NUMERIC WILDLIFE HABITAT CLASSIFICATION OF WELLS ISLANDS, HOOD RIVER COUNTY, OREGON

by

John L. Marshall
2947 SE Kelly St.
Portland, Oregon 97202

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Abstract. Resource managers and planners are often required to make decisions regarding the effects of proposed land uses on existing wildlife habitat. This research provides a numerical method to define and classify wildlife habitat characteristics. This method is applied to Wells Islands but is applicable to non-xeric habitats throughout the Pacific Northwest and can be used to determine regional changes in habitat characteristics over time.

Key Words: numeric classification, wildlife habitat characteristics, change, regional.

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Resource managers and planners must often make decisions effecting management of wildlife habitat. This research provides for the systematic collection of numeric base line data on wildlife habitat characteristics and a method of classifying habitat using these characteristics.

The data are used to construct a wildlife habitat classification. There is no attempt to evaluate the habitat for its general or species-specific wildlife value. The classification describes the wildlife habitat characteristics of three islands.

Wells Island and its two satellite islands [referred to here as Wells Islands] are located near river mile 168 on the Columbia River. The combined area of all three islands is approximately 60 acres. The largest island is about 51 acres and is the largest island in the Bonneville Pool [the impounded water between Bonneville Dam and the Dalles Dam].

The objectives of this project are to:

o Collect significant wildlife habitat data.
o Classify wildlife habitat numerically.
o Develop a map based on the numeric classification.

A multi-step process described by Marshall [1985] was modified and used to classify the wildlife habitat on the islands. Habitat boundaries were provisionally delineated on a black and white aerial photo of the islands [Corps of

Engineers-82-358]. The original imagery was at a scale of 1:48,000. This imagery was subsequently enlarged to approximately 1:5,000. Since the islands were near the center of the original photo, the enlarged photo was judged to have negligible distortion and was found acceptable for mapping and classification purposes /1 . Boundaries were drawn around discernible vegetation, water, and exposed substrate units [here referred to as image units] on clear acetate overlaying the photo. Characteristics used to determine boundaries included image: density, texture, tone, and shape.

Sampling

Each image unit was sampled in the field. Data collected at each sample [Figures 1 and 3] included:

1. Unit wildlife habitat characteristics
   - A. Plant species present
   - B. Water bodies [hydrologic traits] present

/1 A low elevation air photo, taken with a 35 mm camera, was also used to help determine habitat boundaries or image units.

C. Exposed substrate types present

D. Wildlife species observed

2. Numeric and qualitative measurement of unit characteristics

A. Cover class and cover class mid-points for unit characteristics A, B, and C [Table 1]

B. Moisture tolerance and life form for each plant species present:

Species Moisture Tolerance	Life Form
obligate hydrophyte [h]	Tree /2
faculative hydrophyte [h/m]	Shrub
mesophyte [m]	Emergent

C. Mean depth of each water body [hydrologic trait] present

D. Predominant substrate size category [Donahue et al. 1971]:

Substrate Type	Size Category
Stony	> 250 mm
Cobble	250-75 mm
Gravel	75-2 mm
Sand	2-.05 mm
Silt	.05-.002 mm
Clay	< .002 mm

E. Height class for each plant species present [Table 1]

F. Wildlife species observed [Figure 3]

- Number of individuals observed
- Time of day wildlife observations were made
- Sex and age [juvenile or adult] of animals
- Brief description of general behavior, i.e., feeding, incubating, defending territory, etc.
- Brief description of any unit characteristic[s] obviously important to the observed animal[s], i.e., trees used for perching or nesting,

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/2 Trees constitute predominantly woody plants greater than 2 meters in height.

plants or animals used as a food source, plants used for cover, etc.

All tree height measurements were determined using a clinometer. Cover class measurements were subjective estimates made during a visual surveillance of an undefined area within each image unit boundary.

Table 1. Height and Cover Class Parameters (Kuchler 1966).

Height	Height Class	% Cover	Cover Class	(% Mid-Point)
35-45m	8	75-100	5	88
20-35m	7	50-75	4	63
10-20m	6	25-50	3	38
5-10m	5	5-25	2	15
2- 5m	4	0- 5	1	3
.5- 2m	3			
.1-.5m	2			
< .1m	1			

One sample was taken for each image unit. Thirty image units were delineated on the photo. Each unit was photographed in the field with a 35 mm camera.

