

HGM

Hydrogeomorphic Wetland Functional Assessment

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- To assess both losses in function and gains due to mitigation
- To set mitigation ratios
- Genesis:
 - The Adamus technique previously used (WET, Wetland Evaluation Technique) applied a single methodology, regardless of wetland type.
 - However, flow-through and depressional wetlands (for example) have intrinsically different sediment removal capabilities (and other types differ in many categories of function).

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- HGM Keys:
 - Compare only within categories
 - Depressional,
 - flow-through or riverine,
 - fringe,
 - slope,
 - peatlands
 - Use reference wetlands

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Functions Used

- Three major categories:
 - Water quality
 - Hydrology
 - Habitat

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Applied Assessment

- Measurements taken before and after impacts
- Estimates made of functions before and after mitigation
- Impacted and restored wetland functioning compared to reference standard
- Reference wetland functions set at 1.0

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Building Assessment Models

- Measurable indicator variables are combined into indices of function
 - Example of variable: vegetation cover
 - Example of function: removing sediment
- All variables are scaled from 0 to 1

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Output of HGM Model

- Project wetland functional loss is estimated
- Mitigation wetland gain is estimated
- Loss of function in the impacted wetland must be offset by an adequate acreage of increased function in the restoration site, so the replacement ratio is calculated.

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HGM: Using the Functional Assessment Guidelines

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The accounting matrix

- Function loss vs. Function created

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Function Assessed	Project Wetland			Restoration Wetland		
	Index before project	Index after project	Difference (functions lost)	Index before restoration	Index after restoration	Difference (functions gained)
A	0.5	0.0	-0.5	0.2	0.7	+0.5
B	0.9	0.0	-0.9	0.3	0.6	+0.3
C	0.7	0.0	-0.7	0.1	0.1	0.0
D	0.1	0.0	-0.1	0.2	0.5	+0.3
E	0.2	0.0	-0.2	0.2	0.7	+0.5

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- The function that is damaged and least repaired by restoration should set the replacement ratio for the project

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Use of reference wetlands

- Establishes highest function that may be expected (Reference Standard Wetlands)
 - In a similar kind of wetland
 - In the same watershed
- Takes into account
 - Seasonal differences
 - Natural variation
 - Climatic cycles
- Should pick up changes due to impacts

