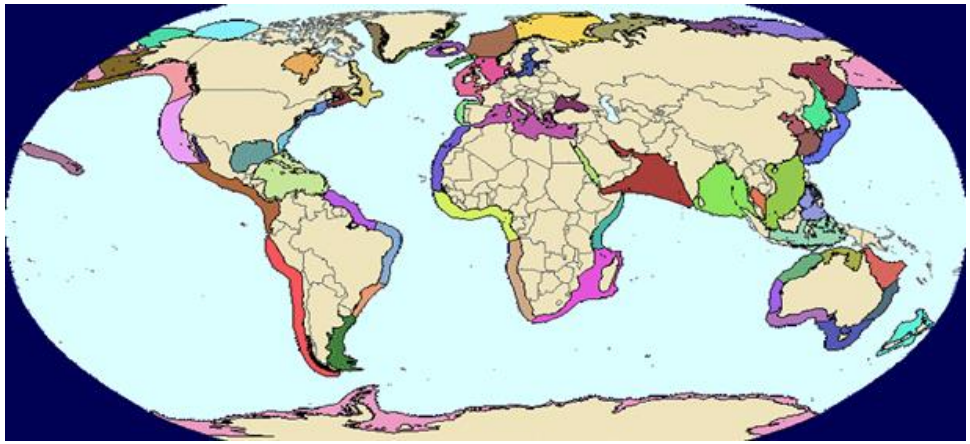
Coastal zone planning and management



- *General concept of integrated coastal management*
- *Coastal issues*
- *Lessons Learned*
- *Analytical Approach*
- *Future*

What is ICZM?

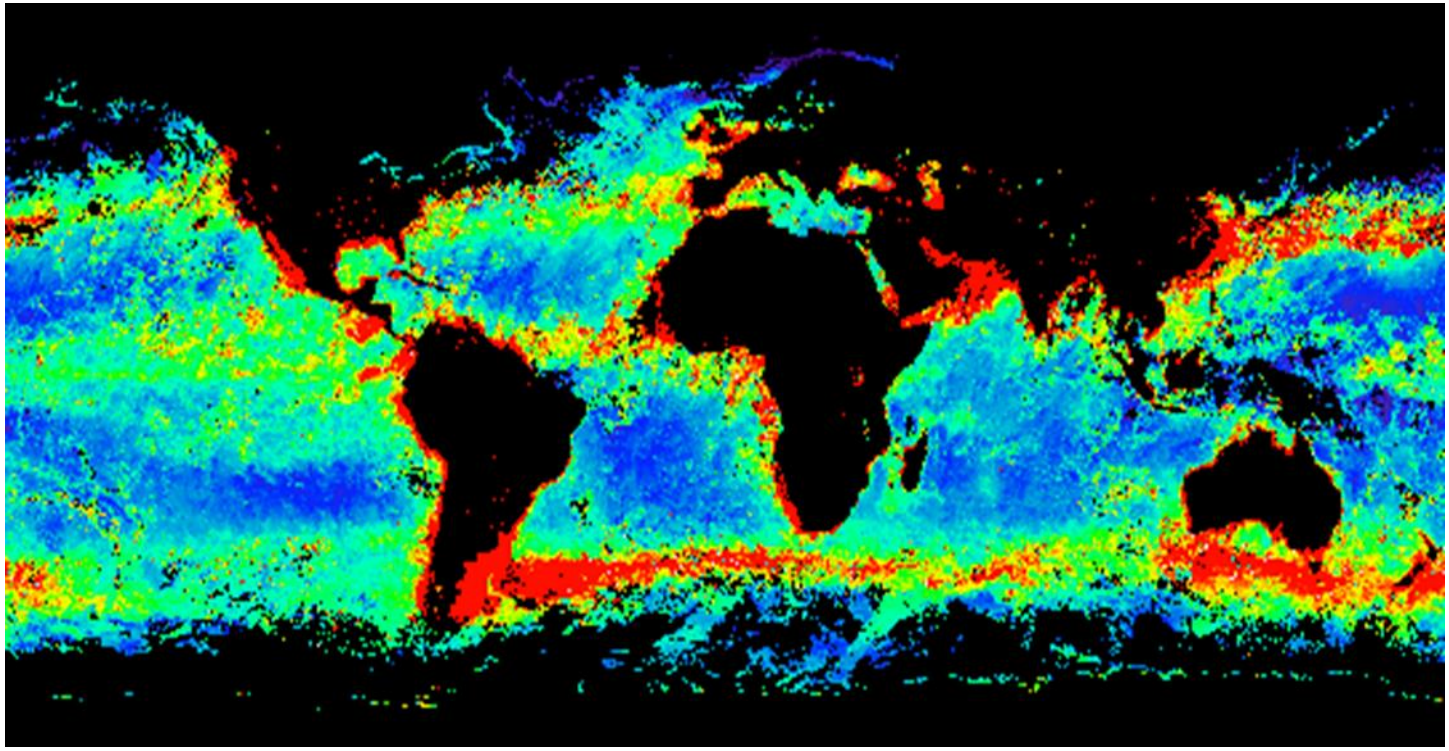
In general, it is a interdisciplinary and comprehensive strategy or framework based on the best available science to be implemented at the community level and national level;

