - Having raw data that facilitates performing analyses valuable for informing conservation (e.g., predictive range modeling);
    - Defining relationships between observations already managed in databases by many member programs, and the other features in the spatial feature development workflow (i.e., SFs and EOs);
    - Maintaining raw observations data, which is consistent with the data managed by partners and other conservation agencies/organizations, thus facilitating data sharing and collaboration.

Implementation Data Management Systems

Both the Biotics and Kestrel biodiversity data management systems developed by NatureServe will be used to implement the updated spatial model. These applications will be integrated such that data from Kestrel can be easily moved into Biotics for use in the spatial development process.

Biotics, used in NatureServe central and throughout member programs, incorporates custom applications that support standard methodologies for collecting, managing, and analyzing biological and ecological data at different scales (i.e., global, national, and subnational geographic levels).

Kestrel, currently in limited use, is a web-based application used for mapping and tracking observations data. Developed for a broad set of users (both internal and external to NatureServe), Kestrel enables users to define templates for data input and management according to their needs.

Spatial Model Stages and Process Details

OPTIONAL

STAGE 1: OBSERVATION FEATURE

Depending on the data available, two pathways can be utilized to develop observations data for use in the spatial model. Note that tracking observations in this model is optional.

PATH 1. Create Observation Feature
PATH 2. Import observations data

[4] This does not address whether observations *should* be mapped without including Locational Uncertainty (LU) within the feature. Some reviewers of the spatial model have expressed concern that mapping observations as-is (without LU) may misrepresent the accuracy of the feature location by not including the larger area required to ensure that the actual on-the-ground location of the observation has been captured within the feature. However, external organizations and agencies that manage biological data utilize raw mapped observations (i.e., mapped as-is, without modification by buffering, etc.), and many member programs already utilize raw observations data to meet client needs and perform analyses. Whether to map, manage, and/or provide raw Observation Features is a programmatic decision, but providing the ability for programs to do so through integration of observations into the updated spatial methodology was mandated, and is important for both meeting the broader needs of member programs as well as for facilitating data sharing and cooperation with external partner organizations and agencies.

PATH 1. Create Observation Features

a. Spatial representation of raw observations data is developed in Kestrel or other database/application:

(1) USER digitizes point(s), line(s), or polygon(s) for Observation Feature 'as-is,' specifically without including any Locational Uncertainty or making other boundary or location modifications

AND/OR

(2) USER records observation location by entering geographic coordinates

b. USER specifies attributes for Observation Feature, including

- Name of species or ecosystem[5]
- Date, or date range, when observation was made
- Name(s) of observers

and necessary if Observation Feature may be processed into a SF at some time:

- Locational Uncertainty Distance (LU Distance)[6]

PATH 2. Import observations data

USER utilizes a tool in Kestrel to upload observation data (i.e., point, line, and/or polygon features, coordinates, and/or other attributes) from an external observations database/application.

OPTIONAL

Import observations into Biotics

Biotics provides an import tool for uploading observations data from Kestrel or another external database/application. Once in Biotics, observations can be used to develop SFs at any time. Observations data to be imported include:

a. Spatial data, at least one of the following for each observation:

- Observation Features – point(s), line(s), and/or polygon(s)
- Geographic coordinates

b. Associated attributes, including

- Unique identifier
- Name of species or ecosystem
- Date, or date range, when observation was made
- Name(s) of observers
- LU Distance

STAGE 2: **SOURCE FEATURE**

Four pathways can be utilized in Biotics to develop SFs, which always include LU.

PATH 1. Developed from Observation Feature

[5] Ecosystem is a colloquial term used to refer to both ecological communities and systems.
[6] Value that indicates the accuracy of an observation, represented as the distance between the actual observed location and the recorded location, either as a mapped feature or as coordinates obtained from a GPS (Global Positioning System). This distance value will serve as the default Locational Uncertainty Distance for a Source Feature developed from that observation.

PATH 2. Digitize Pre-Source Feature[7]
PATH 3. Digitize Source Feature
PATH 4. Import Source Features

The feature type to be used for a SF is dependent on the LU associated with the underlying observation data, and whether an Observation Feature has been imported into Biotics (an optional process). Four LU Types are used in the spatial model, determined by the amount and direction of the uncertainty:

Estimated – boundary that includes LU cannot be delineated

Negligible – LU is less than half the minimum mapping unit for the scale map used

Delimited – boundary that includes LU can be delineated

Linear – LU extends along an axis, and a line that includes the uncertainty can be delineated

PATH 1. Developed from Observation Feature

This pathway can be utilized only when an Observation Feature exists in Biotics for use in developing the SF.

Table 2. Summary of developing Source Features from Observation Features.

LU Type	Source Feature Development
Estimated	AUTOGENERATED by Biotics
Negligible	AUTOGENERATED by Biotics
Delimited	USER digitizes, including LU
Linear	USER digitizes, including LU

a. USER selects specific Observation Feature(s) that already exist in Biotics to be used to develop a SF

b. USER enters attributes for the SF, if not already recorded for underlying observation(s) and imported, including:
   - Scientific name for species or ecological element
   - Location Use Class[8] (if applicable)
   - Size/length of underlying observation (if known)
   - Conceptual Feature Type
   - LU Type

c. SF is developed based on assigned LU Type, as follows:

