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Introduction to the Integrated Guidance Concept

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Introduction to the Integrated Guidance Concept

Tidal shorelines are the site of complex interactions between terrestrial and aquatic systems. These areas have values that far outweigh their relative size in the larger ecosystem. On tidal shorelines, each section of the shoreline is managed independently. The result of this piecemeal shoreline management is that tradeoffs in public and private benefits are frequently not optimized for the entire shoreline system.

To reduce the cumulative and secondary impacts of activities within the multiple jurisdictions and management programs affecting the littoral and riparian zones, better coordination and integration of policies and practices is necessary. Therefore, we have developed a model that incorporates aspects of the entire cross-shore environment, from upland development to subaqueous habitats. When making decisions, it is important to optimize water quality and habitat functions across the entire cross-shore environment. The Integrated Guidance model can be used to identify existing positive attributes of the shoreline and potential areas for improvement. Special emphasis should be placed on the preservation or enhancement of attributes (such as riparian vegetation and wetlands) that contribute to both habitat and water quality.)
Ecosystem Services Assessment Model

The model integrates water quality and habitat features with shoreline risk through a cross-section of the coastal landscape, from the upland through the subaqueous zone. In each zone, we have identified characteristics (such as percentage of tree cover) that affect water quality and habitat across the shoreline.

Water quality and habitat functions were modeled separately, because landscape elements may impact the two services independently. Shoreline risk was also modeled separately because it represents a potential threat to the shoreline, not a service provided by the shoreline.

Each element and its known impacts on water quality and habitat services and shoreline risk are described on the following pages.

Water Quality Model Elements

1) Upland Landuse

Upland areas contribute to nonpoint source pollution through contaminated upland runoff and groundwater.

- Natural landuse (wetland, scrub-shrub, and forest) contributes the least excess nutrients while also removing pollutants and retaining sediment from adjacent upland areas.
- Agricultural landuse has the potential to retain sediments, however may be associated with excess nutrient inputs.
- Developed landuse offers the lowest potential for sediment retention and nutrient removal and may increase contaminated surface runoff.

2) Riparian Landuse

Riparian areas provide capacity for mitigating nonpoint source pollution by reducing upland runoff and intercepting groundwater.

- Natural riparian areas have vegetation associated with high buffering capacity.
- Developed and agriculture riparian areas have reduced buffering capacity due to lack of vegetation and/or excess nutrient inputs.
- Industrial riparian areas lack buffering value and have potential for increased pollution associated with industrial sites.

3) Bank Cover and Stability

- Total cover by vegetation and structures helps to stabilize the bank, reducing erosion and sediment introduction to the waterway.
• Undercut banks indicate a moderate potential for sediment introduction.
• Bare banks have a high potential for erosion and sediment introduction.

4) Intertidal Zone
• Marshes and Phragmites marshes help reduce erosion by intercepting run-off, filtering groundwater and holding sediment in place.
• Coastal primary sand dunes serve as protective barriers from flooding and erosion resulting in decreased sediment and nutrient inputs.
• Riprap and bulkheads are structures that may stabilize shorelines and reduce erosion, improving water quality, but do not provide the same services as vegetative cover.
• Boat ramps introduce pollutants associated with boating.

5) Subaqueous Lands
• SAV and oysters have limited capabilities to dampen waves and stabilize nearshore sediments and may help reduce excess nutrients.
• Aquaculture may have similar benefits as oysters but also can be associated with higher local nutrient levels.
• Marinas introduce pollutants associated with boating.

Relative contribution of different landscape elements to water quality, from positive (improved water quality) to negative (reduced water quality).

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science.
### Habitat Model -- Integrated Shoreview

#### Riparian Landuse

<table>
<thead>
<tr>
<th>(+) Trees, shrubs, tall grass</th>
<th>Marshes, Beaches</th>
<th>Seagrass (SAV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-) Agricultural, crops</td>
<td>Coastal Sand Dunes</td>
<td>Oyster Reefs</td>
</tr>
<tr>
<td>(-) Residential, Commercial</td>
<td>Bulkheads, Boat ramps, Debris</td>
<td>Breakwater, Jetties</td>
</tr>
</tbody>
</table>

Relative contribution of different landscape elements to habitat, from positive (diverse habitat opportunities) to negative (few habitat opportunities).

Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science.

### Habitat Model Elements

1) Riparian Landuse

- Natural landuse provides native or unaltered habitat for terrestrial and avian species and is usually associated with a high diversity of habitat types.
- Agricultural landuse is an altered state that may result in reduced availability of suitable habitat and a less diverse landscape.
- Developed landuse is likely to result in reduced available habitat and increased human disturbance.

