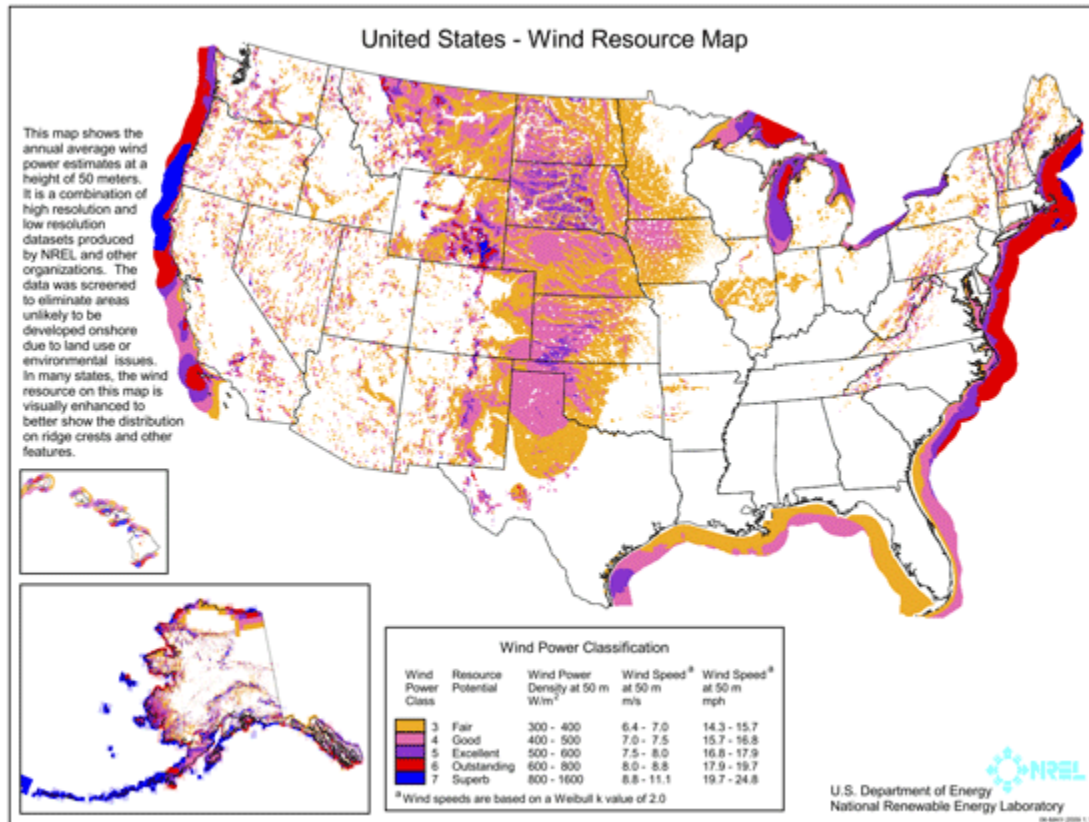


GIS: Geographic Information Systems (GIS)

By Walt Jaslanek

Intro to GIS for Wind Energy Siting for IGERT Wind NSF



NREL, 2010

Challenge: How to encourage offshore wind in the US while managing ecological responsibility and ocean use conflicts?

