

Partners

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Future Partners

Users, Superusers, Governments, People

UN Climate Information: Responding to User Needs BRINGING DATA, MODELING AND PREDICTION INTO GOVERNMENT AND BUSINESS DECISION-MAKING

Forecast tools for decision-makers within critical time horizons

- Goals specified by customers in both private and public sectors and designed for decision support
- Intended to fill critical unmet national objectives

 a national network that integrates the
 strengths of government, industry and academe



Global ESMs for global issues (IPCC negotiations) but regional ESMs for adaptive management, learning-by-doing, and participatory decision-making for sustainability



Murtugudde 2009

Regional Specificities: LEK

Know the USER

- Near-Real Time Applications: Nowcasting and forecasting of the Bay circulation, ecosystem, pathogens, harmful algal blooms, waves and inundation.
- Climate Projections:
 Estimating effect of climate change, between now and 2050, on the health of the Bay and its watershed.
- Provide a decision making tool for users



SeaWiFS true-color image of Mid-Atlantic Region from April 12, 1998.

Working with the users

- "Pilot Applications of the Chesapeake Bay Forecast System: Forecasting Future Drinking Water in an Urbanizing Warmer World"
 - Opportunity to forecast how changes in climate can influence the transport of nutrients, metals and Pathogens, and serve as a resource for water quality managers and decision makers
- A habitat suitability forecasting model for Chesapeake Bay's striped bass population
 - Produce and validate a forecast model of striped bass recruitment using output from the CBFS
- Pilot User Collaboration for Harmful Algae Forecasts in MD Chesapeake Bay
 - Model skill for HABs, and to refine the habitat suitability model.
- Chesapeake Community Modeling Program proposal for CBFS applications
 - Work in coordination with various Chesapeake Bay watershed groups and River Keepers.
- Proposal to be a Pilot Application of the Chesapeake Bay Forecast System
 - Integrate climate data focused on climate change and variability at seasonal-to-decades scale generated by the Chesapeake Bay Forecast System using the IPCC land use scenarios created by various groups.

Old Paradigm: CTB can start the two-way communication with regional modelers to change to the new paradigm







Computational social science: How things spread





Community metabolism





Learning by doing.

Meteorological and air-quality data: CTB-Climate Services-Optimized data gathering with web of sensors





'Fisherman's Disease' afflicts association head

June 27, 2008 Regional CTBs: Regional Specificities, Predictability

Ken Smith, a leader in the fight to clean up the Chesapeake Bay and its watershed, has been hospitalized with a serious vibrio infection commonly known as "fisherman's disease" and believed to be directly related to contaminated marine life and polluted water.

Smith, president of the Virginia Waterman's Association, was admitted on June 14 to Rappahannock General Hospital in Kilmarnock, suffering from a high fever and a badly swollen right arm.

"This reaffirms our belief, as watermen, that the continuing degradation of the Bay and its tributaries has reached the point that it is imperative that dramatic measures must be taken to improve the estuary's water quality," Smith said June 25 from his hospital bed.

Smith said he believes he contracted the vibrio disease on Tuesday when he scratched his arm while emptying a crab pot in Totuskey Creek off the Rappahannock River. He washed the wound, he said, but it became infected soon after.

LEK: Adding Value

Harmful algal blooms

- Sea Nettles
- Human Pathogens
- Anoxia
- Insect Infestation



- Personalized-Preemptive-Predictive Health Information
- Sea level rise, inundation, storm-surge
- Future scenarios for Policy, Agriculture, Population, Health of the Bay

Dynamic Downscaling: Scales that matter – Regional CTBs, multi-models





High resolution winds, temperatures, humidities, raidation, etc. have users from the aviation, public health, solar and windenergy, recreational boating, etc. Designer forecasts for day 8 and beyond are possible. How to depict uncertainties and skill for users from a wide variety of needs and tolerance levels?

20-member ensemble mean forecast of temperatures and winds.

Monitoring waterbodies and forecasting not only sediment and nutrient loadings but pathogen loading will be crucial. DOABLE and In Great Demand. Regional CTBs can bring regional users/superusers.