The prime goal is to overcome sectoral and intergovernmental fragmentation that exist in today's coastal management efforts;

Biodiversity hotspots

Production

Productivity is highest in coastal waters and upwelling zones due to higher nutrient concentrations



After 40 years of coastal management planning we are still trying to develop simple, effective and widely applicable models and approaches; and we still need successfully implemented examples of ICZM!

Today, the environmental problems in coastal areas have been exacerbated by habitat destruction, water contamination, coastal erosion and resources depletion; increasing social and cultural degradation as well as poverty!

What went wrong and what did we learn?

- *The root cause of this crisis is a failure of both perspective & governance;*
- *Oceans & coasts are the largest public domain and has to be managed holistically for the benefit of local communities, recognizing their socio-economic and cultural heritage values;*
- *Involvement of local communities in the planning and decision-making process;*
- *Increased use conflicts can be managed simply by controlling where certain activities are undertaken, but sustainability can only be attained when environmental conditions are appropriate;*
- *Interdependence of land and sea! Watershed and ecosystem management approach;*
- *Use suitability and use conflict analysis support the interdisciplinary and holistic aspects of coastal planning and sustainable development; indicating where better information is needed;*

Objectives and goals of the responsible coastal planning and management

- *Optimize benefits from coastal and marine resources, specifically for local communities*
- *Identify desired uses*
- *Minimize conflicts*
- *Prevent environmental degradations*

But How?

General concept for integrated coastal management

***Resource assessment**: comprehensive inventories of coastal natural and human resources (e.g. physical and biological data, resource uses, cultural heritage, traditional land uses and activities, etc.); includes long term in depth biocomplexity research studies;*

***Impact assessment**: assessing the coastal zone vulnerability to various activity impacts; interactions between uses and resources; a tool to help making decisions and evaluate options for the mitigation and environmentally sound management (e.g. spatial and use conflict analysis, GIS models); based on the best available knowledge and acknowledging uncertainties;*

***Policy and regulatory framework**: a basic tool for training and education, and for local community participation in decision making process; based on analysis of existing institutional and legal mechanisms develop comprehensive policy framework to address coastal issues;*

Socio-cultural & Economic assessment: *understanding of socio-economic incentives at the local level in suggesting alternative income-generating programs; the simpler the national rules the better they are understood and followed on the local levels; the capacity of the community to regulate its own activities and uses; to enforce local rules is an important determinant of perceived management success;*

Implementation*: how to apply science and develop and implement the BMPs? Comprehensive BMPs are 'living documents' open to revision, expansion; provide consistent national standards and practices for implementation;*

Monitoring and evaluation*: assess cumulative effects of changes and update management program elements to reflect changing needs and circumstances; multidisciplinary data as a 'feedback loop' evaluation of our activities and their impacts;*

BMP – Best management Practices

Still the question is how?

And what is the driving force and approach in coastal management?

The general premise is that "the environment sets the limits for responsible and sustainable development".

Why?

Understanding ecosystem's "function, health and resilience" is an imperative for successful application of adaptive coastal management

Site suitability and use conflict analysis: an optimal allocation for user functions

Finding suitable sites for existing and potential use/activity in the marine and coastal environment is one of the most critical challenges facing coastal planning and management.

Analytical Approach –Summary:

Optimal sites are selected based on environmental suitability analysis and GIS models. Environmental parameters required for potential activity sites were selected and generic protocol was developed. Often a modified version of the activity protocol has to be created and applied based on available and spatially explicit data.

