Eine multifunktionale Küstenklassifikation zur Beurteilung der Auswirkungen von Klimaänderungen auf die Küste

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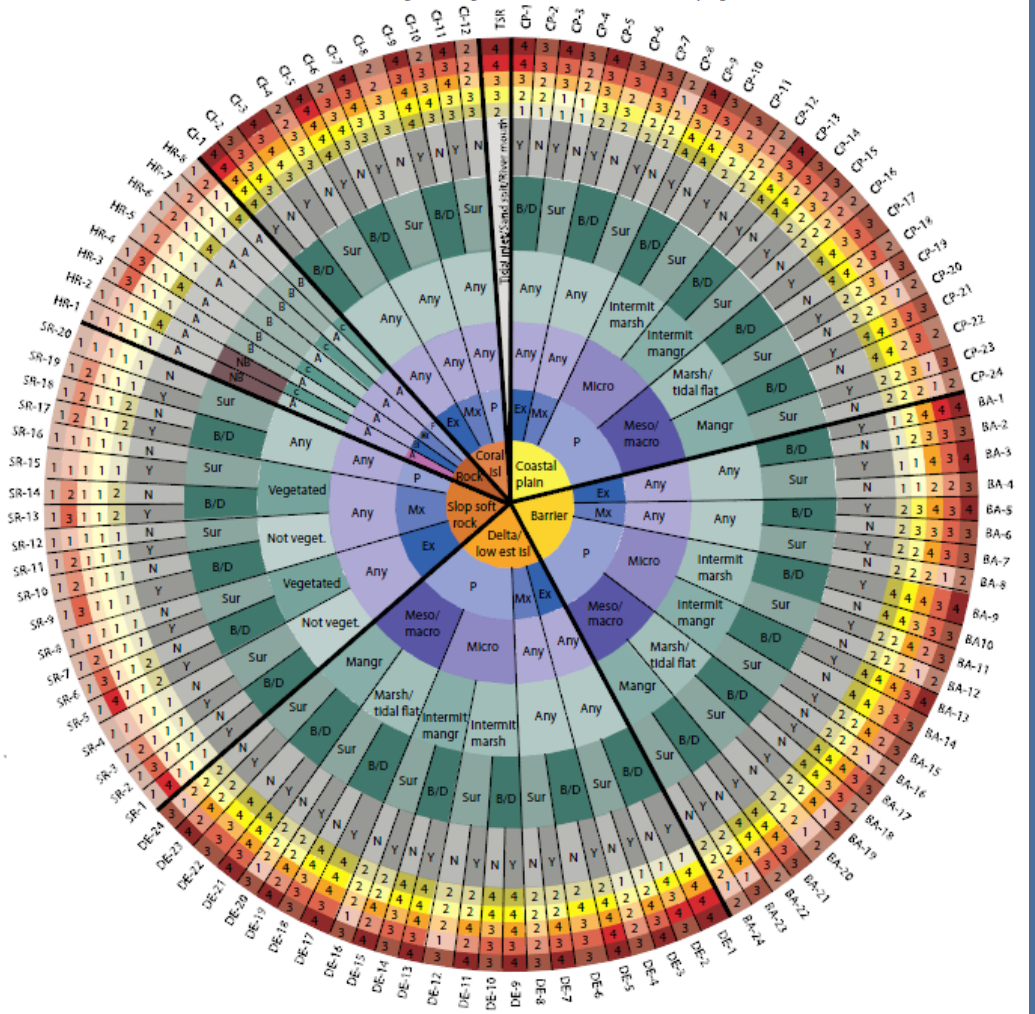
Ausgangslage:

- Unterschiedliche Küstenklassifikationen für unterschiedliche Fragestellungen
- Z. B. geologische, geomorphologische etc.
- Hydrologische (tidal range, hazard index, Ω)
- Biotische
- Sozio-ökonomische

The Coastal Hazard Wheel

Ref.: Lars Rosendahl Appelquist, Generic framework for meso-scale assessment of climate change hazards in coastal environments, Journal of Coastal Conservation, Planning and Management, 2012. Available online at www.springerlink.com



COASTAL CLASSIFICATION (start in wheel center)

Geological layout		
Wave exposure	Ex	Exposed
	Mx	Moderately exposed
	P	Protected
Tidal range		
Flora/fauna		
Sediment balance	B/D	Balance/deficit
	Sur	Surplus
	B	Beach
	NB	No Beach
Storm climate	Y	Yes to tropical cyclone activity
	N	No to tropical cyclone activity

Note: A=Any; C=Corals

INHERENT HAZARD LEVEL

	Low	Moderate	High	Very high
Ecosystem disruption	1	2	3	4
Gradual inundation	1	2	3	4
Salt water intrusion	1	2	3	4
Erosion	1	2	3	4
Flooding	1	2	3	4

