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Critical Elements in the Application of Water Quality Standards to Wetlands:

Classification System, Beneficial Use Designation and the Identification of Exceptional Wetlands

Submitted to the
Virginia Department of Environmental Quality

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Introduction

The development and implementation of water quality standards for wetlands is essential to ensure the protection and enhancement of the State's wetland resources. Water quality standards provide a link to other water quality management activities including the following provisions of the federal Clean Water Act: permitting under section 402 and 404, control of nonpoint source pollution under section 319 and water quality certification under section 401.

Section 401 requires the issuance of a certificate prior to any activity which may result in a discharge to state waters. States administer the §401 certification program and make certification decisions by ensuring that the proposed activity will comply with state water quality standards. In 1989, Virginia adopted legislation establishing the Virginia Water Protection Permit. The Water Protection Permit was designated to constitute the water quality certification necessary under the existing Virginia §401 certification program.

There are five basic steps required in the process of applying state water quality standards regulations to wetlands. They are:

- Include wetlands in the definition of "State waters."
- Designate uses for wetlands.
- Adopt aesthetic criteria ("free froms") and appropriate numeric criteria for wetlands.
- Adopt narrative biological criteria for wetlands.
- Apply the State's antidegradation policy and implementation methods to wetlands. (EPA, 1990).

There are, of course, many ways to approach the development and implementation of a program to apply water quality standards to wetlands. The current effort in Virginia is a comprehensive approach incorporating many components including: wetlands classification, the development of functional assessment techniques, a functional analysis and vegetative characterization of Virginia's nontidal wetlands of the coastal zone, a review of current Virginia legislation, regulations and policy on wetlands and water quality standards and a review of the application of water quality standards to wetlands in other states.

Under a contractual agreement, the Department of Resource Management and Policy of the Virginia Institute of Marine Science, is to assist the Department of Environmental Quality, Water Division in the development of water quality standards to wetlands. As a result of on-going research efforts, and previous contractual agreements, the Department of Resource Management and Policy has been involved in the production of many components necessary for a comprehensive approach to water quality standards for wetlands. RMAP has produced, and previously submitted to DEQ, a draft wetlands classification scheme, a functional assessment technique and a review of the approaches taken by other states in the application of water quality standards to wetlands.

Under the current contract, RMAP is directed to report on several of the remaining components and make recommendations to assist DEQ in the application of water quality standards to wetlands. Specifically, RMAP is to provide the following:

- a report on the functional assessment of Virginia's coastal zone nontidal wetlands,
- a report on wetlands classification,
- a report on the designation of beneficial uses to wetlands, and
- a report on the identification of exceptional wetlands.

RMAP staff visited 300 wetland sites in order to characterize the vegetative communities and assess Virginia's nontidal wetlands using the VIMS Functional Assessment Technique. The preliminary results of the functional assessment analysis and vegetative characterization can be found in Appendix I. The remaining components are reported within the main text of this document.

Wetlands Classification System

There are at least two possible approaches to the implementation of a wetlands classification scheme and the designation of beneficial uses within the framework of the existing Virginia regulatory program. Virginia may choose to use existing general and water-specific classification systems, or they may develop and implement a system just for wetlands.

Wetlands are defined as waters of the state (VR680-14-03, VR680-15-02). As such, it may be inferred that the seven classes of state waters include wetlands where they occur within the area designated by that class. In other words, wetlands located in areas designated as Class II Estuarine are indeed Estuarine waters with all the corresponding numeric criteria and special standards. Under this scheme, wetlands are designated for the same uses as the adjacent waters. Following this process, the designation of beneficial uses of wetlands would result in the same beneficial use designation for all waters within any given class. As such, a wetlands classification within this scheme would need to fit into the current water classes.

The current classes lack designated uses and are basically geographic assignments. The lack of existing designated uses for water classes would make the option of incorporating wetlands uses into the existing classes impractical as it would require the development and adoption of uses for all classes of Virginia waters. The incorporation of wetlands into existing classes is further complicated by the fact that wetlands often violate the existing standards for water quality. While the long term goal may be the incorporation of wetlands into each water class, with associated standards, the development of a wetlands classification scheme built on the existing water classes would result in an ineffective construct at present.

The second possible approach is to create an additional class, or amend and replace an existing class of State waters. Once again, for ease of implementation, the best choice is to incorporate the proposed class into the existing class structure in such a way as to require minimal change to the remaining classes. Of the current classes, the only class vaguely representing wetlands is Class VII Swamp Waters.

Current regulations assign dissolved oxygen, pH or minimum temperature standards to each class of waters. In addition to the dissolved oxygen, pH, and temperature standards, Virginia has adopted numeric criteria for chemical constituents. For purposes of application to the water classes, the numeric standards are separated into saltwater and freshwater standards (See box on next page). Class VII is not included in the class groupings used to apply the saltwater or freshwater standards (VR680-21-01.14), nor is Class VII assigned standards for dissolved oxygen, pH and temperature (VR680-21-01.5).

All state waters are designated by class under VR680-21-08.1. However, no waters have been designated with the classification of Swamp waters under this provision. The Swamp waters classification has only been used in the permitting process for waters which fail to meet the standards of the appropriate class under VR680-21-08.1. This probably explains the lack of standards and the exclusion from the numerical standards groups. The fact that the class is not currently used and has no specific standards creates an opportunity for the replacement of Class VII with a new class of waters with associated standards and designated uses. (See box on next page.)

Options for Classification System Design

As noted above, extant classification systems cover the spectrum from those based entirely on structure to those relying on functional distinctions. Both approaches have advantages and disadvantages, and appropriateness is dependent on the reason or need for classification. With no notable exceptions, regulatory programs are driven by concern for the functions of wetlands. As a result, the classification systems with greatest direct utility to regulatory programs are those based on function. Unfortunately, for purposes of developing an advanced inventory of wetland resources, functional classifications are difficult to implement.

The most widely utilized classification system at the present time is the hierarchical system of Cowardin et al (1979). This system is the one employed by the U.S. Fish and Wildlife Service's National Wetlands Inventory Program. Several states use, or have investigated the use of the Cowardin classification. As such it is well known and has been applied in many areas, including all of Virginia. The system is structurally based with floral composition and hydrologic conditions as the primary determinant characteristics. However, the scheme was developed to be applicable to the entire United States and does not provide regional detail. The system does not address functions of wetlands.

Another classification system available is a hydrogeomorphic classification system under development by Brinson and others for the U.S. Army Corps of Engineers. This system is essentially a structurally based approach, with hydrologic conditions and landscape setting as principal determinants (Brinson 1993). The related functional assessment system is currently under development.

State Waters Classification

Current Virginia Water Quality Regulations define seven classes of state waters. Class designations are used to apply water quality standards and criteria. The classes are:

I. Open Ocean
II. Estuarine Waters (Tidal Water- Coastal Zone to Fall Line)
III. Non-tidal Waters (Coastal and Piedmont Zones)
IV. Mountainous Zones Waters
V. Put and Take Trout Waters
VI. Natural Trout Waters
VII. Swamp Water (VR680-21-01.5).

Classes I through VI have minimum standards for dissolved oxygen, pH and maximum temperature. However, Class VII, Swamp Water, has no set standards for dissolved oxygen, Ph or maximum temperature. The regulations recognize the natural variable quality of swamp waters and the need for a case-by-case determination of water quality.

For the purposes of applying freshwater and saltwater numerical standards (excluding dissolved oxygen, pH, temperature and chlorine), the classes of waters are grouped into 3 groups. Swamp water, Class VII, is not included in any of the numerical standards groups (VR680-21-01.14(C)).

Class of Waters	Numerical Standard
I, and II (Estuarine Waters)	Saltwater standards apply
II (Transition Zone)	More stringent of either the freshwater or saltwater standards apply
II (Tidal Freshwater), III, IV, V and VI	Freshwater standards apply

*NOTE: Class VII is not included in the groupings of water classes.

Functionally based and mixed systems are used by some states as part of their management programs. Generally, these systems place wetlands in three or more categories reflecting relative value. Assignment to a category can depend on either a particular service (habitat for a rare or threatened species is a common high value service) or a structural characteristic (connection to a public water supply or location in a flood plain are examples). Almost all of these systems are designed primarily as regulatory guidance systems, and have not yet found routine application in inventory programs.

Objectives for Proposed Classification System

Three basic objectives have been adopted in the design of a classification system for Virginia's wetlands management program:

- the system should meld with and support the existing management efforts;
- the system should support informed decision making in the regulated community; and
- the system should accommodate future developments of both technical understanding and regulatory effort.

The existing management programs include a tidal wetlands management program (under the Virginia Wetlands Act with the Virginia Marine Resources Commission as lead agency), and a water quality permitting effort (under the Virginia Water Protection Permit program with the Department of Environmental Quality as lead agency). In addition the Commonwealth has an ongoing tidal wetlands inventory program (conducted by the Virginia Institute of Marine Sciences) and a cooperative wetlands mapping program with the National Wetlands Inventory (NWI) program. Melding with and supporting these various efforts can be accomplished by designing a classification system which covers both tidal and nontidal wetlands and which can be related to both the Virginia tidal wetlands classification system developed in the early 1970's and the Cowardin or NWI system.

Supporting the regulated community requires development of a system which embodies general management interests and which can be implemented in conjunction with a continuing inventory program. According to Mitsch and Gosselink (1986), a classification system is necessary to provide consistency for inventories, mapping, concepts and terminology. An ongoing inventory is necessary to track changes in wetland resources through change detection analysis. The coordination of an inventory program and a wetlands classification system allows for change detection to be done by wetland type. Paired with a functional analysis of wetlands types, the long-term goal is the ability to determine changes in wetland functions. This implies a simple, easily interpreted system, and one which can be applied using remotely sensed information.

Accommodating future developments simply means the system must be structured to allow future modification and/or refinement. Ideally it should be possible to extend the system to new levels of discrimination by simply adding information, without necessitating a complete restructuring.

Proposed Classification System

All wetlands can be classified as either riparian or isolated. Riparian wetlands are all those wetlands adjacent to surface waterbodies or water courses, whether permanent or intermittent. Isolated wetlands are all other wetlands. They are not connected to defined watercourses, either permanent or intermittent.

Riparian wetlands may be subdivided into tidal and nontidal wetlands based on hydrologic conditions.

Tidal wetlands may be subdivided according to general ecological value (refer to existing tidal wetlands management program). Assignment to value classes is made on the basis of dominant vegetative community.

Nontidal riparian wetlands can be further classified by the associated stream order designation. Until such time as additional information becomes available to guide valuation, we recommend that general value be assumed to increase as stream order decreases.

Isolated wetlands may be subdivided by general geographic province into coastal plain, piedmont, and ridge/valley wetlands. From the perspective of water quality considerations, isolated wetlands in the piedmont and ridge/valley provinces may be of greater importance due to the increased opportunity to play a role in recharging groundwater aquifers. No other generalization regarding value of isolated wetlands is recommended at this time due to insufficient technical information.

Within this generalized classification system, modifiers should be added to include use or quality designations of adjacent waters. For example, the classification of surface waters currently used by the Department of Environmental Quality should be considered as a modifier for riparian wetlands. Wetlands adjacent to high quality waters should be assumed to have importance for their role in maintaining that water quality. Exceptional wetlands, as a special class, are typically specific wetlands or wetland types particularly valued for exceptional quality. A complete discussion of the Exceptional wetlands class follows this section.

Classification System Rationale

The proposed classification system is designed to: (1) be very simple; (2) depend basically on information available through remote sensing; (3) accommodate existing classification or management efforts in Virginia; and (4) offer opportunities for expansion/ refinement as appropriate information becomes available. The system provides some guidance to regulatory efforts by incorporating both existing policy/management strategy (tidal wetlands management program and Chesapeake Bay Preservation Act) and a conservative synthesis of current technical information.

The distinction between riparian and isolated wetlands is based on two considerations. First, a review of the commonly identified potential roles of wetlands indicates that compared to isolated wetlands, riparian wetlands have a greater opportunity/probability of attaining a broad based importance (evaluated as potential number of simultaneous roles and level of performance). Isolated wetlands lack flowing water and are generally small in water volume. Lack of connectivity means isolated wetlands are unlikely to provide finfish habitat, particularly for anadromous fish, or support navigation. This does not mean that specific isolated wetlands may not have very high value and therefore warrant special management attention. What it does imply is that as a class, riparian wetlands warrant a high level of consideration for their ability to perform functions valued in management programs.

The second consideration in separating riparian and isolated wetlands is the existing focus on riparian wetlands established under the Chesapeake Bay Preservation Act (CBPA) management program. The CBPA seeks to preserve and protect existing riparian tidal and nontidal wetlands by moving land disturbing activities back from their landward boundaries. This is in recognition of the importance riparian wetlands can have for maintenance of surface water quality. This rationale was sound at the time the CBPA was passed and remains so today. Therefore the proposed classification system reflects and accommodates the existing program.

The proposed classification system is designed to be a "nested" system. The riparian/ isolated classification is very broad and very straightforward. It crosses all types of wetlands. Within this broad classification, subclassifications can be, and have been, developed and may be utilized as either current or future need dictates. For example, the tidal wetlands management program subdivides vegetated tidal wetlands into twelve different types (based on dominant plant community) and nonvegetated wetlands into five different types. Both vegetated and nonvegetated wetland types are grouped into five classes based on assumed general ecological value (VMRC 1993). Since tidal wetlands are all riparian wetlands, the existing classification becomes a refinement of the overarching system for the subset of riparian wetlands which are tidal.

It is proposed that nontidal riparian wetlands be further classified according to their landscape position, using stream order as a designation. Within this subclassification, it is proposed that position along low order streams be viewed as an indication of potential importance. Again, this does not imply that position along higher order channels precludes high value. Rather it is a reflection of current thinking which holds that wetlands closest to headwaters have the greatest opportunity to produce beneficial hydrologic and water quality modifications. Wetlands along low order channels have the opportunity to reduce flows and pollutant loadings before water reaches the main channels of the watershed. While these wetlands may be no more efficient at such activities than those elsewhere in the watershed, the fact that they act early in the movement of water through the system implies that their actions can have impact through a much larger portion of the system.

It is noteworthy that this recommendation, if followed, would counter current federal management practices for nontidal wetlands which tend to place lower value/concern on headwater wetlands.

Finally, there is a great deal of research underway seeking to extend current knowledge of wetland functions and the relationships between structure and function. As results of this work become available, refinement of the proposed classification system may be appropriate. In particular, work is underway in Virginia evaluating the relationships between nontidal wetland structure (including landscape position) and function. This work may permit increased discrimination of potential value in both riparian and isolated nontidal wetlands. If a relationship between functions and easily observed structural characteristics can be developed, then the information can be incorporated into the proposed classification system. At present, determination of relative value within the broad classes proposed is best left to site specific functional assessment methods.