Importance Index

After the data were compiled for each sample, an importance index was calculated and used to organize the data and classify the wildlife habitat on the islands. The classification is based on structural characteristics of vegetation, depth and area of water bodies (hydrologic traits), and area of substrate. /3 The importance index is

/3 The hydrologic traits "Shallow" and "Deep Open Water" and all substrate types were arbitrarily assigned a significance coefficient of 4. Significance coefficients for hydrologic traits and substrate types serve the same funcdetermined by running the data from each sample through six steps:

1. Group plant species by life form and moisture tolerance

2. Sum percent cover class mid-points for each life form, hydrologic trait, and substrate type.

3. Determine the mean height class number for each life form and the significance coefficient for each hydrologic trait and substrate type. This is the height class/significance coefficient index.

4. Determine an importance value for each life form by multiplying the sum of the life form cover class mid-points by its respective height class index. The importance value for hydrologic traits and substrate types are derived by multiplying their respective cover class mid-points by their corresponding significance coefficients.

5. Determine sum of importance values for all life forms, hydrologic traits, and substrate types.

6. Determine a relative importance value for each life form, hydrological trait, and substrate type by dividing each respective importance value by the sum of all importance values. This is the importance index number.

The process by which importance indexes were derived can be followed on Figure 1. Data from sample 23, image unit 19 (units were not sampled in the order of their assigned numbers) are displayed to allow the reader to follow the procedure. This form was used for each image unit sample.

/3 (Cont.) tion as height class numbers for vegetation life forms. That is, they weight the importance value of their respective habitat characteristics. Relatively high significance coefficients were selected on the premise that hydrologic and substrate regimes heavily influence the physical and biological character of the units they occupy. Subsequently, they are important influences on wildlife associated with those units. Therefore, the importance index reflects, albeit crudely, ecological factors that contribute to the character of the unit.

Wildlife Habitat Classification

The subsequent task of defining the relative importance of various wildlife habitat classes in each sample was accomplished using Figure 2. The importance index derived for each wildlife habitat component on Figure 1 was transferred to the corresponding life form, hydrologic trait, and/or substrate type on Figure 2. A "dominance threshold index", within the range of 0 to 1, was used to categorize the dominant habitat class. Any life form, hydrologic trait, or substrate type that obtained an importance index greater than or equal to the threshold was considered a dominant habitat class. The threshold was 0.38. A "subordinate threshold index" of 0.14 was selected to delineate subdominant classes. Definitions of threshold indexes were based on field observations at the Jackson-Frazier Wetland [Marshall 1985].

Using the data in unit 19 [Figures 1 and 2], the Moist Forest wildlife habitat characteristic has an importance index of .56; qualifying it for dominant class status. The Exposed Substrate [3] habitat characteristic [sand] received an importance index of .37; qualifying it as a subordinate wildlife habitat class [subclass] in the unit.

An upper case letter code [A-O] was used to define habitat classes in each unit. Habitat classes were represented fractionally in the code with increasing importance to the left. A slash separates the dominant classes from the subordinate. A dash separates codominant or cosubordinate classes. The code for unit 19 is:

A / K

A = Moist Forest [dominant]
K = Sand [subordinate]

Following Larson [1976] and Cowardin et al. [1979], each class is modified by descriptive components [Figure 2] of the chief habitat characteristics of the unit, i.e., short narrow leaf emergents, floating vascular emergents, dead trees, etc. Modifiers are represented here by a lower case letter code and are listed in order of decreasing importance to the right of the class or subclass they describe. /4

They are listed for unit 19 under the following letter code:

Abd/Kh

A = Moist Forest
b = narrow leaf deciduous trees
d = dead trees

K = Sand
h = dry

The modifiers in the Cowardin [1979] classification apply specifically to wetlands. While wetland wildlife habitats are recognized as being associated with the islands, the modifiers here are applied to both nonwetland and wetland units. All wetlands associated with the islands are

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/4 The "water regime" modifier and the "special modifier" are listed at the top of the unit classification sheet. While they are not considered in the hierarchy of relative importance, as are all other modifiers, their position represents the major role water regime and water management play in determining the character of the unit.

considered "Lacustrine" [subsystem "Littoral"] or "Palustrine" wetlands under the Cowardin et al. [1979] classification [Appendix 1].