Introduction



Siemans, Sweden



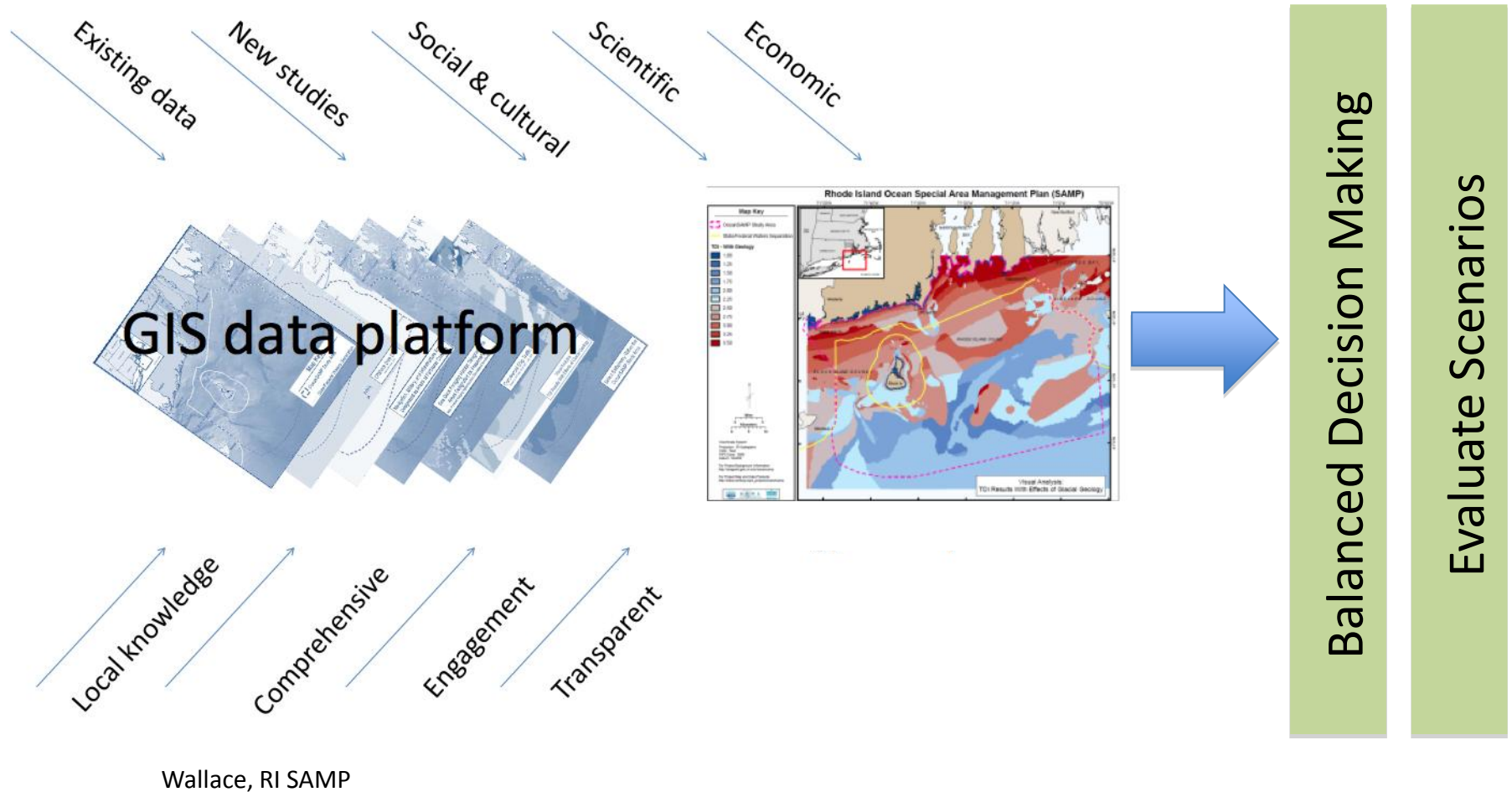
S. Anderson

Parts of the ocean are in high demand

- Multitude of ocean users
- User-user and user-ecological conflicts

Challenges

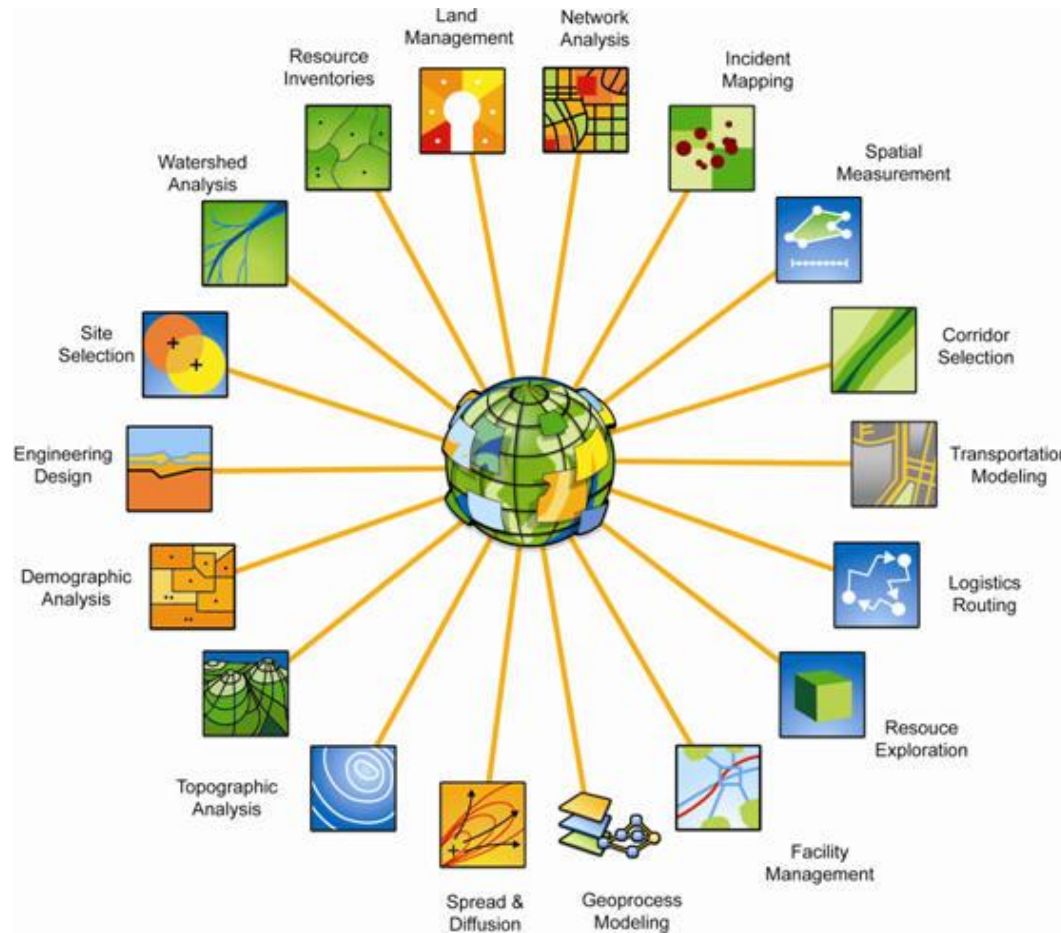
Geographical Information System (GIS) Platform to rank & weight data for better interdisciplinary decision making



A framework for conceptualizing spatial decision support in offshore wind turbine placement

- I. Lit review and socio-ecological framework
organization of data into “institutional landscapes”
- II. GIS-Based Decision Support System Design
- III. Evaluation of System

Need A “Central GIS System & Engine” to store, analyze, and share data we are making decisions from



GIS Layers

Layers Identified By IGERT Thrusts

Environmental

TYPE	LAYER	PERSON
eco	bathymetry	js
eco	bathymetry	aa
eco	BOEM wind energy areas	aa
eco	existing wind installed	js
eco	habitat cover	js
eco	landuse landcover	js
eco	MassGIS MORIS bird	pl
eco	noaa bird survey	aa
eco	proposed wind projects	js
	proteted lands	
eco	conservation	js
eco	seabird colonies	aa
eco	weather data?	js
eco	wind potential	js