Classification System

Class VII as it is currently defined and applied does not specifically address the diverse and complex nature of wetlands. A wetlands classification scheme must be incorporated into Class VII in order to allow for the recognition of the various beneficial uses of different wetland classes. We propose the following classification system be incorporated into Virginia Code under VR680-21-01.5. The current Class VII Swamp waters would be substituted with:

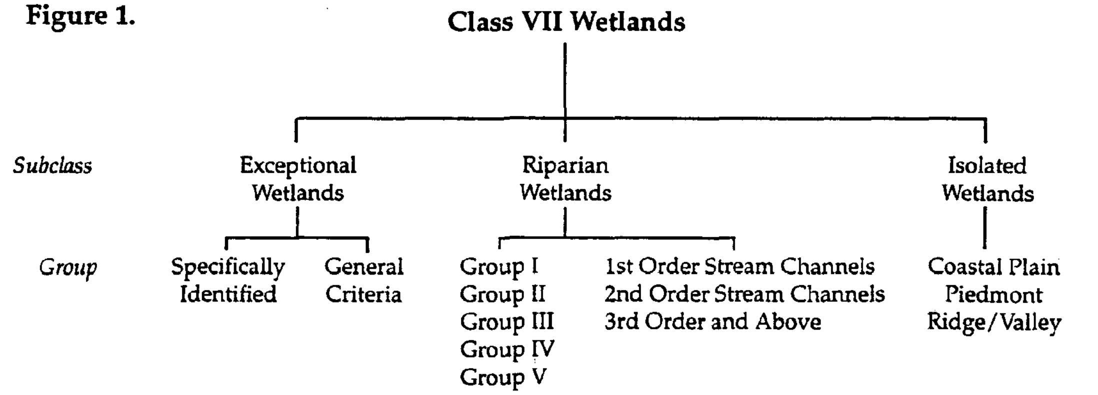
Class VII Wetlands

A. Exceptional Wetlands
   1. Specific geographically identified sites
   2. Specific and general criteria for designation under this provision

B. Riparian Wetlands
   1. Tidal wetlands
      a. Group I
      b. Group II
      c. Group III
      d. Group IV
      e. Group V
   2. Nontidal wetlands
      a. First order stream channels
      b. Second order stream channels
      c. Third order stream channels

C. Isolated Wetlands
   1. Nontidal wetlands
      a. Coastal plain wetlands
      b. Piedmont wetlands
      c. Ridge/Valley wetlands

Figure 1.



Designation Of Beneficial Uses

States should designate uses based on the functions and values of their wetlands. At a minimum these uses must meet the goals of Section 101(a)(2) of the CWA by providing for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water. This baseline is commonly referred to as the "fishable/swimmable" designation and is applicable to all waters. As wetlands are included in the definition of waters of the State, the fishable/swimmable designation applies to wetlands. The propagation of fish and wildlife is an attainable use in virtually all waters, including wetlands. Similarly, all waters provide recreational opportunities, although certain recreational uses may be limited in wetlands based on the presence of sufficient water. States may designate other uses based on wetland functions and values.

There are enumerable ecological functions performed by wetlands. Depending on how functions are defined, a list of wetland functions may include 27 or more different functions (Adamus 1992). More commonly, the scientific literature cites the following functions attributable to wetlands:

- ground-water recharge
- ground-water discharge
- floodwater alteration
- sediment stabilization
- sediment/toxicant retention
- nutrient removal/transformation
- production export
- aquatic and wildlife diversity/abundance
- storm buffering
- recreation
- uniqueness/hertitage (Adamus et al. 1991).

For additional discourse on wetland functions, the reader is referred to:

Our national wetland heritage (Kusler 1983),

Wetland functions and values: the state of our understanding (Greeson et al. 1979),

Tidal wetland values (Wohlgemuth 1990), and

Nontidal wetland functions and values (Wohlgemuth 1991).

Beneficial uses of wetlands, as a reflection of wetland functions and values, are generally designated according to wetland types, ie. classes. After all, different wetland types provide different functions. For instance, wetlands without permanent water are unlikely to provide finfish habitat, isolated wetlands are unlikely to provide erosion protection, and so forth. Similarly, the identification of high value wetlands may recognize the high value of a particular wetland type, or name specific wetland areas. So, prior to the designation of beneficial uses or the identification of exceptional wetlands, a classification scheme is required.

All Virginia state waters are designated for recreational use and for the propagation and growth of a balanced, indigenous population of fish, shellfish, and wildlife (VR680-21-01.1). The "fishable / swimmable" uses are the only use designations defined as such in Virginia's water quality standards regulations. However, there are several categories of waters with special designations. Special designation waters are: Scenic Rivers, Trout Streams, and Waters containing Endangered or Threatened Species (VR680-21-07.2 A-C) and Public Water Supplies (VR 680-21-08.3(D)(1)). Additionally, under VR680-21-07, special standards and designations are set for various waters including shellfish waters. The identification of waters with special designations and/or standards is found along with the assignment of water classes in VR680-21-08.1.

Existing and Potential Uses of Wetlands

	Wetland Type (Cowardin)				
Beneficial Use	Marine	Estuarine	Riverine	Lacustrine	Palustrine
Municipal and Domestic Supply	-	-	X	X	X
Agricultural Supply	-	X	X	X	X
Industrial Process Supply	-	X	o	o	-
Groundwater Recharge	X	X	X	X	X
Freshwater Replenishment	-	-	X	X	X
Navigation	X	X	X	X	X
Water Contact Recreation	X	X	X	X	X
Ocean Commercial and Sport Fishing	X	X	-	-	-
Warm Fresh Water Habitat	-	-	X	X	X
Cold Fresh Water Habitat	-	-	X	X	X
Preservation of Areas of Special Biological Significance	-	-	-	-	-
Wildlife Habitat	X	X	X	X	X
Preservation of Rare and Endangered Species	X	X	X	X	X
Marine Habitat	X	X	-	-	-
Fish Migration	X	X	X	X	-
Shellfish Harvesting	X	X	X	-	-
Estuarine Habitat	-	X	-	-	-

X = existing beneficial use
o = potential beneficial use

EPA guidance (1990) suggests a tabular presentation of existing and potential uses and the designation of such as beneficial uses by wetlands class (The Cowardin classification is used here—See box on previous page). The first step in the development of such a table is the identification of which beneficial uses are to be designated. After all, there are many wetland functions and values which may be designated as beneficial uses. However, in order to meld the beneficial use designations with existing management programs, the logical place to look for acknowledgement of beneficial uses is within the enabling legislation and implementing regulations of Virginia's wetland management programs.

A review of Virginia laws identified several specific cites of beneficial use(s) of waters. The Virginia Water Control Law states that beneficial use means both instream and offstream uses (§ 62.1-10 Va Code Ann.). Instream beneficial uses include, but are not limited to, protection of fish and wildlife habitat, maintenance of waste assimilation, recreation, navigation, and cultural and aesthetic values. Offstream beneficial uses include but are not limited to domestic (including public water supply), agricultural, electric power generation, commercial and industrial uses (§ 62.1-10 and § 62.1-242 Va Code Ann.). The Virginia Water Protection Permit designates the preservation of instream flows for the purposes of the protection of navigation, maintenance of waste assimilation capacity, the protection of fish and wildlife resources and habitat, recreation, cultural and aesthetic values as a beneficial use (§ 62.1-44.15:5 Va Code Ann.).

Additionally, wetlands are attributed several values under the Virginia Wetlands Act (§28.2-1301 Va Code Ann.). The values listed in the Act are ideologically consistent with those parameters currently termed as beneficial uses and are paralleled by many of the beneficial uses listed in the Virginia Water Protection Permit language. The values cited are: production of marine and inland wildlife, waterfowl, finfish, shellfish and flora; protective barrier against floods, tidal storms and the erosion of the Commonwealth's shores and soil; the absorption of silt and pollutants; the recreation and aesthetic enjoyment of the people; and the promotion of tourism, navigation and commerce.

Using the proposed wetland classification system for Virginia and the beneficial uses already acknowledged within the Code of Virginia, it is possible to develop a matrix of beneficial use designation which is compatible with existing wetlands management programs. Table 1 is a simple yes/no table of those beneficial uses which may be assigned to the proposed wetlands classification at the group level. The short-comings of this type of table is that aside from counting check-marks the table does not allow for the determination of relative importance among wetland groups. As such, the table falls short of the goal of providing regulatory guidance for informed wetlands management decision-making.

The assignment of numerical values to the beneficial uses does allow for a numerical ranking of wetlands. The term *value* "...connotes something worthy, desirable or useful to humans. The reasons that wetlands are legally protected have to do with their value to society, not with abstruse ecological processes that proceed therein... Perceived values arise out of functional ecological processes.., but are determined also by the location of a particular wetland, the human population pressures on it, and the extent of the resource." (Mitsch and Gosselink 1986, p393). Since many beneficial uses are societal values, and societal values vary with time and place, certain uses are valued more highly than others by different segments of society. The assignment of value is further complicated by those beneficial uses which elude accurate economic description. In other words, uses such as

Table 1. Beneficial Use According to the Proposed Wetlands Classification.

Beneficial Use	Wetland Classification										
	Riparian								Isolated		
	tidal					nontidal			nontidal		
	I	II	III	IV	V	1st	2nd	3rd	Coast	Pied	RV
Public Water Supply*	-	-	-	-	-	✓	✓	✓			
Threat & Endangered	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fish & Wildlife Habitat*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recreation*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Navigation*	✓	✓	✓	-	-	o	✓	✓	-	-	-
Cultural/ Aesthetic*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Agricultural/(Harvest)*	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓
Electric Generation*	-	-	-	-	-	-	-	✓	-	-	-
Waste Assimilation*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Commercial/ Industrial*	✓	✓	✓	-	-	-	-	✓	-	-	-
Erosion Protection•	✓	✓	✓	✓	✓	✓	✓	✓	-	-	-
Flood Buffering•	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ = existing use
o = potential use

* As per §62.1-10 Virginia Water Protection Permit
• As per §28.1-1301 Tidal Wetlands Act

recreation, cultural/aesthetic and threatened and endangered species habitat would be assigned the lowest value if the assessment is based solely on market-based evaluation techniques. Thus, the actual assignment of numerical values is a difficult, complex task which requires some balance between those beneficial uses which are easily valued economically and those uses which are not easily defined in economic terms.

Once again, it is most expeditious to look to the existing management programs for any prioritization of uses. In the State Policy as to Waters (§ 62.1-10 Va Code Ann.) and the Surface Water Management Act (§ 62.1-242 Va Code Ann.), domestic use (public water supply) is the highest priority beneficial use. The regulations implementing the Surface Water Management Act provide a water-use classification system (VR 680-15-03) for the purposes of permitting under the Act. In this system domestic use is Class 1, fish and wildlife habitat, waste assimilation, agriculture, power generation, commercial and industrial uses are in Class 2, and Class 3 includes recreation, navigation, cultural and aesthetic uses. This grouping provides a basis for the assignment of numerical values to beneficial uses. However, the class designations in this regulation appear to be exclusively an acknowledgement of economic value and do not account for uses which are difficult to define economically such as environmental sensitivity. Furthermore, the regulations have not yet been applied, so there are no Surface Water Management Areas in Virginia.

Table 2. Beneficial Use Ranking by Group.

BENEFICIAL USE	Rank	WETLAND CLASSIFICATION										
		Riparian								Isolated		
		tidal					nontidal			nontidal		
		I	II	III	IV	V	1st	2nd	3rd	Coast	Pied	RV
Public Water Supply	3	0	0	0	0	0	3	3	3	0	0	0
Treat & Endangered	3	3	3	3	3	3	3	3	3	3	3	3
Fish & Wildlife Habitat	2	2	2	2	2	2	2	2	2	2	2	2
Recreation	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Protection	2	2	2	1	1	1	2	2	2	0	0	0
Cultural/ Aesthetic	2	2	2	2	2	2	2	2	2	2	2	2
Flood Buffering	2	2	2	2	2	2	2	2	2	2	2	2
Waste Assimilation	2	2	2	2	2	2	2	2	2	2	2	2
Navigation	1	1	1	1	1	1	1	1	1	0	0	0
Commercial/ Industrial	1	1	1	1	0	0	-	1	1	0	0	0
Agricultural/Harvest	1	1	1	0	0	0	1	1	1	1	1	1
Electric Generation	1	0	0	0	0	0	0	0	1	0	0	0
TOTAL		18	18	16	15	15	20	21	22	14	14	14

A numerical designation should reflect both societal value (often economic) and the environmental sensitivity of the function to impacts or loss due to human activities. In other words, the ranking should consider which functions are either very valuable economically, and/or very important ecologically. The numerical rankings in Table 2 acknowledge societal values while attempting to account for ecological sensitivity. These rankings are also consistent with the use ranking or prioritization of other state programs. In the table, the numbers correspond directly with the use priority, with 3 being the highest and 1 being the lowest. Depending upon the level of detail necessary for the rankings, more general tables amy be created using the same ranking designations (Table 3).

Wetlands functions are not uniformly susceptible to change as a result of human activity. Small anthropogenic changes in water quality may greatly affect certain wetland functions while other functions are affected either moderately or not at all. Of the most sensitive functions, those which also have high societal value are public water supply and threatened and endangered species habitat. A third function, similarly sensitive and valuable, is water quality maintenance necessary for the provision of native trout habitat.

Public water supply, per se, is not typically associated with wetland use. Wetlands do co-occur with surface waters that are used as public water supplies. Public water supply is, however, recognized as a special class of waters by most states and afforded extra protection. Some states including Connecticut, Georgia, New York, Florida, have chosen to include these waters in the highest class in recognition of the societal importance and ecologic sensitivity of this beneficial use. As previously stated, wetlands adjacent to waters with special designations should share the designation.

Table 3. Beneficial Use Ranking.

BENEFICIAL USE	RANK	WETLAND CLASSIFICATION		
		Riparian		Isolated
		tidal	nontidal	nontidal
Public Water Supply	3	0	3	0
Threatened & Endangered	3	3	3	3
Fish & Wildlife	2	2	2	2
Recreation	2	2	2	2
Cultural/ Aesthetic	2	2	2	2
Waste Assimilation	2	2	2	2
Flood Buffering	2	2	2	2
Erosion Protection	2	2	2	0
Navigation	1	1	1	0
Agricultural	1	1	1	1
Electric Generation	1	0	1	0
Commercial/ Industrial	1	1	1	0
TOTAL		18	22	14

It is a common practice in the development of regulations promulgating water quality legislation to include verbatim language from the enabling legislation. The implementing legislation for the Virginia Water Protection Permit legislation (§ 62.1-44.15:5 Va Code Ann.) includes waste assimilation as a beneficial use. The adoption of waste assimilation as a designated use is however, prohibited under the federal Water Quality Standards Regulation (40 CFR 131.10(a)). (Wetlands designed, built and operated as wastewater treatment systems are considered by EPA as a special case.)

