AN EXPERT GIS SYSTEM TO EVALUATE NATURAL CONDITIONS AND AUTOMATICALY SELECT LOCATIONS THAT MEET SELECTION CRITERIAS.

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This paper presents a ready to use GIS environment, that manipulates various sources of digitized input data, to locate field points or boundaries that match the given criteria. As a case study we selected the island of Zante, to demonstrate the use of this system.

Input data depend on the selection problem we attempt to answer. Our paper deals with the automatic selection of a waste desposal area, depending of certain criteria that rule this kind of selections. The data layers that were used for this example, were geology and lithology, average % slope, drainage system structure, main towns, touristic places, airport, beaches, faults, touristic places, karstic forms, springs, wells, floods, etc.

The already known selection criteria, were applied on the above GIS database, to isolate the areas of the island that are suitable to establish a waste desposal unit.

The results were expressed through thematic maps. Other similar selections can be applied by altering the initial database and the selection criteria, to answer other problems like the foundation of a large touristic hotel unit.

The aim of this study, is to apply an automated methodology of selecting specific parts of a territory, applying certain criteria as selection or restriction rules. In our study we pilotically used the island of Zakynthos, and in order to apply the selection/restriction process, we used the rules of the following table, to locate suitable waste disposal areas.

• 3.000 m from airports
• 300m from Primary Roads
• 400m from surface water
• Not on Limestones
• 400m from wells
• 300m from touristic areas
• Not on possible flood areas
• At areas with slope <20%
• 60m from active faults

The first layer we digitized was the base layer of lithology. Zante is consisted of four lithological units: 1)Allouvial Cones, 2)Allouvials, 3)Marls/Sandstones, 4)Marly Limestones / Limestones. Different colors were used to visualise the units on the map.

On top of that layer, we digitized all the relevant geomorphological information, such as springs (medicinal, mineral, normal, salty), wells, surface water areas, closed karstic forms, etc. Flood events were also imported to our study.

Tectonic elements of the island, mainly faults were also included to the digitization. Concerning faults, we had to make a distinction of active and not active faults, as waste disposal areas must be at least 60 meters away from active faults.

The average % slope of the island's refief, was also created in a grid form. The grid's cells, were updated with the % slope, using the mathematical type :

$$P = 100 * \frac{\Sigma L * i}{E} \qquad \text{(equation A)}$$

,where ΣL is the summit of each contour's length included into the cell,
i is the contour interval,
E is the area included into the cell.

Finally, we digitized the main cities and villages of the island, the airport, the touristic atractions, and the famous beaches. The map of figure 1, shows all the information layers that were digitized for the selection of the waste disposal areas.

Once we have all the information into the GIS (in separate tables), we create a new field in each table, next to the description field, to hold the minimum distance of the selected area from this map object.

After updating all the tables with the new field, we copied all the objects into one table. The new table, holds the fields of description and distance. The whole process is then using the buffer algorithm to create buffer zones of given radious, around each object. The radious of each buffer is retrieved from the distance field. The result map, has the initial objects, plus the new buffer objects around the initial ones. All these objects represent the areas that must be excluded from the island. At figure 2, we can see a map of all the excluded areas, with different colors and shapes, depending on their initial parameters. The legend of the map, indicates the meaning of each color.

Inverting the excluded area's boundaries, we get the selected areas, suitable for the positioning of the waste disposal area. The map representing this result is shown in figure 3. This map shows all the initial information layers as previously explained at map 1, and the selected areas superimosed to the other layers. In this way, we can understand better, how the selection criterias were applied and why we have theese results.

The 3-D map of figure 4, is demonstrating the selected areas, over the 3-D model of the island. At this 3-D model, we have the sea level 'blue', and the seashore area 'cyan'. Viewing heigher areas, the colors are starting from 'yellow' and turning to 'red' colors.

This kind of study intents to demonstrate the use of automated GIS-based methodologies to solve area selection or exclusion problems, like the one with the selection of all the possible

waste disposal area. More initial parameters could have been used, in order to obtain more preceice results, but the method would still be simple, fast and accurate.

