

DEFINITION OF DPLAS AND SPLAS

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Point of departure

The definition of minimum density criteria for densely populated livestock areas (DPLAs) and maximum density criteria for sparsely populated livestock areas (SPLAs) will be made on the basis of animal numbers only. Further research should indicate whether other factors (e.g. farm density, proportion of self-supporting farmers within an area) are also important in determining the riskiness of DPLAs and SPLAs for contagious animal diseases. In a later stage all important factors will be combined into a so-called risk index, and animal density will surely be one of them.

The density calculations are performed on community level, because this is the smallest level for which statistics on animal numbers are available in the European Union (EU). Total land area is used for the density calculations and not agricultural land only. The rationale behind using total land is, that – at least for definition purposes – we are only interested in pure animal densities. Adding farm density to these animal density calculations should make clear whether the animals are concentrated on a few farms or spread throughout the area.

In defining density criteria for the definition of DPLAs and SPLAs, a distinction will be made between classical swine fever (CSF) and foot-and-mouth disease (FMD). The domestic animals susceptible to FMD are cattle, pigs, sheep and goats. Therefore the densities of all four species should be taken into account when defining DPLAs and SPLAs for FMD. For CSF, on the contrary, only pigs are susceptible and only pigs can carry the virus and transmit the virus to other susceptible animals in an area. Therefore only pig densities will be used for defining DPLAs and SPLAs for CSF.

Materials

Animal density data were available for five member states of the EU: Germany, Belgium, the Netherlands, France and Italy. Although the availability of data differed between the countries, they were considered the best that could be obtained after a one and a half year search. For the Netherlands data were available from 1997 on the community level. For France data were available from 1988 on the canton level.

Because the area size of cantons in France is comparable to the area size of communities in the other countries, the data on canton level were used in the analysis. For Italy data were available from 1990 on the community level. For Belgium data were available from 1996 on the community level. A conversion was used to calculate the number of piglets in Belgium, since in the official statistics only places for sows and fattening pigs are counted. For Germany data were available from 1996 on community level. However, data were lacking for four out of the five Bundesländer in the Eastern part of Germany. Besides, for many communities in Germany the data on animal numbers were closed due to privacy reasons. If three or less farms have more than 40% of the total number of animals of a certain animal type the data are not available. Data for goat numbers are not available for German communities. In Germany goats are not counted for the official statistics, because there are not many goats.

Methodology and results

A table has been made in which the following density classes were distinguished: 0 pigs/km², 1-50 pigs/km², 51-100 pigs/km², 101-150 pigs/km², 151-200 pigs/km², etc. For each density class the number of communities belonging to it, the cumulative number of communities, the percentage of the total number of communities in this density class and the cumulative percentage were calculated and presented. This table is presented in table 1. On the basis of this table it became clear that the majority of communities had a density of 0-50 pigs/km² (78%) and that only a small share of the communities had more than 250 pigs/km² (6%) This can also be clearly seen in figure 1, in which the percentage of communities in each density class is presented per country.

A similar table has been made for density classes of 0 animals/km^{2*}, 1-50 animals/km², 51-100 animals/km², 101-150 animals/km², 151-200 animals/km², etc. This table is presented in table 2. On the basis of this table it was clear that the majority of the communities had a density of 0-150 animals/km² (78%) and that again only a small share of the communities had more than 250 animals/km² (12%). In figure 2 the percentage of communities in each density class is presented per country.

On the basis of these tables it was concluded that no clear cut off points exist between SPLAs and DPLAs in the sense that communities are either very sparsely populated or very densely and that there are hardly any communities with in-between-densities. Because DPLAs can be considered as being more densely populated than usual, it was decided that only some five percent of the communities should be classified as a DPLA on the basis of the density criteria set. Therefore the 0.95 percentile was used to set the minimum pig density (CSF) and minimum animal density (FMD) for DPLAs. It was assumed that for the EU it would be acceptable that some five to ten percent of the total land area classifies as DPLA. This would also justify special legislation for such areas. If, for instance, almost forty or fifty percent of the land area would classify as a DPLA, it would be more logical that the legislation for the entire EU would be adapted to DPLA-conditions. Based on the 0.95 percentiles, the

* Throughout the document the density of domestic animals susceptible for FMD (cattle, pigs, sheep and goats) is meant by 'animals/km²'.

minimum density for an area to classify as a DPLA was set at 301 pigs/km² for CSF and 451 animals/km² for FMD.