   Estimated

   Biotics AUTOGENERATES SF by applying LU Distance to buffer Observation Feature

   Negligible

   Biotics AUTOGENERATES SF from Observation Feature

   Delimited

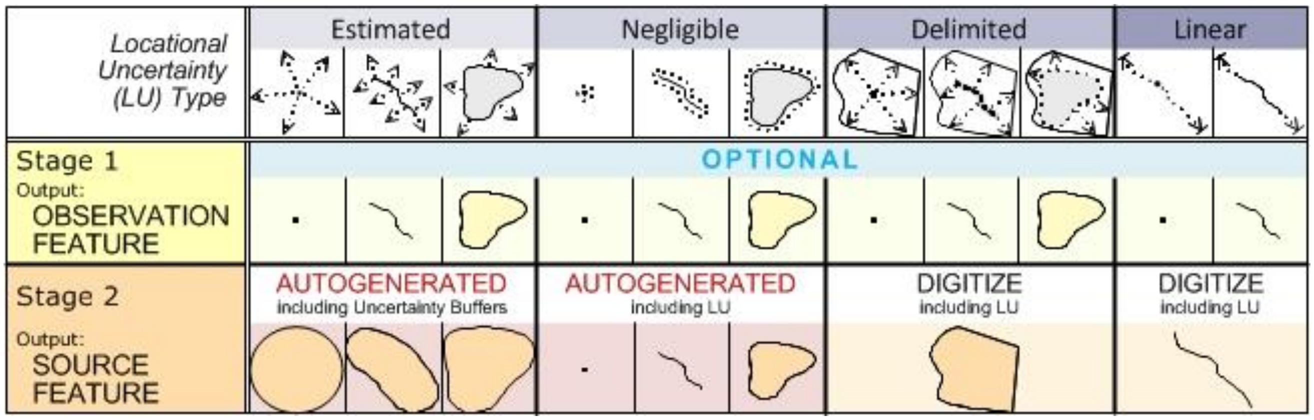
   USER digitizes polygon SF that includes LU; digitized SF is larger than underlying Observation Feature

[7] Pre-source Features are only used for developing Source Features from observations with associated Estimated Locational Uncertainty.
[8] When creating a Source Feature for disjunct migratory animals from multiple Observation Features, the seasonal use of each of the component observations should be the same.

Linear

USER digitizes line SF that includes LU; digitized SF is longer in extent than underlying Observation Feature

Figure 1. Process for developing Source Features from Observation Features.



d. USER enters additional attributes for SF as appropriate, including the following:

- Digitizing Base
- Digitizing Comments
- Mapping Comments
- Representation Accuracy
- Representation Comments

and indicates whether the SF

- Excludes unsuitable habitat

PATH 2. Digitize Pre-source Feature

This pathway is utilized only in cases when there is no existing Observation Feature in Biotics to be used for developing the SF, and the associated LU Type is Estimated.

Table 3. Summary of developing Source Features by digitizing Pre-source Features.

LU Type	Source Feature Development
Estimated	AUTOGENERATED by Biotics, from Pre-source Feature digitized by USER
Negligible	N/A
Delimited	N/A
Linear	N/A

Estimated

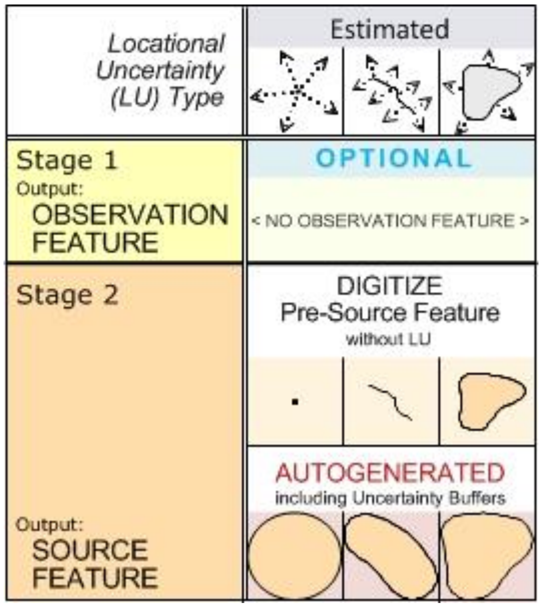
a. USER specifies attributes for Pre-source Feature to be digitized in Biotics, including:

- Scientific name for species or ecosystem
- Location Use Class (if appropriate)
- Size/length of underlying observation (if known)
- Conceptual Feature Type

- LU Type = Estimated

b. USER digitizes point, line, or polygon Pre-source Feature without including any LU
c. USER specifies LU Distance and distance unit
d. Biotics AUTOGENERATES SF by applying LU Distance to buffer Pre-source Feature

Figure 2. Process for developing Source Features by digitizing Pre-source Features.



e. USER enters additional attributes for SF as appropriate, including the following:
- Digitizing Base
- Digitizing Comments
- Mapping Comments
- Representation Accuracy
- Representation Comments

and indicates whether the SF
- Excludes unsuitable habitat

PATH 3. Digitize Source Feature

This pathway is utilized when there is no existing Observation Feature in Biotics for use in developing the SF, and the associated LU Type is Negligible, Delimited, or Linear (i.e., any type except Estimated).

Table 4. Summary of developing Source Features by digitizing.

LU Type	Source Feature Development
Estimated	N/A
Negligible	USER digitizes, including LU
Delimited	USER digitizes, including LU
Linear	USER digitizes, including LU

a. USER specifies attributes for SF to be digitized initially in Biotics (i.e., not developed from Observation Feature[s] existing in Biotics), including:
   - Scientific name for species or ecosystem
   - Location Use Class (if appropriate)
   - Size/length of underlying observation (if known)
   - Conceptual Feature Type
   - LU Type

b. SF is developed based on assigned LU Type, as follows:

   Negligible

   USER digitizes a point, line, or polygon SF that includes LU[9]