The water regime modifier consists of eight descriptors. /5 All but the eighth descriptor were adopted from Cowardin et al. [1979]:

1. <u>Permanently Flooded</u>

   Water that covers the land surface throughout the year in all years. Vegetation is composed of obligate hydrophytes.

2. <u>Semipermanently Flooded</u>

   Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

3. <u>Seasonally Flooded</u>

   Surface water is present for extended periods early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.

4. <u>Saturated</u>

   The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

5. <u>Temporarily Flooded</u>

   Surface Water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season. Plants that grow both in uplands and wetlands are characteristic of the temporarily flooded regime.

6. <u>Intermittently Flooded</u>

   The substrate is usually exposed, but surface water is present for variable periods without detectable seasonal

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/5 These descriptors were called modifiers in Cowardin et al. [1979].

Physiographic Province: Columbia River Gorge	Land Form: Island	Area Type: Upland nonwetland / Upland wetland / Bottomland nonwetland / [Bottomland wetland]	Wetland System/Subsystem: Marine / Subtidal, Intertidal; Estuarine / Subtidal, Intertidal; Riverine / Tidal, Lower Perennial, Upper Perennial, Intermit.; [Lacustrine] / Limnetic, [Littoral]; Palustrine

Location: Columbia River (Bonneville Pool) River Mile 160	Island: Wells 1	Sample: 23	Unit: 19	Date: 4-29-85

(Step 1)

Plant Species /1	Plant Moisture Tolerance: W	W/U	U	Hydrologic Trait (H.T.)	Exposed Substrate Type (S.T.)	Trees (T)	Shrubs (S)	Herbs (H)	Open Water Wetland: Shallow (<2 m) OW(1)	Deep (>2 m) OW(2)	Exposed Substrate: St	C	G	S	Si	Cl
SALIX	X					5 88										
SOOC		X						2 15								
POTR	X						1 3									
COST	X						1 3									
					SAND									5		
(Step 2) Sum the percent cover mid-points for each site characteristic (L.F., H.T., and S.T.).						88	6	15						5*		

* 5=88

(Step 3) HEIGHT CLASS/SIG. COEFF. INDEX
Find the mean H.C. for each respective L.F. and the significance coefficient for each S.T. and H.T.

Plant Species	Hydrologic Trait	Substrate Type	Life Form Height Class: T	S	H	Hydrologic Trait Sig. Coeff. (S.C.)	Exposed Substrate Type Sig. Coeff. (S.C.): St	C	G	S	Si	Cl
SALIX			6									
SOOC					3							
POTR				3								
COST				3								
		SAND								4		

H.C./S.C. Index /2: T	S	H	OW1	OW2	St	C	G	S	Si	Cl
6	3	3						4		

T = Trees > 2 m
S = Shrubs < 2 m
H = Herbs
OW1 = Open Water < 2 m deep
OW2 = Open Water > 2 m deep
St = Stone > 250 mm
C = Cobble 250 - 75 mm
G = Gravel 75 - 2.0 mm
S = Sand 2.0 - .05 mm
Si = Silt .05 - .002 mm
Cl = Clay < .002 mm

	Trees: W	W/U	U	Shrubs: W	W/U	U	Herbs: W	W/U	U	Open Water: Shallow (< 2 m)	Deep (>2 m)	Exposed Substrate: St	C	G	S	Si	Cl
(Step 4) IMPORTANCE VALUE For each L.F., H.T., and S.T., multiply the sums of cover class mid-points by their respective H.C. and S.C. indexes.	528			18				45							352		
(Step 5) Sum the importance values.	943.00																
(Step 6) IMPORTANCE INDEX Divide each importance value by the sum of importance values.	.56			.02				.05							.37		

/1 Key to plant acronyms is in Appendix 2.