References:

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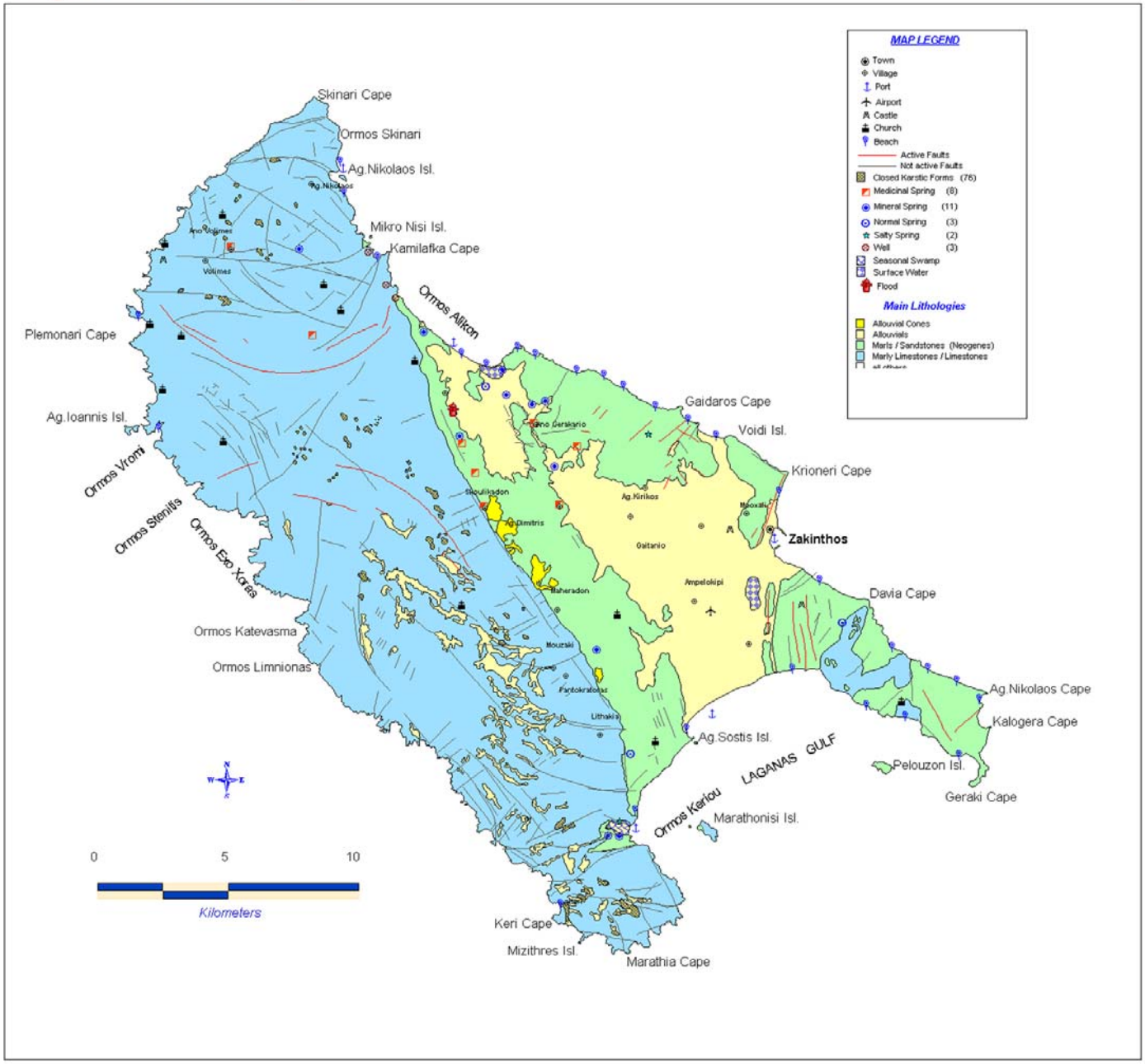
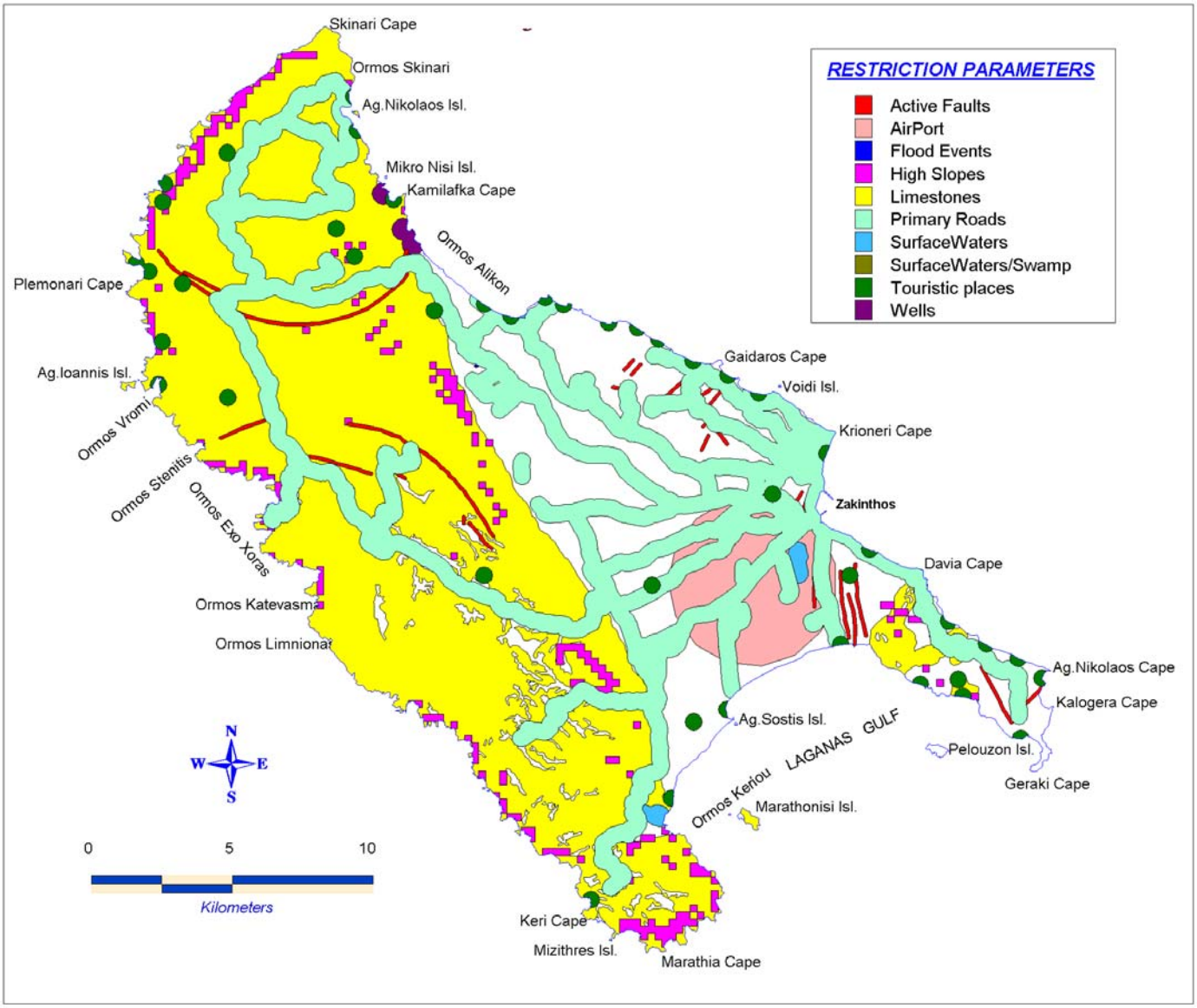