20-member ensemble forecast of daily rainfall and temperature in the Rappahannock Basin. Heavy black line shows the ensemble mean.

Projected 2047 daily precipitation anomalies superimposed (left) on 1995 observed daily precipitation (mm) (right): Smart growth, RGGIs, Adaptation. JAN 1995 JAN 2047



Regional CTBs: Adaptive, sustainnable, participatory decision-making, learning by doing, what-if scenarios.

- On a 30 m square!
- Soil look up tables, manure/fertilizer applications, water withdrawals, crop types, wetlands, riparian buffers, forests, Best Management Practices
- Data from EPA, USGS, DNR, MDE, USDA
- Can provide details needed for effective policy and management



Most useful, data-intensive, laborious but most relevant



Below normal stream flow for the coming months: Impact on the Bay?

Coastal CTBs: Two-way Nesting? Land-Oceanecosystem services-habitat restoration.





16-Day Fcst of Karlodinium Veneficum at 2009-09-14 00:00:00









An End-to-End Early Warning System: Can we provide reliable early warning? Multi-user interfaces, naturalhuman system interactions, socio-economic CTBs?





Predictability of biogeochemistry and ecosystems: **R20** – **Ecosystem CTBs?**





How to consider sustainable-green methods and adaptation in CTB?

- Dryponds (detention) and Wetponds (retention)
- Grass Swales
- Permeable Pavers
- Storm Gardens

Maryland Scenario Project





Counties at High Risk of Weather-Related Problems That Could Be Made Worse by Global Warming

Hazard	Counties at Risk
Drought	Frederick, Montgomery, Howard, Carroll, Baltimore City and County, Harford, Cecil
Extreme Heat	Baltimore City
Flash/River Flooding	Frederick, Allegany
Thunderstorm	Frederick, Montgomery, Anne Arundel
Tornado	Frederick, Anne Arundel
Winter Weather	Garrett
Tidal/Coastal Flooding	Dorchester, Worcester
Tropic Cyclone	Somerset, Worcester

CTB interactions with policy makers



Chesapeake Bay Forecast Tool

M	Time Scale		
	0 months	Compute	
S dan	Output Variables		
	Sealevel	Phosphorus	
	🔄 Storm surge	🗹 Oxygen	
3	Land coverage	🗹 Nitrogen	
I TANK SIL	🔄 Fish / Crabs	Temperature	
	🗌 Air quality	Salinity	
Case and the	Winds	🖌 Algae bloom	
	Precipitation	🖌 Sea nettles	
	Input Variables		
	O Population density	Eand use	
Set the region	CO2 pollution	⊖ Stream runoff	
	◯ Hi/low prognosis	Agricultural mix	
Decision-making under CTB			







CORN COTP GRSG SOYB PNUT TOBC BARL WWHT HAY RYE OATS ALFA GRBN POTA AGRR SPOT AGRL STRW FESC PAST CFRM ORCD RNGE CANT CABG WATR URLD URHD UTRN URML URMD FRSD FRSE FRST WETF

WETN



Eliminate selected land use

Reference map not available

Show corresponding land use map

Show advanced

🔾 Nettle 🗌 HAB

● N ○ P ○ DO

Update results

Emergencies under CTB

- Accessible streets, Hospital evacuations, resource allocations
- User Interfaces and rapid responses to special requests





18-Sep-2003 00:30:00



Sustainability: Goal and Strategy-Tactics



Figure 2.2-1

Schematic structure of a pelagic marine ecosystem. Green arrows: input to primary production; black arrows: interaction with the carbonate system; brown arrows: decomposition of biomass. In the interest of clarity, marine mammals and seabirds are not shown. Source: WBGU





Fig. 2. Extension of Kleiber's 3/4-power law for the metabolic rate of mammals to over 27 orders of magnitude from individuals (blue circles) to uncoupled mammalian cells, mitochondria and terminal oxidase molecules, CcO of the respiratory complex, RC (red circles). Also shown are data for uncellular organisms (green circles). In the region below the smallest mammal (the shrew), scaling is predicted to extrapolate linearly to an isolated cell *in vitro*, as shown by the dotted line. The 3/4-power re-emerges at the cellular and intracellular levels. Figure taken from West et al. (2002b) with permission.





