Modification of the Riverine Cover Type Component of the Habitat Suitability Index Model for Mink

by

Randy Devendorf and Tim Yager

Modification of the Riverine Cover Type Component of the Habitat Suitability Index
Model for Mink

by
Randy Devendorf and Tim Yager

General

The U.S. Fish and Wildlife Service published a habitat suitability index model for the
mink (Mustela vison) to address potential habitat quality in four different cover types:
Lacustrine, Riverine, Palustrine Emergent Wetlands and Palustrine Forested Wetlands
(Allen 1986). The model assumes the availability of surface water and cover density
indirectly address the availability of suitable prey and directly address the cover quality
for mink. As such, the model incorporates the use of 6 different suitability index
variables, in different combinations dependent on cover type, to develop the Habitat
Suitability Index (HSI) for each cover type. For riverine corridor habitat, the variables
utilized to address habitat quality are: percent of the year surface water is present; tree
cover and/or shrub canopy closure with 100 meters of the water's edge; and percent
shoreline cover within 1 meter of the water's edge.

Allen (1986) and references cited therein, states that decreased diversity in shoreline
configuration, elimination of aquatic vegetation and decreased abundance and diversity
of riparian vegetation caused by channelization reduced habitat quality, prey availability,
and mink use of riverine habitats in Mississippi and Alabama. Further, the abundance of
suitable mink prey is reduced when shallow, detritus rich sloughs associated with
meandering streams are replaced with an abrupt, monotypic interface between aquatic
and terrestrial cover types as a result of channelization. Habitats associated with small
natural streams are preferred to those associated with large, broad rivers.

Permanent water, a reliable food source and adequate shoreline vegetation are keys to
good mink habitat. Natural stream channels, when compared to ditched or channelized
stream segments, typically are more diverse and provide higher quality and more habitat
for aquatic invertebrate, fish and amphibian species. Natural channels generally support
a wider variety and greater abundance of aquatic species which serve as prey/forage for
mink. In addition to generally providing less prey/forage of mink, stream ditching or
channelization reduces the amount of habitat available by reducing the length of the
stream.

While the current model is useful for evaluating habitat conditions along a riverine
corridor, it is not sensitive to the potential increase in habitat quality associated with a
natural stream channel when compared to the ditched or channelized stream segment.
An additional variable called V^{stream} was derived and integrated into the existing mink
model to provide a more useful tool for evaluating mink habitat along disturbed riparian

corridors. A discussion of the incorporation of the V^{stream} variable into the evaluation of habitat quality of riverine/stream habitat is provided below. (NOTE: *The variable numbers (V1, V5 and V6), related variable descriptions and discussions presented for water and cover are directly from the referenced mink model by Allen (1986).*)

Model Applicability

      Geographic Area. The modifications are applicable throughout the range of the species in North America.

      Season. The model is applicable to the potential quality of year-round habitat for mink.

      Cover types. The modification was developed to improve the evaluation of the quality of mink habitat along stream/riverine corridors.

      Minimum Habitat Area. As noted in the referenced model documentation, the size and shape of mink home ranges vary in response to topography, food availability and sex, and tend to parallel the configuration of the body of water. No minimum habitat area for mink is defined in the model. It is assumed that any stream area large enough to be identified and evaluated as such, has the potential to support mink.

      Verification Level. The mink HSI model provides habitat information useful for impact assessment and habitat management. The model is a hypothesis of species-habitat relationships and does not reflect proven cause and effect relationships.

The modification for evaluating the riverine/stream cover type includes an additional variable to incorporate stream conditions when evaluating the Cover component of the model. In 2011 the modified model for the riverine/stream cover type was reviewed by a panel of experts as part of the Corps of Engineers model certification process. Overall, the reviewers agreed that the application of the revised riverine component of Mink HSI Model is sound for planning in efforts in riverine environments with minor recommendations to correct the spreadsheet calculation errors. The modification was initially developed for application to streams and rivers in the Upper Midwest US. Reviewers felt that the geographic applicability of the modifications would be the same as the referenced model. Reviewers also felt that the validity of the model could be strengthened with field verification. This comment has been inherent in the review of most FWS HSI models or proposed revisions.