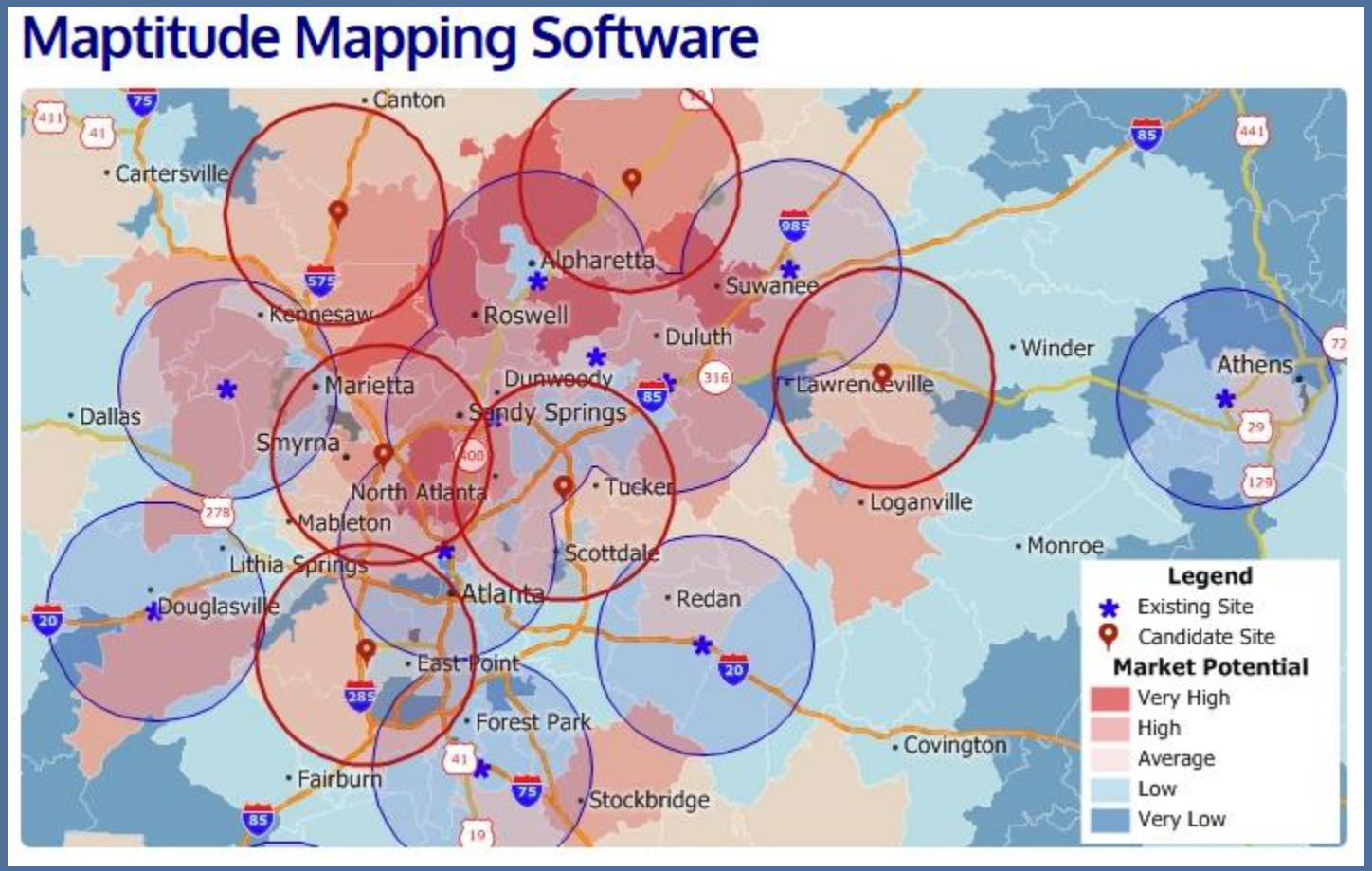
UNEP RISØ CENTRE

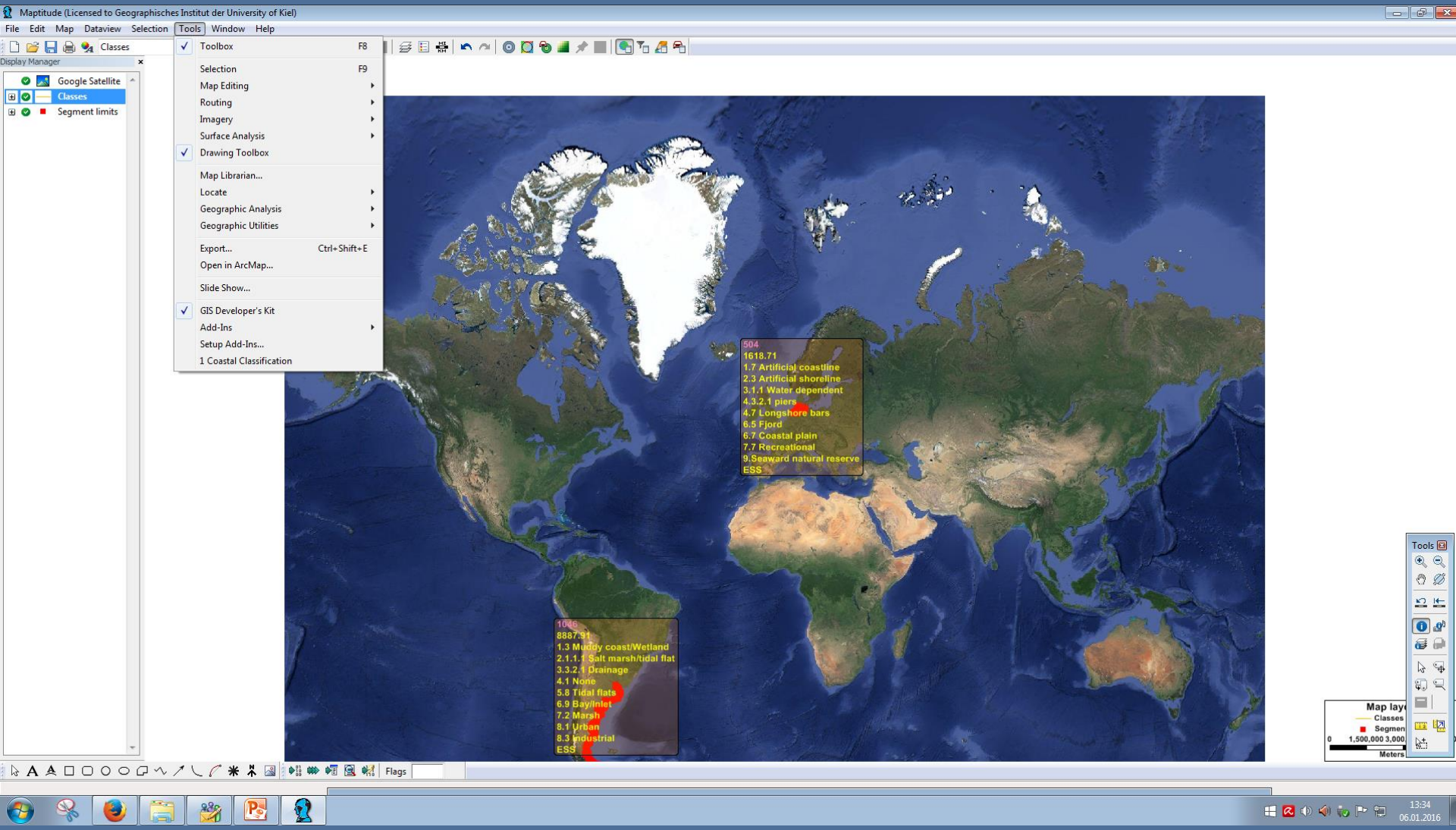
Company for Environment and Coast

Probleme:

- Keine fächerübergreifende Klassifikation
- Keine Klassifikation die die Reaktion des Systems auf den Klimawandel berücksichtigt

Ansatz: GIS gestützte Analyse von Küstensegmenten

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1 Coastal Classification
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1618.71
1.7 Artificial coastline
2.3 Artificial shoreline
3.1.1 Water dependent
4.3.2.1 piers
4.7 Longshore bars
6.5 Fjord
6.7 Coastal plain
7.7 Recreational
9.Seaward natural reserve
ESS
1048
8887.31
1.3 Muddy coast/Wetland
2.1.1.1 Salt marsh/tidal flat
3.3.2.1 Drainage
4.1 None
5.8 Tidal flats
6.9 Bay/Inlet
7.2 Marsh
8.1 Urban
8.3 Industrial
ESS
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Drei grundlegende Schritte:

- Einteilung der Küste in Segmente +/- gleicher Struktur
- Erfassung der bestimmenden Naturraumelemente sowie der sozio-ökonomischen Bedingungen für jedes Segment
- Ermittlung und Bewertung der Ecosystem Services (ESS)

10 Kategorien für die Segmente:

- DOMINANT FEATURE
- SUBSTRATE
- DOMINANT MANMADE FEATURES
- ADDITIONAL MANMADE FEATURES
- NEARSHORE ENVIRONMENT
- SEAWARD ENVIRONMENT
- LANDWARD ENVIRONMENT
- PREDOMINANT LAND USE
- OTHER LAND USE
- ECOSYSTEM SERVICES (ESS)

Beispiel: DOMINANT FEATURE

1 Beach and dunes
2 Beach
3 Muddy coast/Wetland
4 Spit/beach ridge
5 Cliffs
  5.1 Soft Cliff
  5.2 Rocky Cliff
6 Barrier island
7 Artificial coastline
