Species Habitat Suitability Model – White-tailed Kite

Model Approach. BDCP Species Habitat Suitability Models are formulated primarily using vegetation data from existing GIS data sources (described below). Habitat suitability for each species is determined on the basis of whether or not a vegetation type or association is likely to be occupied based on the species' habitat requirements as described in the species account. The models are not formulated on the basis of species occurrence data, which is incomplete for most Covered Species in the Planning Area. Instead, species occurrence data are used to verify the habitat models and as necessary revise the vegetation input data.

By its nature, this type of model tends to provide conservative results with respect to the extent of suitable habitat. The tendency is to overestimate suitable habitat by attempting to be as inclusive as possible in the absence of site-specific data on vegetation structure, species composition, hydrology, occurrence of or proximity to other habitat elements and other variables that would provide more certainty with respect to habitat quality and the potential for occurrence.

However, due to minimum mapping unit limitations, it is possible to underestimate as well as overestimate the extent of suitable habitat. For example, suitable habitat areas that are below the minimum mapping unit size (1 acre) may not be identified. This may be important for species that can use small isolated habitats, such as individual trees or small groups of trees. Still, the more likely scenario is that an overestimate occurs as small acreages of unsuitable habitat are absorbed into larger suitable habitat polygons. Nonetheless, it is also important to note that while the models portray a reasonable distribution of habitat suitability for each Covered Species, they do not necessarily indicate with certainty that Covered Species would not occur in all areas identified as non-habitat; but instead indicate that non-habitat areas have a much lowered probability of species occurrence compared with areas identified as suitable habitat.

Where applicable, habitat suitability is also identified according to the life requisite of the species, such as breeding, foraging, or movement/dispersal habitat, and in some cases according to minimum habitat area requirements using home range or territory size data. Where appropriate, habitat suitability is also defined qualitatively (e.g., high, medium, and low value) based on broad suitability categories (e.g., grassland, pastureland, cultivated land) or through a general examination of species associations within vegetation types (e.g., species and range of percent cover of understory shrub layer) such as that provided in Hickson and Keeler-Wolf 2007. Finally, other input variables are used to address specific conditions that are not accounted for in the vegetation data bases but that can be generated through GIS analysis. These include incorporating buffers, connectivity between habitat types, and specific land use types, such as levee slopes.

For each model, the mapping data sets are identified and each vegetation type or association is identified along with its life requisite association. Finally, the assumptions used in the formulation of the model are described and if and how the model is expected to over- or under-estimate the extent of habitat in the planning area.

GIS model data sources. The white-tailed kite model uses vegetation types and associations from the following data sets: BDCP composite vegetation layer (Vaghti and Keeler-Wolf 2003 [Suisun Marsh]; Hickson and Keeler-Wolf 2007 [Delta]; TAIC 2008 [Yolo Basin]); USDA 2005 aerial photography; and DWR 2007 land use survey of the Delta and Suisun Marsh area-version 3. Using these data sets, the model maps the distribution of suitable white-tailed kite habitat in the Planning Area according to the species' two primary life requisites, nesting habitat and foraging habitat. Vegetation types were assigned based on the species requirements as described above and the assumptions described below.

Breeding Habitat: Nesting habitat in the Delta includes the following types from the BDCP composite vegetation layer:

- Agricultural Land
  - Eucalyptus
- Valley Riparian
  - White alder (*Alnus rhombifolia*)
  - *Alnus rhombifolia/Salix exigua*
  - *Alnus rhombifolia/Cornus sericea*
  - Oregon Ash (*Fraxinus latifolia*)
  - Box elder (*Acer negundo*)
  - *Acer negundo-Salix gooddingii*
  - Hinds walnut (*Juglans hindsii*)
  - Fremont cottonwood (*Populus fremontii*)
  - Black willow (*Salix gooddingii*)
  - *Salix gooddingii*/wetland herbs
  - *Quercus lobata-Salix exigua-Rubus discolor*
  - *Salix goodingii – Quercus lobata*/wetland herbs
  - *Salix gooddingii/rubus discolor*
  - Coast live oak (*Quercus agrifolia*)
  - Valley oak (*Quercus lobata*)
  - *Quercus lobata/Rosa californica*
  - *Quercus lobata – Acer negundo*
  - *Quercus lobata – Alnus rhombifolia*
  - *Quercus lobata – Fraxinus latifolia*
  - Arroyo Willow (*Salix lasiolepis*)
  - *Salix lasiolepis* – Mixed brambles
  - *Salix lasiolepis – Cornus sericea/Scirpus* spp – complex unit
  - Shining willow (*Salix exiqua*)