GIS use-suitability modeling: application of available environmental suitability indicators from developed protocols; includes evaluation of the model with existing activity sites.

GIS use-conflict modeling and analysis: identification of exiting and potential uses,and use conflicts.

Characterization of management issues and options. Providing outcome scenarios and recommendations, identifying gaps to help guide future scientific research, monitoring and decision-making processes.

Phase One:

The most important step is to identify the environmental conditions necessary for each use/activity to succeed.

Based on extensive literature review and present knowledge, the environmental use suitability indicators (parameters or criteria), for activity to be long-term sustainable, can be identified and derived.

Note: GIS software were used to write algorithms to model protocols, and perform conflict modeling and analysis.

Suitability Indicators	Desirable	Undesirable
Water quality	Closed for direct marketing of shellfish; no potential for future productivity	Approved, seasonally approved for shellfish harvesting
Fecal coliforms Cfu/100 ml	200	> 200
Salinity (‰)	Unsuitable for shellfish growth	Suitable for shellfish growth
Nitrate mg/l	1	
Phosphate mg/l	0.1	
Suspended solids/ sediments (mg/l)	10	
Mex. Wave height (m)	< 0.5	> 0.5
Dissolved oxygen (mg/l)	> 5	< 2
Current/exposure	< 1 knot	> 1 knot
Bathymetry (m)	> 1	< 1
Proximity to natural or improved channels	< 50 feet to navigational channel	> 50 feet
Threatened or endangered species and habitats	Absent	Present
Designated shellfish grounds	No present or planned private lease or public ground within affected area	Private lease or public oyster ground in proximity
Dredging	Does not require dredging	Requires frequent dredging
Adjacent wetlands	Suitable buffer could be maintained around marine site	Cannot maintain suitable buffer area
Existing use of site	Not presently used for recreational, tourism uses, fishing, crabbing, etc.	Presently used for recreational activities and fishing, crabbing
Shoreline erosion	Shoreline protected by natural or planted riparian vegetation	No shoreline stabilization
Finfish habitat	Unimportant area for spawning or nursery for any commercial or recreational species	Important spawning and nursery area

Protocol example for: Tourism Suitability Indicators

Environmentally Suitable Indicators	Excellent	Good	Poor
Beach area capacity (m^2/person)	8 -10	6 - 8	< 6
Sea Temp. (°C) for swimming	> 25		
Water supply (l/day/person)	200 – 250	100 - 200	< 100
Dissolved oxygen (mg/l)	> 5		
Water quality (E.coli) Drinking Swimming (*)	0< 100	40 - 50 100 - 200	> 50 (MPN/100 ml) > 200 (MPN/100ml)
Suspended solids/ sediments (mg/l)	> 5		
Bottom type	Sand, small gravel		mud
Current/exposure	Sheltered bays		
Bathymetry (m)	0-5		
Shoreline slope (%) topography	2-5		
Beach area access (buffer zone 2000m)	Within buffer zone		
Energy supply	Sufficient, solar and alternative resources present		
Sewage systems (Waste water treatment)	Present		
Protected areas, Nature Reserves, MPAs	Present		
Cultural Heritage Preservation	Present		
Food Supply, local mariculture, autochthon products	Sufficient and present on site		
Sustainable Infrastructure & landscape Design	Present		