8 Montaineous coast
9 Reef/Atoll
10 Estuary, Rivermouth, Delta
99 Other

Beispiel: SUBSTRATE

1 SOFT COASTLINE
1.1 Muddy
1.1.1 Salt marsh/tidal flat
1.1.2 Marshes
1.1.3 Mangroves
1.1.4 Swamps
1.1.5 Sabkha
1.1.6 Chenier
1.1.7 Veneer
1.1.8 Other muddy
1.2 Clastic sediments
1.2.1 Compact sediment
1.2.1.1 Soft cliff
1.2.1.2 Beachrock
1.2.2 Loose sediment
1.2.2.1 Beach Gravel
1.2.2.2 Beach Sand
1.2.2.3 Mixed sand/gravel
1.2.2.4 Dunes
1.2.2.5 Stones and rocks
1.2.2.6 Dune cliff
1.2.9 Other Clastic
1.2.3 Soft artifical shoreline
2 HARD COASTLINE
2.1 Rocky Cliff
2.1.1 Vertical
2.1.2 Inclined
2.2 Abrasion platforms
2.3 Mountain slope
2.4 Uplifted/fosil platform
2.5 Other hard coast
2.6 Biologic concretions
2.6.1 Coral reef
2.6.2 Bivalves concretions
2.7 Permafrost
3 Artificial shoreline
3.1 Hard
3.2 Soft (nourishment/biotecnic)

Beispiel: DOMINANT MANMADE FEATURES

1 Economically functional structures
 1.1 Water dependent
 1.1 Non water dependent
2 Canalization structures
3 Coastal protection structures
 3.1 Parallel to the shoreline
  3.1.1 Seawall/promenade/steal piling
  3.1.2 Revetment
  3.1.3 Rip rap
  3.1.4 Dike
  3.1.5 Artificial reef/breakwaters
  3.1.6 Road and bridge structures
  3.1.7 Surge Barrier
  99 Other
 3.2 Perpendicular to the shoreline
  3.2.1 Groins
  3.2.1 Jetties
  3.2.1 Drainage
  3.2.1 piers
  3.2.1 Slips
  3.2.1 Road and bridge structures
  99 Other
4 Residential and urban infrastructure
5 Nourished/Artificial beach
6 No artificial structures present
7 Land reclamation structures
99 Other type of artificial structure