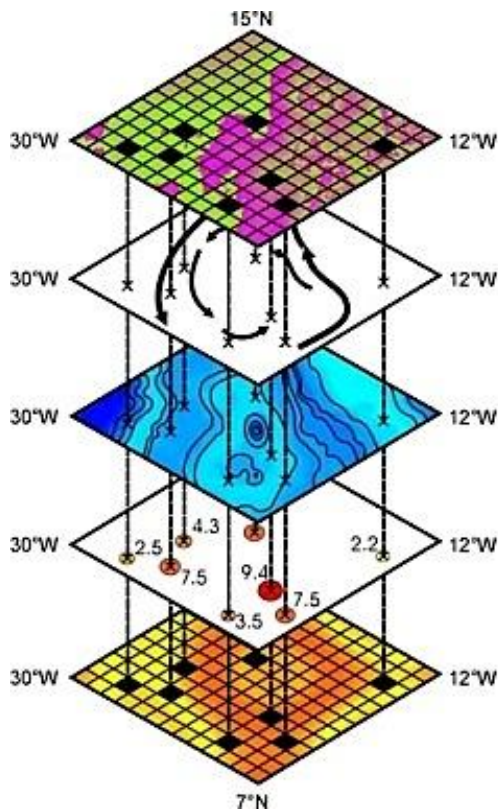
Engineering

TYPE	LAYER	PERSON
eng	bathymetry	wc
eng	bird migration paths	cp
eng	bounty boundaries	cp
eng	cities	cp
eng	construction resticted	cp
eng	interstates	cp
eng	mean sea level	wc
eng	national park	cp
eng	native amaerican reservations	cp
eng	noaa buoys	gs
eng	power density	gs
eng	protected lands elevation	cp
eng	railroads	cp
eng	rivers	cp
eng	shipping lanes	cp
eng	soil type	wc
eng	streams	cp
eng	towns	cp
eng	transmission lines	cp
eng	water bodies	cp
eng	water depth	cp
eng	wave height	gs
eng	weibull k and a	gs
eng	wildlife range	cp
eng	wind direction	gs
eng	wind spped	gs

Policy

TYPE	LAYER	PERSON
policy	% BA degree	eb
policy	airports	rw
policy	average wind power	eb
policy	census	rw
policy	current electrical supply	eb
policy	education level	rw
policy	electricity demand	eb
policy	electricity rates	rw
policy	electricity use	rw
policy	energy generated source	rw
policy	home ownership	rw
policy	income level	rw
policy	Labor data	rw
policy	landuse	rw
policy	location marginal prices	eb
policy	median house in	rw
policy	median income	eb
policy	NAICS data	rw
policy	population	eb
policy	population	rw
policy	poverty rate	eb
policy	railroads	rw
policy	roads	rw
policy	shipping lanes	rw
policy	shipping ports	rw
policy	tax rates/base	rw
policy	transmission elecrtic	rw
policy	transmission petroleum	rw
policy	transmission system	eb
policy	utility ownership (provision)	rw
policy	wind capacity value	eb

Many Datasets – How GIS Platform can help make decisions on multiple criteria and multiple scale data



Satellite
ocean color images
(E.g. Sea surface
chlorophyll distribution)

Ocean currents
(Vector data)

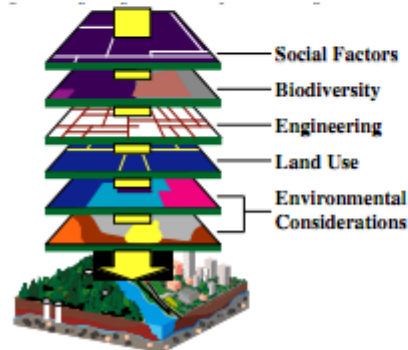
Bathymetry
(Gridded data,
Vector data)

Data base access
(coordinates, stations,
measurements)

Sea floor maps
(Sedimentary facies)

Definition of MCDM

- *"Multi-Criteria Decision Making (MCDM) is the study of methods and procedures by which concerns about multiple conflicting criteria can be formally incorporated into the management planning process", as defined by the [International Society on Multiple Criteria Decision Making](#)*



To Help See the Whole Picture

Avg. Wind Speed (m/s)	Grading Value
>7	10
6.5-7	9
6-6.5	8
5.5-6	7
5-5.5	6

Proximity to Transmission lines (m)	Grading Value
0-1,000	10
1,000-2,000	9
2,000-3,000	8
3,000-4,000	7
4,000-5,000	6

