

# GIS AS A MEANS TO IDENTIFY THE ENVIRONMENTAL CONDITIONS OF WILD BOAR DIURNAL RESTING PLACES

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**Abstract:** A sample of 1529 resting places of Wild boar, recorded in four areas in southern France, was analysed as regards habitat selection. Two areas were heavily forested and showed a medium or high density of Wild boar. The landscape in the two other areas was composed of cultivated fields with small scattered woods. Each resting place, located by radio-tracking, was assigned a one-hectare cell. A Geographic Information System was set up to include descriptive information on each cell in the study areas (5,000 to 19,000 hectares each). Selection of habitat by resting wild boars was analysed by comparing the frequency of selected habitats with their frequency in the corresponding study area. There is an overall preference for the most secure habitat class (wood with dense low stratum). Results also show that the selection is broader in the open landscape than in the forested landscape. In the open landscape the preference is extended to "incomplete" mixtures of the two strata.

**Keywords:** Wild boar, *Sus scrofa*, Suidae, Artiodactyla, GIS, habitat, landscape, resting place.

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## 1. Introduction

Geographic Information Systems (GIS) are particular databases where information is stored by reference to geographic objects defined in a rectangular coordinate system. Geographic objects may be assemblages of vectors like points, lines, or polygons (giving a vector GIS) or assemblages of square cells (giving a raster GIS). Geographic Information Systems are very useful to deal with ecological data collected in natural conditions.

Wild boar spend half of their daily time-budget at a resting place (Mauget, 1980; Cousse & Janeau, 1992). This site is of particular importance for them and we expect that the habitat used for resting places will be carefully selected. Security, quietness and comfort are important (Dardaillon, 1986). Despite the fact that the study of resting places is relatively easy, few publications deal with this subject (Janeau & Spitz, 1984; Cousse *et al.*, in press).

To study the selection of habitats by wild boars for their resting places, we used radio-tracking locations obtained in 4 study areas in the south of France.

## 2. Study areas

Two of the study areas were predominantly forested: Caroux (19,000 hectares) and Cabardes (13,000 hectares) located at about 43° 20' N and 2° 00' E are mountainous areas (elevation 200 m to 1,200 m) extending from

mediterranean to deciduous forest climate, more than 50% composed of broad-leaf forest, conifer plantation and shrubland, the remaining part including areas of pasture, clearing and cultivated valleys.

The two other sites were predominantly open environments: Camargue (9,000 hectares, 43° 30' N and 4° 30' E) and Lauragais (5,000 hectares, 43° 30' N and 1° 20' E) are low elevation, open landscape areas. Camargue is a low-lying area along the Mediterranean sea, covered in approximately equal proportions of agricultural land and marshes with a few small scattered woods and shrubland. Lauragais is an extensive hilly agricultural region with very small areas of woodland or copse.

## 3. Material and methods

In each study area, resting places of several radio-collared individuals were located daily, as far as possible at different times of the year. Locations were assigned to 100 m x 100 m cells (one hectare). It means that the study did not account for the proximate environment of the resting place but only the general environment within a cell.

The GIS was built from classified SPOT images (Joachim *et al.*, 1992). To fit with the Wild boar data (one-hectare cells), original 20 x 20 m pixels from SPOT were aggregated into 100 x 100 m squares. The habitat type within each square was defined by a hierarchical selection

system (see below) using ERDAS software. Original image pixels were classified according to the vegetation cover, considering its consequences for security and quietness. Two simple parameters were considered: does the original pixel contain trees? Does the pixel contain dense woody plant cover between 0 and 2 m above ground? Then we considered three aggregation processes giving three differing classifications of the one-hectare cells:

- Classification 1 is made according to the vegetation type covering the largest relative area (*i.e.* the relative majority in number of pixels among 25 in the cell). This provides 4 majority types: (i) not wooded without predominant dense vegetation; (ii) not wooded with predominant dense vegetation; (iii) wooded without predominant dense vegetation; (iv) wooded with predominant dense vegetation.

- Classification 2 is made with respect to the simple presence of tree cover in non-wooded cells. The presence of at least one pixel containing trees classifies the cell as "with tree". Otherwise, the hectare is classified as "no tree at all".

- Classification 3 is made with respect to the simple presence of dense vegetation. It was applied to cells without predominant dense vegetation. As for classification 2, cells with at least one pixel with dense vegetation were classified as "with some dense vegetation". Otherwise they were classified as "no dense vegetation at all".

When combining the 3 classifications, each one-hectare cell falls into one of 9 classes (Fig. 1).

The observed distribution of resting places among the habitat classes was compared with the expected distribution, *i.e.* the frequencies of habitats in the study area, using a Kolmogorov-Smirnov's test. For each study area, each class (or group of classes, see hereafter) of habitat was identified as avoided, neutral or selected.

#### 4. Results

The upper part of table 1 shows the observed and expected distribution for each class; the list of classes is arranged by rank of density of cover. In all samples the distributions in the "study site" and the "resting places" samples are significantly different (Tab. 1, bottom part). Table 2 gives the classification of habitats in the three categories "avoided", "neutral" or "selected". For each study site, two or several successive classes were cumulated when they showed similar differences between observed and expected frequencies (intercalated classes with insignificant number of observations were associated in the sequences). In all samples, class 9 (majority of wood with dense vegetation) was selected but in Lauragais the selected habitat was the sequence 5-7-9. In open landscapes (Camargue, Lauragais) class 4 (completely open) was avoided and the intermediate classes were neutral. In Caroux, the sequence of classes 8-6-5-7 (moderately dense) was avoided, whereas predominantly open classes (4-2-3-1) were neutral. In Cabardès, the only neutral class was class 1, whereas 4-2-3 and 8-6-5-7 were avoided.