Beispiel: NEARSHORE ENVIRONMENT

1 Lagoon
2 Stream mouth
3 Spit
4 Stream
5 Bay/Inlet/Gulf
6 Shoal
7 Longshore bars
8 Tidal flats
9 Mangroves
10 Coral reefs
11 Marshes
12 Rocky platform
13 Continuous slope
steep slope
14 Land reclamation structures
15 Breakwaters
99 Other

Beispiel: PREDOMINANT LAND USE

1 Urban
2 Rural (includes forestry and agriculture)
3 Industrial
4 Transport
5 Scattered settlement (villages)
6 Nature Reserve
Landward natural reserve
Seaward natural reserve
Landward and seaward natural reserve
7 Recreational
8 Military
8 None
99 Other

Beispiel: Ecosystem Service (ESS)

ESS Provisioning

ESS Regulating

ESS Cultural

1 low
2 medium
3 high
4 very high
9 none

ESS Auswahl und Ergänzung

Provisioning Services

P1: Food; products derived from plants, animals and microbes

P2: Fiber; wood, jute, cotton, hemp, silk, and wool, materials serve as sources of energy

P3: Genetic resources; genes and genetic information used for animal and plant breeding and biotechnology, bio-chemicals, natural medicines, and pharmaceuticals

P4: Mineral resources (Sand, gravel, stones etc.), Wave- and/or Thermo energy

Regulating Services

R1: Climate regulation; climate both locally and globally

R2: Water regulation; timing and magnitude of runoff, flooding, and aquifer recharge

R3: Erosion regulation; Vegetative cover plays an important role in soil retention and the prevention of landslides

R4: Water purification and waste treatment; source of impurities but also can help filter out and decompose organic wastes

R5: Natural hazard; such as mangroves and coral reefs can reduce the damage caused by hurricanes or large waves, longshore bars, active cliffs, Erosions-platform (tilt ridge), pebble, stones (on beach and foreshore), beach ridge, spit, beach wrack etc.