/2 The deep and open water hydrologic traits were arbitrarily assigned the numerical significance coefficient of 4. This was done on the premise that these traits significantly affect the physical and biological character of wetlands. The exposed substrate types were also assigned a common significance coefficient of 4. This was done to reflect the effect exposed substrate has on the physical and biological character of both wetlands and uplands.

Figure 1. Importance indexes for Wells Island unit number 19.

Physiographic Province: Columbia River Gorge	Land Form: Wells Island No. 1	Area Type: bottomland wetland	Wetland System/Subsystem: Lacustrine/Littoral
Location: Columbia River (Bonneville Pool) River Mile 168		Water Regime: 7	Special Modifier: 2
Date: 06-20-85	Unit: 19	Sample: 23	Code: Abd/Kh

A	B	C	D	E	F	G
T (> 60% h) > 2 m Moist Forest	T (> 60% m) > 2 m Mesic Forest	S (> 60% h) < 2 m Moist Shrub- land	S (> 60% m) < 2 m Mesic Shrub- land	H (> 60% h) Frequent Emergent Wetland	H (> 60% h/m) Infrequent Emergent Wetland	H (> 60% m) Meadow or Mesic Herb
.56		.02			.65	
a. Broad Leaf Decid. b. Narrow Leaf Decid. X c. Evergr. d. Dead X	a. Broad Leaf Decid. b. Narrow Leaf Decid. c. Evergr. d. Dead	a. Broad Leaf Decid. X b. Narrow Leaf Decid. c. Evergr. d. Dead e. Lianas	a. Broad Leaf Decid. b. Narrow Leaf Decid. c. Evergr. d. Dead e. Lianas	a. Short Narrow Leaf < 2 m b. Tall Narrow Leaf > 2 m c. Short Broad Leaf < 2 m d. Tall Broad Leaf > 2 m e. Robust f. Persist. g. Nonpers. h. Floating Vasc.	a. Short Narrow Leaf < 2m X b. Tall Narrow Leaf > 2m c. Short Broad Leaf < 2 m d. Tall Broad Leaf > 2 m e. Robust f. Persist. g. Nonpers.	a. Short Narrow Leaf < 2m b. Tall Narrow Leaf > 2m c. Short Broad Leaf < 2 m d. Tall Broad Leaf > 2 m c. Robust d. Persist. e. Nonpers.

H	I	J	K	L	M	N	O
ES(1) > 50% Stone	ES(2) > 50% Cobble	ES(3) > 50% Gravel	ES(4) > 50% Sand	ES(5) > 50% Silt	ES(6) > 50% Clay	OW(1) Shallow Open Water Wetland < 2 meters	OW(2) Deep Open Water Wetland > 2 meters
			.37				
a. Consol. b. Fragments c. 15-50%: d. Cobble e. Gravel f. Sand g. Silt h. Clay i. Very Wet j. Mod Wet k. Dry	15-50%: a. Stone b. Gravel c. Sand d. Silt e. Clay f. Very Wet g. Mod. Wet h. Dry	15-50%: a. Stone b. Cobble c. Sand d. Silt e. Clay f. Very Wet g. Mod. Wet h. Dry	15-50%: a. Stone b. Cobble c. Gravel d. Silt e. Clay f. Very Wet g. Mod. Wet h. Dry X	15-50%: a. Stone b. Cobble c. Gravel d. Sand e. Clay f. Very Wet g. Mod. Wet h. Dry	15-50%: a. Stone b. Cobble c. Gravel d. Sand e. Silt f. Very Wet g. Mod. Wet h. Dry	a. Algal b. Aquatic Moss c. Sub- merged Vascular	a. Algal b. Aquatic Moss c. Sub- merged Vascular

Figure 2. Wildlife habitat classification of Wells Island unit number 19.

Wildlife Species Observed	Number of Individuals	Sex/Age	Time of Day	Brief Description of Behavior	Brief Description of of Site Characteristics Obviously Important to Animal(s)
Canada Goose	3 eggs	N/A	4 pm	N/A	Exposed sand levee Cover & Water
Black-Capped Chickadee	2	Adult Male & Female	4pm	Diversion act	Dead willow snags for cavity nesting

Figure 3. Wildlife observations.

periodicity. Weeks, months, or even years may intervene between periods of inundation. The dominant plant communities under this regime may change as soil moisture conditions change. Some areas exhibiting this regime do not fall within the Cowardin (1979) definition of wetland because they do not have hydric soils or support hydrophytes.