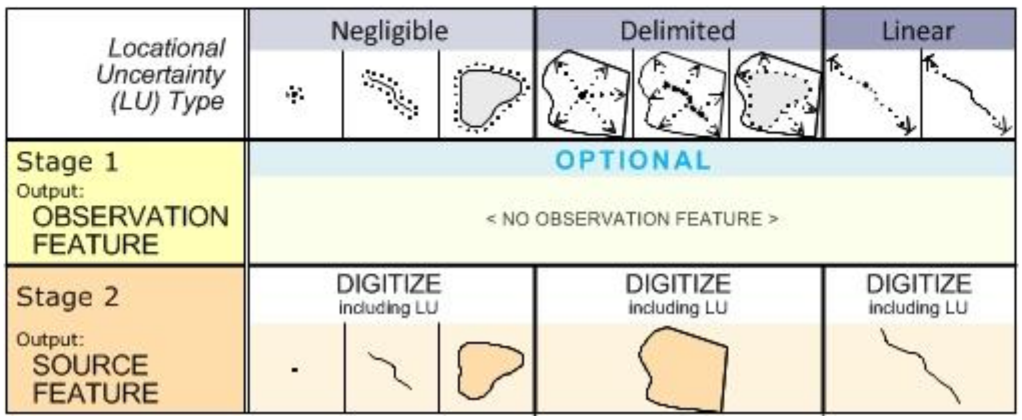
   Delimited

   USER digitizes a polygon SF that includes LU

   Linear

   USER digitizes a line SF that includes LU

Figure 3. Process for developing Source Features by digitizing.



c. USER enters additional attributes for SF as appropriate, including the following:
   - Digitizing Base
   - Digitizing Comments
   - Mapping Comments
   - Representation Accuracy
   - Representation Comments

   and indicates whether the SF
   - Excludes unsuitable habitat

PATH 4. Import Source Features

This pathway is utilized to bring existing data into Biotics as SFs, which must include LU in the mapped feature.

[9] Note that although Negligible LU is included in a digitized Source Feature (SF), because the amount of LU is less than the minimum mapping unit for the map scale being used, the LU is not visible as added area/length to the SF. Thus, a SF with Negligible LU is identical to the feature that would have been digitized 'as-is' to represent the underlying raw observation data.

Table 5. Summary of developing Source Features using an import process.

LU Type	Source Feature Development
Estimated	AUTOGENERATED by Biotics
Negligible	Uploaded by Biotics
Delimited	Uploaded by Biotics
Linear	Uploaded by Biotics

a. USER utilizes a Biotics tool to batch upload SFs from an external database. Data to be uploaded include:
   (1) Spatial data, at least one of the following:
   - Point(s), line(s), and/or polygon(s)
   - Geographic coordinates

   (2) Associated attributes, including
   - Unique identifier
   - Scientific name for species or ecosystem
   - Date, or date range, when underlying observation was made
   - Location Use Class (if appropriate)
   - Size/length of underlying observation (if known)
   - Conceptual Feature Type
   - LU Type

b. SFs are developed based on assigned LU Type, as follows:

   Estimated

   (1) USER specifies LU Distance(s) and distance unit(s) for features
   (2) Biotics uploads spatial data as Pre-source Features
   (3) Biotics AUTOGENERATES SFs by applying LU Distance buffers to Pre-source Features

   Negligible

   Biotics uploads SFs

   Delimited

   Biotics uploads polygon SFs

   Linear

   Biotics uploads line SFs

c. USER enters additional attributes for SFs as appropriate, including the following:
   - Digitizing Base
   - Digitizing Comments
   - Mapping Comments
   - Representation Accuracy
   - Representation Comments

   and indicates whether the SF
   - Excludes unsuitable habitat

Table 6. Source Feature development pathways, by Locational Uncertainty Type.

SOURCE FEATURE DEVELOPMENT PATHWAYS	LOCATIONAL UNCERTAINTY TYPE			
	Estimated	*Negligible*	*Delimited*	*Linear*
Develop from imported Observation Feature	AUTOGENERATED	AUTOGENERATED	Digitized (including LU)	Digitized (including LU)
Digitize Pre-source Feature (without LU)	AUTOGENERATED	N/A	N/A	N/A
Digitize Source Feature	N/A	Digitized (including LU)	Digitized (including LU)	Digitized (including LU)
Import Source Feature	AUTOGENERATED from upload	Uploaded	Uploaded	Uploaded

OPTIONAL

Define Unsuitable Habitat Features

Source Features should be developed without including habitat known to be unsuitable for supporting the species or ecosystem whenever possible. Omitting those areas within a SF that cannot be utilized by the species/ecosystem improves the accuracy of the mapped feature in representing the location of a species or ecosystem.

However, in cases when such areas have not been eliminated during SF development, Biotics provides the option to create Unsuitable Habitat Features (UHFs) for automated exclusion of this habitat from existing SFs.

Process for utilizing Unsuitable Habitat Features

a. USER creates UHF(s) in Biotics by:
   - Manually digitizing polygon(s)

     AND/OR
   - Copying polygon(s) from existing spatial layer(s)

b. USER selects SF to be associated with the UHF(s)

c. Biotics AUTOMATICALLY:
   - Saves UHF(s) in a managed theme
   - Associates the UHF(s) with the selected SF, and archives a copy of the SF as-is
   - Clips unsuitable habitat from the original SF using the UHF(s) as a 'template' for area to be removed, and saves the (now clipped) SF
   - Re-clips unsuitable habitat from the SF each time it is regenerated

Procedural Buffers

A Procedural Buffer, equal to half the minimum mapping unit (MMU) for a map at a particular scale, is added to SFs that are smaller (in at least one dimension) than the MMU to ensure their visibility on that map. Essentially a construct used for point and line SFs[10], a Procedural Buffer is applied simply to bring features up to the size of the MMU for representation at a particular scale.

