Vegetation Mapping of the Rio Grande Floodplain 2002-2004

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I. Introduction

A GIS-based inventory and mapping project was conducted to collect baseline data on riparian vegetation for the ESA Collaborative Program and the Upper Rio Grande Basin Water Operations Review (URGWOPS) Environmental Impact Statement. The study area included the Chama from El Vado Dam to the confluence with the Rio Grande and from the confluence south along the Rio Grande to the full pool elevation for Elephant Butte Reservoir. GIS analysts and biologists representing: Army Corps of Engineers, Bureau of Reclamation, and New Mexico Interstate Stream Commission, developed the mapping methods.

The method employed a vegetation community and structure classification system, using methods created by the Middle Rio Grande Biological Survey (Hink and Ohmart, 1984). Hink and Ohmart conducted an exhaustive biological analysis on the Rio Grande, including a classification of vegetation community and structure in the riparian zone of the river (levee to levee). In addition, an inventory of wildlife correlated bird and mammal abundance with vegetation types, making this system valuable for determining the wildlife value of vegetation types. The goal for this vegetation mapping effort was to replicate (as accurately as possible) the original Hink and Ohmart (1984) methods, so that the two data sets could be compared. Our methods are a compilation of methods used by Hink and Ohmart (1984) and methods developed by this team.

There were two stages for the mapping effort: field work and Geographic Information Systems (GIS) integration. Both are broken out and detailed below.

II. Methods: Field Procedures for Vegetation Surveys

1. Overview

Crews of field technicians were employed to complete vegetation classifications along specified portions of the Rio Grande, as well as portions of the Rio Chama. Fieldwork was conducted between January 2002 and January 2004.

Aerial photographs were used as base maps for fieldwork. These aerial photographs were color-infrared, flown in August 2002 at 1:24,000 (1" = 2000'). Coverage of the photos spans the Middle Rio Grande from Arroyo Aquaje de La Petace to 8 miles south of the southern extent of The Narrows of Elephant Butte Reservoir. Total coverage consisted of approximately 250 river miles.

The classification method included categorizing vegetation polygons into community types and structure classes, using an alphanumeric descriptive code (referred to also as the Modified Hink and Ohmart). Each woody riparian plant species was assigned a letter code (the species code), and generally the original Hink and Ohmart study species codes were used wherever possible. For new species or in certain rare cases, the species code was changed, and team members agreed upon the new code assigned. These one, two, or three letter species codes then became a part of the Modified Hink and Ohmart code.

The Modified Hink and Ohmart code (described in more detail below) consisted of species codes for the canopy layer, species codes for the understory layer, and a number signifying the height of the canopy and thickness of the understory. The Modified Hink and Ohmart code took on the following format:

- Where there is a canopy layer:
  Canopy Layer / Understory Layer+Type Number (1-4)
  Example: C-TW/SC3

- Where there is no canopy layer:
  Shrub or Young Growth Layer + Type (5-6)
  Example: SC-B5

Classifying vegetation using the Modified Hink and Ohmart codes was usually done in the field using aerial photos. Technicians would navigate the banks of the river, and evaluate the surrounding vegetation as they moved through it. Using the aerial photograph field map as a guide, the technician would draw a polygon on the map estimating the extent of similar vegetation. Continuing on to the area delineated by the next polygon the technician would evaluate their decision of Modified Hink and Ohmart code, and the polygon boundary. A GPS unit was used to aid in navigation and to mark locations. A photograph was taken to represent the vegetation community and structure of each polygon.

Another set of tools to aid the field effort was the 1997 Hink and Ohmart style GIS coverage. In 1997, the US Fish and Wildlife Service completed a vegetation classification and GIS layer on the Rio Grande. Where the data was available, the 1997 Hink and Ohmart polygons were overlaid on the field maps (aerial photos). The 1997 polygons were also used as a guide where the aerial photos did not show obvious changes between community-structure types. When it was not possible to access an area of riparian vegetation on foot (due to restricted access or private property), the area was flagged by field technicians as places to re-visit, or to be photo interpreted later.

Technicians filled out data sheets for every polygon (ideally), which essentially led them through the Modified Hink and Ohmart classification process. Each polygon was given a unique reference code, based on the river mile, the east or west side of the river, and a sequential polygon number. These codes, the Polygon-ID, then became each polygon's identifier, in the GIS and the database. At a minimum, the field worker gathered community/structure data and reference numbers for each of their assigned polygons.

2. Modified Hink and Ohmart Definitions

Plant species were recorded according to the relative abundance of the species cover within two layers. Species within a layer were separated by a **"-"**. Canopy and understory layers were separated by a **"/".** Typically one or two species were recorded for each layer, but as many species as qualified (up to 4) were recorded. For a species to be recorded in the Modified Hink and Ohmart code, they had to have over 25% relative abundance.

Plant species dominance (or relative abundance) was determined by visual estimation. Tree and shrub height, as well as plant cover, were also determined by visual estimates.

A. Type Definitions

Multiple Story Communities

Type 1 – Tall trees with well-developed understory.
Tall or mature to mixed–aged trees (>40ft) with canopy covering >25% of the area of the community (polygon) *and* understory layer (0-15ft) covering >25% of the area of the community (polygon). Substantial foliage in all height layers.