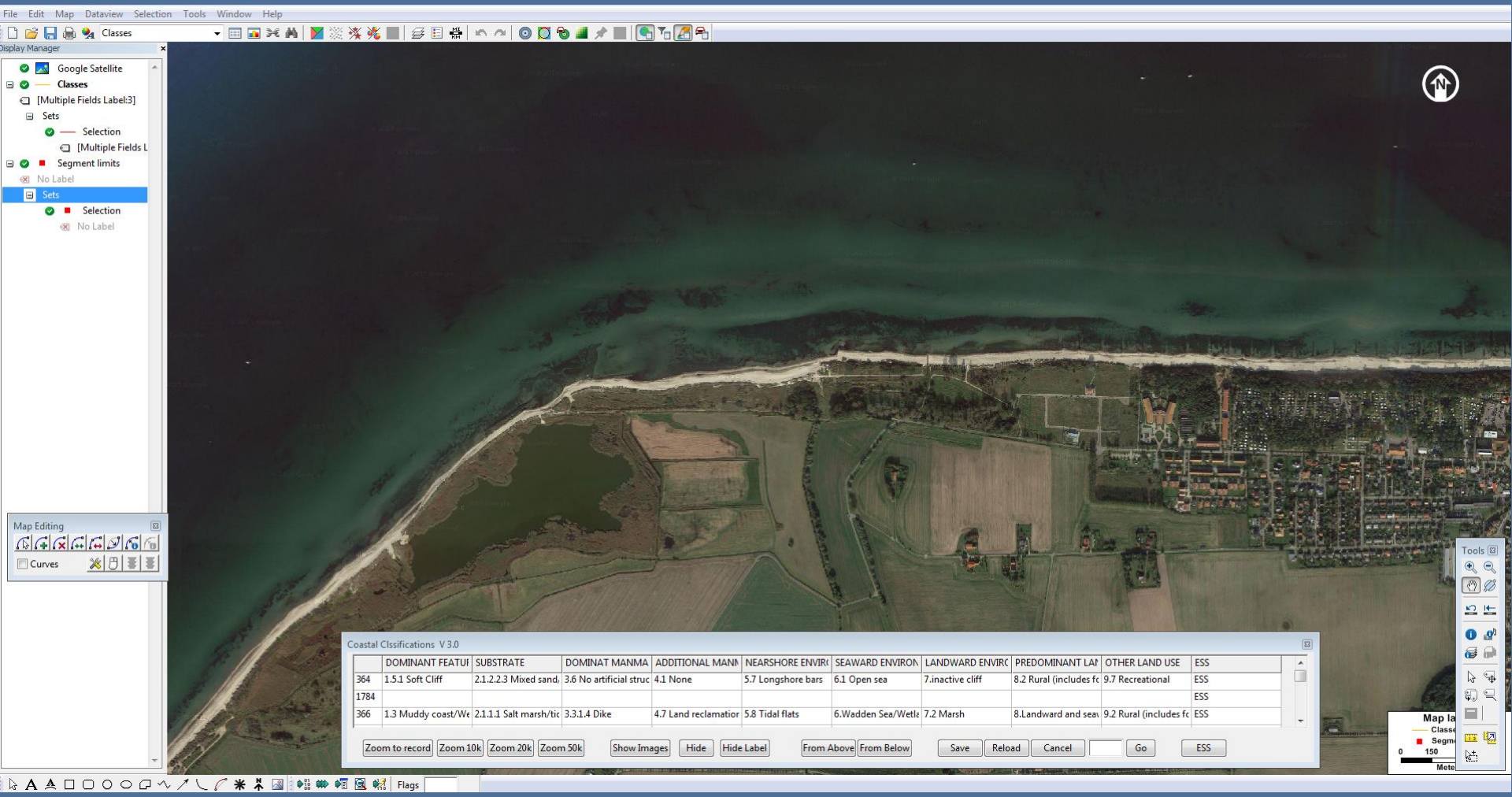
Cultural Services

C1: Aesthetic values; beauty or aesthetic value in various aspects of ecosystems

C2: Cultural heritage values; Many societies place high value on the maintenance of either historically important landscapes (“cultural landscapes”) or culturally significant species

C3: Recreation and ecotourism; spend leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area (bathing, diving, angling, sailing etc.)