7. Artificially Flooded

The amount and duration of flooding is controlled by means of pumps or siphons in combination with dikes or dams. The vegetation growing on these areas cannot be considered a reliable indicator of water regime. Examples of artificially flooded wetlands are some agricultural lands managed under a rice-soybean rotation, and wildlife management areas where forests, crops, or pioneer plants may be flooded or dewatered to attract wetland wildlife. Neither wetlands within or resulting from leakage from man-made impoundments, nor irrigated pasture lands supplied by diversion ditches or artesian wells are included in this modifier.

8. Permanently Exposed

Upland areas that are outside of the 100 year flood fringe and have moderate to well drained soils. Dominant plant communities are mesic or xeric site indicators. Herbaceous plant communities indicate flood regime on sandy soils.

In addition to the above descriptors, Cowardin et al. (1979) lists six special modifiers. These modifiers are also recognized in this classification:

1. Excavated

Lies within a basin or channel excavated by man.

2. Impounded

Created or modified by a man-made barrier or dam which purposefully or unintentionally obstructs the outflow of water. Both man-made dams and beaver dams are included.

3. Diked

Created or modified by a man-made barrier or dike designed to obstruct the inflow of water.

4. Partly Drained

The water level has been artificially lowered, but the area is still classified as a wetland because soil moisture is sufficient to support hydrophytes. Drained areas are not considered wetlands if they can no longer support hydrophytes.

5. Farmed

The soil surface has been mechanically or physically altered for production of crops, but hydrophytes will become reestablished if farming is discontinued.

6. Artificial

Refers to substrates classified as Rock Bottom, Unconsolidated Bottom, Rocky Shore, and Unconsolidated Shore that were emplaced by man, using either natural materials such as dredge spoil or synthetic materials such as discarded automobiles, tires, or concrete. Jetties and breakwaters are examples of Artificial Rocky Shores. Man-made reefs are an example of Artificial Rock Bottoms.

The classification of each unit [without modifiers and descriptors] is recorded in Table 2. Figure 4 shows the distribution of units sampled on Wells Islands. Figure 5 shows the distribution of dominant and subordinate wildlife habitat classes for the islands.

Table 2. Wells Islands Wildlife Habitat Unit Classification.

Unit	Class	Subclass
1	A	G-K
2	N	A
3a	G	A /1
3b	A	E
4	G	
5	G	

/1 Units 3a and 3b were split in the field due to the obvious differences in habitat characteristics.

Table 2. (Continued) Wells Islands Wildlife Habitat Unit Classification.

Unit	Class	Subclass
6	G	K
7	A	G
8	G-D	
9	A	G
10	K	G
11	G	
12	A	F
13	A	F-C
14 /2		
15	G	
16	A	G
17	K	
18	A	G
19	A	K
20 /3		
21	A	K
22	A	G
23a	A	G
23b	K	A
24	A	G
25	G	D
26	U /4	
27	A	G
28	A	G
29	B	G
30	G	

/2 Unit 14 was joined with unit 15 in the field due to the obvious similarities in habitat characteristics and their spatial proximity.