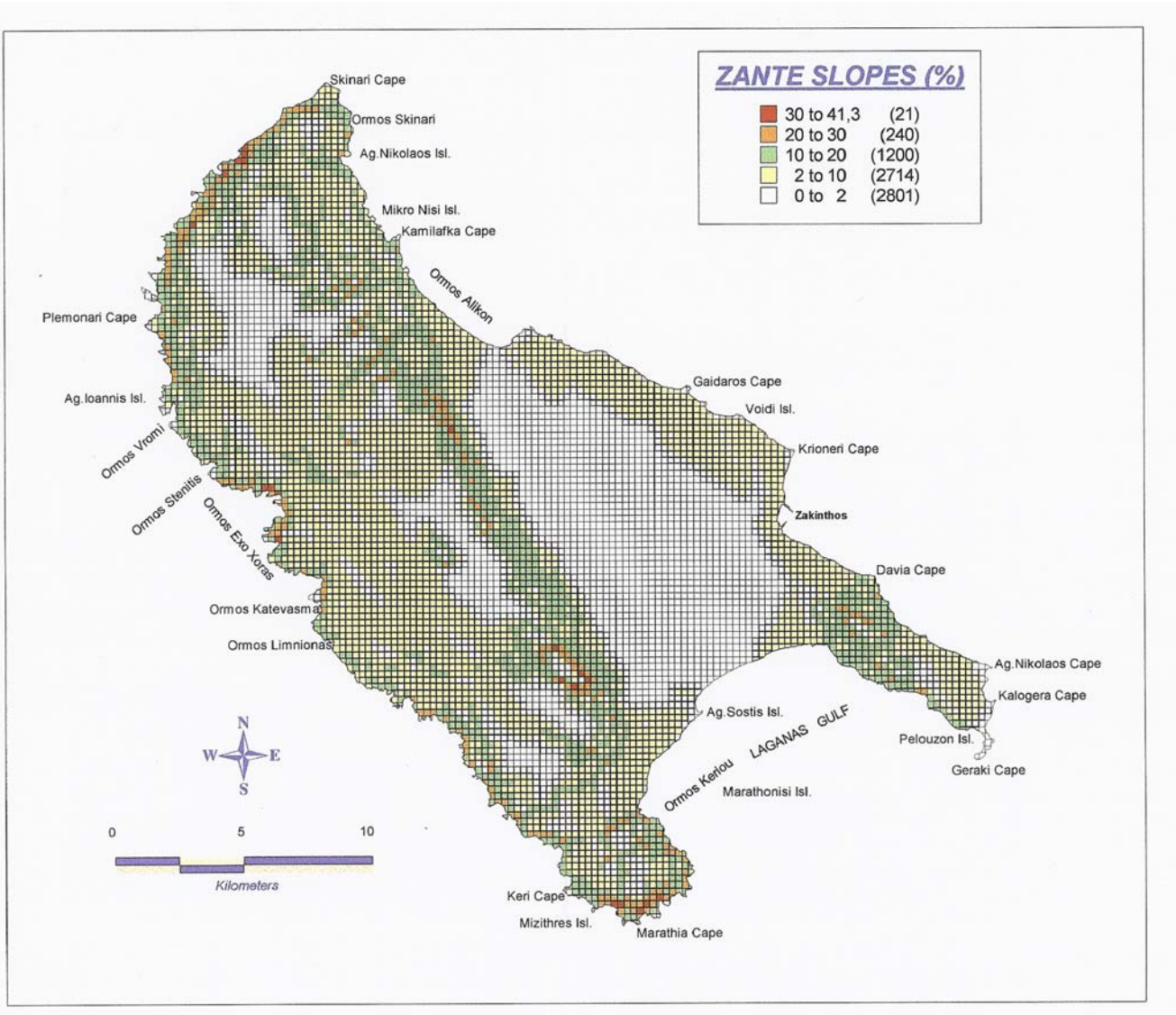
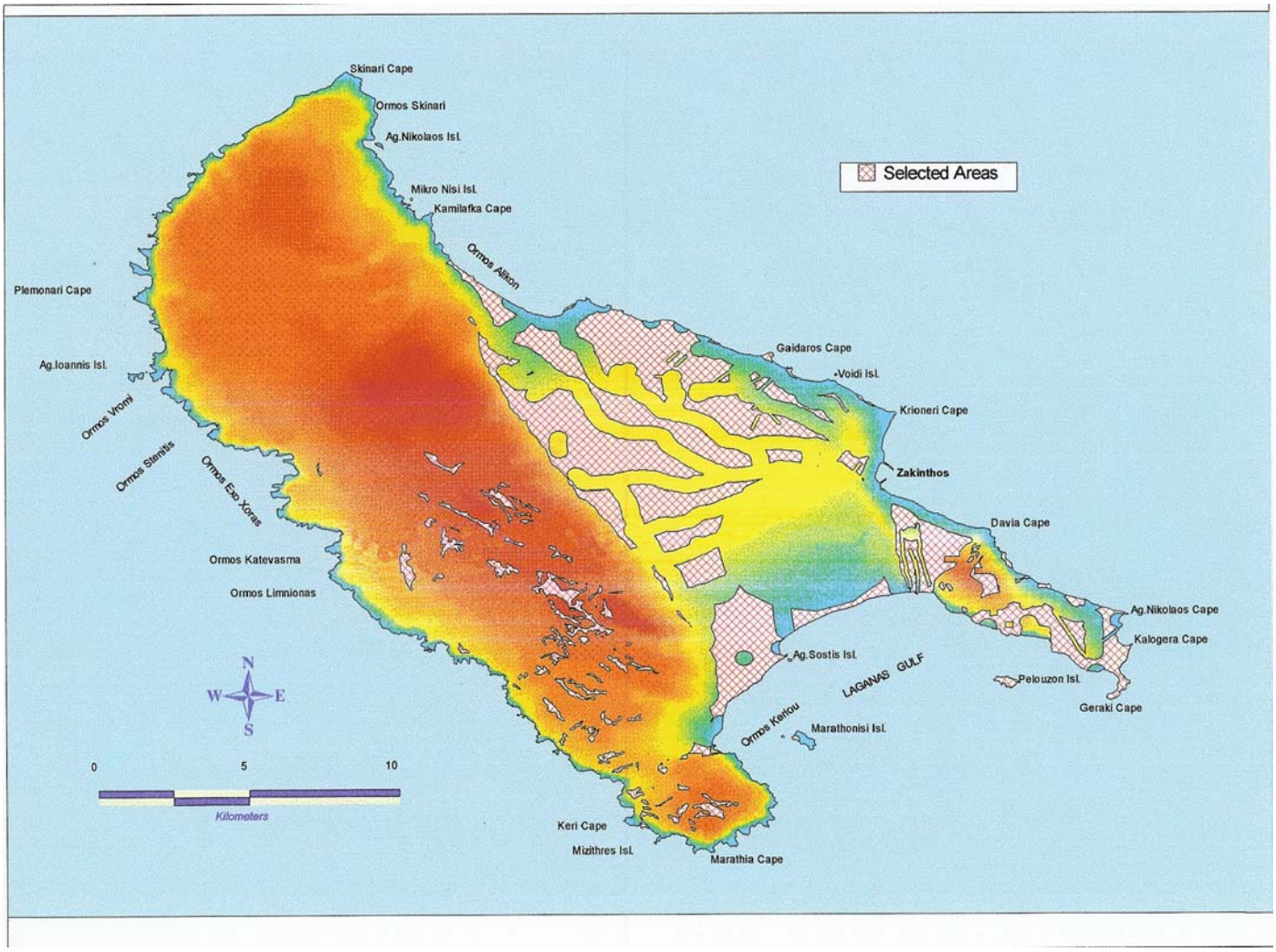
Input Data Map