For wetlands adjacent to waters with special designations under VR 680-21-07.1 (A-C) (Scenic Rivers, Trout Streams, and Waters containing Endangered or Threatened Species or VR680-21-08.3 (D)(1) (Public Water Supplies), we recommend the adoption of the same as designated uses. As previously stated, wetlands are included in the definition of waters of the state. As a result, wetlands inundated by waters with a special designation have the same designation. Wetlands occupy a transitional position in the landscape between upland and water. Thus, wetlands are ecologically linked to both uplands and waters. The hydrologic connection between wetlands and adjacent waters makes it impossible to separate the two for purposes of defining many ecological parameters. The exclusion of wetlands from the special designations of adjacent waters could result in a scenario where impacts which degrade the wetland also degrade adjacent waters.

According to EPA guidance (1990), wetlands which may be considered as candidates for designation of exceptional quality include:

- Parks, refuges, wild and scenic rivers, estuarine sanctuaries, and wildlife management areas;
- Wetlands adjacent to other exceptional waters;
- Priority wetlands identified under the Emergency Wetlands Resources Act of 1986 through Statewide Outdoor Recreation Plans (SORP) and Wetland Priority Conservation Plans;
- Sites within joint venture project areas under the North American Waterfowl Management Plan;
- Sites under the RAMSAR Treaty on Wetlands of International Importance;
- Biosphere reserve sites identified as part of the "Man and the Biosphere" Program sponsored by the United Nations;
- Natural Heritage areas and other similar designations established by the State or private organizations (e.g., Nature Conservancy); and
- Priority wetlands identified as part of comprehensive planning efforts conducted at the local, State, Regional, or Federal levels of government; e.g., Advance identification (ADID) program under section 404 of the CWA and Special Area Management Plans (SAMPs) under the CZMA (EPA, 1990).

Criteria For Exceptional Wetlands Designation

The establishment of a class of Exceptional Wetlands is critical to the protection and special management of wetlands. In Virginia, Exceptional Waters are afforded the highest level of protection (i.e., no degradation) under the antidegradation policy (VR680-21-01.3(C)). Exceptional Waters are analogous to Outstanding National Resource Waters (Section 131.12(a)(3) of the Federal Water Quality Standards Regulation). The designation of Exceptional Wetlands may be based on exceptional environmental settings and exceptional aquatic communities or exceptional recreational opportunities. A review of other state water classification systems reveals particular beneficial uses that are commonly afforded special protection within management programs (EPA 1988). Two of these uses are specific wetland functions. The third use covers a suite of functions. The specific functions afforded special protection are; Public water supply (an economically valuable and ecologically sensitive use) and habitat for threatened and endangered species (a highly sensitive use). The third "use" recognizes a suite of values—particularly aesthetics—in the establishment of a national or state park, refuge, wild or scenic river, etc. Some 20 different states designate wetlands in these areas with the highest value category of their classification, be it High Value or Outstanding Resource Waters (Jessup 1994). As wetlands already afforded special protection within the park system, these wetlands potentially function at high levels for many beneficial uses, ie. fish and wildlife habitat, recreation, and cultural and aesthetic uses. This category also offers an opportunity to make use of protection tools already in place due to the park, refuge or wild and scenic river designation.

In addition to the Exceptional designation, state regulations and federal guidance provide for the maintenance and protection of High Quality Waters. The protection of High Quality Waters is provided for under VR680-21-01.3(B). High quality waters are waters which meet all of the water quality standards. The designation of wetlands as high quality may be problematic as wetlands often fail to meet existing water quality standards. However, it is likely that wetlands adjacent to high quality waters would meet the standards and should be designated as high quality wetlands. Advances in wetlands science should allow for the subsequent development of water quality standards specific to wetlands making the designation of high quality wetlands more feasible.

We propose the creation of a subclass of Exceptional wetlands and the protection of these wetlands under VR680-21-01.3 (C) of Virginia's Antidegradation Policy. The antidegradation policy should provide for the protection of existing uses in wetlands and the level of water quality necessary to protect those uses. Concerns arise over the application of Section C at the anti-degradation policy. A strict application of the antidegradation policy would result in preventing the issuance of any discharge permits including wetland fill permits under §404 of the CWA. This would preclude, for instance, the development of a state park with waters and wetlands designated as Exceptional Wetlands. However, EPA allows a slightly different interpretation of existing uses under the antidegradation policy in the case of wetland fills. The EPA guidance, found in *Questions and Answers on: Antidegradation*, is stated below:

> *Since a literal interpretation of the antidegradation policy could result in preventing the issuance of any wetland fill permit under §404 of the Clean Water Act, and it is logical to assume that Congress intended some such permits to be granted within the framework of the Act, EPA interprets 40CFR 131.12(a)(l) of the antidegradation policy to be satisfied with regards to fills in wetlands if the discharge did not result in significant degradation to the aquatic ecosystem as defined under §230.10(c) of the §404(b)(1) guidelines.*

Under the proposed classification system, wetlands may be specifically identified or generally identified through the application of criteria. The first category requires, by definition, a case-by-case review of the wetlands to be included. For instance, New York state specifically identifies two kettle-hole bog wetlands in the state as worthy of highest protection due to unique natural heritage. Minnesota and Ohio have also designated specific wetlands for the highest order of protection (EPA 1989). Similarly Virginia may have rare, unique or otherwise highly valuable wetlands that may be listed as high quality wetlands. The second category allows for the inclusion of a wetland, or wetlands, based upon a designated beneficial use. This category of general criteria may include, for example, wetlands adjacent to waters which are public water supplies or native trout waters (class i or ii after Department of Game and Inland Fisheries classification). The most logical choice is the use of the Exceptional designation as acknowledgement of the beneficial uses of greatest value and sensitivity, public water supply and threatened and endangered species habitat.

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Appendix 1.

Preliminary Characterization of Nontidal Wetlands in Virginia's Coastal Plain

Gene Silberhorn, Pam Mason, Julie Herman, and Carl Hershner

Introduction

Nontidal wetlands in coastal Virginia are valued for their ecological functions that benefit man. These functions include flood storage, protecting surface and ground-water through filtration, wildlife habitat, erosion buffer especially along streams, primary production, and resources for recreational, educational, and research activities.

There are approximately 750,000 acres (303,643 hectares) of nontidal wetlands in Virginia (Tiner, 1987; Odum, 1988). Approximately 64% or 480,000 acres of nontidal wetlands are in Virginia's coastal zone (Tiner, 1987). Most of these wetlands are forested palustrine wetlands. Over 90% of the nontidal wetlands in Virginia are forested or scrub/shrub, the former representing 83% of the woody wetlands in the state or 625,804 acres (253,362 hectares) (Odum, 1988).

Effective nontidal wetland management can be enhanced or facilitated by a body of knowledge and information of existing resources, their ecological function, and vegetative composition. There is very little published material of use to wetland managers regarding nontidal wetlands in Virginia's coastal plain. In order to increase our knowledge of nontidal wetlands, the Virginia Institute of Marine Science (VIMS) has undertaken a two-phased study in coastal Virginia. The two components of the study are integrally linked: wetland functional assessment and vegetative community characterization. The functional assessment analysis is grouped by wetlands type, and uses the vegetative community descriptions to demonstrate linkages between any one of a suite of wetlands functions and vegetative community type(s).

Nontidal Wetland Communities

Forested Wetlands

<u>Blackwater wetlands</u> Blackwater streams are typical of the southeastern Atlantic coast of the United States. They are narrower and shorter than larger alluvial southern rivers that originate in the Appalachians or deep within the Piedmont Plateau. Blackwater rivers originate within the coastal plain or nearby piedmont fringes (Wharton, et al, 1982). They

are less turbid and are relatively clear or colored (coffee-colored) because of organics and tannins (Wharton, et al, 1982; Smock and Gilinsky, 1992).

Blackwater bottomland hardwood forests in Virginia are similar to BLH forests farther south although not as extensive. The forested wetlands along three blackwater waterways (Blackwater, Nottoway, and Meherrin Rivers), and the Chickahominy River and Dragon Run north of the James River represent the northern-most extent of typical southeastern bottomland hardwood forests (BLH) (Wharton, et al., 1982, Smock and Gilinsky, 1992). These forests have developed on narrow flood plains of smaller, shallower streams which usually do not become flooded except during local storm events (Penfound, 1952; Virginia Water Control Board, 1985 and Smock and Gilinsky, 1992). Dominant canopy species are bald cypress (PFO2E) and bald cypress/tupelo (PFO1/2E) in large segments of the state's blackwater streams (Cowardin et al., 1979). In some areas along the Nottoway and Blackwater and their tributaries nearly monospecific stands of tupelo predominate (PFO1E).

As the flood plain narrows farther upstream from the mouths of these waterways, bald cypress often codominates with *Nyssa sylvatica* var. *biflora*, green ash (*Fraxinus pennsylvanica*) and red maple. Near the headwaters or along smaller tributaries broad leaved species dominate such as red maple associated with ash, river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*) and black gum (*Nyssa sylvatica* var. *sylvatica*). These wooded wetlands are typically classified as palustrine forested, broad-leaved deciduous and seasonally flooded (PFO1C).

The narrowest flood plain forests (50 to 30 m wide), usually located in the headwaters of tributary streams, are often dominated by red maple in association with sweet gum (*Liquidambar styraciflua*), black gum, river birch, American hornbeam (*Carpinus carolinina*) or loblolly pine (*Pinus taeda*). Wooded wetlands that often occupy these narrow ravines are typically 'winter wet woods' or PFO1A's or PFO1/4A's.

<u>Small Stream Bottoms</u> Small stream wetlands occupy a significant amount of the landscape in the Mid-Atlantic and Southeastern States (Penfound, 1952; Monk, 1963; Bernard, 1966; Gemborys and Hodgkins, 1971 and Glascock and Ware, 1979). Many of these streams are tributaries of estuarine waterways, large alluvial or blackwater rivers. Their appellation varies from locale and region i.e., branch bottoms, shallow swamps, creeks, runs, branches and drains.

Small stream wetlands in coastal Virginia typically are found in the inner coastal plain where local relief may range from 25 to 200 feet. The narrowest streams usually have steep sided banks and intermittent flow. Temporary flooding often occurs at irregular intervals (Glascock and Ware, 1979) especially during local storm events. Often the hydrology of the streams are impacted by road construction and beaver dams.

Nearly all of the small stream wetlands are dominated by trees. There is a remarkable similarity in dominant canopy species distributed in these wetlands from New Jersey south to Florida and Alabama. Our own findings and other works in Virginia (Glascock and Ware, 1979) indicate that red maple, ashes (*Fraxinus* spp., black gum (*N. sylvatica*), *L. styraciflua*, and elms are all common components in these narrow wetlands throughout the east and Gulf coasts (Bernard, 1963; Monk, 1966; Gemborys and Hodgkins, 1971; Tiner, 1985; Tiner, 1988 and Kuenzler, 1989).

Pocosins

Pocosins, also known by other common names such as bays, Carolina bays, bayheads, shrub bogs, southern bogs and other designations, are distributed along the Atlantic Coast from Virginia to northern Florida, but are most extensive in North Carolina (Ash, et al. 1983, Gresham 1989; Richardson 1991). Description varies in the literature for these wetlands but, in North Carolina they occupy poorly drained, flat, shallow basins, with soils ranging from sandy humus, mineral soils, organic muck and peat (Brinson 1991). Vegetation typically found in North Carolina pocosins are pond pine (*Pinus serotina*) as the dominant tree, with red bay (*Persea borbonia*), loblolly bay (*Gordonia lasianthus*), Atlantic white cedar (*Chamaecyparis thyoides*) and sweet bay (*Magnolia virginiana*) as associated trees (Ash, et al. 1983, Richardson 1991). Common shrubs found in pocosins of North Carolina are titi (*Cyrilla racemiflora*), fetterbush (*Lyonia lucidia*), honeycup (*Zenobia pulverulenta*), inkberry (*Ilex glabra*), wax myrtle (*Myrica cerifera*) and others (Ash, et al. 1983, Richardson 1991).

Emergent (herbaceous) Nontidal Wetlands

Emergent nontidal wetlands are not nearly as extensive (less than 10%) in Virginia, compared to forested and scrub/shrub wetlands (Tiner 1987, Odum 1988). Herbaceous dominated wetlands usually exist in isolated depressions, narrow fringes along the margins of ponds, lakes and streams. In our study, many emergent wetlands were the result of disturbed wooded wetlands, often because of clear-cutting for power line right-of-way or timbering. Emergent wetlands are typically associated with palustrine scrub/shrub wetlands. Both of these wetland types (Cowardin et al. 1979) are smaller and less frequently encountered than palustrine forested wetlands in Virginia's coastal zone.

Maritime dune swales, found only sporadically in undisturbed coastal dune fields are wetlands of seeming contradictions. Plants growing there vary from season to season, hydrophytes to upland species, halophytes to freshwater species. Typically, *Juncus* species would indicate wet conditions, however, *Andropogon virginicus*, a grass indicating xeric conditions coexist (Jones 1992). Other species common to these sites are *Centella asiatica*, *Scirpus americana*, *Drosera intermedia*, and *Xyris* spp. (Tyndall and Levy 1978, Ludwig 1990, Jones 1992). Many of the plants are difficult to identify because they are dwarfed when compared to their more robust inland conspecifics (Jones 1992).

Scrub/Shrub Wetlands

Nontidal scrub/shrub wetlands represent only about 10% of nontidal wooded wetlands in the state (Tiner 1987). Many of the wetlands designated as palustrine scrub/shrub on National Wetland Inventory maps (NWI) are cut-over areas that were once palustrine forested wetlands. Often scrub/shrub wetlands are depicted as long narrow strips, which are cut-over utility line right-of-ways. Clear cutting forested wetlands for utility right-of-ways is a major type of alteration in the Northeast (Golet et al, 1993). Typically these disturbed wetlands are dominated by red maple and sweet gum saplings.

Undisturbed scrub/shrub wetlands usually have a mixture of shrubs such as silky dogwood (*Cornus ammomum*), alder (*Alnus seruulata*), button bush (*Cephalanthus occidentalis*), swamp rose (*Rosa palustris*); trees such red maple, sweet gum, black willow (*Salix nigra*) and a diverse emergent plant component.