Type 1f – Type 1 with willow flycatcher potentially suitable habitat >75% total aerial vegetation cover
Type 1s – Type 1 with a sparse or clumpy, or patchy understory (but not sparse enough to be a Type 2)

Type 2 – Tall trees with little or no understory.
Tall or mature to mixed–aged trees (>40ft) with canopy covering >25% of the area of the community (polygon) *and* understory layer (0-15ft) covering <25% of the area of the community (polygon). Majority of foliage over 30 ft.

Type 3 – Intermediate-sized trees with dense understory.
Intermediate sized trees (20-40ft) with canopy covering >25% of the area of the community (polygon) *and* understory layer (0-15ft) covering >25% of the area of the community (polygon). Majority of foliage between 0-30 ft.

Type 3f – Type 3 with willow flycatcher potentially suitable habitat >75% total aerial vegetation cover

Type 3s – Type 3 with a sparse, clumpy, or patchy understory (but not sparse enough to be a Type 4)

Type 4 – Intermediate-sized trees with little or no understory.
Intermediate-sized trees (20-40ft) with canopy covering < 25% of the area of the community (polygon) ***and*** understory layer (0-15ft) covering < 25% of the area of the community (polygon). Majority of foliage between 15-30 ft.

Single Story Communities

Type 5 - Stands with dense shrubby growth.
Understory layer only (0-15 ft) covering >25% of the area of the community (polygon). Majority of vegetation between 0-15 ft. Stands where there is a significant amount of foliage between 5-15 ft (this distinguishes a Type 5 from a Type 6).

Type 5f – Type 5 with willow flycatcher potentially suitable habitat >75% total aerial vegetation cover
Type 5s – Type 5 where the cover is sparse, clumpy, or patchy (but not sparse enough to be a Type 6 or OP)

Type 6 – Very young and low growth.
Young understory layer (0-5 ft) covering >25% of the area of the community (polygon). Majority of foliage between 0-5 ft. If there is <25% of area covered, the Type is OP (see below).

Other Types (non-woody)

CAT – Cattail (can be used as a species AND a Modified Hink and Ohmart type)
MS – Meadow
MH – Marsh with cattail, rush, or other permanent marsh vegetation

AG – Agriculture
OP – Open area (vegetation < 25% aerial coverage)
R – River
OW – Open water
LFCC – Low Flow Conveyance Channel

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- Species Codes

A = False Indigobush
ATX = Fourwing Saltbush
B = Baccharis (Seep Willow)
BD = Broom Dalea
C = Cottonwood
CAT = Cattail
CR = Creosote
CT = Catalpa
CW = Coyote Willow
HL = Honey Locust
HMS = Honey Mesquite
J = Juniper
LC = New Mexico Locust
LY = Wolfberry
MB = Mulberry
NMO = New Mexico Olive
RO = Russian Olive
SB = Silver Buffaloberry
SBM = Screwbean Mesquite
SC = Salt Cedar
SE = Siberian Elm
SS = Sand Sage
TH = Tree of Heaven
TS = Threeleaf Sumac
TW = Tree Willow

B. Exceptions

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Some methods were either refined or spelled out more clearly, from the original Hink and Ohmart study.

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a) All polygons were intended to be more than 2 acres in size. The only exception was polygons where there was a good or important native seed base (less than 2 acres) or to if there was especially suitable Southwest Willow Flycatcher habitat.

b) For all "non-woody" vegetation classes, there was no number attached to the code. "MH" was defined to mean "marsh" – or an area that would be inundated with water at least several times throughout the survey season. If there were cattails in an area that was not an "MH", the cattails could be included as a species in the Modified Hink and Ohmart code.

c) If there was an area where the canopy was mostly dead, standing trees (as in a fire or diseased stand), those canopy trees were not counted as part of the classification. In other words, the Modified Hink and Ohmart classification was solely for green, growing woody vegetation. A note was made on the field sheet, if there was a stand of dead or stagnant trees.

d) Different combinations of cameras, GPS units, and field maps were used in the field. If the photos were digital, they may be incorporated into the GIS coverage(s). The GPS units used varied a great deal, and no accuracy report was gathered with the points collected. Most field technicians used a civilian-grade GPS unit, which (in good reception) have an error of up to 40 feet (US). GPS coordinates were reported in Universe Transverse Mercator (UTM) values, with the conversion from latitude/longitude to UTM occurring in the GPS unit itself.

III. Methods: Procedures for GIS Integration

1. Post Field Processing Overview

The data sheets and fields maps used in the field were collected at the end of the survey season, as well as the cameras and GPS units. The digital photographs were downloaded. The data sheets were entered electronically into Excel worksheets. The coordinates recorded on GPS units were downloaded and converted to a spatial coverage in ArcView. Then, using the digital aerial photos as a backdrop, a technician drew in the polygon boundaries from the field maps. The precise attributes and format for each of the steps (GIS coverages and Excel worksheets) simply outlined here rather then described in detail.

2. Digitizing

Digitizing (drawing the polygons from the field work) was done entirely with ArcView software. Each agency digitized their field data, and the resulting final coverages were merged into one. Efforts were made to coordinate digitizing methods, to be as consistent as possible.

This part of the process involved photo-interpretation. In many places, the polygon boundary (intended by the field technicians) was obvious on the aerial photo. Where the boundary was not a clear demarcation of change of vegetation type, the estimated line was drawn based on the technician's notes and drawings.

IV. References

Hink, V. C., and R. D. Ohmart. 1984. Middle Rio Grande biological survey. Army Corps of Engineers Contract No. DACW47-81-C-0015. Albuquerque, NM