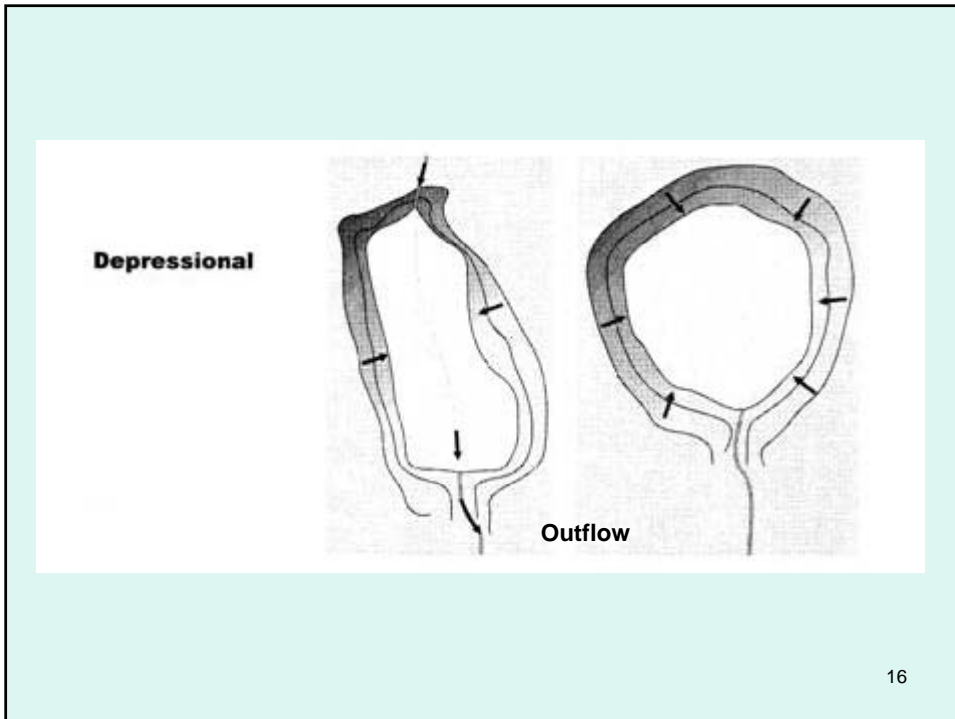
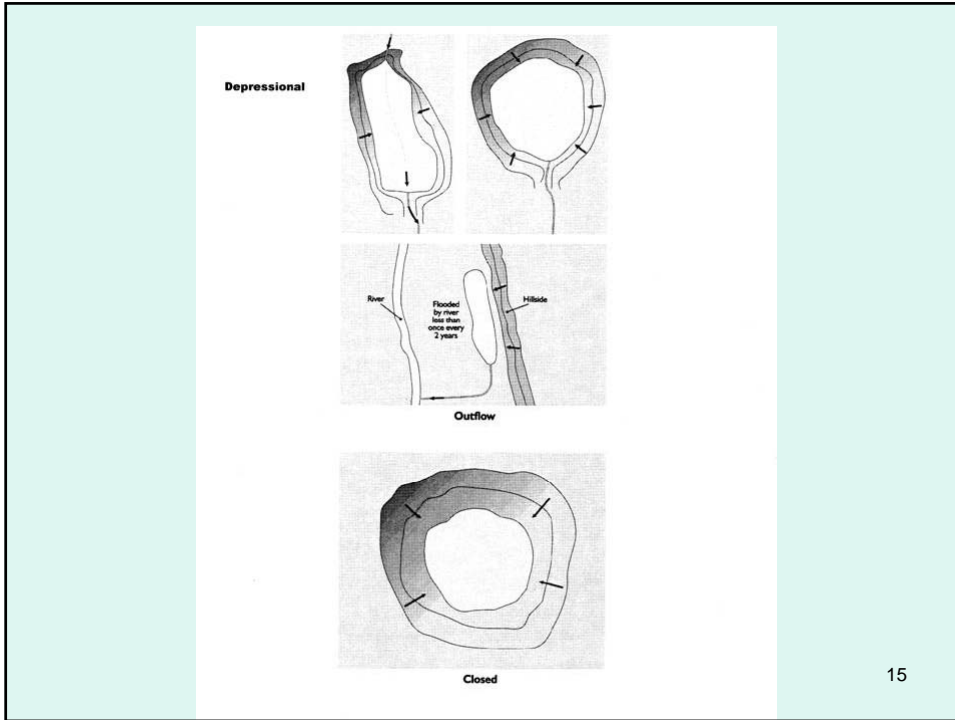
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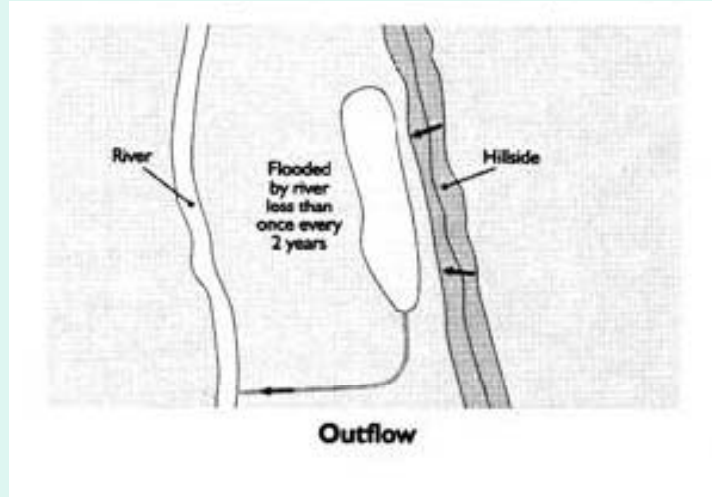
“Methods for Assessing Wetland
Functions: Riverine and
Depressional Wetlands in the
Lowlands of Western
Washington”