Methods

Site Selection and Assessment

Potential study sites were identified and located using NWI maps, USGS topographic maps and SCS soil surveys. Staff from the Virginia Institute of Marine Science, College of William and Mary visited 300 potential sites. All sites were visited in the field between March and November (1991-92) with 85.0% of the sites visited between late May and August. Data collection for the vegetative characterization and the field portion of the VIMS Functional Assessment Technique (Bradshaw, 1991) were performed on 268 sites. The remaining sites were eliminated either due to the fact that the site was misidentified on the NWI map and was an upland site, or major disturbance had made characterization and assessment of the wetland impossible.

The Cowardin classification on the NWI maps was used to categorize wetland types. On those occasions when the field observations were inconsistent with the assigned NWI classification, the wetland was assigned a class by the assessment team.

Upon returning to the lab, the vegetative data and the data from the functional assessment field sheets were entered into a dBase database for analysis.

All field site wetlands were marked on the mylar National Wetlands Inventory Maps (NWIS). Most of the NWIs used were the maps produced in the 1970's. Any missing maps were replaced with 1990's map. The total areal extent of each wetland was not field checked. In some cases the extent of the wetland was noted by the field team, and in the rest, the extent of the wetland was assumed to be what was on the NWI. On the old NWIs it was assumed that the classification type of some of the very large wetlands changed where roads crossed them (roads would affect their drainage and therefore hydrology).

Watersheds were delineated using the NWI's and United States Geological Survey topographic maps (topos). As required by the functional assessment technique, primary and secondary (upstream) subwatersheds were delineated.

The area of primary watersheds is affected by the number and proximity of wetlands near the wetland of interest. It appears that the primary watersheds on the newer NWIs would be smaller because so many wetlands are more finely subdivided. Wetlands that "straddled" stream courses had watersheds delineated that encompassed all the upstream area. In some cases this produces a secondary watershed with a very large area (e.g. in the Blackwater River watershed). The watersheds for wetlands that sat adjacent to stream courses only included the land area on that side of the stream.

Wetlands and watersheds were digitized and coded. Arc/INFO Macro Language (AML) programs were used to extract the primary and secondary watersheds for each wetland. Every primary and secondary watershed generated was doublechecked.

ERDAS imaging processing software was used to overlay 1989 National Ocean and Atmospheric Administration Coastwatch landuse/land cover data on the watersheds. Slope of watersheds was estimated from topo maps using change in elevation (from the contour lines) over distance. Stream order was also determined from topo maps.

A dBase program was used to enter and calculate the landuse/landcover acreages and percentages required on the functional assessment technique office data sheet.

Community Characterization Sampling

Trees were sampled using a modified Bitterlich method. Utilizing a Cruz-Angle, this technique is a standard method used by foresters and is efficient, rapid and accurate sampling process to measure tree dominance (Grosenbough, 1952; Phillips, 1959; Mueller-Doumbois and Ellenburg, 1974 and Bell and Dilworth, 1988). For this study, trees are defined as greater than 4.0 in. (10.2 cm) in diameter at breast height (dbh) and greater than 20.0 feet tall (6.0 m). Density of saplings and shrubs were counted within a 10.0 m circumference. Saplings were defined as tree species that are less than 4.0 in. dbh and less than 20.0 feet tall.

Herbaceous plants, woody seedlings and vines were estimated as percent cover using 1m x 1m quadrats. Percent 'no cover' was also recorded. No cover was often mud, or bare soil, water (void of subaquatic vegetation), or 'blackened leaves'. Sites were sampled with two 1m x 1m quadrats during the growing season. Plots were systematically placed to measure the lower and higher elevations within the 10.0 m circle.

Hydrologic conditions were recorded as flooded when the site was covered with surface water (depth measured), partially flooded when hummocks extended above the water, and not flooded when surface water was not evident. Determination of hydrologic conditions, when no surface water was present, was facilitated by indicators of flooding. The following indicators were recorded, if present: 1) buttressed or fluted tree trunks, 2) pneumatophores (cypress knees), 3) wrack or debris accumulation, 4) water marks, 5) crayfish chimneys, 6) blackened leaves, 7) oxidized rhizospheres, 8) saturated soil and 9) adventitious roots. The site was considered saturated if the soil was wet within the root zone.

Hydric soil conditions were determined using the guidelines in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory, 1987), Munsell Soil Charts (1990), and frequently local soil maps. Soil samples were taken by probe.

Recent plant manuals were used to assist in plant identification (Radford et. al., 1968; Godfrey and Wooten, 1979, 1981). Plant indicator status was determined according to Reed (1988).

Results

Community Structure

There are very few expansive nontidal emergent wetlands in coastal Virginia (PEMs). Our study indicates that PEMss are usually quite wet and are often dominated by broad-leaved herbs including; dicotyledons such as lizard's tail (*Saururus cernuus*), smartweeds (*Polygonum* spp.), jewel-weed (*Impatiens capensis*) as well as monocotlydons such as arrow arum (*Peltandra virginica*). Species composition is often similar to tidal freshwater wetlands, but quite dissimilar to salt and brackish water marshes which are generally dominated by grasses with associated rushes and sedges. Field observations made throughout the growing seasons of the two year study revealed that most broad-leaved, emergent dominated wetland types were flooded or partially flooded most of the time. Maritime dune swales, often grass and rush dominated, appeared to be the driest of the emergent wetland types.

The PFO1As in our study (n = 68) were saturated (63.9%) or partially flooded (19.1%) during the growing season. This wetland type, often referred to as 'winter wet woods', is common in poorly drained areas of tidewater Virginia, often at or near the headwaters of small streams, or on the fringes of large, wetter forests. The canopy species are predominately *Acer rubrum* in association with sweet gum (*Liquidambar styraciflua*), and sycamore (*Platanus occidentalis*). Upland trees or saplings did not dominate or codominate at any of the PFO1A sites and accounted for less than 10% of the canopy in only a few sites. FACU tree species did not dominate at any of the sites, but *Ilex opaca* (FACU) did dominate or codominate in the sapling strata in 8 or 15.7% of the 68 sites. Shrub and herbaceous components in PFO1A sites indicate a higher percentage of FACW species than the tree and sapling strata.

Seasonally flooded palustrine forested wetlands (PFO1Cs), are similar to PFO1As, but typically are wetter and have a higher percentage of hydrophytic species (facultative wetland plants (FACW) and obligate wetland plants (OBL)), Reed (1988). PFO1Cs are typically found on higher flood plain terraces along blackwater rivers, usually above cypress/tupelo forests. They are also commonly found below headwater streams in areas were the flood plains are broader than the narrow flood plains of PFO1As. Nearly one half of all sites (N=68) were at least partially flooded during the growing season in 1991-92 (Figure 2). More than one quarter of the sites were completely flooded with shallow water (averaging less than 30 cm). None of the sites were dry, even during peak growing season (June-July-August).

Bald cypress swamps (PFO2E) were always flooded or partially flooded (50% or more of site area flooded) during our sites visits during the growing season (March - September 1991-1992). The largest expanse of this wetland type occur along the blackwater rivers, the Nottoway, Blackwater, and Chickahominy rivers and the Dragon Run. FACU plants were not found in any of the lifeform categories in the cypress swamp study sites (N=17). FAC species dominated (55.5%) only in the sapling strata and were not found in the other three strata. *Acer rubrum* was the sole species represented (Table 6). Obligate plants totally dominated the canopy strata (99.9% - *Taxodium distchium*), shrubs (99.9%) and were significantly abundant as herbaceous cover (84.5%).

PFO1/2Es, bald cypress/hardwood mixed forests were nearly always flooded or partially flooded. In wetlands where cypress codominated with red maple, most of the later were smaller trees growing on deadfall or isolated hummocks of elevated substrate. Cypress/maple swamps were usually partially flooded or saturated. Cypress/tupelo swamps were mostly flooded and the trees had buttressed trunks and knees. In PFO1/2E sampled wetlands, facultative wetland (FACW) species were found in all categories, but were more prevalent as saplings 49.9% (mainly *Acer rubrum*), shrubs 30.8% (*Clethra alnifolia*), herbs 31.5% and least common in the canopy strata (16.2%). Obligate species, *Taxodium distichum* and *Nyssa aquatica* (Table 5) dominated the canopy (58.1%) of the sites. OBL plants (*Saururus cernuus* and *Murdannia keisak*) also dominated most of the herbaceous strata (69.5%).

Tupelo dominated swamps (PFO1E) were nearly always flooded or partially flooded. PFO1E sampled sites did not have any dominating FACU plants in any of the four lifeform categories. Facultative (FAC) species dominated/codominated 21.6% of the canopy strata and 41.6% of the sapling/understory strata and 0.0% in the shrub and herbaceous strata. Facultative wet (FACW) hydrophytes were found in all four categories: trees 41.1%, saplings 58.1%, shrubs 41.1% and herbs 25.0%. Obligate (OBL) wetland plants dominated/codominated the tree strata at 36.6% of the study sites, 0.0% of the sapling understory, 58.3% of the shrub category and 75.0% of the herbaceous cover.

Discussion

Community Structure

The nontidal palustrine forested wetlands of Coastal Virginia have affinities with palustrine forested wetlands of both the Mid-Atlantic States and the Southeastern States. Generally, PFO1A and PFO1C types, based on this study, are similar in dominant and associated canopy species composition to those found in Maryland (Tiner, 1988). *Acer rubrum* appears to be the dominant canopy tree in these wetland types in both Virginia and Maryland. Other common dominant/codominant trees are *Nyssa sylvatica* var.*biflora, Liquidambar styraciflua*,and *Platanus occidentalis*.

PFO1E, PFO1/2E and PFO2E forests in Virginia are similar to bottomland forests farther south (Wharton, et al, 1982, Smock and Gilinsky, 1992) (Fig.1a). PFO1E forests are commonly dominated by *Nyssa aquatica, N. sylvatica* var. *biflora, Fraxinus pennsylvanica* and *A.rubrum*. PFO1/2E forests are dominated by *Taxodium distichum* and *N. aquatica* and PFO2E by *T.distchum*. The tupelo and tupelo/cypress bottomland forests reach their northern distribution in coastal Virginia.

Functional Assessment

The functional assessment technique used in this study allowed us to rapidly sample a large number (268) of nontidal wetlands in coastal Virginia over two growing seasons (1991-1992). The method was not only designed to facilitate our needs for the study, but to be of possible use to wetland managers as an easily deployed yet scientifically sound tool to be used in the field. Rapid assessment programs have been recently developed to sample the environment where time is a critical factor because of human impacts (Abate, 1992).

The results of the functional assessement are still being analyzed. The preliminary data is presented in a series of graphs summarizing rankings of all sampled wetlands for each function by wetland type and by stream order. This data is being analyzed to determine if wetland type or position can be useful predictors of wetland function. Preliminary analysis suggests weak relationships exist within the sample population of wetlands. This analysis will continue and be extended during the summer of 1995. The graphs presented here are simple data summaries and have not been used to draw any conclusions thus far.