16	17	19	12	8
11	15	Nodata	5	6
9	11	6	3	5
8	9	Nodata	2	10
4	6	7	11	16

Raster Surface Values

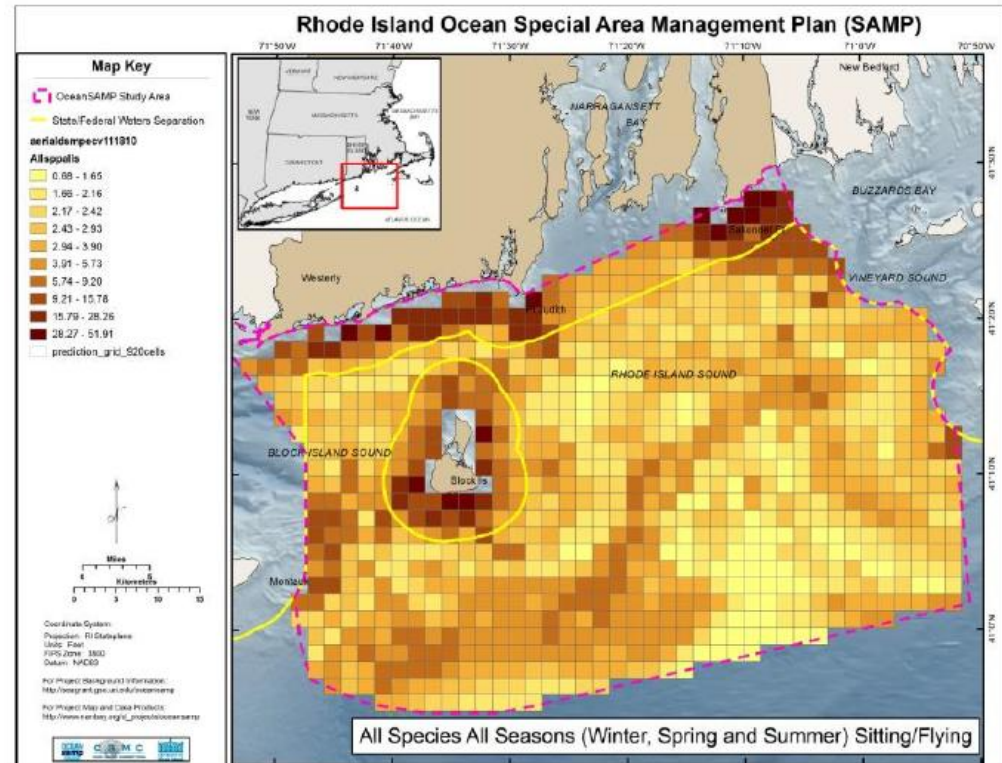
How GIS works – Data Relationships By Location

Siting Decisions –

Ex. Overlay Analysis

Technique for applying a common scale of values to diverse and dissimilar inputs to create an integrated analysis in raster format

- Define the problem and scale ->
 - Regional or sub regional
- Break the problem into submodels.
- Determine significant layers.
- Reclassify or transform the data within a layer.
- Weight the input layers.
- Add or combine the layers.
- Analyze
- Result – DSM composites to compare