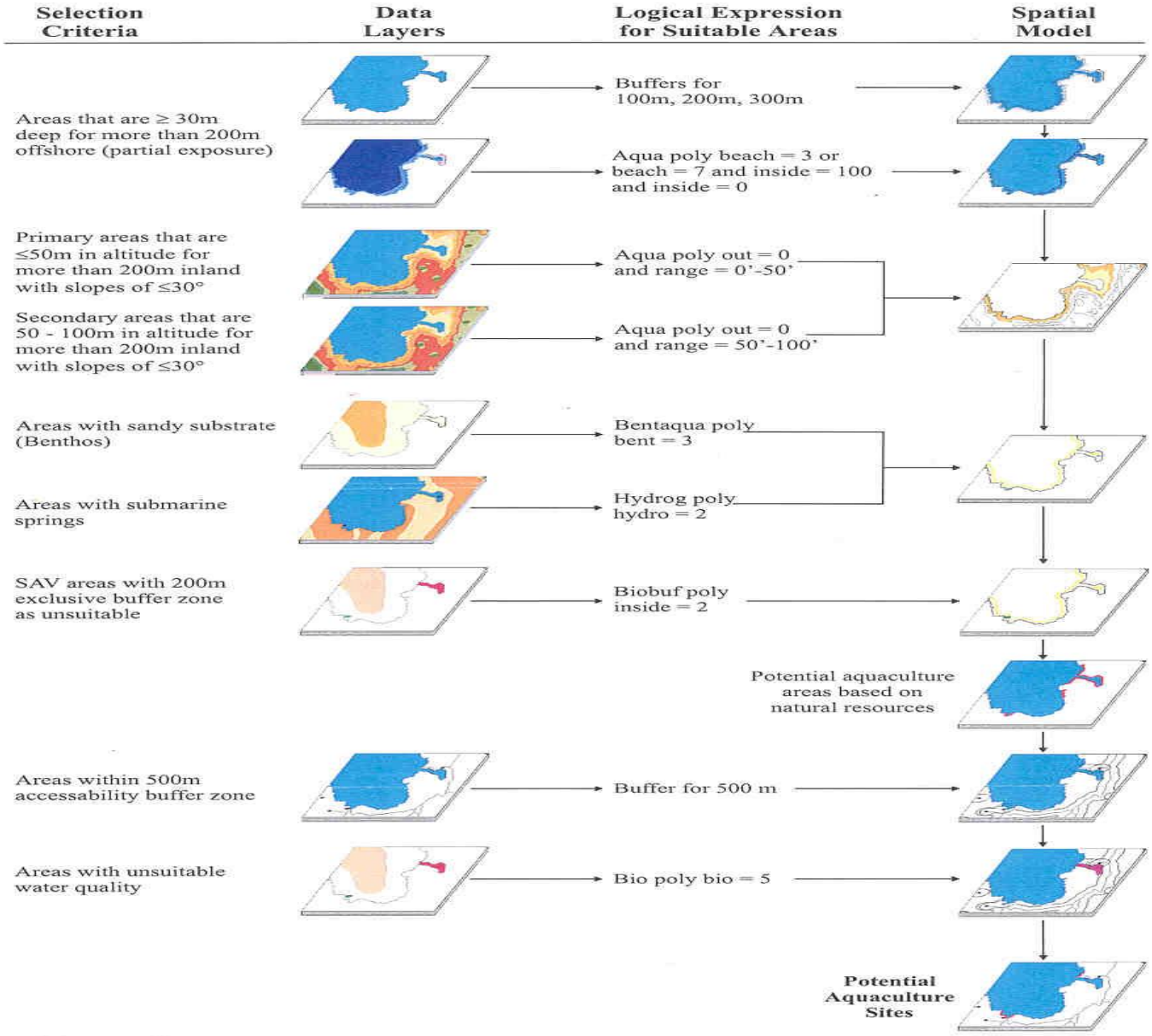
Phase Two:

GIS use-suitability modeling *: Identification of areas in which environmental conditions for each specific use are found*

This includes spatial analysis (aerial photos and satellite images); integration of GIS coverages (data layers) for e.g.: temp, salinity, bathymetry, water quality, substrate types, benthic biocenoses, slope, hydrology, geology-pedology, critical habitats and protected species/areas, etc.

GIS application of available environmental suitability indicators from developed protocols and evaluation of use suitability models;