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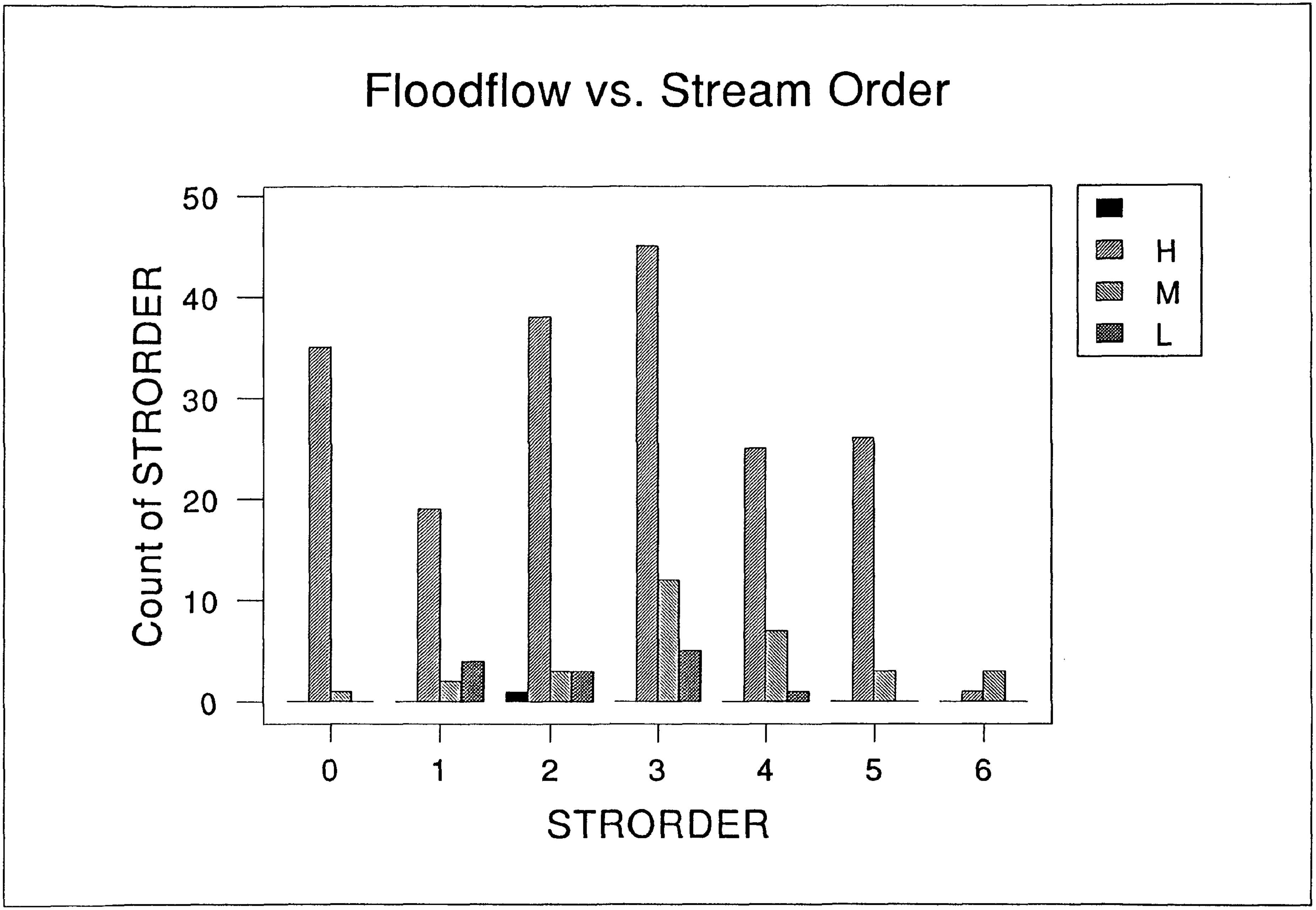
Floodflow vs. Stream Order
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30
20
10
0
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2
3
4
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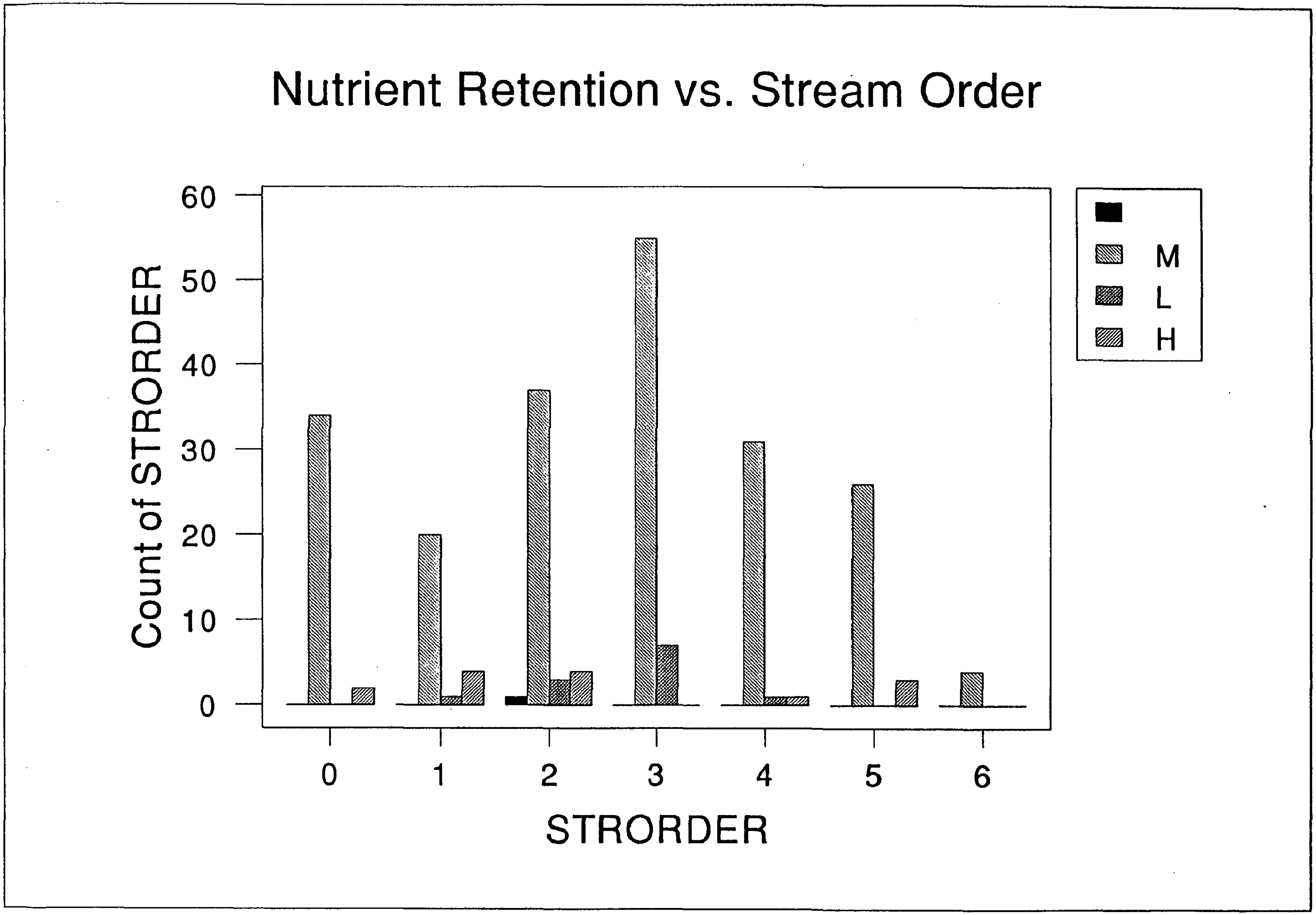
6
STRORDER
H
M
L


Nutrient Retention vs. Stream Order
Count of STRORDER
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M
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1
2
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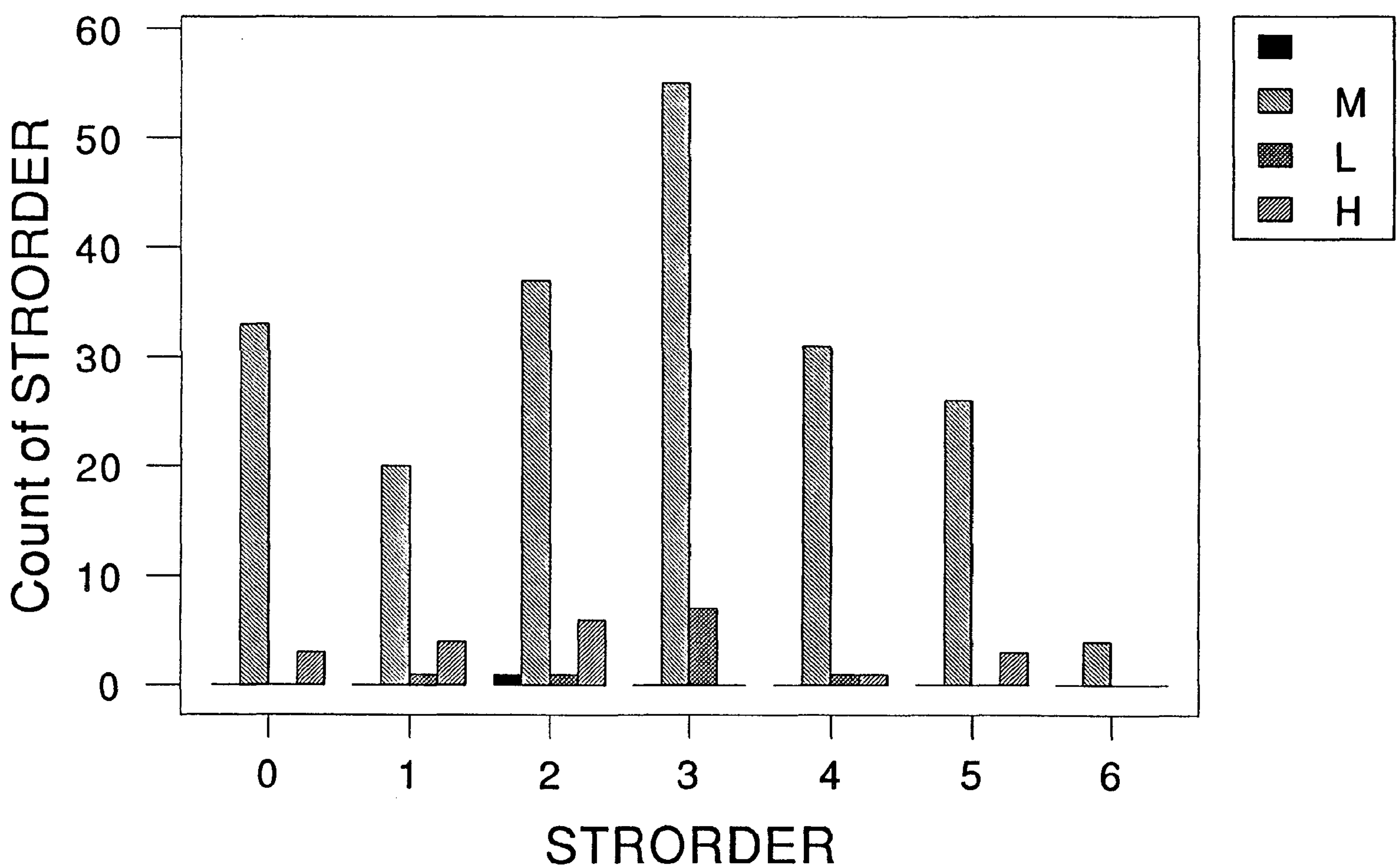
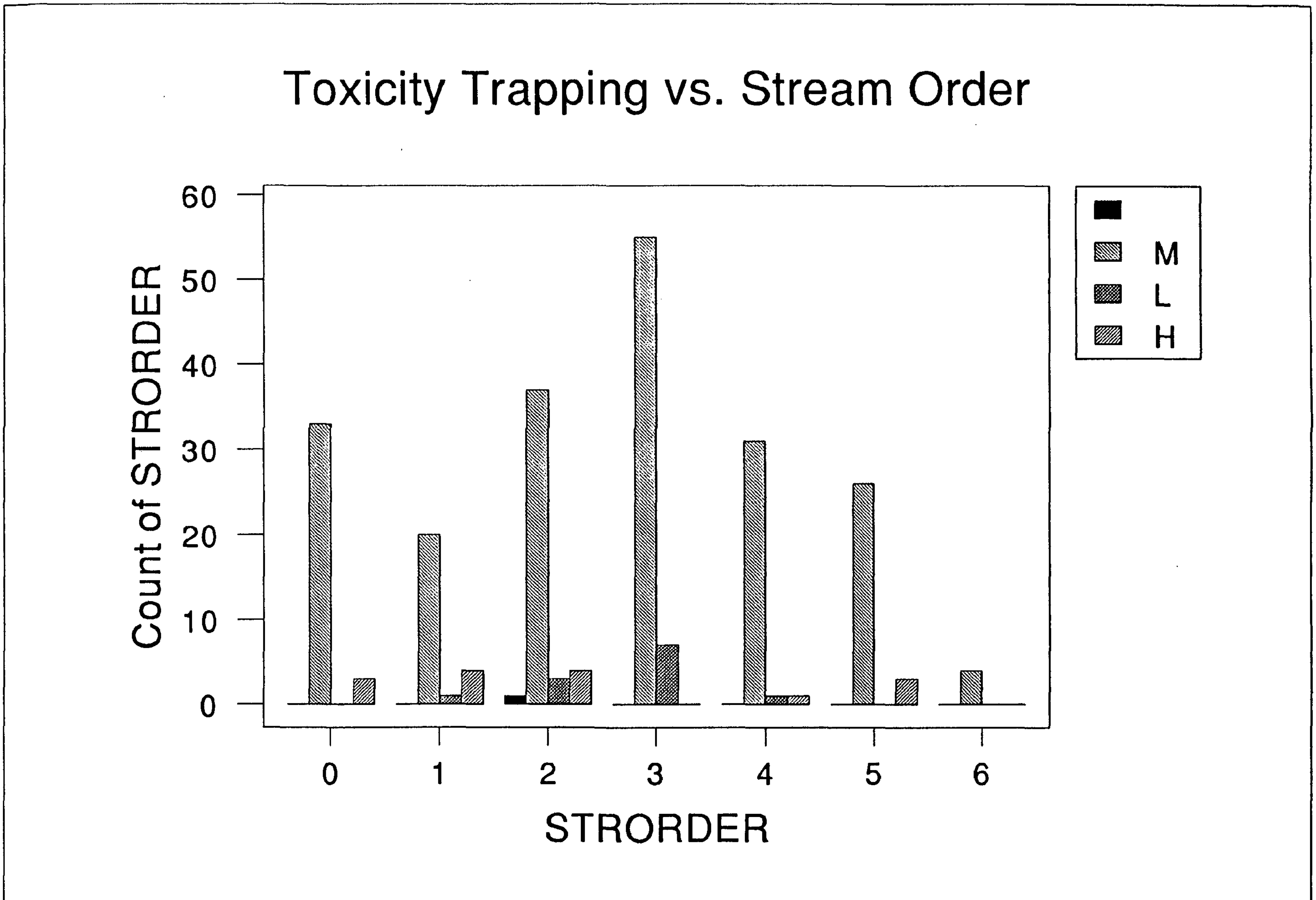
4
5
6
STRORDER

Sediment Trapping vs. Stream Order





Toxicity Trapping vs. Stream Order
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40
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20
10
0
Count of STRORDER
0
1
2
3
4
5
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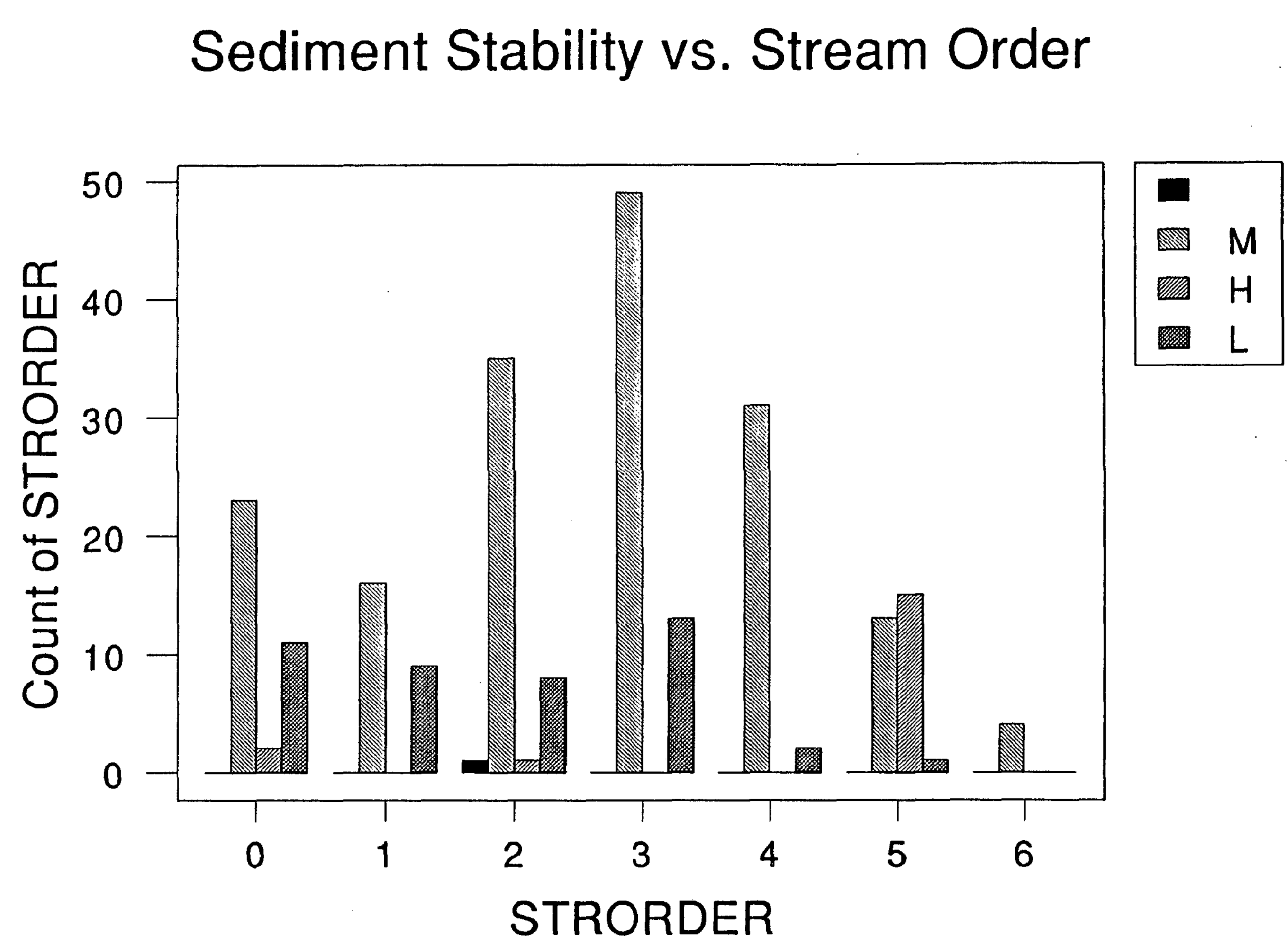
STRORDER
M
L
H