Procedural Buffering process

Biotics AUTOMATICALLY applies a Procedural Buffer to any SF smaller than the MMU for the target map scale when the feature is saved, regardless of whether that SF has been used to develop an EO, or is being retained as an Independent SF. [11]

Note that a SF with a Procedural Buffer added (and thus, a larger footprint) is more appropriately used for different purposes than that feature before the buffer was applied, as shown in Table 3. This differentiation in uses is not needed for SFs larger than the MMU for the target map scale as they are not modified by Procedural Buffers.

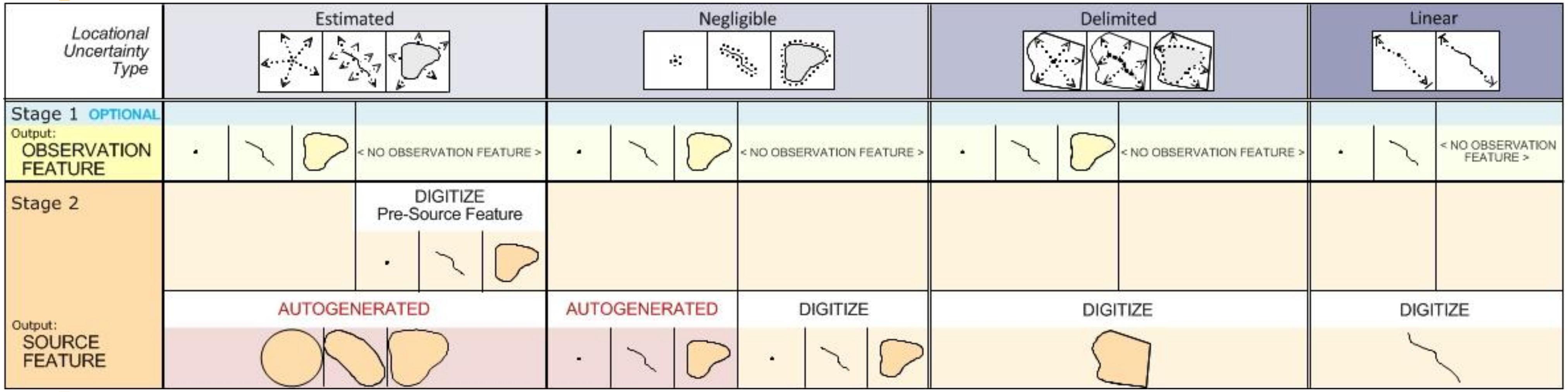
Table 7. Uses for Source Features smaller than MMU, with and without Procedural Buffers.

Items for Source Feature Comparison	Source Feature < MMU **WITHOUT Procedural Buffer**	Source Feature < MMU **WITH Procedural Buffer**
*What is **Included** in the feature?*	• Observation • Locational Uncertainty	• Observation • Locational Uncertainty • Procedural Buffer
*What is its **shape**?*	• Point • Line • Polygon	• Polygon
*What are appropriate **uses**?*	• Separation Distance assessment • Modeling • Calculations • Analyses	• Preview of Element Occurrences from Separation Distance assessment • Element Occurrence component • Independent Source Feature • Map products • Published maps

[10] While always added to points and lines at the target map scale, Procedural Buffers are also added to polygon Source Features that are smaller than the mmu for that scale.

[11] A Source Feature is 'Independent' if it is not a component of any Element Occurrence.

Figure 4. Source Feature development processes, by Locational Uncertainty Type.



STAGE 3: **ELEMENT OCCURRENCE**

Biotics provides two development pathways for EOs in this spatial model, typically initiated once new SF(s) have been developed. The first pathway consists of an **automated process that includes USER evaluation at the end; the second is a completely manual process** for creating EOs. Note that all EOs are developed from one or more SFs through the application of Separation Distances based on characteristics of the species or ecosystem.

PATH 1. Autogenerated EOs
PATH 2. Manual development of EOs

PATH 1. Autogenerated EOs

Automatic Separation Distance Evaluation

a. USER specifies the Separation Distance (stored in the Element Occurrence Specifications for the species or ecosystem) to be applied to SFs from the choices displayed AUTOMATICALLY by Biotics, shown in the table below

Table 8. Distance choices for automatic Separation Distance evaluation.

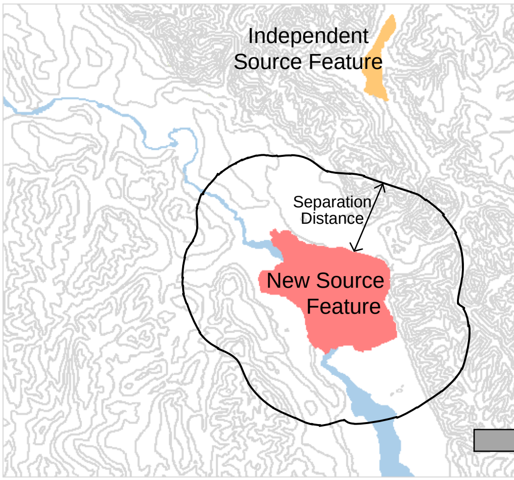
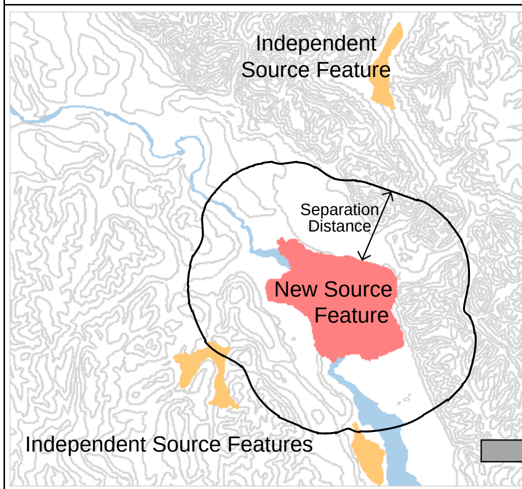
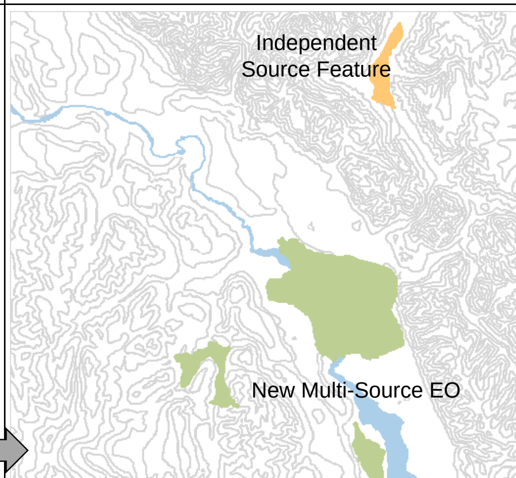
Distance	Source of Separation Distance Value
Suitable Habitat	Suitable habitat value from EO Specifications[12]
Unsuitable Habitat	Unsuitable habitat value from EO Specifications
Custom	User-defined Separation Distance