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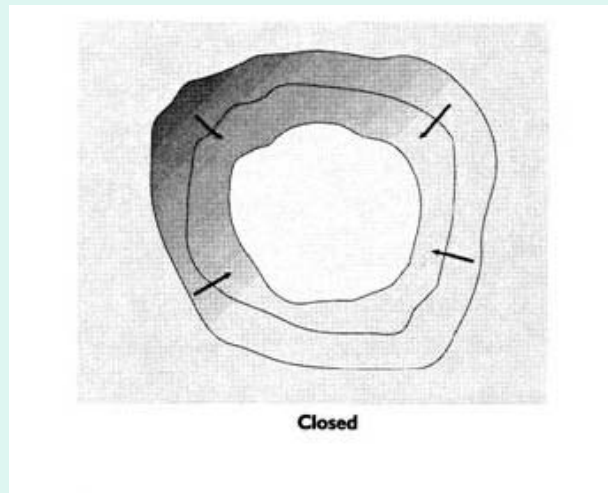
- Focus is on Riverine and Depressional Wetlands
- There is overlap:
 - Depressional outflow
 - Depressional closed
 - Riverine impounding
 - Riverine flow-through

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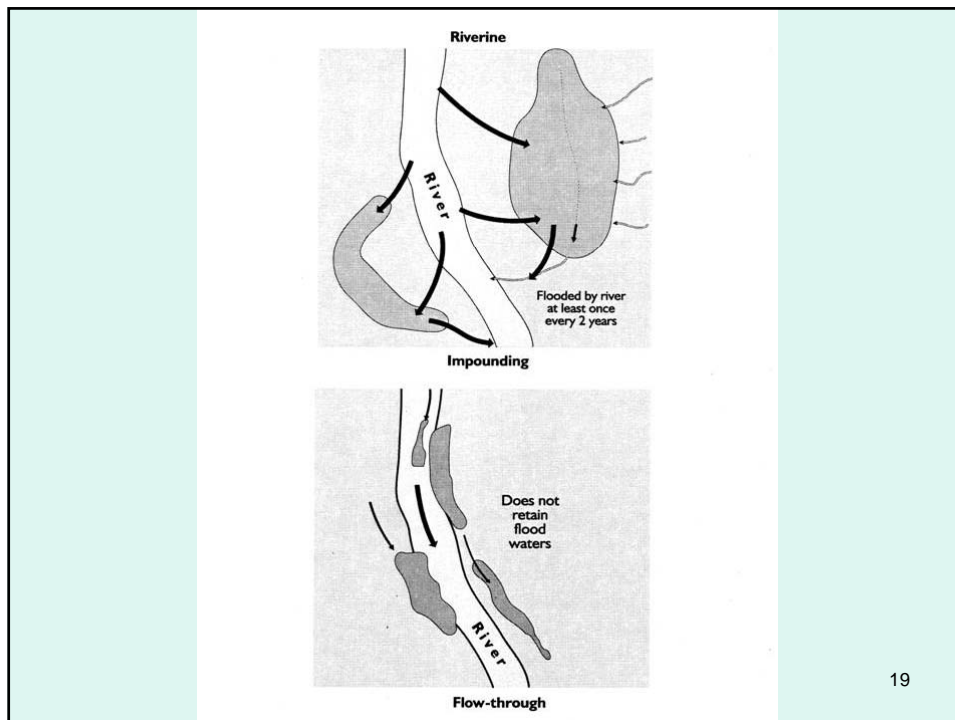


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Closed

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Three main functional categories

- Hydrology
 - Potential for reducing peak flows
 - Potential for decreasing downstream erosion
 - Potential for recharging groundwater
- Water quality
 - Potential for removing sediment
 - Potential for removing nutrients
 - Potential for removing heavy metals
- Habitat

- Habitat suitability
 - General
 - Invertebrate
 - Amphibian
 - Anadromous fish
 - Resident fish
 - Wetland-associated birds
 - Wetland associated mammals
 - Native plant richness
 - Primary production

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Example of assessment of a function

- A function (such as sediment removal) is represented by a score that combines several variables (V).
- Variables represent measurable environmental characteristics (D values) that are considered important in the performance of a function.
- Function scores are calculated for
 - Effectiveness
 - Reduced performance

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Depressional Outflow Wetland - Function: Removing Sediment