- *Salix Exigua – (Salix lasiolepis – Rubus discolor – Rosa californica*)
- Black willow (*Salix gooddingii*)-Valley oak (*Quercus lobata*) restoration
- Valley oak (*Quercus lobata*) restoration
- White alder (*Alnus rhombifolia*) Arroyo willow (*Salix lasiolepis*) restoration

Nesting habitat in the Suisun Marsh and Yolo Basin includes the following types from the BDCP composite vegetation layer:

- Eucalyptus
- *Eucalyptus globules*
- *Fraxinus latifolia*
- Fremont Cottonwood-Valley Oak-Willow Riparian Forest
- Landscape trees
- Mixed Fremont Cottonwood – Willow
- Mixed Willow Super Alliance
- Oaks
- *Quercus agrifolia*
- *Salix lasiolepis/Quercus agrifolia*
- Valley Oak Alliance – Riparian
- Willow Trees

Breeding habitat for white-tailed kite includes all valley riparian types that support an overstory component. The model does not distinguish habitat quality according to overstory composition, tree density, structure, or patch size. Natural vegetation types designated as species habitat in this model correspond to the mapped vegetation associations in the BDCP composite vegetation data layer.

Assumptions: White-tailed kites nest in a variety of woodland habitat types (Dunk 1995, Erichsen 1995). Primary nesting habitat on the valley floor includes all riparian forest and some willow scrub habitats regardless of width or density. On the valley floor, kites also nest in isolated trees along irrigation canals, wind breaks and other tree rows, roadside trees, and in trees around rural residences (Erichsen 1995). Because these habitats are often below the minimum mapping unit, kite breeding habitat may be underrepresented here.

Foraging Habitat: Foraging habitat in the Delta includes the following types from the BDCP composite vegetation layer:

- Grasslands
  - Ruderal herbaceous grasses and forbs
  - California annual grasslands
  - *Bromus diandrus-Bromus hordeaceus*
  - Italian rye-grass (*Lolium multiflorum*)

    - *Lolium multiflorum-Convolvulus arvensis*
- Managed Seasonal Wetlands
    - Temporarily flooded grasslands
    - Rabbitsfoot grass (*Polypogon monspeliensis*)
    - Poison hemlock (*Coniumm maculatum*)
    - Intermittently flooded perennial forbs
    - Managed annual wetland vegetation (Non-specific grasses and forbs)
    - Shallow-flooding with minimal vegetation
    - Seasonally flooded undifferentiated annual grasses and forbs
    - Managed alkali wetland (*Crypsis*)
    - Intermittently or temporarily flooded undifferentiated annual grasses and forbs
- Natural Seasonal Wetlands
    - *Distichlis spicata* – Annual grasses
    - Saltgrass (*Distichlis spicata*)
    - Seasonally-flooded grasslands
    - Vernal pools
    - *Juncus balticus* – meadow vegetation
    - Temporarily flooded perennial forbs
    - Alkaline vegetation mapping unit
    - *Allenrolfea occidentalis* mapping unit
    - *Suaeda moquinii* mapping unit
    - Salt scalds and associated sparse vegetation

Foraging habitat in the Suisun Marsh and Yolo Basin includes the following types from the BDCP composite vegetation layer:

- *Agrosits avenacea*
- Annual grasses generic
- Annual grasses/weeds
- *Atriplex lentiformis* (generic)
- *Atriplex triangularis*
- *Atriplex*/annual grasses
- *Atriplex/Distichlis*
- *Atriplex/S. maritimus*
- *Atriplex/Sesuvium*
- *Baccharis*/annual grasses
- *Brassica nigra* (generic)
- *Bromus* spp.*(Hordeum)*
- *Crypsis schoenoides*
- *Crypsis* spp. – Wetland Grasses – Wetland Forbs
- Cultivated annual graminoid
- *Distichlis* (generic)
- *Distichlis spicata*