The map bellow, indicates the excluded areas, and the reason for each exclusion.




ZANTE SLOPES (%)
30 to 41,3 (21)
20 to 30 (240)
10 to 20 (1200)
2 to 10 (2714)
0 to 2 (2801)
Skinari Cape
Ormos Skinari
Ag.Nikolaos Isl.
Mikro Nisi Isl.
Kamilafka Cape
Ormos Alikon
Plemonari Cape
Ag.Ioannis Isl.
Ormos Vromi
Ormos Stenitis
Ormos Exo Xoras
Ormos Katevasma
Ormos Limnionas
Gaidaros Cape
Voidi Isl.
Krioneri Cape
Zakinthos
Davia Cape
Ag.Nikolaos Cape
Kalogera Cape
Ag.Sostis Isl.
LAGANAS GULF
Pelouzon Isl.
Geraki Cape
Ormos Keriou
Marathonisi Isl.
Keri Cape
Mizithres Isl.
Marathia Cape
N
W
E
S
0
5
10
Kilometers


Selected Areas
Skinari Cape
Ormos Skinari
Ag.Nikolaos Isl.
Mikro Nisi Isl.
Kamilafka Cape
Ormos Alikon
Plemonari Cape
Ag.Ioannis Isl.
Ormos Vromi
Ormos Stenitis
Ormos Exo Xoras
Ormos Katevasma
Ormos Limnionas
Gaidaros Cape
Voidi Isl.
Krioneri Cape
Zakinthos
Davia Cape
Ag.Nikolaos Cape
Kalogera Cape
Ag.Sostis Isl.
LAGANAS GULF
Pelouzon Isl.
Geraki Cape
Ormos Kerkou
Marathonisi Isl.
Keri Cape
Mizithres Isl.
Marathia Cape
N
W
E
S
0
5
10
Kilometers