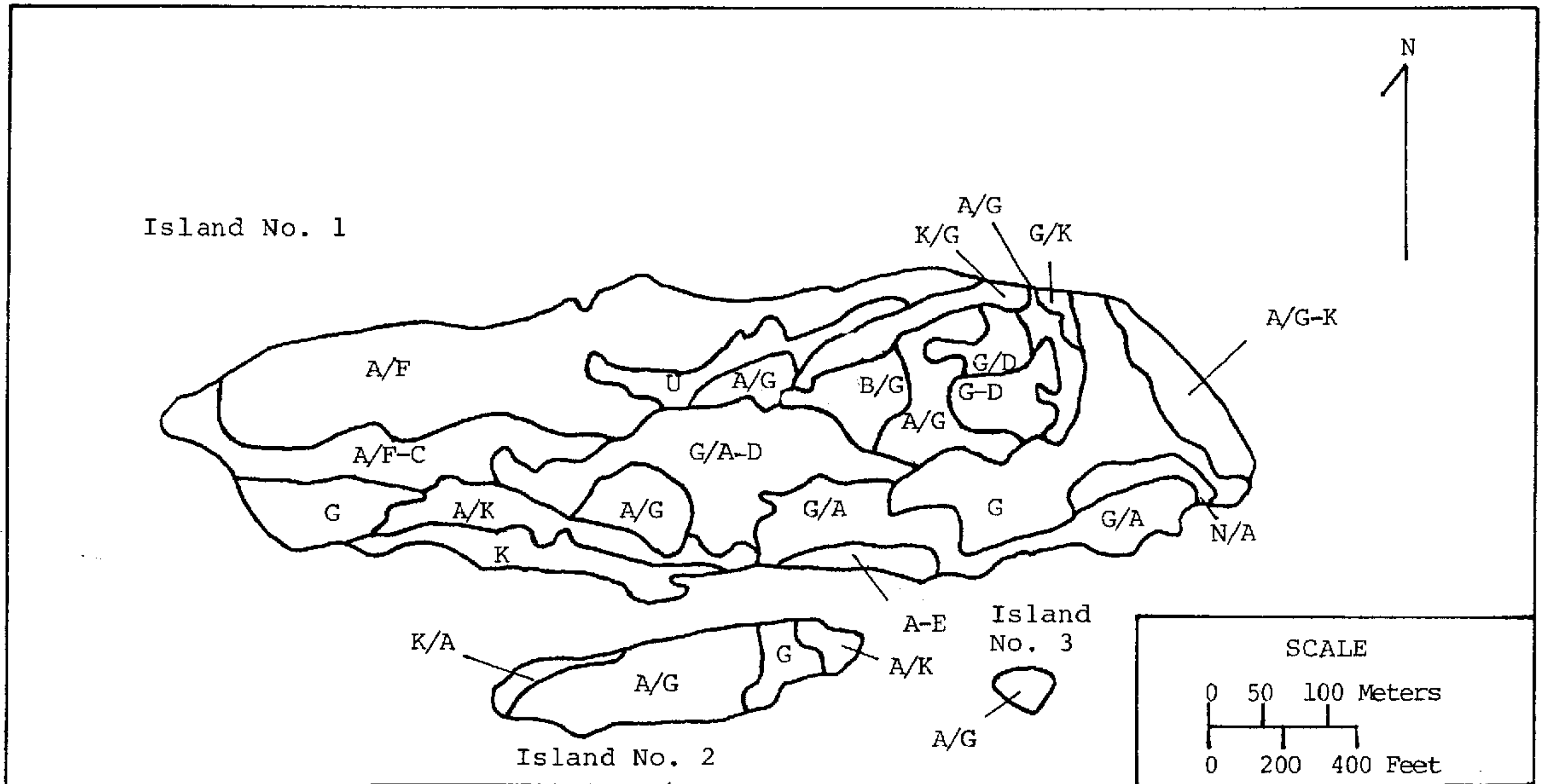
/3 Unit 20 was joined with number unit 11 in the field.

/4 Unit 26 has not been classified.

Conclusion

The numeric method of habitat classification is capable of documenting specific habitat types and providing base line data with which to compare change. While it was designed to be applicable at a regional scale, the data collection phase of the process requires detailed ground truthing. However, air photo surveillance may be sufficient in cases where detailed information already exists or where resource managers are willing to make assumptions. Further investigation on the range of potential habitat types may be necessary for regional application of the system.

A detailed numeric classification may be useful when there are border line decisions regarding habitat type [e.g., wetland vs non-wetland] or class dominance. The numeric method of classification allows the integration of proximate habitat characteristics that may otherwise require special categories [e.g., areas where evergreen and broadleaf trees cohabit a unit] and is readily incorporable into the Cowardin et al. [1979] classification at the system and subsystem level [there are potential deviations at the class level]. A numeric classification also lends itself to computerization. This would speed the classification process considerably.