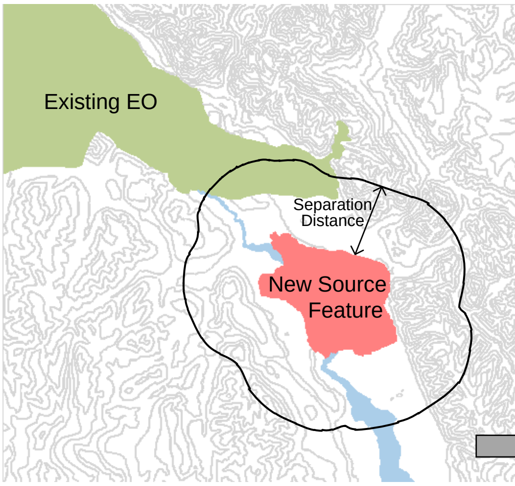
b. Biotics AUTOMATICALLY:
   - Applies the specified Separation Distance between new and existing SF(s)[13] of the same Location Use Class[14] (if applicable), including both components of EOs as well as Independent SFs
   - Develops a new EO or modifies an existing EO(s) based on SFs located within the Separation Distance from each other, as illustrated in Figure 1 below
   - Displays a preview of the AUTOGENERATED EO(s), along with tabular data

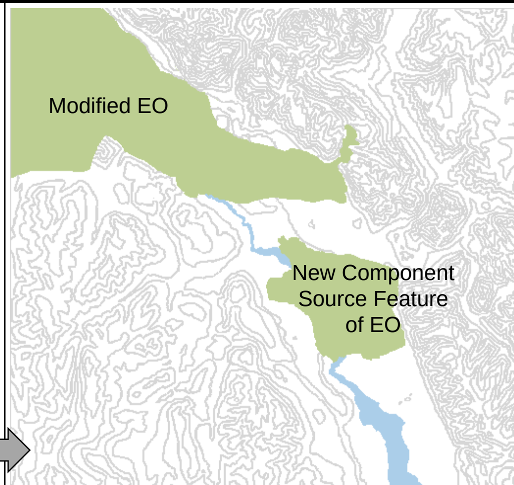
c. USER evaluates the previewed EO(s), designating principal and sub-EOs if multiple existing EOs are included, and indicates whether to:
   - Accept the EO(s) as-is; Biotics AUTOMATICALLY saves the EO(s)
   - Add or remove SFs to/from the EO(s), and initiate the save operation
   - Not accept the EO(s); Biotics cancels the automatic EO development process, and AUTOMATICALLY redirects User to EO pathway 2 (described below)

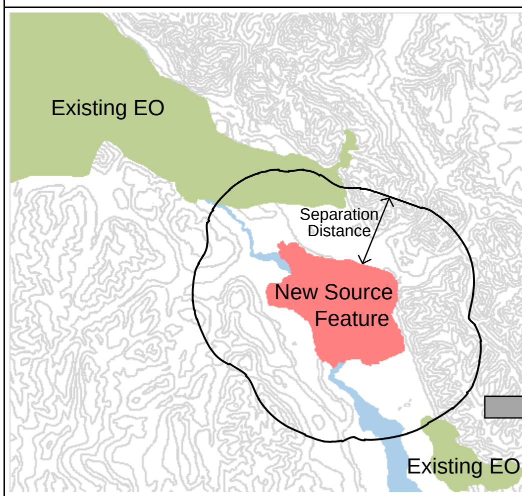
[12] Element Occurrence Specifications contain criteria for developing EOs of a particular species or ecosystem.
[13] Separation Distance is applied to Source Features without added Procedural Buffers.
[14] Source Features (SFs) comprising a single EO must have the same Location Use Class, (i.e., represent the same season of use) for animals that are disjunct migrants. Example: bat SFs that are class Maternity Colony are not grouped with those that represent the Hibernacula class or Bachelor Colony class, even in cases when the locations overlap, so that separate EOs can be defined for each season in the species' life cycle.

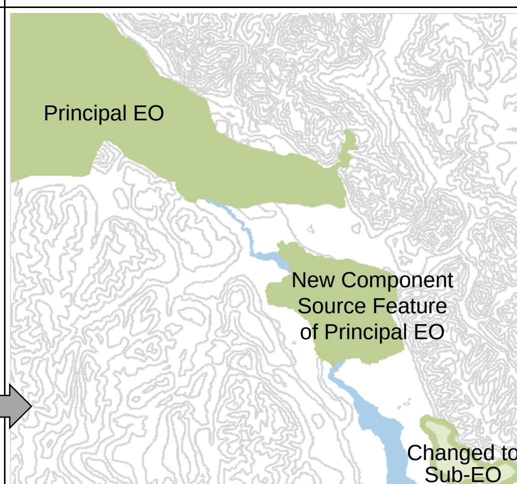
Figure 5. Autogenerated EOs, based on automatic Separation Distance evaluation.