Sediment Stability vs. Stream Order
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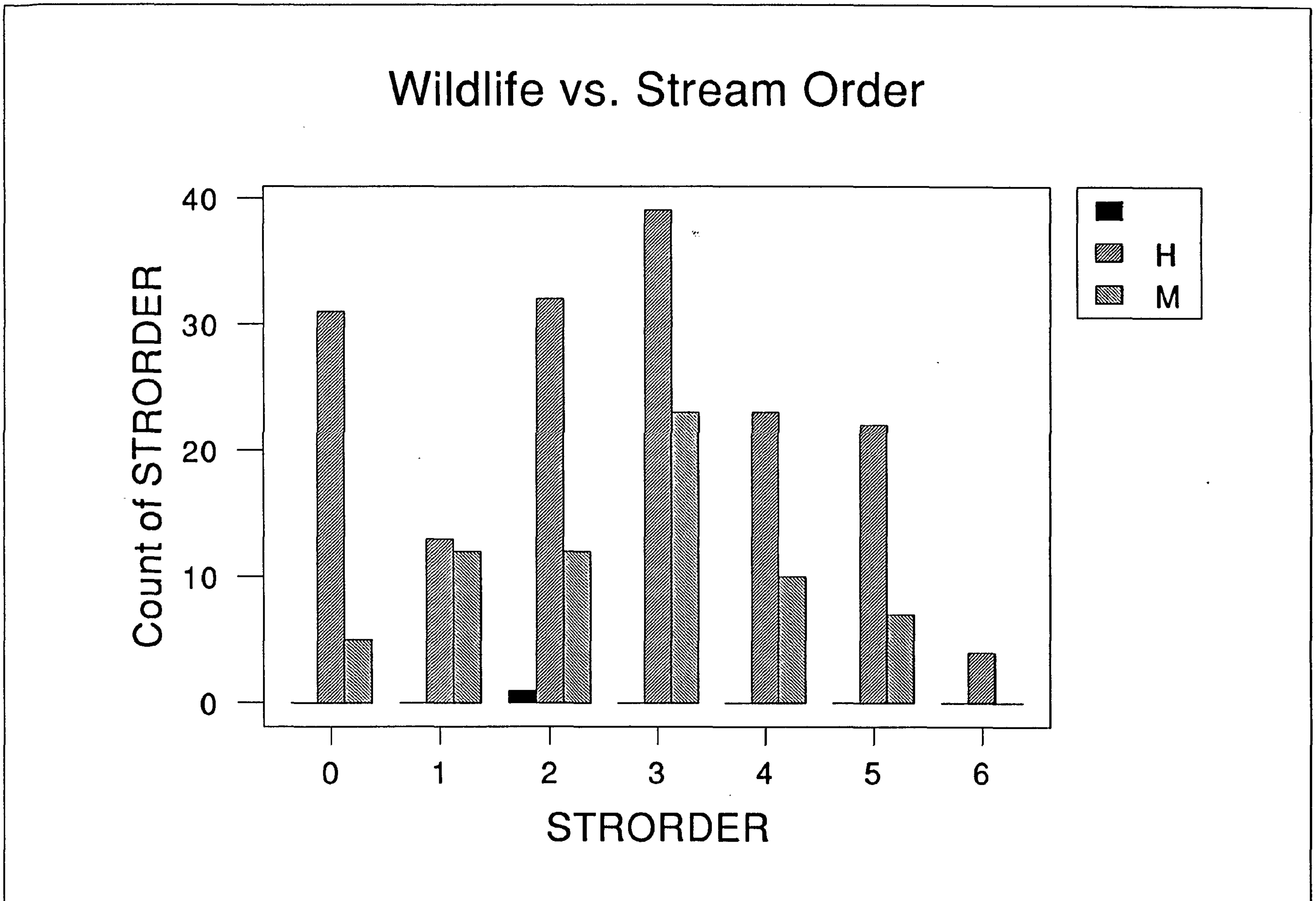
Wildlife vs. Stream Order
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STRORDER
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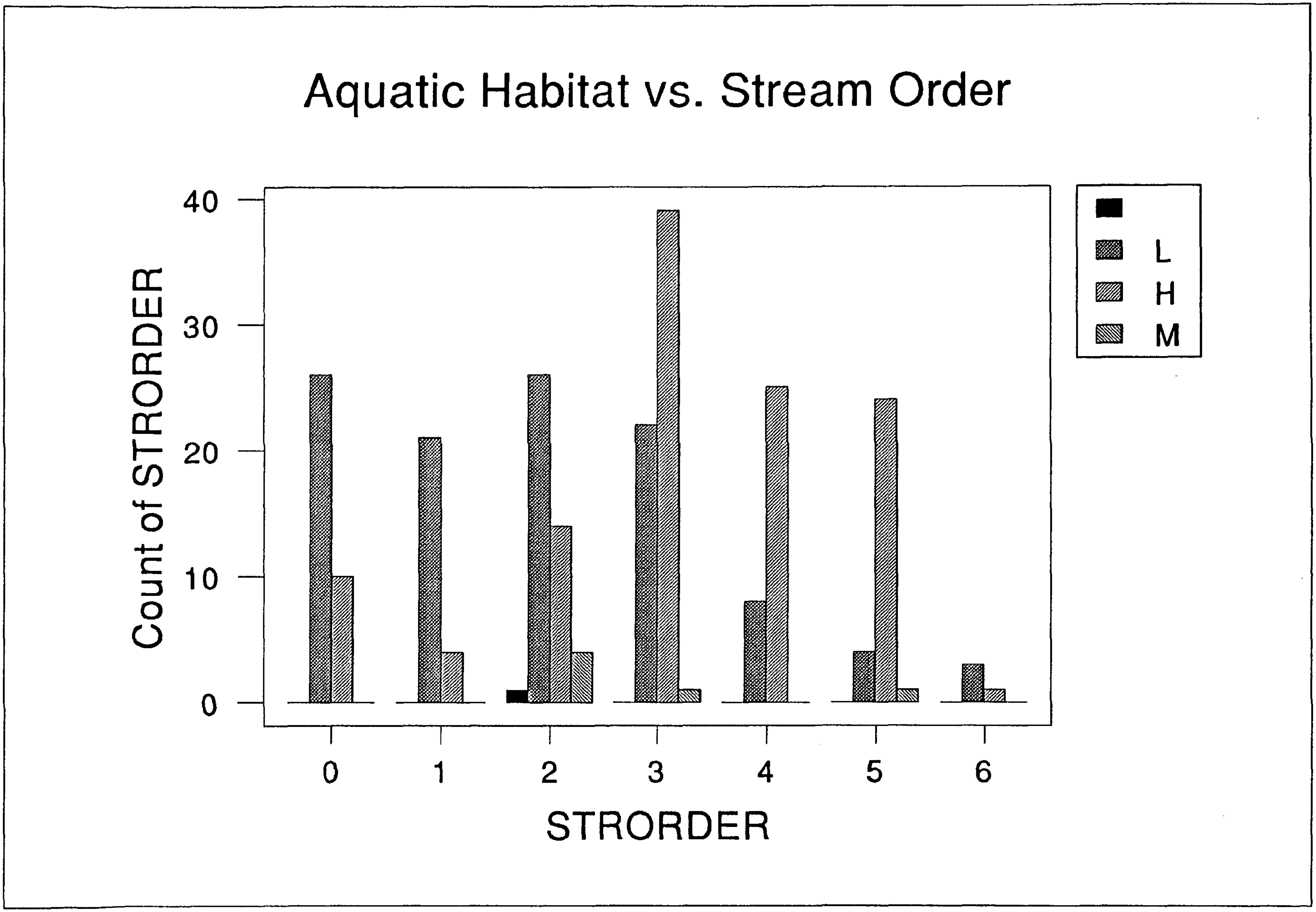
Aquatic Habitat vs. Stream Order
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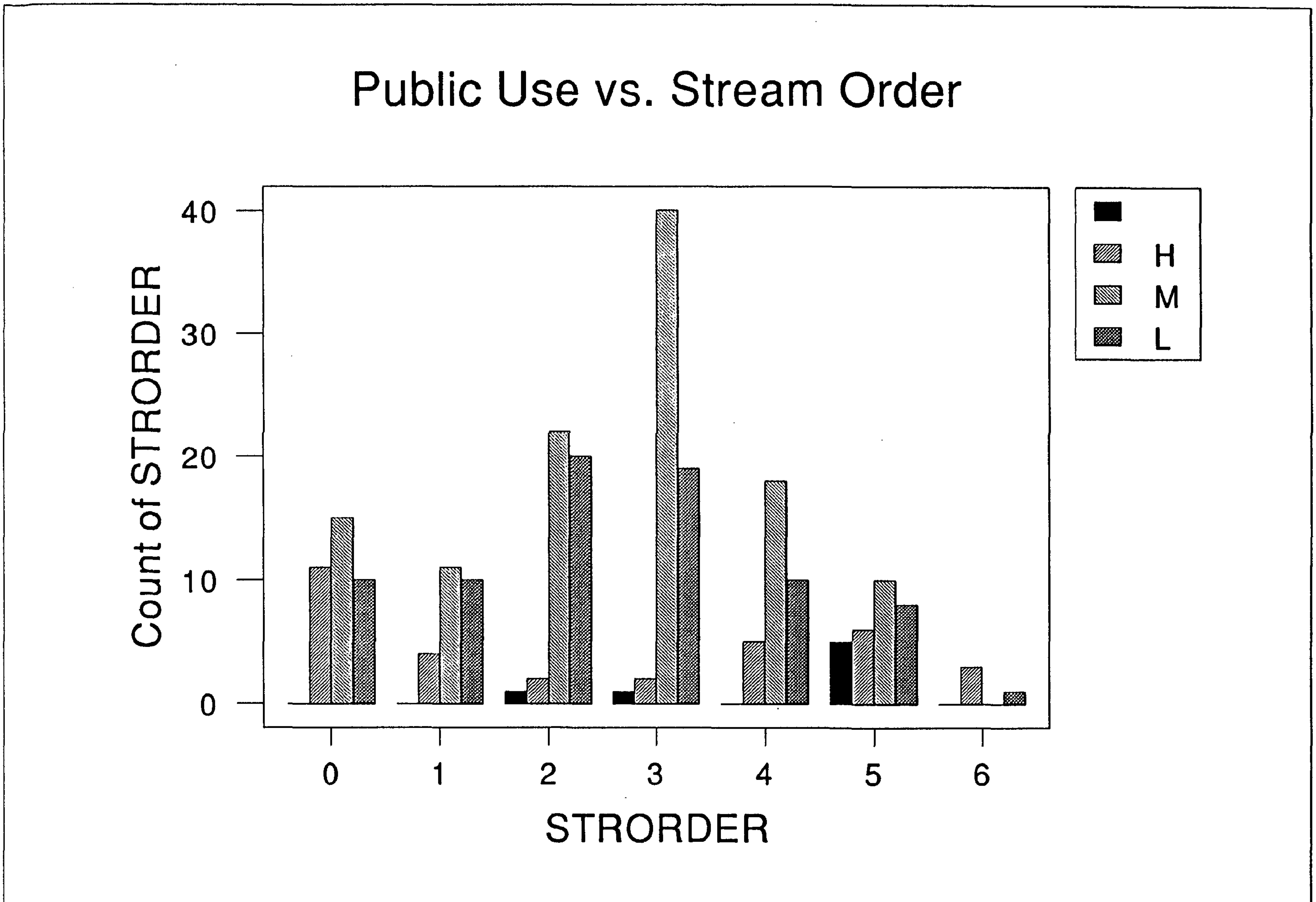