Dataflow 5.5

Water Quality Mapping program uses a technology known as DATAFLOW to rapidly collect spatially intensive water quality data.





Dissolved Oxygen Sensor

MDDNR Continuous Monitoring Program - 54 continuous monitoring stations. Roughly a third of the sites will be equipped with cellular telemetry equipment powered by solar panels. The remaining sites will posted on a biweekly basis.

Noblis



Norfolk

Chesapeake Bay Dead Zone

Dissolved oxygen (mg l⁻¹)

Baltin

Washingto

Crabs and flounder crowd into shallow water to escape low dissolved oxygen



Sensor Web











Major need for co-ordinate land use for the health of the Bay

The large-scale environmental and natural resource programs in the PNW region have several key features: (1) common land use and conservation objectives, (2) overlapping administrative programs of multiple agencies and organizations involving multiple species, and (3) similar database and analysis tool requirements. These three commonalities among natural resource programs motivate the need for similar watershed databases (e.g., stream networks, vegetation, roads, and so forth) and analysis tools that utilize those databases (e.g., fish habitat quality, erosion potential, fish migration blockages, and so forth).

Are there groups that are particularly difficult to engage?

a) State legislators; b) Hispanics and other minorities; c) retirees, newly relocated from outside of Florida

Absentee homeowners; average citizens

African-Americans

Agricultural community

Agricultural community, local officials

Agriculture and development communities

Agriculture industry; township governments

All involved with planning

Although insurance agents are not our target audience, their lack of knowledge has a negative statewide effect

Army Corps of Engineers, Soil and Water Conservation Districts, consulting engineers, planners, landscape designers

ATV users

Building industry

Business community

CalTrans, Corps of Engineers; agricultural groups at state, local, and federal level

CCA

Charter boat guides

Citizens

Citizens that are not angry or concerned about a topic

Coastal property owners

Coastal stakeholders

Coastal tourism industry members and managers

Commercial and recreational fishermen, NOAA higher level staff, Natural Sea Grant Office

Commercial fisherman and citizens sometimes believe our bureau is regulatory when it is not