Application of Separation Distance (SD) to new Source Feature	Resulting Autogenerated EO developed by Biotics for User review
	
No other Source Features within SD	New EO developed from new Source Feature
	
Independent Source Features within SD	New EO developed from grouped Source Features

<table>
<tr><th>Application of Separation Distance (SD)
to new Source Feature</th><th>Resulting Autogenerated EO
developed by Biotics for User review</th></tr>
<tr><td>

One existing EO within SD</td><td>

Existing EO modified by adding new Source Feature</td></tr>
<tr><td>

Multiple existing EOs within SD</td><td>

User input

Specify:

which existing EO is to become the principal EO and which the sub-EO(s)
OR
that Biotics create a new principal EO from the new Source Feature, and others become sub-EOs

Select EO that Source Feature will be added to, if new EO is not created

Automatic Biotics processes based on User input

Principal EO is created/assigned
Other existing EO(s) become sub-EO(s)
New Source Feature is added to specified EO, if new EO is not created

Note: Graphic above illustrates results from only one of the possible User input scenarios</td></tr>
</table>

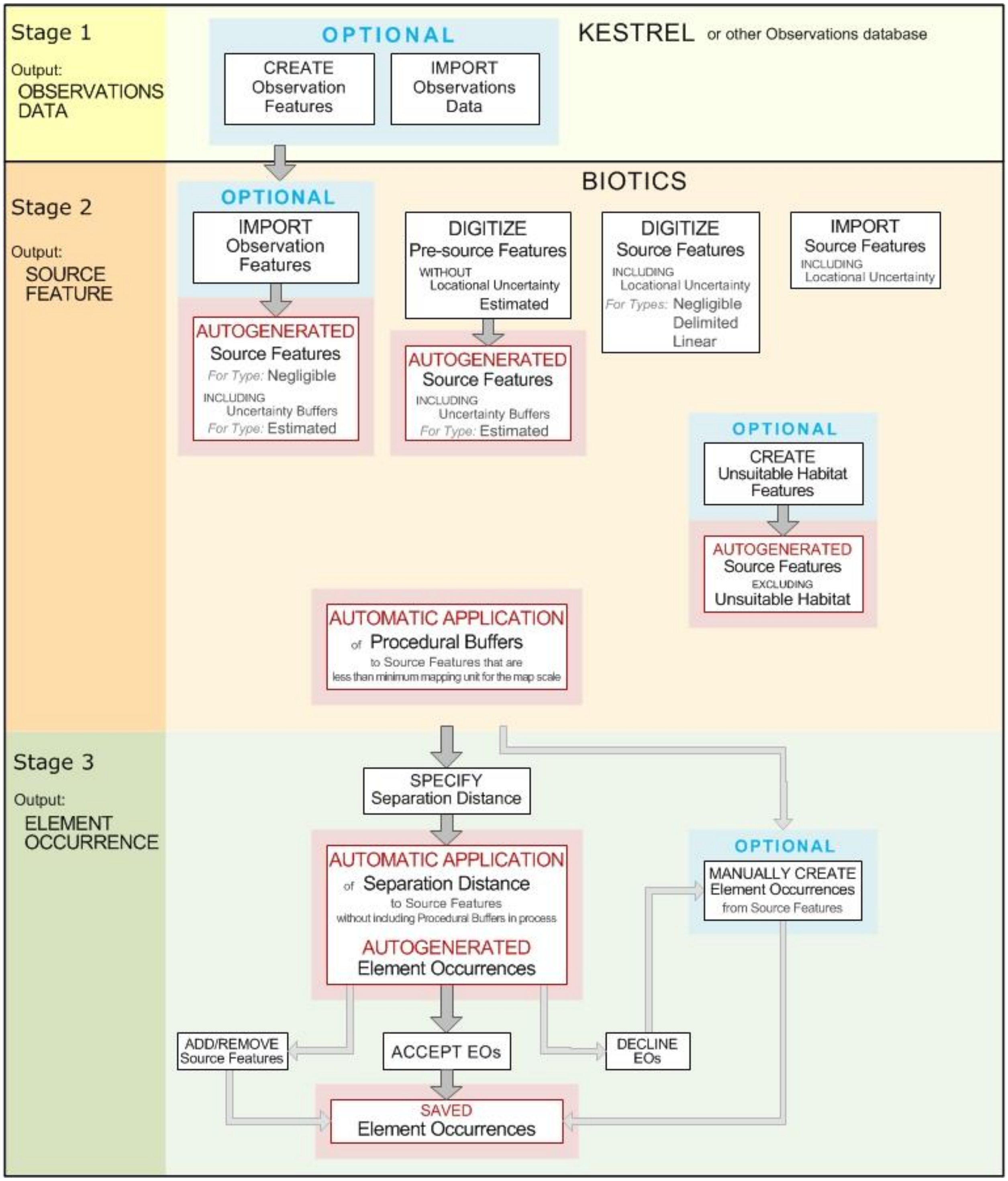
OPTIONAL

PATH 2. Manual development of EOs

a. USER evaluates Separation Distance by:
   (1) Using Biotics tool to apply Separation Distance to new SF[15]
   (2) Identifying existing Independent SFs and EOs within that distance
b. USER selects the SF(s) to be used to develop a new EO or added to an existing EO
c. Biotics saves EO developed by the USER.

[15] Separation Distance is applied to Source Features without added Procedural Buffers.

Figure 6. Summary of spatial model workflow.