2) Intertidal Zone

- Beaches interact with primary and secondary sand dunes and serve as habitat for benthic animals and microalgae living on or within the sand. Beaches can also serve as refuge and forage areas for finfish, blue crabs and wading shorebirds.
- Marshes provide habitat (food and shelter) for both aquatic and terrestrial animals such as blue crabs, small fish and marsh birds.
• *Phragmites* marshes generally represent a monotypic community, which limits their habitat value relative to more diverse communities. The non-native variety of *Phragmites* may be highly competitive, displacing native marsh vegetation.
• Coastal primary sand dunes represent transitional areas that bridge marine and terrestrial habitats and provide essential habitat for plants and animals.
• Bulkheads, boat ramps and debris have an adverse impact on habitat because they displace native environments and interrupt the marine-terrestrial interface.

3) Subaqueous Resources

• Submerged aquatic vegetation (SAV) and oyster reefs. Both SAV and oysters were once prevalent throughout the Chesapeake Bay and the surrounding watersheds, however they have become increasingly rare, making them a management priority. They are important components of the coastal ecosystem, providing critical forage and nursery habitat for a wide variety of estuarine species.
• Breakwaters and jetties involve the placement of stone in the subaqueous zone. These structures may provide attachment surfaces for aquatic animals such as oysters, barnacles, and jingle shells, but are not native habitats.
• Marinas have an adverse impact on habitat because they cover subaqueous bottom and increase shading.

*On this shoreline the house is set back from the shoreline and a forested riparian buffer, a beach and a fringe marsh all contribute to high water quality and habitat services.*

*On this shoreline the house is close to the shoreline, the riparian area is lawn, and there is a shoreline structure. These characteristics indicate reduced water quality and habitat services.*
1) Fetch

Fetch (the unobstructed distance across open water from the shoreline) greatly influences the wave climate in a given reach, with longer fetches correlating with higher potential wave energy.

- Fetch >1,000m represent high wave energy that is difficult to manage.
- Fetch <1,000m are less significant and more easily managed.

2) Bathymetry

Bathymetry (the pattern of water depths off shore) affects erosion risk because shallow water habitat (water depths < 2m) provides shoreline protection by forcing waves to break offshore, thereby dispersing a significant portion of the wave’s energy before it reaches the shoreline.

- Where distance to the 2m depth contour is ≤100m the nearshore exerts less wave-reducing influence and therefore less shoreline protection.
- Distances >100m have an increased ability of nearshore bathymetry to enhance shoreline protection.

A) Located on unsheltered shoreline this property is subject to a longer fetch with more potential for erosion. The house is close to shoreline, there is no riparian forest and there is a shoreline structure, all of which reduce habitat and water quality functions.

B) Located in a shallow, protected cove this property is subject to a very short fetch with low potential for erosion. The house is set back from the shoreline and the upland and riparian zones are forested, all of which contribute to high water quality and habitat functions.

All the different choices on and around this cove affect local water quality and habitat functions.
The output of the integrated guidance model can be used retroactively as a guide to improve habitat and water quality functions of shorelines that have already been developed. It may also be used proactively to maximize habitat and water quality functions as applications are submitted to the various regulatory agencies for landuse decisions about undeveloped areas.

Compare the two properties below...

- Developed upland – source of pollutants.
- Developed riparian – lawn and mulch do little to trap nutrients and sediment, and may actually be a source of nutrients if lawn is fertilized or contains animal waste.
- Reduced habitat value.
- Bank/intertidal zone is stabilized.

**Water quality & habitat could be improved by establishing a more natural riparian buffer with deep-rooted native grasses and woody vegetation, and by establishing a flat or marsh with offshore stabilizing structure for necessary erosion protection.**

- Developed upland – source of pollutants.
- Natural riparian buffer – high water quality and habitat value, mitigating adverse effects of developed upland.
- Bank is stable but is slightly undercut, contributing some sediment. However, the undercut and fallen trees provide habitat.

**Water quality & habitat values of the upland are maximized, given the existing development. Aquatic habitat value could be improved by establishing a flat or marsh with offshore stabilizing structure**
The Problem
Many different authorities have legislative and regulatory responsibilities on the shoreline, however, ecologically the shoreline is a single unit.

The Result
Management of shorelines in pieces means that water quality may be protected at the cost of habitat, habitat may be protected at the cost of water quality, or neither is protected.

The Goal
Managing shorelines as one system to protect water quality, habitat and erosion control.

How It Works
An integrated shoreline plan will often require impacts to one or more jurisdictions. These impacts may not be acceptable, or allowed, under the current management structure.

The Solution
Ensure management authorities have flexibility in decision-making to accommodate trade-offs among decision-makers.

- Promote joint decision-making of Wetland Boards and Chesapeake Bay authorities to integrate decisions.
- Projects that avoid impacts to one zone but result in impacts to the other zone may not be the preferred option. Decision-makers should be empowered to consider actions outside their jurisdictions to avoid transferring impacts to another resource.
- Flexibility in vegetative mitigation requirements may be necessary for both riparian and wetland zones to accommodate a preferred option that maximizes water quality and habitat benefits.