Startmaske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1.5.1 Soft Cliff
2.1.2.2.3 Mixed sand,
3.6 No artificial struc
4.1 None
5.7 Longshore bars
6.1 Open sea
7.inactive cliff
8.2 Rural (includes fc
9.7 Recreational
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1.3 Muddy coast/We
2.1.1.1 Salt marsh/tic
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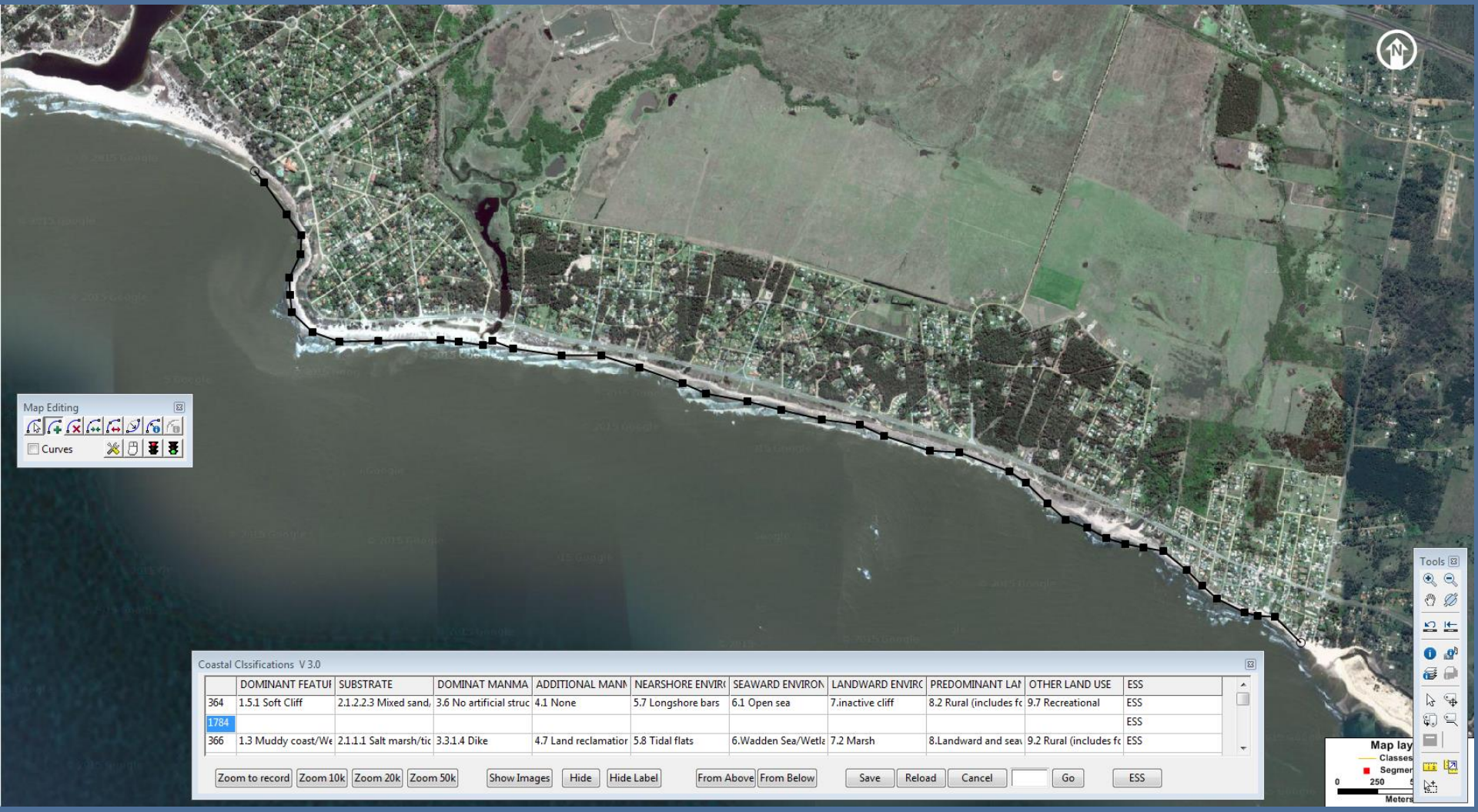
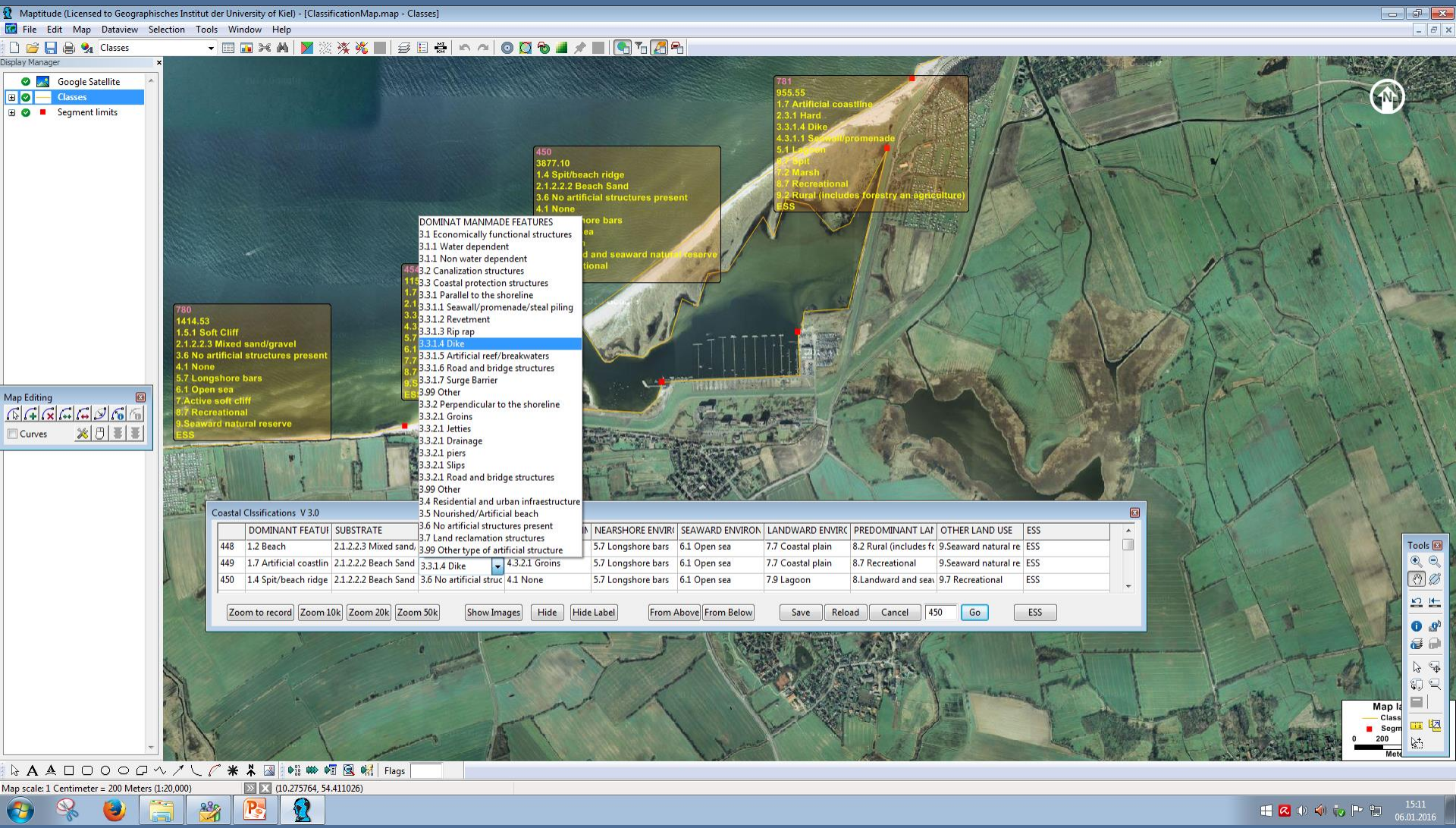
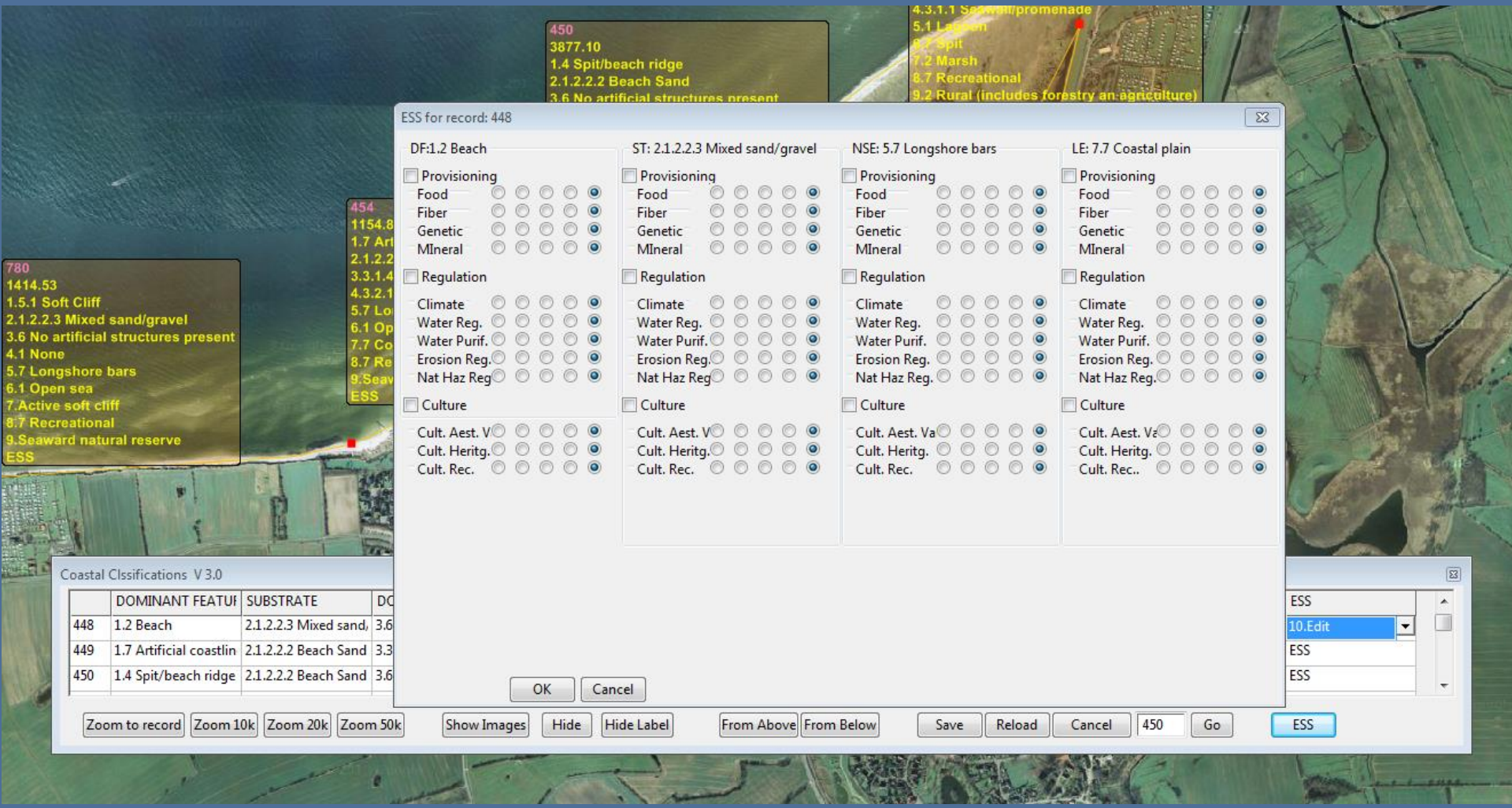
Schritt eins: Segmentierung