Public Use vs. Stream Order
Count of STRORDER
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STRORDER
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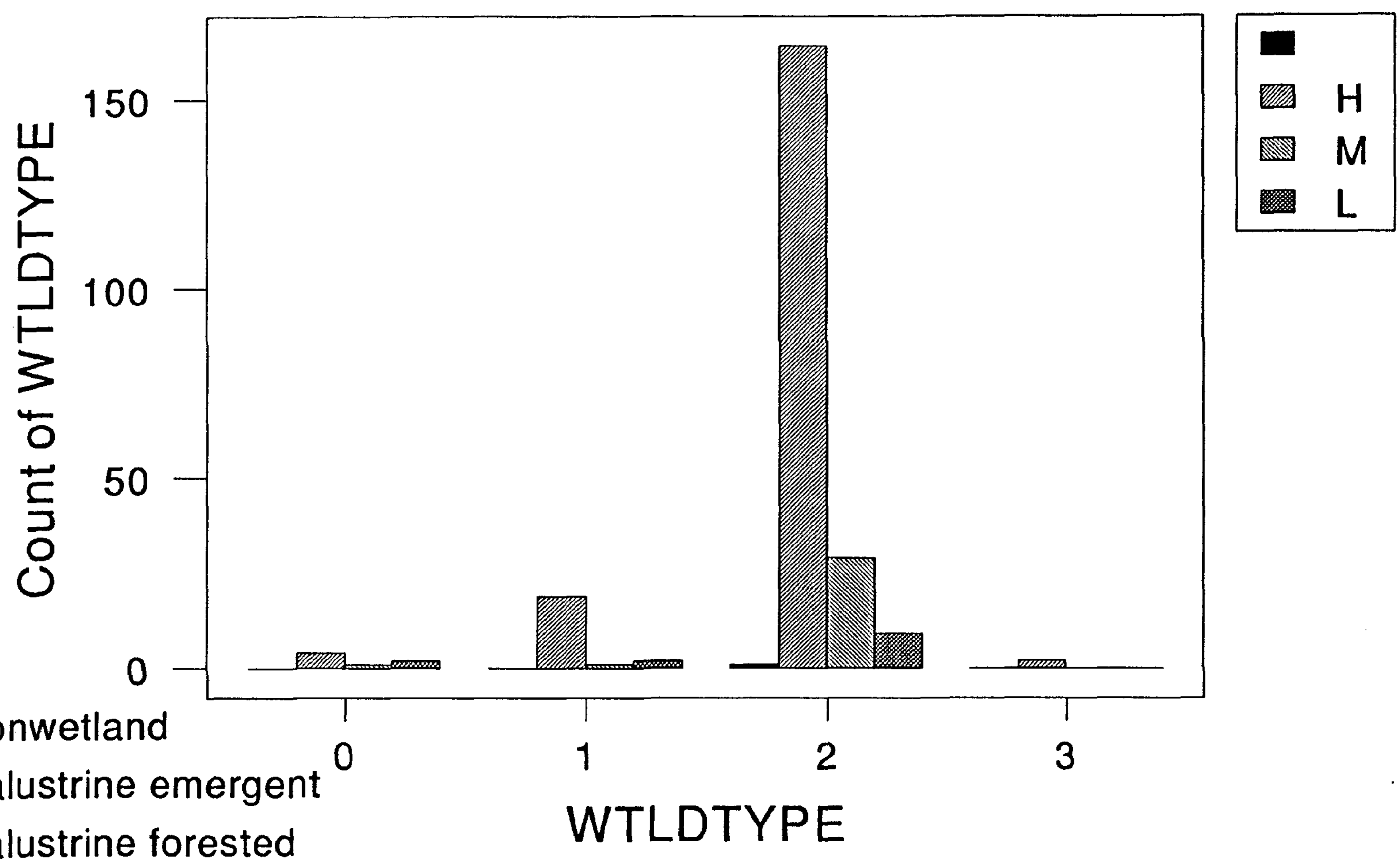
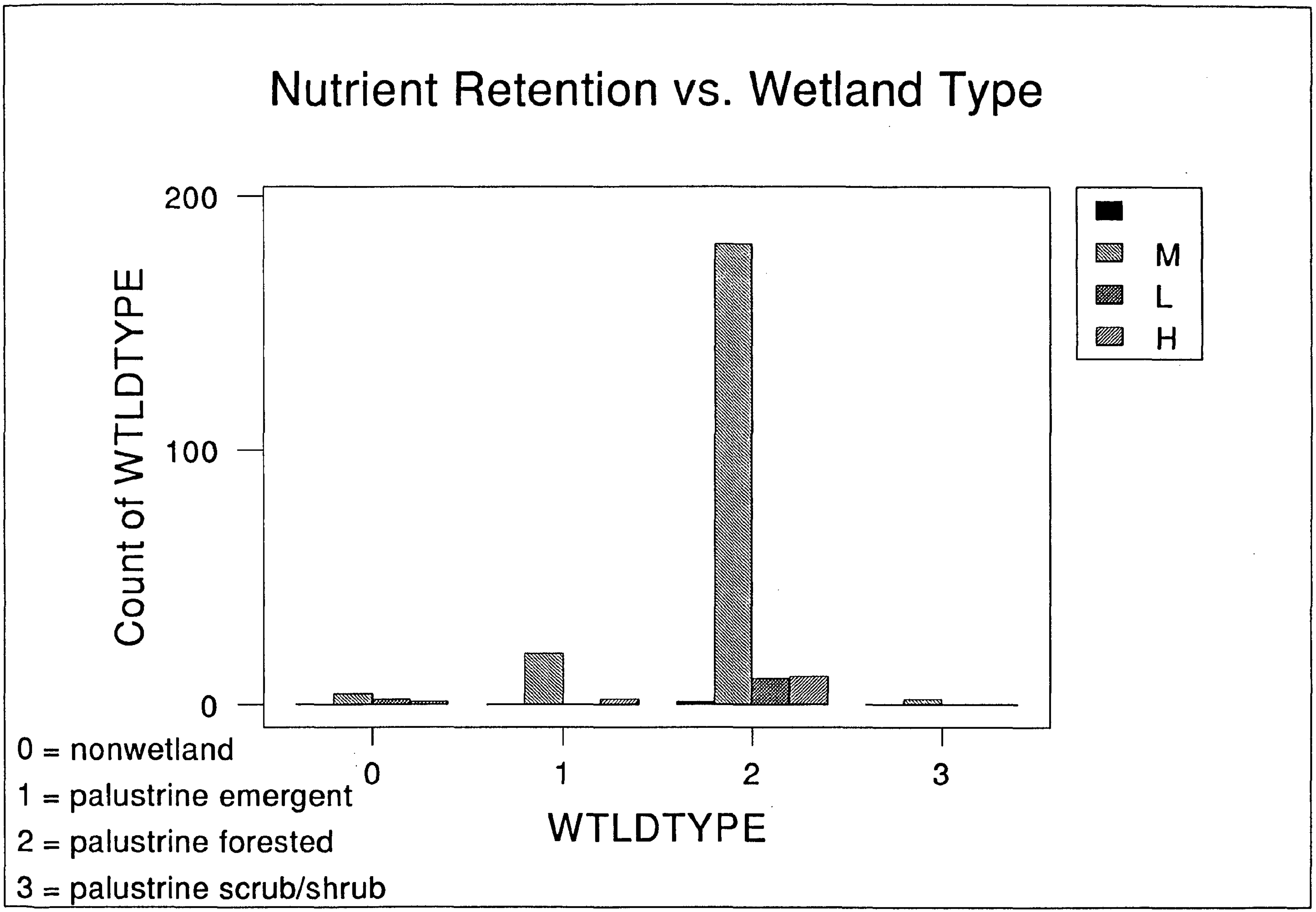
M
L

Floodflow vs. Wetland Type



0 = nonwetland
1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub



Nutrient Retention vs. Wetland Type
Count of WTLDTYPE
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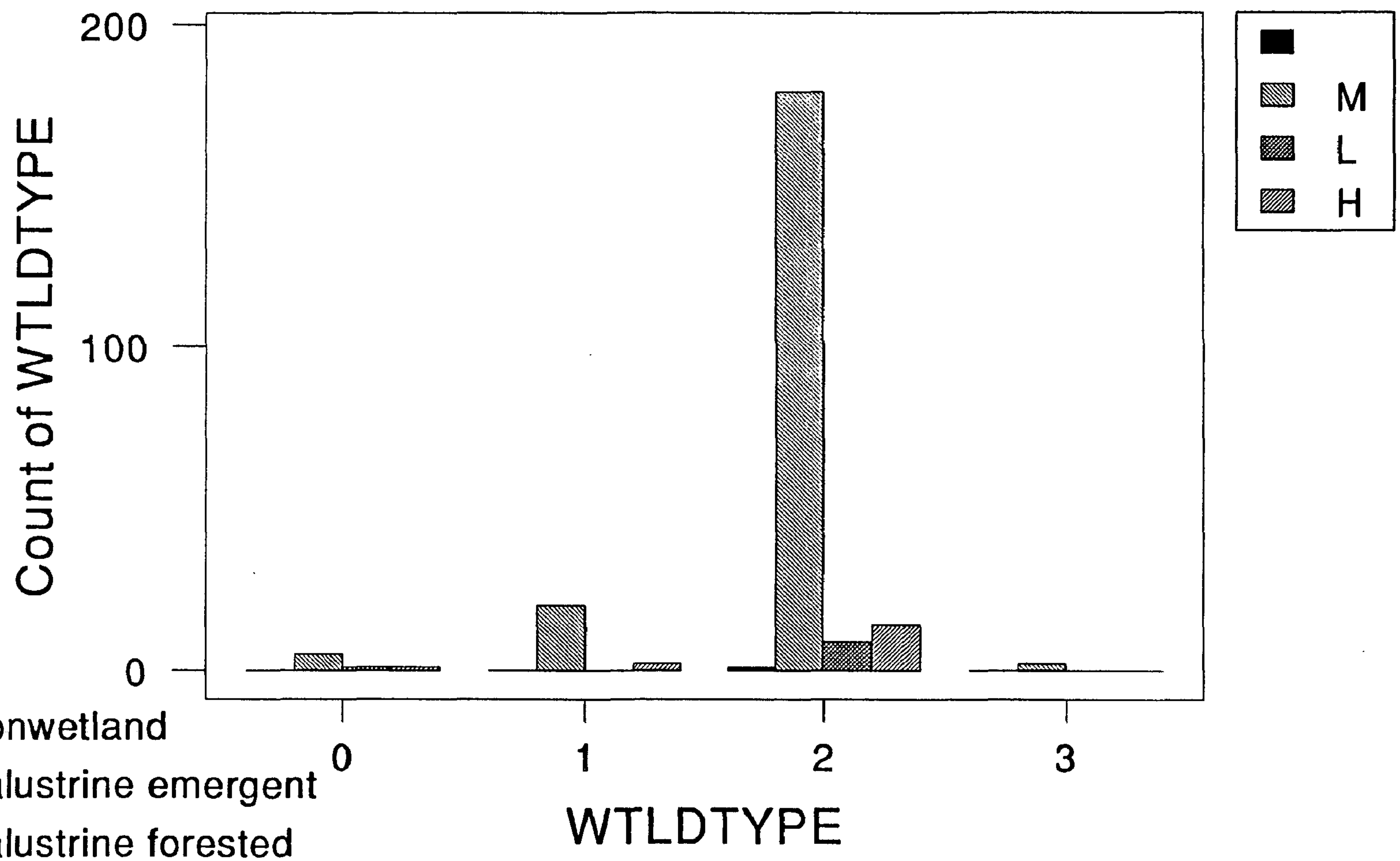
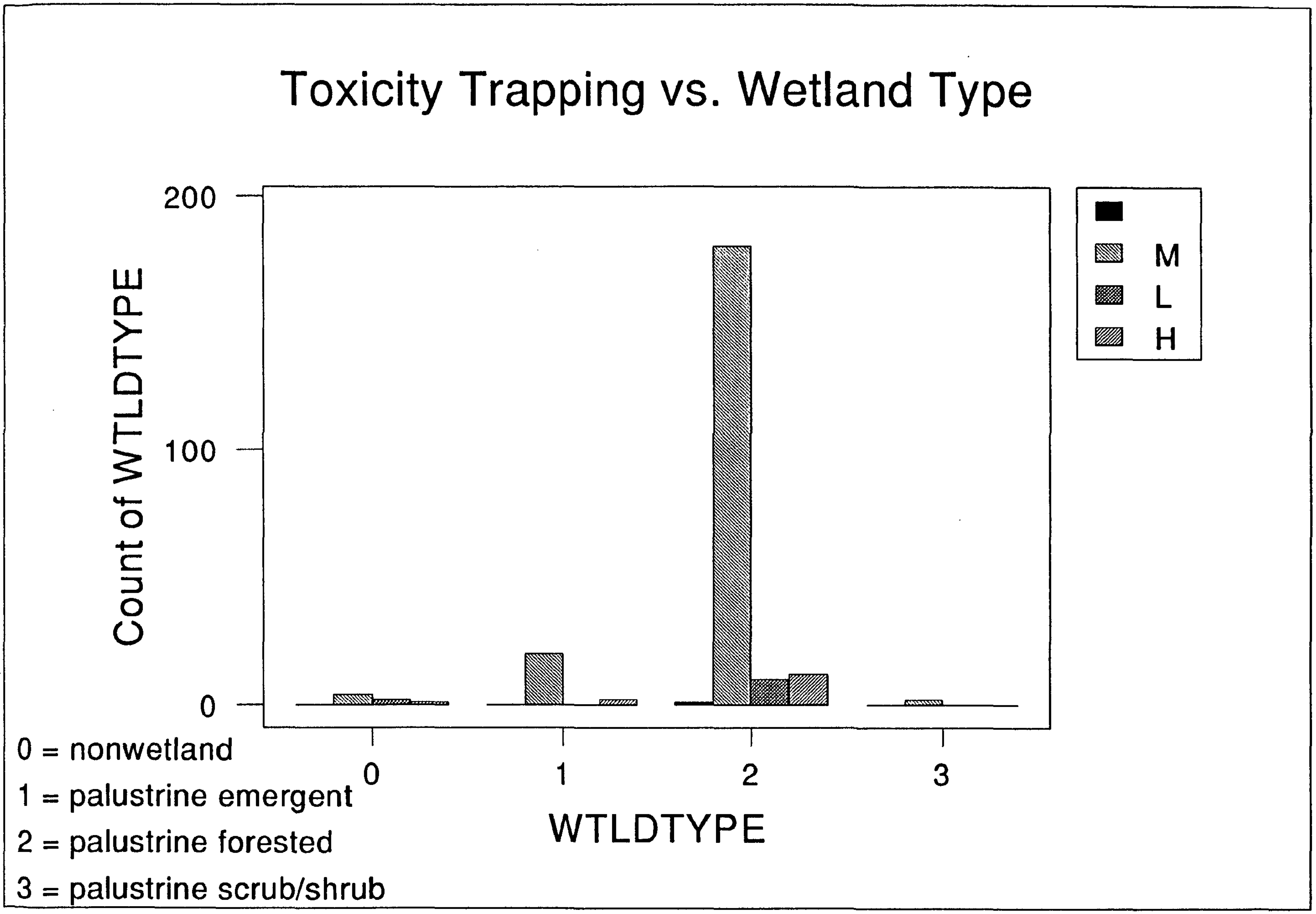
100
0
M
L
H
0
1
2
3
WTLDTYPE
0 = nonwetland
1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub

Sediment Trapping vs. Wetland Type



0 = nonwetland
1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub


Toxicity Trapping vs. Wetland Type
Count of WTLDTYPE
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M
L
H
0
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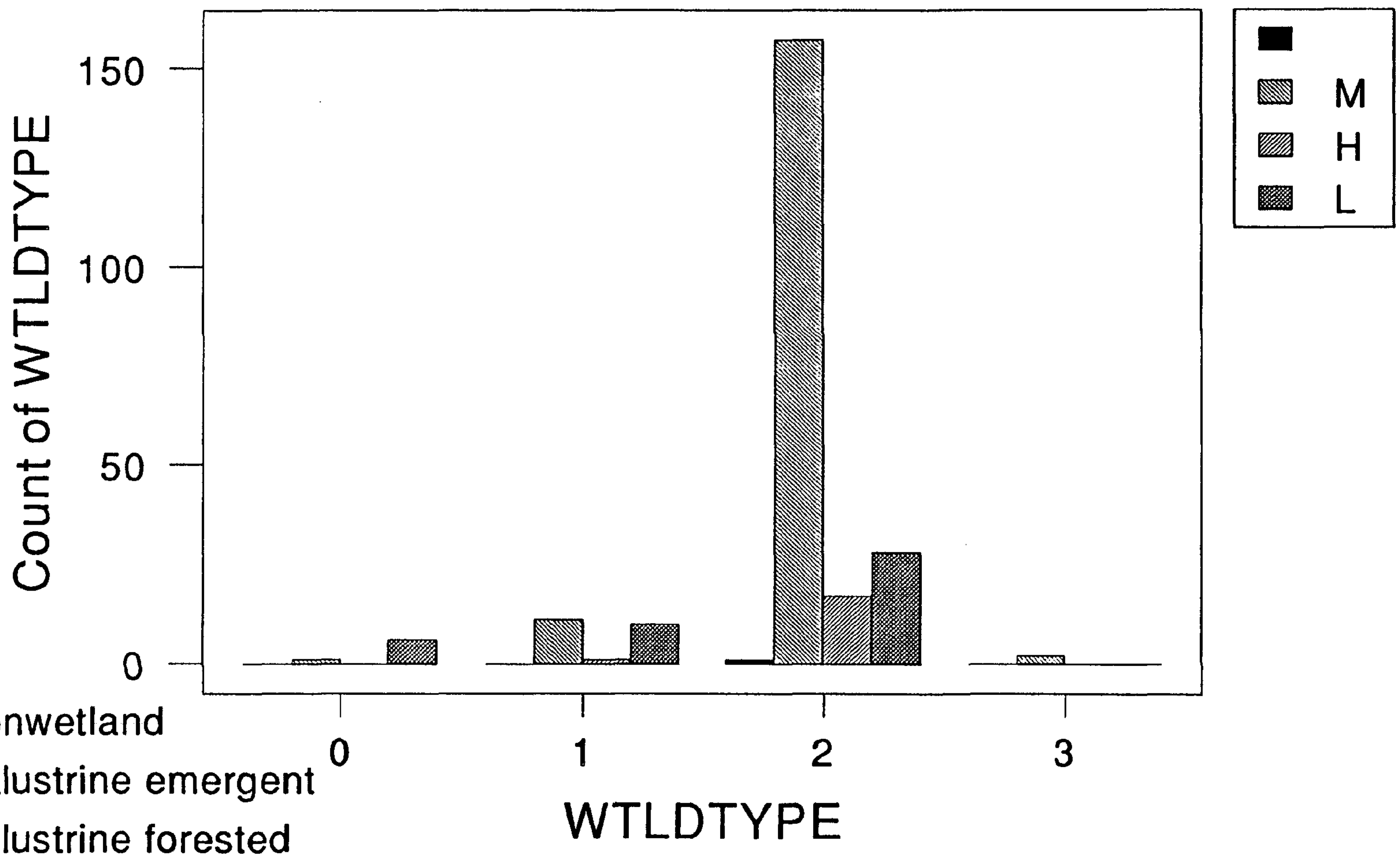
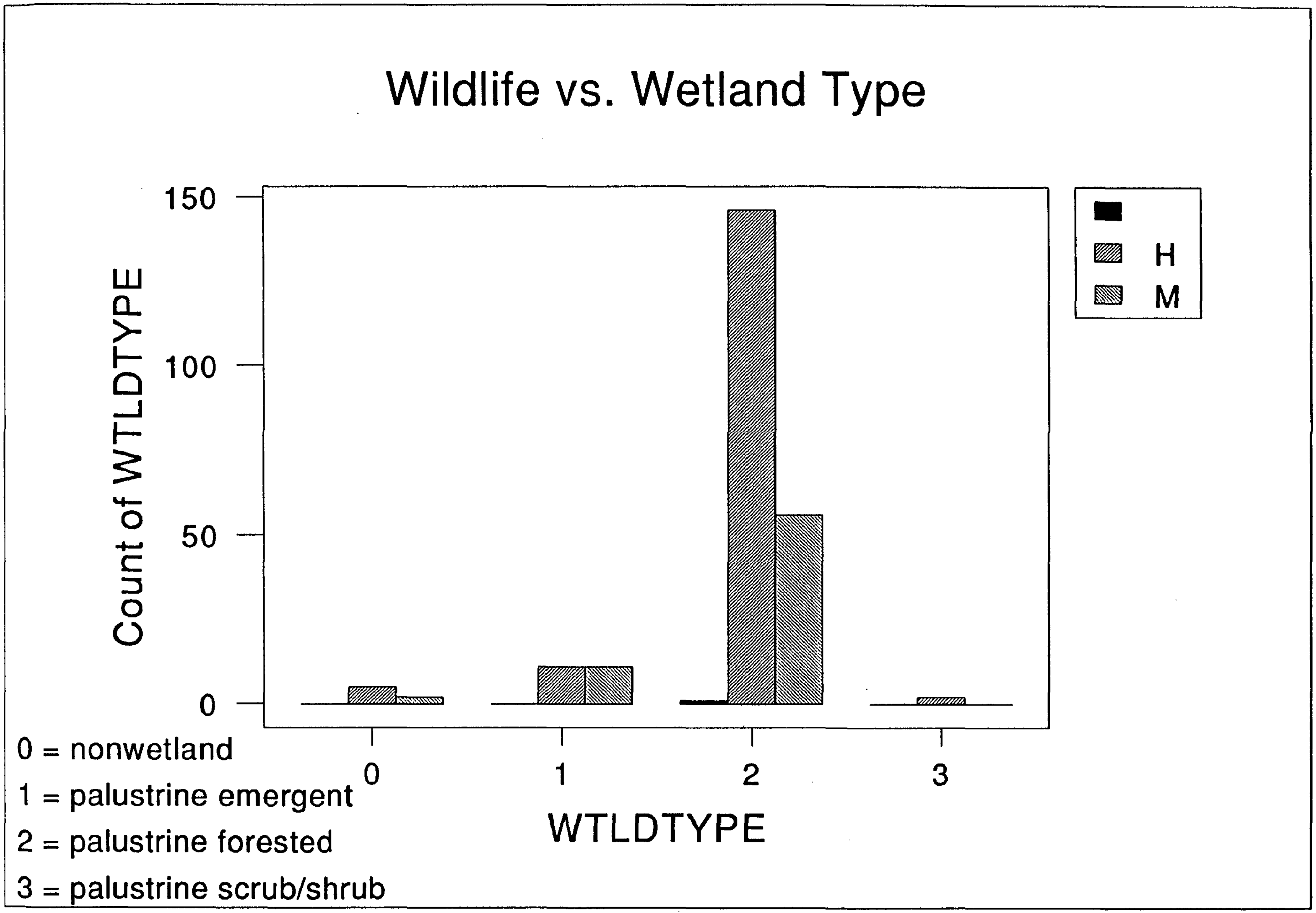
2
3
WTLDTYPE
0 = nonwetland
1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub

Sediment Stability vs. Wetland Type



0 = nonwetland
1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub


Wildlife vs. Wetland Type
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Count of WTLDTYPE
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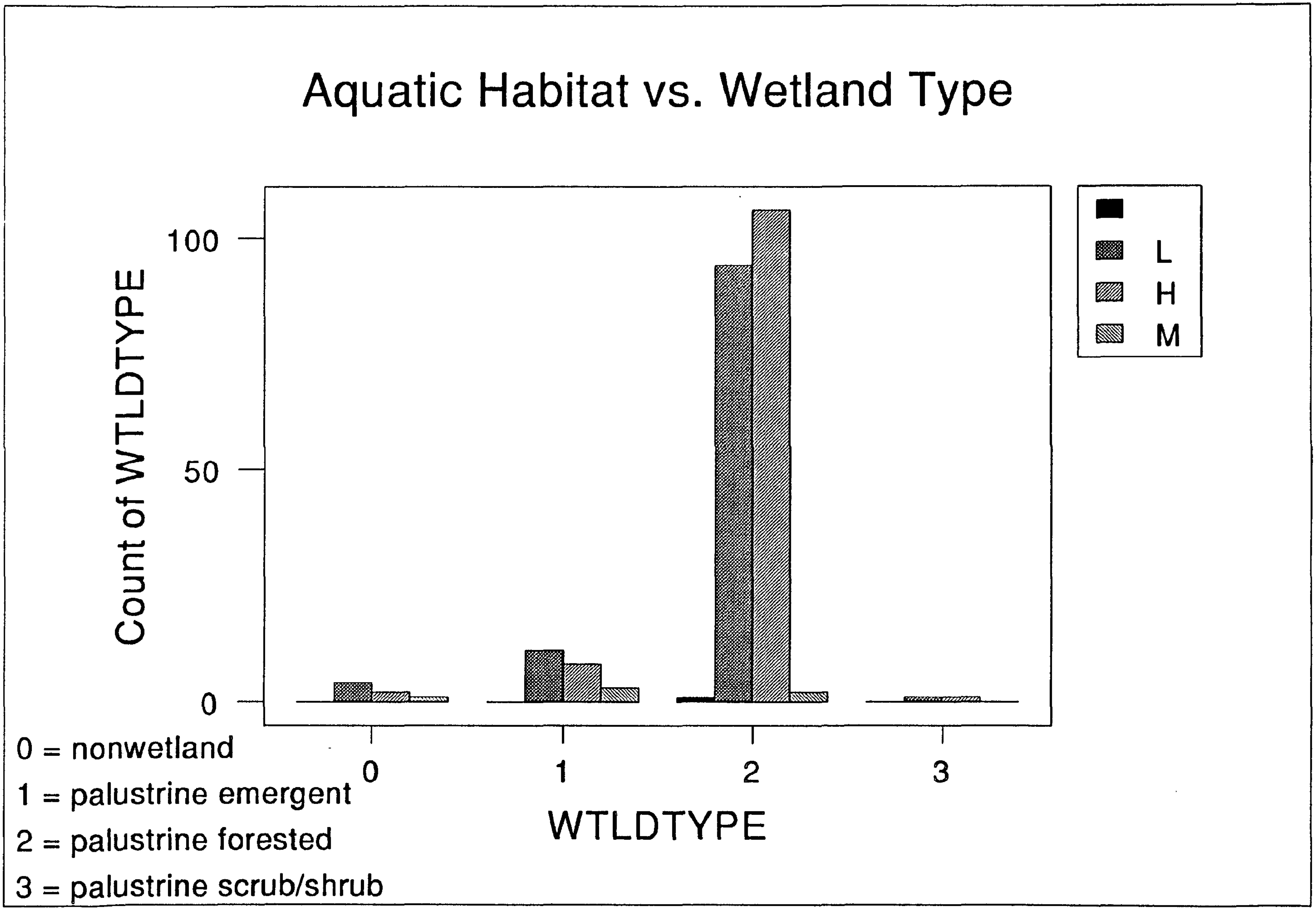
WTLDTYPE
H
M
0 = nonwetland
1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub


Aquatic Habitat vs. Wetland Type
Count of WTLDTYPE
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WTLDTYPE
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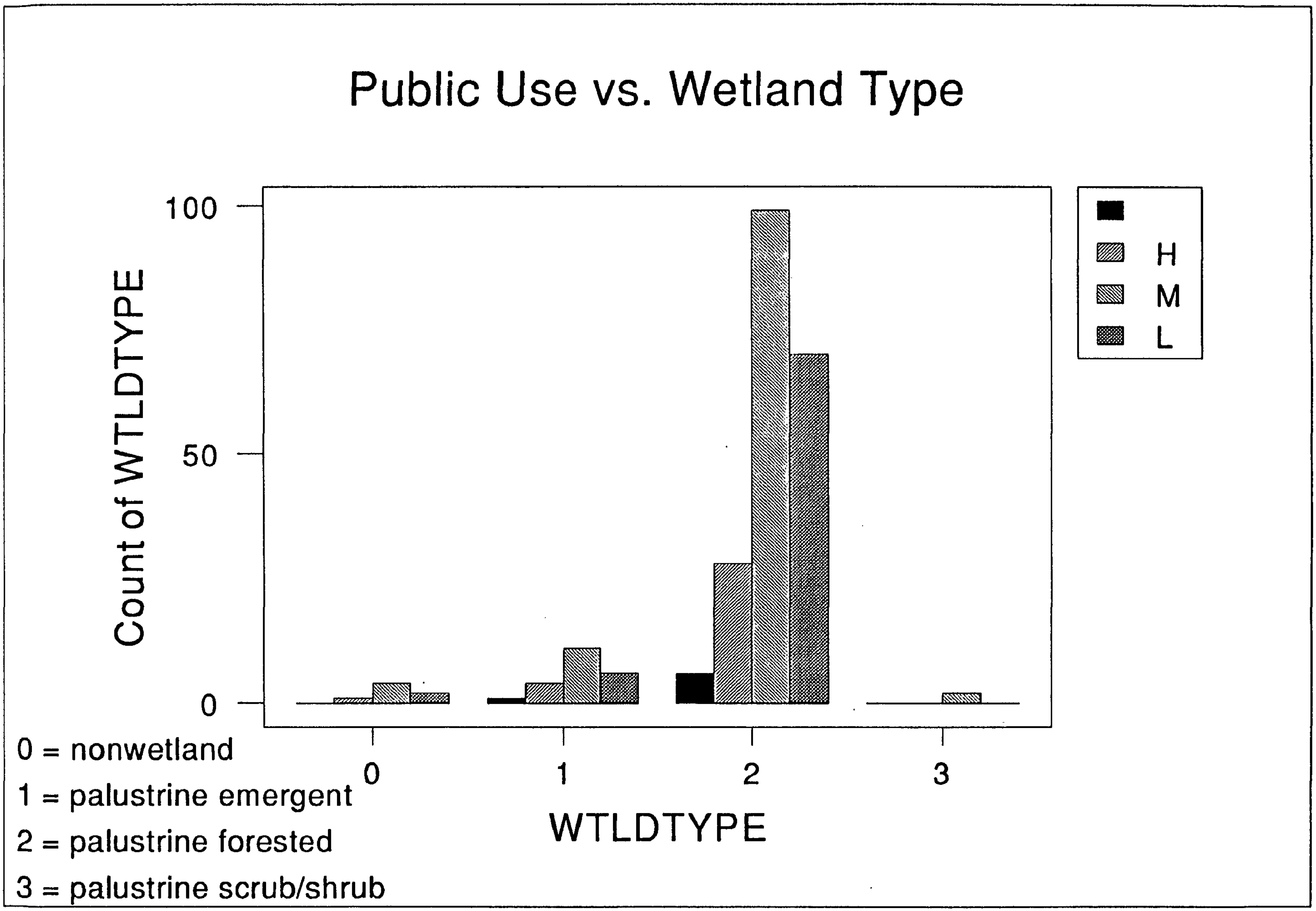
0 = nonwetland
1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub


Public Use vs. Wetland Type
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WTLDTYPE
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1 = palustrine emergent
2 = palustrine forested
3 = palustrine scrub/shrub