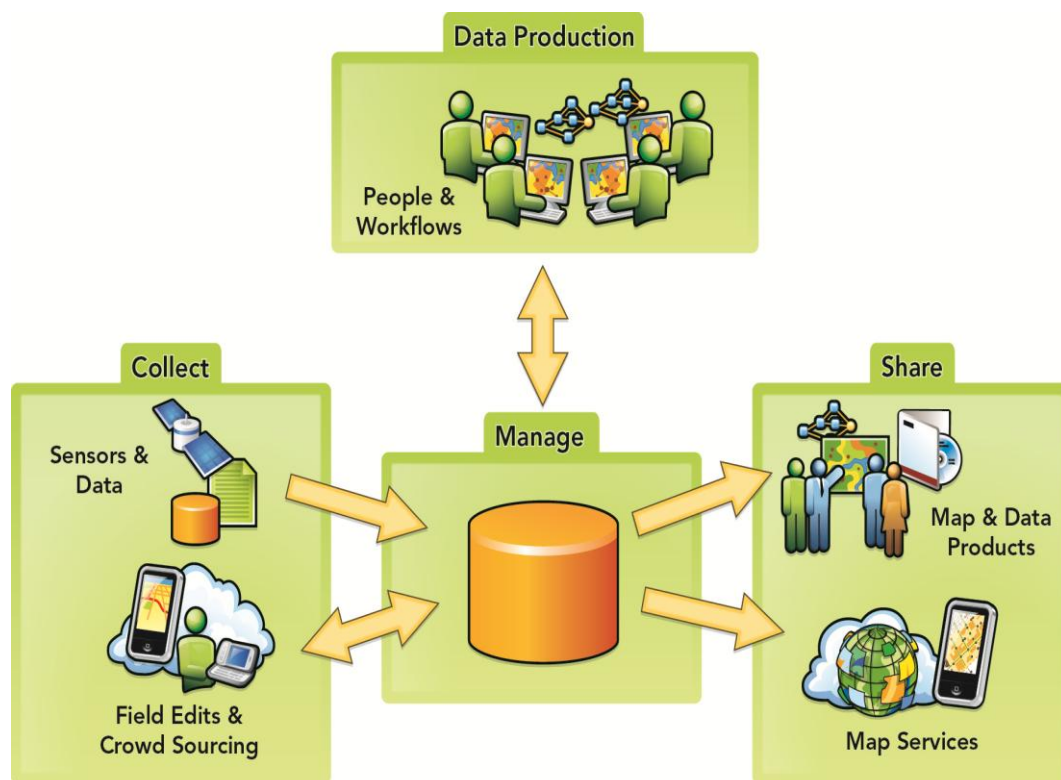


Example – Patton 2011

Translation To Stakeholder Meaningful Data Sets

Web GIS

- Maps
- Web services
- Live decision making
- Live user input



Example deliverable - Screenshot Walt Jaslanek GIS System 2012

Collecting and Sharing Information

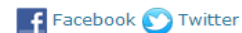
ArcGIS Online

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[GALLERY](#)
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UMASS WIND ENERGY IGERT GIS



Test GIS Collaborative Site for UMASS Wind Energy IGERT

Group Content

All Results

- Maps
- Applications
- Tools

Title Owner Rating Views **Date**



[Open](#) [Details](#)

testwebmap

test
 Web Map by walterjumass
 Last Modified: October 23, 2012
 ☆☆☆☆☆ (0 ratings, 0 comments, 0 views)



[Open](#) [Details](#)

Cape Cod Project Area

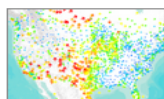
Cape Cod Project Area
 Web Map by walterjumass
 Last Modified: October 23, 2012
 ☆☆☆☆☆ (0 ratings, 0 comments, 5 views)



[Open](#) [Details](#)

IGERT_CAPEWIND

IGERT WIND WJ TEST
 Feature Service by walterjumass
 Last Modified: October 23, 2012
 ☆☆☆☆☆ (0 ratings, 0 comments, 23 views)



USA Wind Speed and Direction

This map shows the current wind speed and direction in the U.S. The map contains comprehensive service of live feeds containing several live layers from NOAA.
 Map Service by Federal User Community