Commercial fishermen

Are there groups that are particularly difficult to engage? (continued)	Are there groups that are particularly difficult to engage? (continued) General nublic unaware or unsymmatric for the need for escronsible stepartchic of the
Local governments and NGOs	environment
Local governments, elected officials, NOAA's Office of Ocean and Coastal Resources	General public, including residents, tourists, school children, etc.
Management, National Marine Fisheries Service	General public—getting them to attend meetings about programs or rules General public—hard to engage in a manner that results in tangible actions
staff/time/resources	Groups that have organized to oppose a specific issue
Local municipalities and landowners	Groups that have widely varying agendas
Local officials Local planning and zoning boards	High school aged kids
Local planning committees and emergency managers	I'm a GIS guy, so I don't do a lot of partnering, but getting the US Army Corps of Engineers
Local recreational groups, and the general public who are supportive but hot active	to release data, return calls, etc., is tough In a general sense, just people who do not feel the tonic is important or the information will
Locally elected officials, residents inland of the coastal zone	not support their cause
Low-income groups, schools, the elderly	Independent user groups without an organizational structure
Major land developers, elected municipal and county officials	Indigenous communities
Management	Industrial interests with drastically different missions, and Native interests where economic
Minority population (Hispanics): This group has other priorities that they are focused or	n development is a priority
Municipal governments	Industry groups: commercial fisheries and recreational fishing groups, developmental groups
Municipal water system managers — a large community over an extensive regional domain	Industry, developers
Native American groups from local area: Tlingit, Hoonah, Tagish-Carcross, First Nation	ns Institutional special interest groups
Native corporations	Interest groups, special interest groups, landowners, general public It is hard to engage the unorganized stakeholder groups (example: recreational fishermen.
Natural resource managers are onen noo secretive to encentrely work what common	coastal landowners, etc.)
NOAA	K-12 teachers
NOAA CSC in a truly collaborative manner-staff seem to have limited time engaging	Land developers and county povernments
NOAA ERD group; lack of interest in local governmental agencies	Land trusts, mostly volunteers and they have high turnover rates
NOAA Fisheries, US Army Corps of Engineers' Regulatory Branch	Landowners
North Carolina citizens	Landowners and developers who resist land-use regulation and seek ways to dodge
state agencies	Large commercial homebuilders, universities, extension programs
Other federal agencies	Large, poorly funded government agencies
Other sections within our agency Other state acencias especially MDE because of past interactions	Law enforcement
Other state or local governing agencies	Legislators and their staff
Our target audience is the public at large so I don't know 9th graders?	Lending industry, real estate
People and organizations that perceive government agencies as untrustworthy and unne	Limited time from local government officials in more rural coastal areas—they often have to
People involved in the fishing industry Personnel within the state agency in which we are housed	Local citizens and politicians
Power boaters	Local commercial and recreational fishermen
Private individual shore land property owners; manufacturers and distributors of docks	and Local development NGOs
Private landowners who are suspicious of government involvement in their efforts	Local elected officials, closest local government's planners
Private owners of large properties; higher strata of elected officials	Local fishermen, government officials
Private sector	Local governments
Private sector developers, engineers, and development consuming minds	Local governments
Are there groups that are particularly difficult to engage? (continued)	Are there groups that are particularly difficult to engage? (continued) Provide sector, public sector with strict mandales, and manorites
Commercial fishermen	Proveed and design engineers
Commercial fishermen	Public
Commercial fishermen (aren't at home to attend meetings): tribal governments	Public accessing the coast
Commercial fishermen because of their distrust for managers	Resident and developers don't want to hear about environmental sensitivity and coastal
Commercial fishermen, hunters, campers	Readmons, lenders diggers, enablers, recreational users of living estuatine resources, off-
Commercial fishermen, private landowners	Religious and non-emergency groups
Community action groups	Schull Businessen
Community: it is difficult to achieve citizen's participation	Some (but not all) local farmers
County governments and local and state elected/appointed officials	Some agencies often show a lack of flexibility toward other goals due to their own constraints. Some foderal agencies (e.g., DOD)
Department of Defense	Science provides are difficult to engage promising because the proup's objectives and or mission are deformed than ours one following promising the second s
Department of Marine and Wildlife Resources [American Samoa?]	Science additionals to get development rights organizations and conservation organizations in the rooms together
Departments of public works, some municipal boards	Sometimes fishing proups are difficult to engage due to time constraints/distance/financial
Developers	State: approximations. homeocommere
Developers, city and county planners, "non-environmentalists," politicians	State regulations - some are so proofly obscured they don't understand the basics State regulation y agencies due to lack of staff
Developers, land olanpare, elected officiale	States - they are all organized differently, have their own priorities and constraints - SUNY College of Environmental Science and Forestry
Developers, municipal offices	 Surfaces and administrators (politicarily a policy) of byting to stop all coastal construction without
Developers, politicians, teenagers, vegans	The present public
Developers/uninterested homeowners/overworked town officials	The large majority of folks in the middle, those who doo 'tican't attend public forums, development community
bereiopers uninterested nomeowners/overworked town officials	The legislature
Due to the shorters of our organizational existence, we are still trying to more closely engage	The legislation is group in the harder is to engage them and the more you need an introduction in them.
Due to the shortness of our organizational existence, we are still trying to more closely engage multiple audiences	The legislature a group in, the harder it is to engage them and the more you need an introduces to them. The new special interest public. These who have been allowaited from the agency mission/activities in the past and continue a
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What are the prospects for the future? Capacity Building

New environmental forecast products will be feasible



Possible Threats-Summer 2020: hot, dry and unhealthy

Sustainability, Ecosystem-based management, Integrated assessment, adaptive management with participatory decisionmaking, and such require a reliable and scientific tool.