      Model Constraints. The model is designed to evaluate the potential of an area to provide year-round habitat for mink in riverine covert types and is not necessarily meant to predict carrying capacity. While considered to be fundamentally sound for planning purposes, consideration should be given to field verification based on post project monitoring where the model is utilized to strengthen the validity of the variables and relationships.

As a matter of course, evaluators should document the reasoning and source for arriving at SI values. Evaluators are especially encouraged to document the factors considered when arriving at a value for the categorical variable of stream condition for a given study to ensure a consistent approach is applied within a project over time. This approach will assist in providing meaningful interpretation of monitoring results and project accomplishments.

Model Description

Overview: The modification of the model incorporates stream condition as component of the cover life requisite for riverine areas. Incorporation of a stream condition variable increases the sensitivity of the model to overall riverine corridor condition, primarily as it relates to sinuosity and the potential for a less disturbed stream course to provide a more diverse and consistent forage/prey base.

Water Component: It is assumed that surface water must be present a minimum of 9 months of the year to provide optimum foraging habitat and prey availability for mink. The value calculated for the water suitability index is based on the permanence of surface water (V1) shown in Figure 1. The equation for the water suitability index (SI Water) for mink is:

$$SI\ Water = SIV1$$

V1: The relationship between the permanence of surface water (V1) and habitat quality for mink are based on the following assumptions. Cover types that have surface water present <25% of the year are assumed to be unsuitable year-round habitat due to the absence of aquatic prey species. Abundance and availability of aquatic prey are assumed to increase as the permanence of surface water increases. Cover types that maintain surface water for >75% of the year are assumed to provide conditions conducive to maximum availability of aquatic prey.

Cover Component: Although mink will use upland cover types, they are most often found in close association with wetlands and the vegetative communities immediately adjacent to streams, rivers and lakes. Small terrestrial mammals become an important component of the mink's diet during the fall and winter months. Terrestrial mammals may be an important component in the diet of the male mink throughout the year. Sufficient vegetative cover interspersed with, or immediately adjacent to, water is assumed to provide an adequate source of prey species to supplement the aquatic portion of the mink's diet. Dense woody cover of trees and shrubs provides the mink with potential den sites, escape cover and foraging cover. Persistent herbaceous vegetation also may provide mink with sufficient cover for foraging and shelter. It is assumes that nonpersistent herbaceous vegetation, by itself, will not provide sufficient cover for mink during winter. Within riverine cover types, suitable cover for mink is assumed to be related to the density of woody vegetation within 100m of the water's edge and the availability of foraging and security cover at the water land interface.

The modified cover suitability index for riverine cover type is related to the density of woody vegetation within 100 meters of the water's edge (V5), the percent shoreline cover within 1 meter of water's edge (V6) and stream/river condition as it relates to the level of disturbance associated with ditching/channelization (V^{stream}). The equation for the cover suitability index for river/streams (SI Cover$^{stream/river}$) is:

$$\text{SI Cover}^{stream/river} = (\text{SIV5} \times \text{SIV6} \times \text{SIV}^{stream})^{1/3}$$

The equation assumes the relationship of the variables are compensatory in that a low value of one variable may be offset by higher values of the other variables. Optimum conditions in terms of cover for prey species and mink will be obtained only when the tree and shrub canopy cover within 100 m of the water's edge is $\geq 75\%$, 100% of the shoreline provides cover within 1 m of the water's edge and the steam is not channelized or ditched. Lower values on either of the variables will result in a SI Cover$^{stream/river}$ of < 1.0.

V5: Ideal cover conditions are assumed to exist when tree canopy cover and shrub canopy cover, within 100 m of the water's edge, either singly or in combination account for $\geq 75\%$ canopy cover (Figure 2). Less dense vegetative cover adjacent to river or stream channels characterize less suitable cover conditions to mink as a result of decreased foraging cover, den sites and cover for prey species. Riverine wetlands lacking adjacent wood vegetation are assumed to have low value as mink habitat due to the absence of cover for both mink and their terrestrial prey.