Schritt zwei: Klassifizierung



Schritt drei: Ermittlung der ESS



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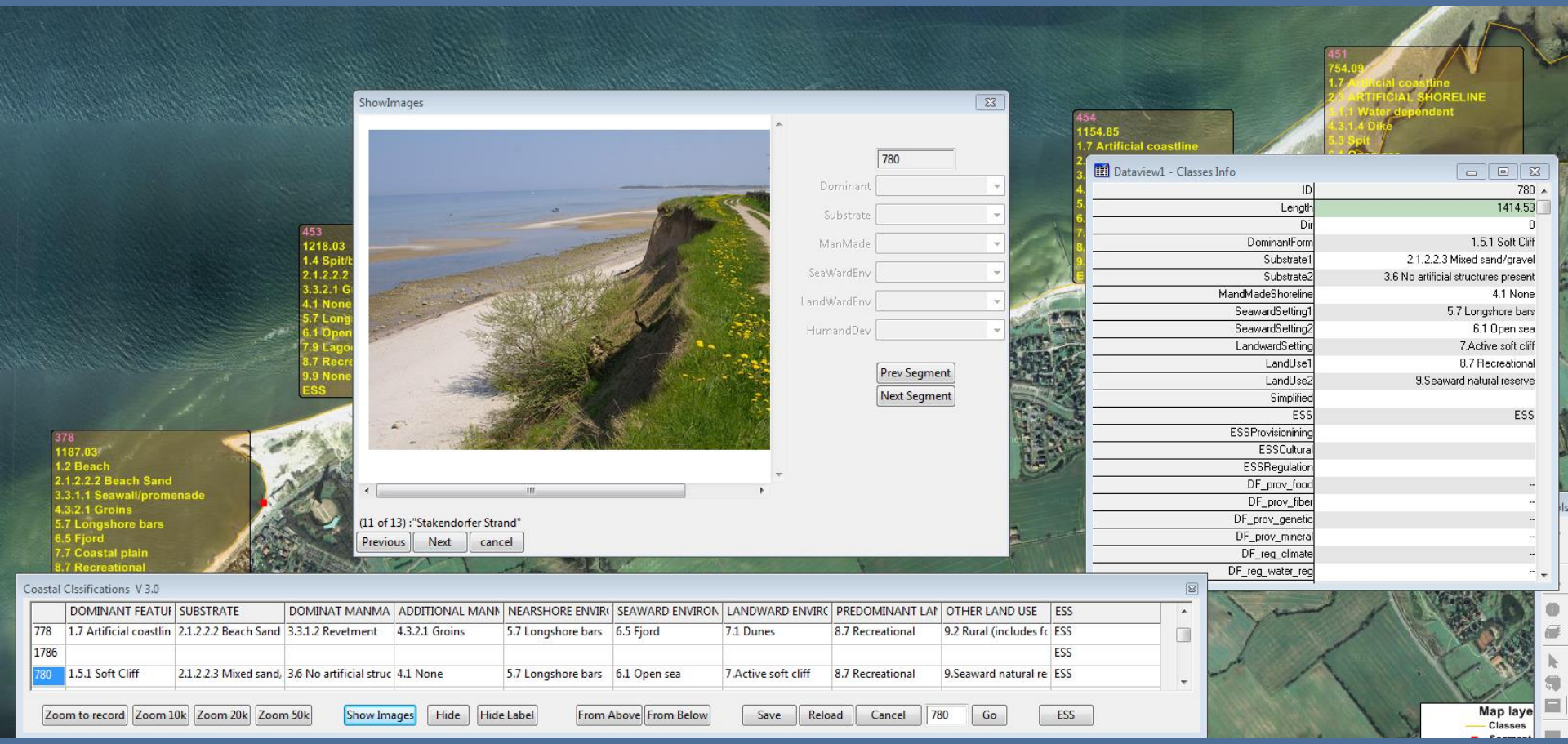
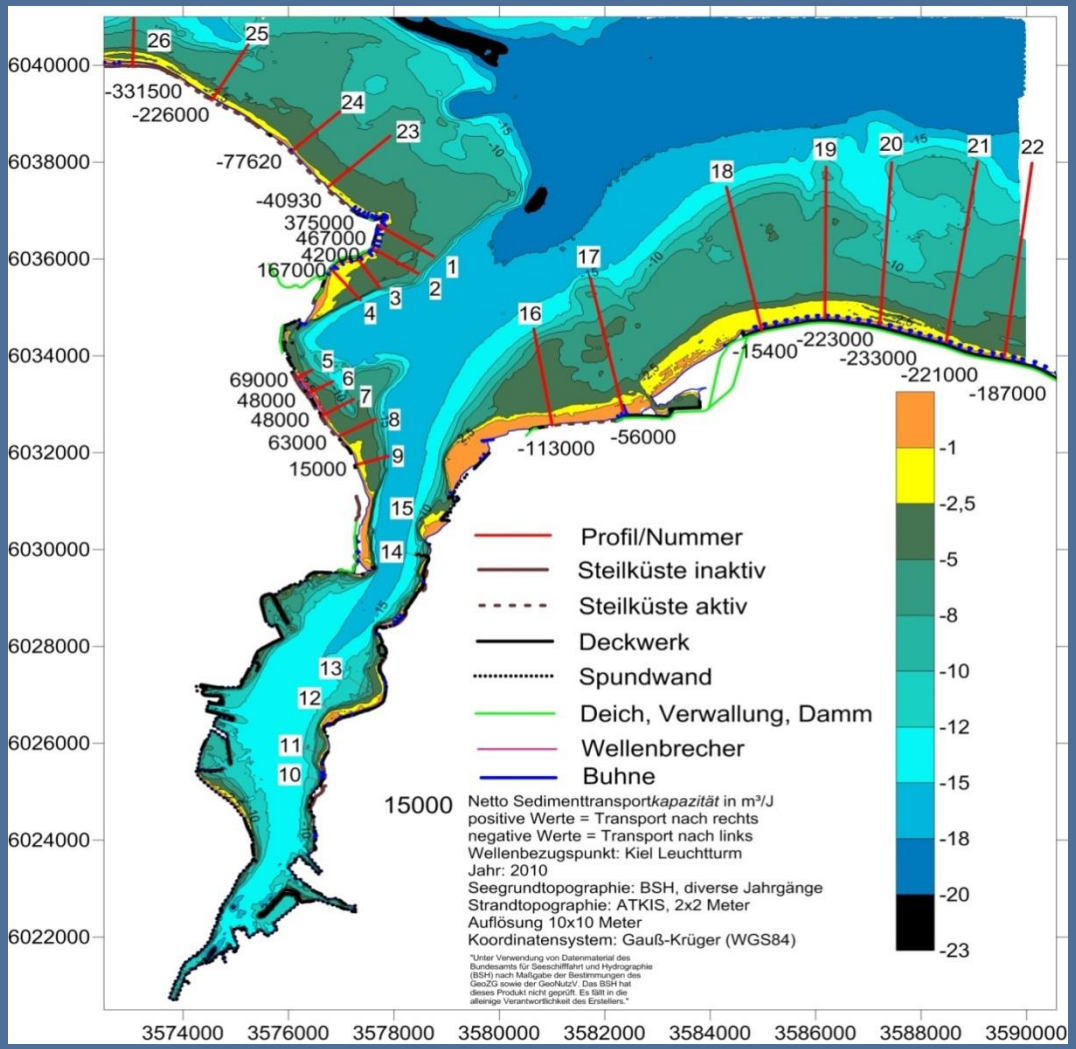


Weitere Schritte:

- Clusterung der Segmente im Ist-Zustand
- Szenarien über die Auswirkungen der Klimaänderungen im Jahre 2050 und 2100
- Szenarien für Landnutzung im Jahre 2050 und 2100 (demograph. Entwicklung)
- Abschätzung der ESS im Jahre 2050 und 2100 basierend auf den Szenarien
- Clusterung der Segmente für die Jahre 2050 und 2100
- Erstellung eines Vulnerabilitätsindex
- Ableitung von Managementplänen, Prioritätenliste
- (Erweiterung um Ergebnisse aus HN-Modellierungen, Sedimenttransport, Sedimentverfügbarkeit an sandigen Küsten etc.)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-15400
-223000
-233000
-221000
-187000
Profil/Nummer
Steilküste inaktiv
Steilküste aktiv
Deckwerk
Spundwand
Deich, Verwallung, Damm
Wellenbrecher
Buhne
15000
Netto Sedimenttransport*kapazität* in m³/J
positive Werte = Transport nach rechts
negative Werte = Transport nach links
Wellenbezugspunkt: Kiel Leuchtturm
Jahr: 2010
Seegrundtopographie: BSH, diverse Jahrgänge
Strandtopographie: ATKIS, 2x2 Meter
Auflösung 10x10 Meter
Koordinatensystem: Gauß-Krüger (WGS84)
-1
-2,5
-5
-8
-10
-12
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Ich danke für Ihre Aufmerksamkeit