Table 1: Comparison of expected and observed distributions of habitat classes (classes are arranged by rank of density of cover).

Class number	Lauragais		Camargue		Caroux		Cabardès 90		Cabardès 91	
	expect.	obs.	expect.	obs.	expect.	obs.	expect.	obs.	expect.	obs.
4	48	5	132	16	9	9	15	2	12	10
2	2	2	16	22	4	12	8	0	7	3
3	32	7	—	—	1	1	5	0	5	8
1	36	52	59	59	13	14	35	36	30	47
8	<1	0	—	—	15	2	3	0	3	0
6	<1	0	—	—	5	1	9	0	7	0
5	2	14	34	38	7	4	64	5	55	5
7	<1	1	31	32	18	1	17	7	15	11
9	11	51	16	121	27	55	212	317	183	232
D max	0.5152		0.4028		0.2828		0.2877		0.1569	
Critical value 1%	0.2068		0.1400		0.2388		0.1239		0.1335	

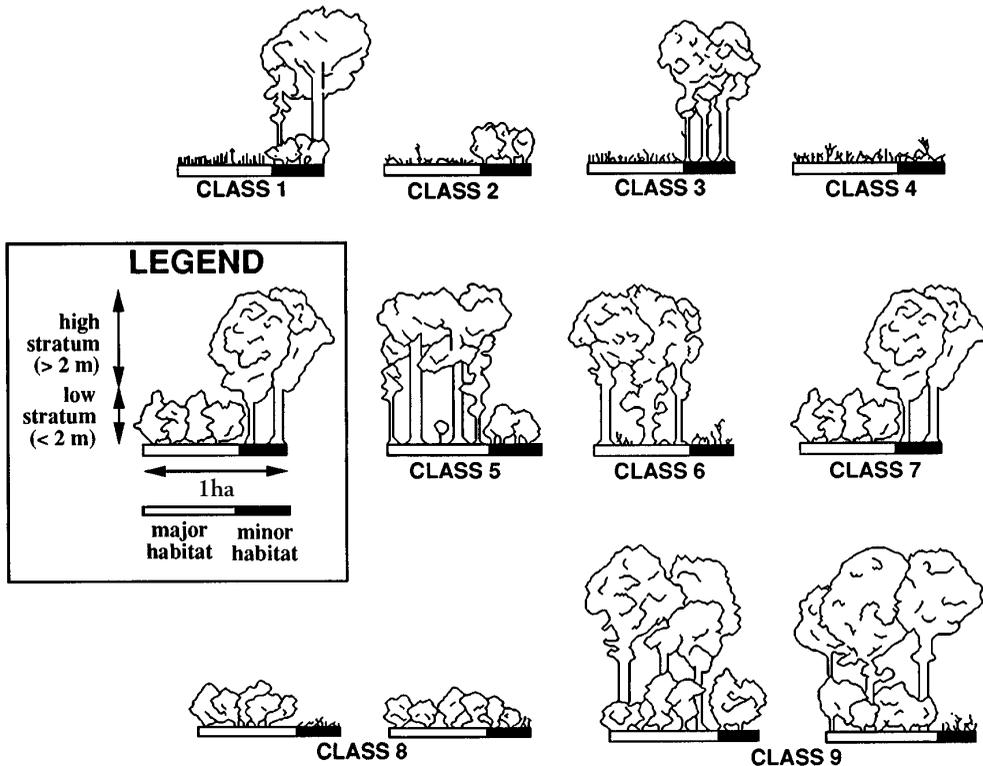


Figure 1 - Schematic description of the nine classes of habitat.

Table 2: Selection of habitat classes by resting wild boars. For explanation of the cumulation of classes, see text.

Study areas	Avoided	Neutral	Selected
Lauragais	(2+3+4)	(1+6+8)	(5+7+9)
Camargue	4	(1+2+5+7)	9
Caroux	(5+6+7+8)	(1+2+3+4)	9
Cabardes 90	(2+3+4),(5+6+7+8)	1	9
Cabardes 91	(5+6+7+8)	(1+2+3+4)	9

## 5. Discussion and conclusion

In all landscapes, Wild boar resting places were preferentially located in environments with a majority of woods with dense vegetation. In Lauragais, *i.e.* the most open and agricultural landscape, Wild boar also selected a mixture of woods without dense vegetation and tree-less bush patches. In open landscapes, avoidance is restricted to predominantly open cells, except when a minority of wood with dense vegetation is present. In forested landscapes, it is remarkable that a part of the predominantly open classes are neutral. These results are in agreement with the hypothesis that selection is

broader in areas where the selected habitats are scarce, and narrower in areas where the selected habitats are predominant and distributed in very large patches. Neutrality of some the predominantly open habitats in the forested landscapes is puzzling. An explanation would be that in these areas large patches of natural low vegetation (heathland or similar) are secure enough to not be avoided by resting wild boars. Selection rules established can be extrapolated to larger areas, and using the GIS vegetation maps issued from it, zones potentially favoured by wild boars for their resting places can be identified.

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