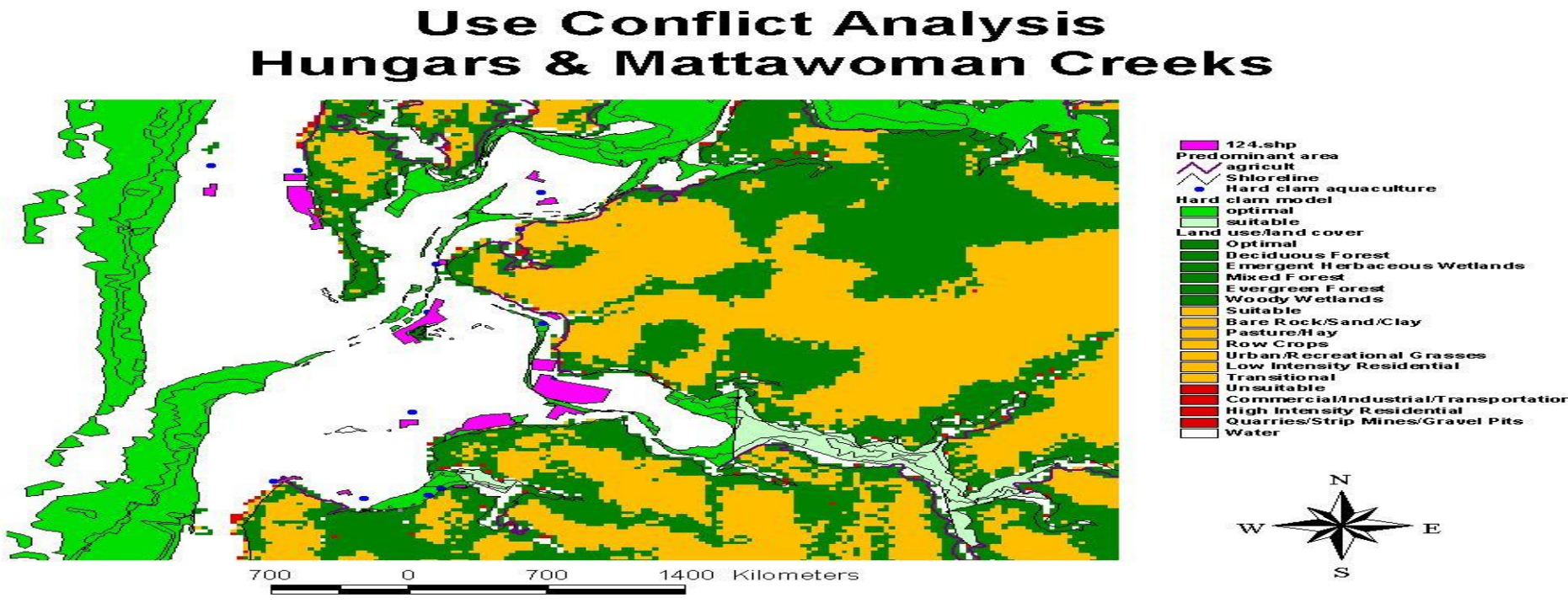
Performing the Spatial Analysis for Aquaculture



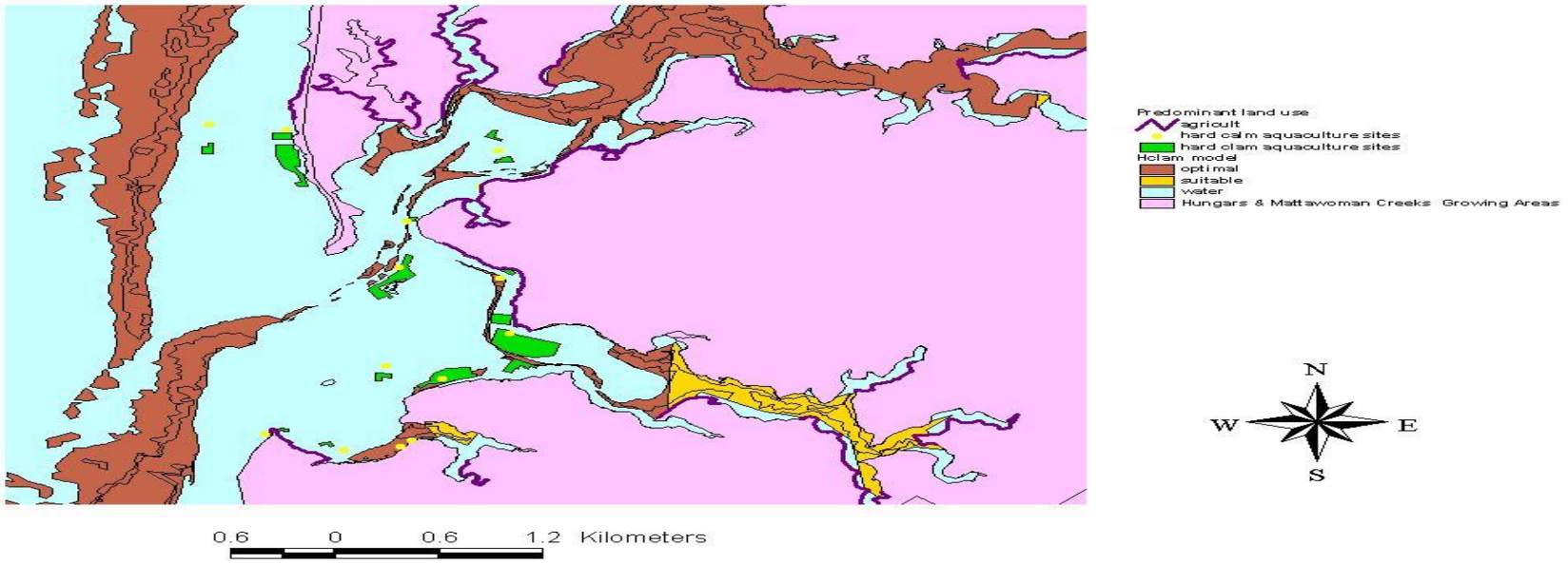
Phase Three:

- *Identification and mapping of coastal, marine and land uses*
- *Performing the GIS use conflict analysis and modeling; The goal is to identify areas that, although suitable for aquaculture on the basis of suitable environmental assessment (from Phase Two), may be less desirable due to incompatible uses that are present or planned (tourism, recreation, fishing, protection, agriculture, etc.)*

Example of identified land uses for aquaculture site suitability analysis (Ch. Bay, Virginia) (Source: VIMS/CCRM, A. Frankic)



Potential Land Use Conflict
Hungars & Mattawoman Creeks



Model	Suitable area (Acres)	Aesthetic conflict area	SAV historic area potential for restoration	Dredging area for boat access	Agriculture (shoreline length/km)
Hard clams	199297	65051	5903	388	1406
Oyster	404589	138336	25179	662	1404

Phase Four:

- *Identification of all possible management issues that could be caused by or related to aquaculture development in certain area (includes local community knowledge and participation);*
- *Assessment of existing policies, regulations and laws related to e.g. aquaculture, identify and characterize management issues and conflicts;*
- *Analysis will incorporate socio-economic considerations, and each management issue will be presented with adequate management options and recommendation scenarios;*

Use conflicts and management issues:

- *Aquaculture and SAV*
- *Aquaculture and other uses of the water column*
- *Incompatible adjacent land use, and*
- *Water quality impairments.*

Adjacent Coastal activity/use	**Management issues**	**Management options**	**Outcomes**
Terrestrial: Residential	Water quality (NPS urban runoff, storm water runoff, wastewater runoff) Socio-economic issues – aesthetics;	1) priority use zones 2) areas with multiple uses If priority area for aquaculture no permits for other activities; Storm water permitting Retention ponds; Irrigation ponds; creating riparian/wetland buffers; Erosion and sediment control; Water quality recommendations (classes for aquaculture through regulation – tier [illegible])	Suitable if buffers exists; Socio-economic cost benefit analysis (advantages and disadvantages of management options)
Agriculture commodity (e.g. crops, tomato farms; livestock; organic farms)	Water quality (agricultural runoff, pesticides, nutrients, erosion, sedimentation)		
Industry Sewage power plants	Wastewater discharge, Sediment contamination Out falls; elevated water temp.	Buffers Designating priority use zones	To be determined by environmental and socio-economic assessments
Marina	Water quality (wastewater discharges)	200 m buffer (match regulations, ½ mile DOH)	Suitable depending on water quality
Navigation (potential conflict everywhere)	Physical damage	Buffer - 100 feet for oysters	Suitable for aquaculture outside buffer
Piers	Recreational fishing and boating; Water quality	Buffer area in residential priority zones Permit required for >100 feet in active lease	Suitable for aquaculture
Beaches(public); and bare areas as potential beaches	Water quality (pathogen contamination)	2 m in-shore buffer; buffer maybe reduced with public facilities	Suitable or optimal with adequate facilities; Bathing lease (1/2 acre)
Recreation: (rec. fishing, boating and hauling) Wild harvest	In vicinity of residential areas; water quality issue; Physical/spatial issue	Designating priority use zones No wake zones Buffer zones	Suitable for aquaculture
Golf courses Protected areas Sanctuaries	Habitat restoration/protection: Clam (brood stock area) Oyster reefs; B. crabs; SAV restoration	Buffers: 100 feet for SAV	Vicinity is a plus/optimal outside buffer areas, except SAV restoration areas;

Conclusion:

- *This analytical approach support interdisciplinary aspects for coastal planning, and indicate that use suitability models are useful for discriminating environmental potential among sites but they are inadequate as predictors for long-term sustainability.*

Why?

- *The major shortcoming is inability to integrate socio-economic considerations as measurable indicators in use suitability assessment and use conflict models of ICZM!*