V6: Mink foraging activity is riverine cover types is concentrated along the shoreline and land/water interface. Therefore the amount of cover or vegetative structural diversity along shorelines is important in evaluating habitat quality. Shorelines with a high degree of cover, which may be provided by overhanging or emergent vegetation, exposed roots, debris, log jams, undercut banks, boulders or rock crevices, provide cover for prey species as well as secure foraging cover for mink. It is assumed that ideal cover for mink is present where 100 % of the shoreline provides dense foraging and security cover (Figure 3). Shorelines devoid of vegetative or structural cover are assumed to have extremely low value as mink habitat.

V^{stream} : Stream condition is primarily defined as whether or not the stream, or a portion of the stream, has been ditched or channelized (Figure 4). Water courses that have not been ditched or channelized are assumed to provide better mink habitat, not only due to the inherent diversity associated with natural stream courses, but also because of more mink feeding habitat within a given linear distance due to stream sinuosity. Streams that have been entirely or partially channelized and have a high degree of disturbance along the banks are assumed to have lower value as mink habitat because they are expected to support fewer numbers and types of prey items. Factors to consider when determining a stream index value may include stream sinuosity, percent of the evaluation reach that has been ditched, degree of erosion along stream banks, presence of undercut banks, degree of channel incision, land use conditions (grazing, presence of a buffer strip, etc) and water quality. While the Index for this variable is presented as discrete intervals,

consideration should be given to assigning intermediate values if the evaluator feels is warranted. Since the determination of this value may be based in large part on professional judgment, the reasoning for assigning the values for stream condition should be included in the documentation for the habitat analysis.

Habitat Suitability Index for Riverine Cover Type

The HSI model for mink considers life requisite values for water and cover.

SI Water = SIV1

SI Cover$^{stream/river}$ = (SIV5 x SIV6 x SIV^{stream})$^{1/3}$

The HSI for the riverine cover type is equal to the lowest value calculated for either life requisite.

REFERENCES:

Allen, A.W. 1986. Habitat suitability index models: Mink, revised. U.S. Fish and Wildlife Service Biological Report 82(10.127). 23pp. [First printed as:FWS/OBS-82/10.61, October 1983.]

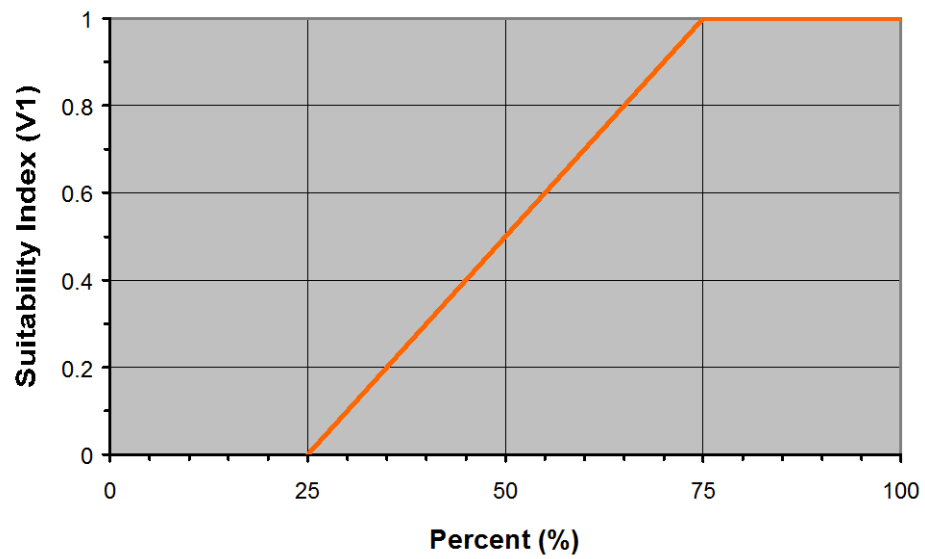Figure 1. Variable V1 - Percent of Year with Surface Water Present.

Figure 2. Variable V5 - Percent Canopy Cover within 100 Meters of Water.

Figure 3. Variable V6 - Percent Cover within 1 Meter of the Shoreline

Figure 4. Variable Vstream - Stream condition.