- *Distichlis-Juncus-Triglochin-Glaux*
- *Distichlis/*annual grasses
- *Distchilis cotula*
- *Distichlis/Juncos*
- *Distichlis/Lotus*
- *Distichlis/S. americanus*
- *Distichlis/S. maritimus*
- *Distichlis/Salicornia*
- *Agrostis avenacea*
- Annual grasses generic
- Annual grasses/weeds
- *Atriplex lentiformis* (generic)
- *Atriplex triangularis*
- *Atriplex triangularis* (generic)
- *Atriplex/*annual grasses
- *Atriplex/Distichlis*
- *Atriplex/S. maritimus*
- *Atriplex/Sesuvium*
- *Baccharis/*annual grasses
- Fallow disced field
- Field crops
- Flooded managed wetland
- *Frankenia/Agrostis*
- *Frankenia/Distichlis*
- *Hordeum/Lolium*
- Intermittently flooded to saturated deciduous shrubland
- *Juncus balticus*
- *Juncus balticus/Conium*
- *Juncus balticus/Lepidium*
- *Juncus balticus/Potentilla*
- *Lepidium* (generic)
- *Lepidium/Distichlis*
- *Leymus* (generic)
- *Lolium (*generic*)*
- *Lolium/Lepidium*
- *Lolium/Rumex*
- *Lotus corniculatus*
- Medium upland herbs
- Medium upland shrubs
- Medium wetland graminoids
- Medium wetland herbs
- Flooded managed wetland

- Pasture
- Perennial grass
- *Phalaris aquatica*
- *Polygonum-xanthium-echinochloa*
- *Polypogon monspeliensis* (generic)
- Rice
- *Rumex* (generic)
- *Salicornia* (generic)
- *Salicornia virginica*
- *Salicornia*/annual grasses
- *Salicornia/Atriplex*
- *Salicornia/Cotula*
- *Salicornia/Crypsis*
- *Salicornia/Polygonum-Xanthium-Echinochloa*
- *Salicornia/Sesuvium*
- *Sesuvium verrucosum*
- *Sesuvium/Distichlis*
- *Sesuvium/Lolium*
- Short upland graminoids
- Short wetland graminoids
- Short wetland herbs
- Tall wetland graminoids
- Tall wetland herbs
- Truck/nursery/berry crops
- Upland annual grassland and forbs formation
- Upland herbs
- Wetland herbs

Agriculture

The following DWR 2007 Land Use survey types are included as suitable agricultural foraging habitats for white-tailed kite. These types represent the typical agricultural cover types in the planning area that are included in the DWR 2007 land use survey. Rotational crop types that are not common to the planning area are not included here. Pasture types are mostly perennial; alfalfa is semi-perennial (3 to 7 years); and all other types are annually or seasonally rotated irrigated crops, only some of which provide suitable foraging habitat for white-tailed kites.

- Grain and Hay Crops
    - Barley
    - Wheat
    - Oats
    - Miscellaneous and mixed grain and hay

- Rice
- Field Crops
    - Safflower
    - Sugar beets
    - Corn
    - Grain sorghum
    - Sudan
    - Beans
    - Miscellaneous field
    - Sunflowers
- Pasture
    - Alfalfa and alfalfa mixtures
    - Clover
    - Mixed pasture
    - Native pasture
    - Induced high water table native pasture
    - Miscellaneous grasses
- Truck, Nursery and Berry Crops
    - Asparagus
    - Beans
    - Onions and garlic
    - Tomatoes
    - Peppers
- Idle
    - Land not cropped the current or previous crop season, but cropped within the past three years.
    - New lands being prepped for crop production

Assumptions: Foraging habitat types noted above are considered available year-round; however, flooded seasonal wetlands receive less use during periods of inundation. During the breeding season, kites generally restrict their foraging territories to an approximately 1 square mile area around the nest (Warner and Rudd 1975). During the non-breeding season, kites are not confined to the limits of breeding territories and can be found throughout the BDCP Planning Area. Breeding and wintering season foraging habitat was not differentiated in this model.

A variety of foraging habitat types are used, but those that support larger and more accessible prey populations, particularly meadow voles, are more suitable (Stendell 1972). Grassland and seasonal wetland cover types generally provide more stable food resources over the long term; however, irrigated croplands and pasturelands are also widely used. Agricultural cover types that appear to be preferred include alfalfa and other hay crops, irrigated pastures, and some cultivated habitats, particularly sugar beets and tomatoes, both of which can support relatively large populations of voles and which

have been highly correlated with kite nest site densities (Erichsen et al. 1994). Kites also forage in pastures, rice stubble fields, and occasionally in orchards (Erichsen 1995). Winter foraging habitat is similar to breeding season foraging habitat – particularly the association with agricultural habitats and vole populations; however, there is less association with riparian forests and woodlands.

Kites generally forage in agricultural fields based on prey abundance and accessibility, which is highly variable among the crop types listed above. Some crop types provide higher value during the growing season than others due primarily to vegetation structure. However, because the Grain and Hay, Field, and Truck, Nursery and Berry Crop types listed above are seasonally rotated, the value of individual fields changes each year. Therefore, these crop types are not differentiated based on their seasonal value and are instead combined into a category of seasonally rotated croplands. As a result, this model overestimates the extent of available agricultural foraging habitat in any given year.