Group Details

walterjumass
 Status: organization
 Tags:
 UMASS IGERT WIND ENERGY GIS

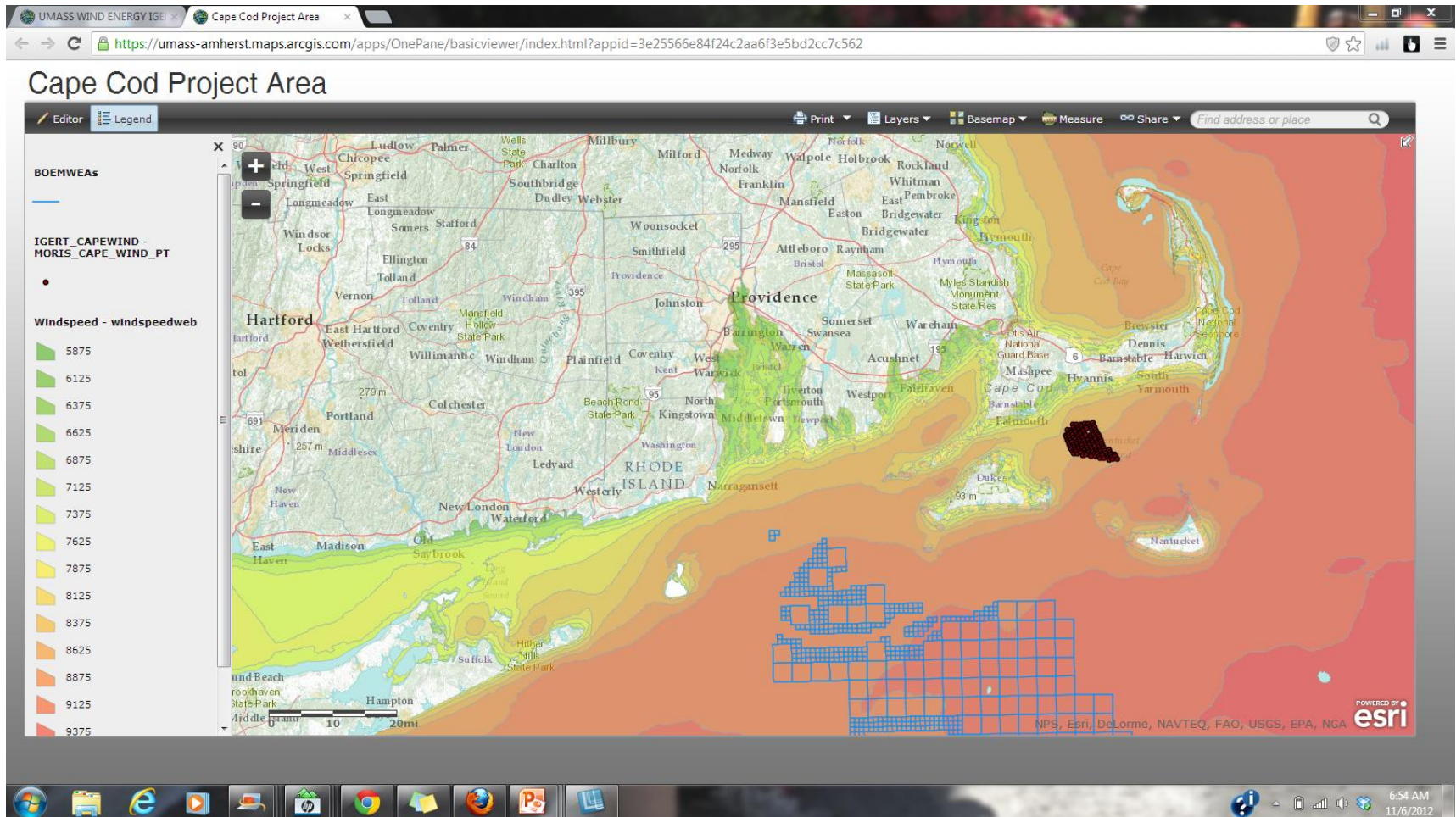
2 Members

- walterjumass
- UMassAmherstGis

Screenshot Walt Jaslanek GIS Sytsem 2012

Flexible Web GIS Map & Data Interface

New ways to share knowledge



Screenshot Walt Jaslanek GIS Sytem 2012

Custom Services & Applications

Connect to social networks

The screenshot shows a web browser window displaying the Twitter profile for IGERTWINDGIS. The browser's address bar shows the URL https://twitter.com/IGERTWINDGIS. The Twitter navigation bar includes Home, Connect, Discover, and Me, along with a search bar and settings icons. The profile header features a profile picture of wind turbines, the name IGERTWINDGIS, the handle @IGERTWINDGIS, and a button to 'Edit your profile'. Statistics show 6 tweets, 6 following, and 0 followers. A left sidebar contains navigation links for Tweets, Following, Followers, Favorites, Requests, and Lists, along with footer links for Twitter's policies and services. The main content area displays a list of tweets from IGERTWINDGIS, including a presentation link, a project area link, and several tweets with a specific hashtag.

Twitter, Inc. [US] https://twitter.com/IGERTWINDGIS

Home Connect Discover Me

Search

IGERTWINDGIS
@IGERTWINDGIS

Edit your profile

6 TWEETS
6 FOLLOWING
0 FOLLOWERS

Tweets

Following
Followers
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Requests
Lists

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Advertisers Businesses Media Developers

Tweets

IGERTWINDGIS @WJGIS
IGERT WEB GIS PRESENTATION V1 bit.ly/REO3eo
Expand 18h

IGERTWINDGIS @WJGIS
Cape Cod Project Area umass-
amherst.maps.arcgis.com/apps/SocialMed... #EsriSMT
Expand 21h