Glossary

BIOTICS

Biotics 5 is the updated online version of biodiversity data management software developed and used by NatureServe and its network programs. Biotics comprises an integrated tabular database and customized geographic information system application which supports standard methodology for mapping and managing biodiversity information. Back

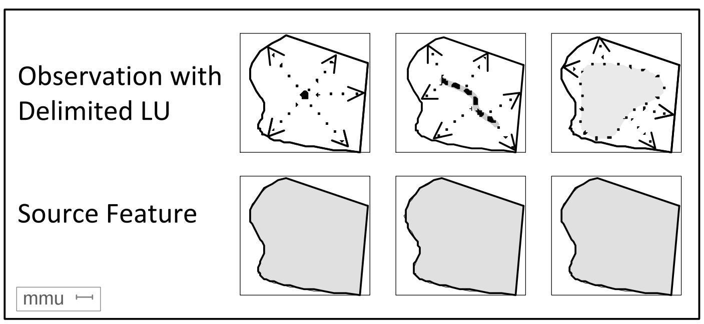
CONCEPTUAL FEATURE TYPE

Conceptualization of the observation data underlying a Source Feature on a map. The type of Conceptual Feature Type – point, line, or polygon – depends on the minimum map unit for the scale map being used, and the size of the species or ecosystem observation. Back

DELIMITED UNCERTAINTY

Type of Locational Uncertainty assigned to a Source Feature (SF) when the uncertainty associated with the underlying observation can be circumscribed by a mappable boundary that is not based on the same defined distance in all directions, and the extent of uncertainty is greater than half the minimum mapping unit for the map scale. SFs with Delimited uncertainty are always polygons. Back

Figure 7. Delimited Locational Uncertainty.



ELEMENT OCCURRENCE (EO)

An area of land and/or water in which a species or ecosystem is, or was, present, developed to identify locations of the element that have the potential to persist if current conditions prevail. Consistency in EOs throughout the range of an element is achieved through the use of standard minimum data criteria and rules of separation specific to that element or group of similar elements.

An EO is developed from one or more Source Features, and may be represented as a single contiguous feature, or comprising discrete patches. Back

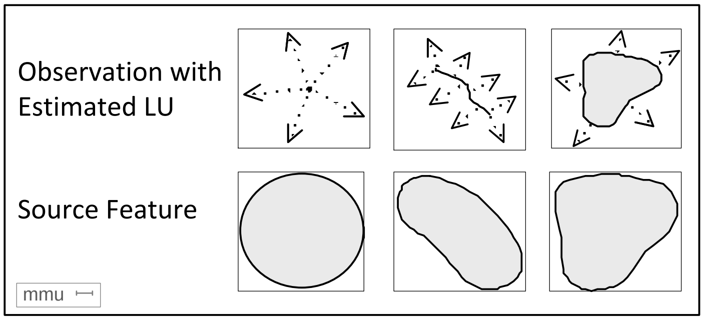
ELEMENT OCCURRENCE SPECIFICATIONS (EO SPECS)

Detailed criteria for defining and delineating Element Occurrences (EOs). Specifications are developed and maintained for individual species and ecosystems, or in many cases, for related groups of elements (e.g., *Catocala* Moths - Prairie Species; *Ambystomatid* Salamanders). Use of EO Specifications when developing EOs helps to ensure that occurrences are consistently created and mapped across the NatureServe program network. Back

ESTIMATED UNCERTAINTY

Type of Locational Uncertainty assigned to a Source Feature (SF) when the uncertainty associated with the underlying observation cannot be delimited, and the extent of uncertainty is greater than half the minimum mapping unit for the map scale. Uncertainty for these features is represented by an applied Locational Uncertainty Distance buffer. SFs with Estimated uncertainty are always polygons. Back

Figure 8. Estimated Locational Uncertainty.



INDEPENDENT SOURCE FEATURE

A Source Feature that is currently not a component of an Element Occurrence (EO). Back

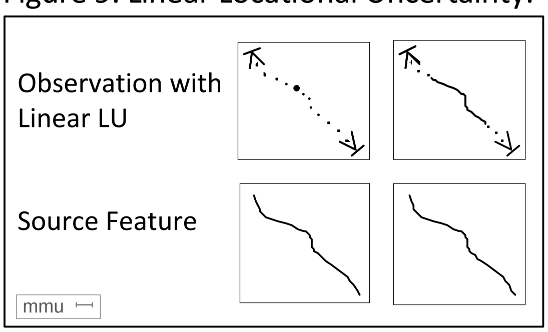
KESTREL

Online observations data management system developed by NatureServe. Kestrel comprises an integrated tabular database and customized geographic information system application for mapping and managing observations. Back

LINEAR UNCERTAINTY

Type of Locational Uncertainty assigned to a Source Feature (SF) when the uncertainty associated with the underlying observation extends along an axis (e.g., shoreline, ridge, stream, etc.) which can be delineated, and the extent of uncertainty is greater than half the minimum mapping unit for the map scale in one dimension. SFs with Linear uncertainty are always lines. Back

Figure 9. Linear Locational Uncertainty.