Process	Variables	Measures or Indicators
Velocity reduction	V storage	Average depth of both live and dead storage
Velocity reduction	V out	Qualitative descriptors of outlet constriction
Velocity reduction	V effectarea1	% of AU seasonally inundated
Filtration	V vegclass	% of AU in different Cowardin vegetation classes
Filtration	V understory	% area if herbaceous understory in AU

$$V_{storage} + V_{out} + V_{effectarea1} + V_{vegclass} + V_{understory}$$

Index: _____

Score from reference standard site

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D- (Data) Values for calculating Variables, "Removing Sediment" Function

V storage

D10: Usual (annual) height of flooding above the lowest point of outflow (estimating live-storage).

D11: Cross section of live-storage

D8: Area of inundation

V out

D13: Constriction of outlet

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V effectarea1

D8: Area of inundation

V understory

D16: Percent of forest or scrub/shrub areas with an herbaceous understory

D14: Percent of AU with different Cowardin vegetation classes

V vegclass

D14: Percent of AU with different Cowardin vegetation classes

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Depressional Outflow Wetland - Function: Removing Nutrients

Process	Variables	Measures or Indicators
Phosphorus removal	S sed	Index for Removing Sediments
Phosphorus removal	V sorp	% of AU with clay soil; % of AU with organic soil
Nitrogen transformation	V effectarea2	Area of seasonal inundation minus area of permanent open water
Nitrogen transformation	V out	Qualitative description of outlet characteristics

$$S \text{ sed} + V \text{ sorp} + V \text{ effectarea2} + V \text{ out}$$

Index: _____
 Score from reference standard site

D- (Data) Values for calculating Variables, “Removing Nutrients” Function

V sorp

D47: Soils in A horizon

D47.3: Mineral with clay fraction < 30%

Vout

D13: Constriction of outlet

*Depressional Outflow Wetlands - Function: Potential for Primary Production
and Organic Export*

Process	Variables	Measures or Indicators
Primary Production	V vegcover	% of AU with vegetation cover
Primary Production	V non-evergreen	% area of all non-evergreen vegetation
Primary Production	V understory	% area of herbaceous understory in AU
Export	V org	Extent of organic soils in AU
Export	V effectareal	% of AU that is seasonally inundated
<i>Reducers:</i> Bogs	V bogs	% of AU covered by a sphagnum bog

Index:

$$(V_{vegcover} + V_{non-evergreen} + V_{understory}) \times (V_{org} + V_{effectareal}) \times V_{bogs}$$

Score from reference standard site

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D- (Data) Values for calculating Variables, “Primary Production” Function

V vegcover

D14: Percent of AU with different Cowardin classes

V understory

D16: Percent of area with a herbaceous understory

V org

D47: Soils in A horizon

V effectareal

D8: Percent of AU inundated

Vbogs

D23: Percent of AU with sphagnum

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Depressional Outflow Wetlands - Function: Habitat Suitability for Amphibians

Process	Variables	Measures or Indicators
Breeding, feeding and refuge for amphibians	V buffcond	Descriptive table of conditions in buffer
	V substrate	Types of surface substrates present
	V wintersp	Diagrams
	V lwd	Categories of LWD present
	V water	% of AU with permanent water, or permanent water under FO or SS
	V substruc	Categorization by dichotomous key
<i>Reducers:</i>	V phow	pH tabs, direct measurement
	V upcover	Land uses within 1 km of wetland

Index:

$$\frac{(V_{buffcond} + V_{substrate} + V_{wintersp} + V_{lwd} + V_{water} + V_{substruc}) \times (V_{phow} + V_{upcover})}{\text{Score from reference standard site}}$$

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- D- (Data) Values for calculating variables, “Amphibian Habitat” Function**
- V buffcond**
- D42:** Characteristics of the buffer
- V substrate**
- D46:** Composition of AU non-living surface
- V wintersp**
- D38:** Interspersion between vegetated areas and open water
- V lwd**
- D44:** Large Woody Debris on AU surface
- D45:** Large Woody Debris in permanent open water
- V water**
- D8.3:** Percent of AU with permanent open water
- D14.6:** Percent of AU in Aquatic Bed
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