IGERTWINDGIS @WJGIS
@IGERTWind - hi
Expand 5 Nov

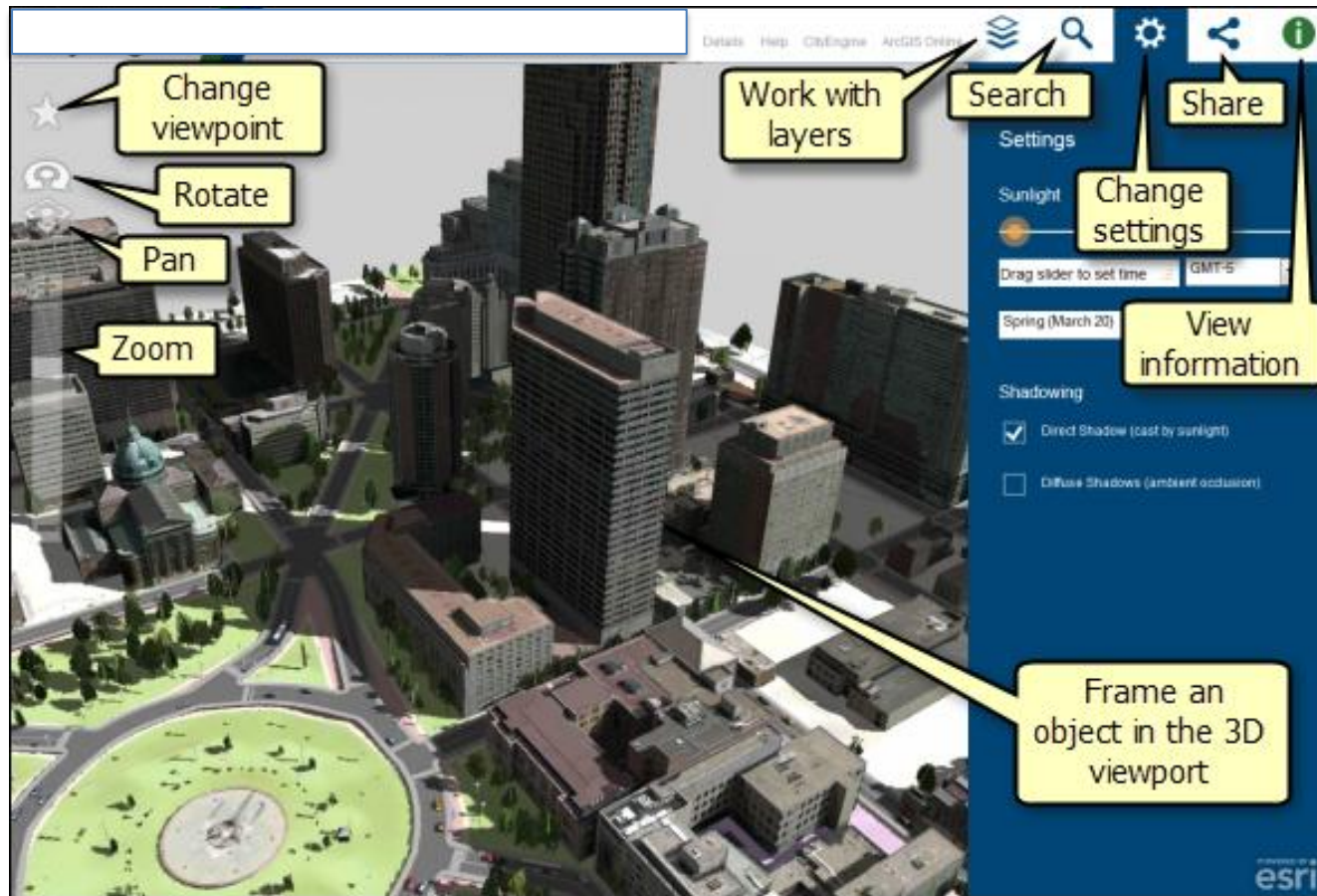
IGERTWINDGIS @WJGIS
tweet3 UMASS+WIND+ENERGY+IGERT+GIS bit.ly/UxBagi
Expand Reply Favorite 5 Nov

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Expand 5 Nov

Social Media

And visualize scenarios via GIS driven rules



Future 3D Interface

Special Thanks to my committee members 😊



Thank You