LEGEND

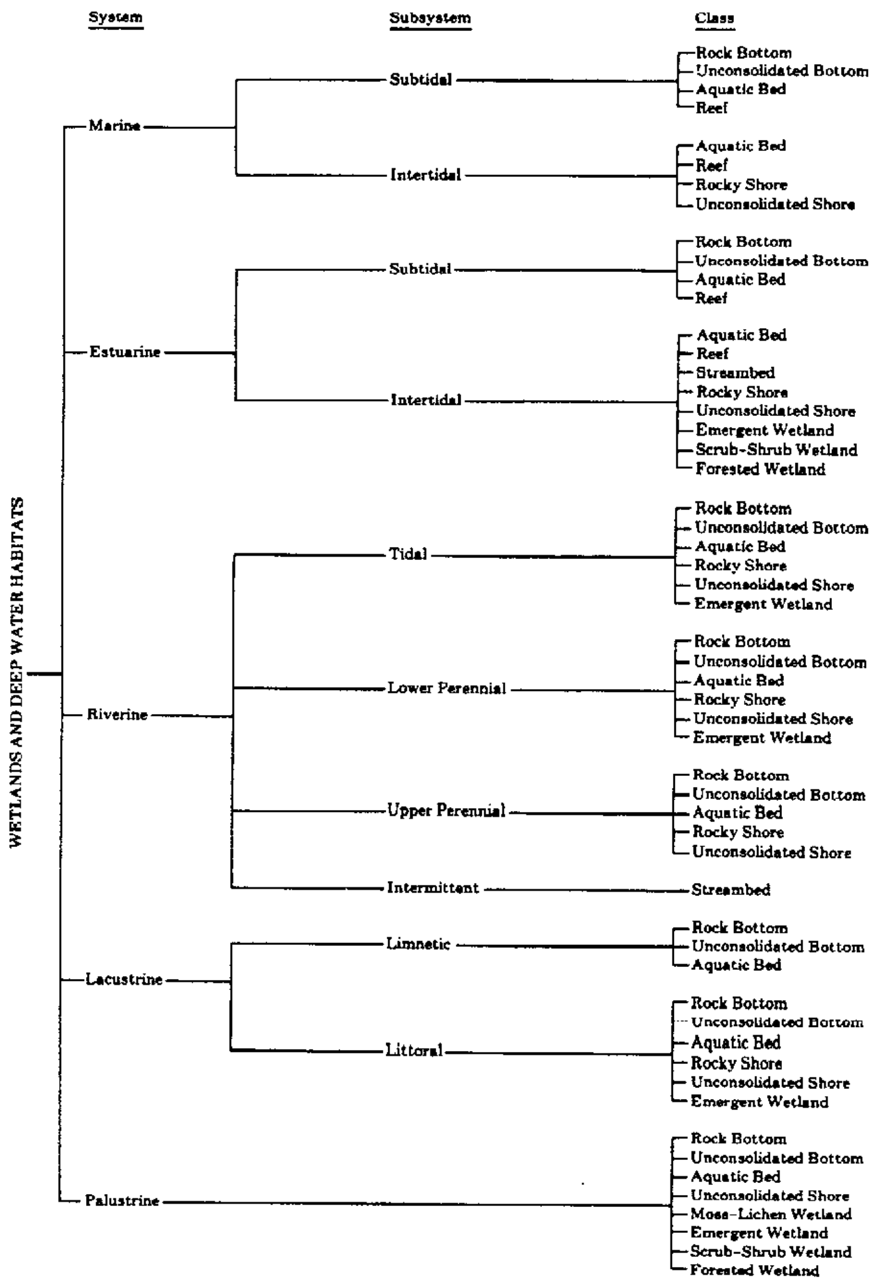
A Moist Forest
B Mesic Forest
C Moist Shrubland
D Mesic Shrubland
E Frequent Emergent Wetland
F Infrequent Emergent Wetland
G Meadow /1
K Sand
N Shallow Open Water Wetland
U Unclassified

/1 If "G" is a subclass, it reads as "Mesic Herbaceous".

Figure 5. Wells Islands wildlife habitat classification.

Appendix 1

Classification Hierarchy of Wetlands and Deepwater Habitats, Showing Systems, Subsystems, and Classes



Source: Cowardin et al. (1979).