LOCATIONAL UNCERTAINTY (LU)

Represents uncertainty in location, specifically the difference between the recorded location of an observation and its actual location. LU is affected primarily by survey equipment and protocols used to collect observations data. Back

LOCATIONAL UNCERTAINTY DISTANCE

Value specified by the user for Source Features (SFs) with Estimated Locational Uncertainty (LU). The Uncertainty Distance is used to buffer an Observation Feature or Pre-source Feature in order to add include associated LU in the SF. Back

LOCATIONAL UNCERTAINTY TYPE (LU TYPE)

Different kinds of Locational Uncertainty (LU) – Estimated, Negligible , Delimited, and Linear – that have been defined on the basis of the extent and direction of variability between the actual and mapped locations of an observations. An LU Type is assigned to a Source Feature (SF) according to the LU of the underlying observation(s), and helps to determine the shape of that SF (i.e., point, line, or polygon). Back

LOCATION USE CLASS

Label assigned to Source Features (SFs) and Element Occurrences (EOs) of migratory animals that occupy disjunct locations by season (e.g., aerial and marine migrants) to identify when the location is used by the animal, helping to ensure that locations utilized at different seasons throughout the animal's life cycle are considered for conservation. Thus, EOs are developed from SFs that belong to the same Location Use Class, enabling identification of the EO as to its season of use. Examples of classes include Breeding and Nonbreeding classes; specifically for bats, Maternity Colony, Bachelor Colony, and Hibernaculum. The definitive set of Location Use Classes utilized is maintained by NatureServe Central Zoology, and when appropriate for the animal, are specified in its Element Occurrence Specifications. Back

MINIMUM MAPPING UNIT (MMU)

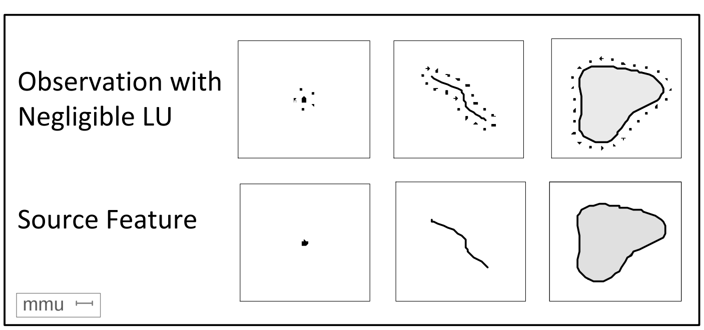
Size of the smallest feature that can be delineated with boundaries on a map. The MMU differs by map scale, for example the MMU used for a 1:25,000 scale map in the spatial model is 12.5 m, and a 25 m MMU is used for a 1:50,000 scale map.

Back

NEGLIGIBLE UNCERTAINTY

Type of Locational Uncertainty assigned to a Source Feature (SF) when the uncertainty associated with the underlying observation is less than half the minimum mapping unit (MMU) for the scale map being used. For example, on a 1:24,000 scale map, the MMU is 12.5 m, so the difference between the actual and mapped locations of the observation is less than 6.25 m for Negligible uncertainty. SFs with Negligible uncertainty can be points, lines, and polygons. Back

Figure 10. Negligible Locational Uncertainty.



OBSERVATION

Presence or historical presence of a species or ecosystem at a location indicated by the collection of information; also, a location where a target species or ecosystem was searched for but not detected. Observations are not evaluated in terms of potential persistence according to standards, but encompass a broad range of different quantitative and qualitative information types useful for assessing locations, or potential locations, of elements.

One or more observations can be represented using a mapped Observation Feature, which may serve as the basis for developing a Source Feature. Back

OBSERVATION FEATURE

A feature developed to represent one or more field observations, mapped 'as-is' (i.e., without adding area for Locational Uncertainty or making other modifications). One or more Observation Features may be used to develop a Source Feature. Back

PRE-SOURCE FEATURE

In cases when an Observation Feature has not been imported into Biotics for developing a Source Feature (SF) and the Locational Uncertainty (LU) associated with the data is Estimated, a Pre-source Feature is digitized without LU included. Biotics uses the Pre-source Feature to automatically develop a SF, applying the specified Locational Uncertainty Distance to the feature as a buffer during the development process. Back

PRINCIPAL EO

A principal Element Occurrence (EO) represents the known extent of a species or ecosystem at a location, defined according to EO Specifications. At the top of a nested relationship among EOs for a particular element, a principal EO can contain one or more sub-EOs. Back

PROCEDURAL BUFFER

Buffer equal to half the minimum mapping unit for the map scale, which is added to Source Features that are less than the size of the MMU in at least one dimension to ensure that the features are visible at the target map scale.

Back

REPRESENTATION ACCURACY

Value assigned to indicate the relative amount of a Source Feature (SF) that was observed to be occupied by the species or ecosystem (i.e., the area or length of the underlying field observation) vs. area added for Locational Uncertainty. Thus, the smaller the amount of uncertainty included in a SF, the higher the Representation Accuracy (RA). A dichotomous key can be used to assign RA, with values ranging from very high to very low accuracy. Back

SEPARATION DISTANCE

Defined distances designated in Element Occurrence Specifications, which are used to group Source Features of a particular species or ecosystem into potentially viable units, i.e., Element Occurrences. The bases for Separation Distances include dispersal distance and home range (for species only), and spatial and temporal patterns of occurrence for all elements. Distances are provided for use across suitable and unsuitable habitat for species, and different intervening areas for ecosystem. Back

SOURCE FEATURE (SF)

The mapped representation of one or more observations, including Locational Uncertainty to ensure that the actual on-the-ground location of the underlying observation(s) is captured within the SF.

One or more SFs can be used to create an Element Occurrence. Back

SUB-EO

A sub-Element Occurrence (sub-EO) represents an area nested within a principal EO of the same species or ecosystem (e.g., a den sub-EO within a bear home range principal EO; an old-growth patch sub-EO within a matrix forest ecosystem principal EO). Although optional, a sub-EO is generally used to identify an area within the parent principal that is: 1) used for a specific behavior or life history function; 2) contains differing composition, density, or quality, or 3) for which a significant amount of data needs to be managed. Back

UNSUITABLE HABITAT FEATURE

Optional feature developed to represent habitat that cannot be utilized by a particular species or ecosystem. Unsuitable Habitat Features can be used to indicate portions of a Source Feature that should be excluded in order to better represent the area actually occupied by the element. Back