Table 1. The numbers of communities and their percentages per pig density class.

density class	number of communities	cumulative number of communities	percentage of total number of communities	cumulative percentage
0	2877	2877	14.48	14.48
1-50	12705	15582	63.92	78.40
51-100	1507	17089	7.58	85.98
101-150	769	17858	3.87	89.85
151-200	445	18303	2.24	92.09
201-250	296	18599	1.49	93.58
251-300	243	18842	1.22	94.80
301-350	160	19002	0.81	95.61
351-400	131	19133	0.66	96.27
401-450	97	19230	0.49	96.75
451-500	81	19311	0.41	97.16
501-550	78	19389	0.39	97.55
551-600	65	19454	0.33	97.88
601-650	52	19506	0.26	98.14
651-700	37	19543	0.19	98.33
701-750	31	19574	0.16	98.49
751-800	25	19599	0.13	98.61
801-850	23	19622	0.12	98.73
851-900	25	19647	0.13	98.85
901-950	25	19672	0.13	98.98
951-1000	20	19692	0.10	99.08
1001-6000	183	19875	0.92	100.00

Table 2. The numbers of communities and their percentages per animal density class.

density class	number of communities	cumulative number of communities	percentage of total number of communities	cumulative percentage
0	977	977	5.35	5.35
1-50	7338	8315	40.21	45.56
51-100	3834	12149	21.01	66.57
101-150	2069	14218	11.34	77.91
151-200	1106	15324	6.06	83.97
201-250	757	16081	4.15	88.12
251-300	494	16575	2.71	90.82
301-350	315	16890	1.73	92.55
351-400	238	17128	1.30	93.85
401-450	172	17300	0.94	94.79
451-500	140	17440	0.77	95.56
501-550	112	17552	0.61	96.18
551-600	86	17638	0.47	96.65
601-650	68	17706	0.37	97.02
651-700	69	17775	0.38	97.40
701-750	69	17844	0.38	97.78
751-800	39	17883	0.21	97.99
801-850	27	17910	0.15	98.14
851-900	25	17935	0.14	98.27
901-950	25	17960	0.14	98.41
951-1000	16	17976	0.09	98.50
1001-6000	274	18250	1.50	100.00

With regard to the SPLAs it was tried to use a similar approach: only a small percentage of the communities should classify as an SPLA on the basis of density criteria set. From table 1 it can be seen, however, that almost 15% of all communities had a density of (almost) 0 pigs/km². A density of 0 pigs/km² was considered too low for an SPLA, since in the project SPLAs will be compared with DPLAs for their risk on disease introduction and spread. And for a contagious animal disease to spread, there should at least be some animals in the area. The percentage of communities with a density of 0-50 pigs/km² is already 78%. Therefore the maximum pig density for an SPLA (CSF) was set at 50 pigs/km². In order to use similar criteria for the definition of SPLAs for FMD and CSF, the maximum animal density for an SPLA for FMD was also set at such a level that 78% of the communities belonged to the SPLA category. Therefore the maximum animal density for an SPLA (FMD) was set at 150 animals/km² (table 2). In table 3 the density criteria for DPLAs and SPLAs for FMD (animals) and CSF (pigs) are presented.

The density criteria for DPLAs and SPLAs are thus based on the percentage of communities that adhere to these criteria and not on the basis of the percentage of total land area that adheres to the criteria. Since the communities in the EU differ largely in size (total land area in km²), the total land area of the communities that classified as DPLAs and SPLAs was calculated, as well as its percentage of the total land area of all communities. It appeared that the land area occupied by DPLAs and SPLAs as a percentage of total land area was very similar to the number of communities classified as DPLAs and SPLAs as a percentage of the total number of communities (table 3).

Table 3. Communities classifying as DPLA and SPLA as a percentage of the total number of communities and as a percentage of the total land area covered by all communities.

		percentage of communities	percentage of total land area
CSF	DPLA (> 300 pigs/km ²)	5.20	4.41
	SPLA (0-50 pigs/km ²)	78.40	81.71
FMD	DPLA (> 450 animals/km ²)	5.21	4.19
	SPLA (0-150 animals/km ²)	77.91	79.46

The minimum density criterion for a DPLA for FMD (more than 450 animals/km²) can be considered as being quite high, because FMD is known to spread very rapidly, also when densities are less high. Nevertheless, the minimum density criterion was set at the level of 450 animals/km², because the task was to decide which areas are really densely populated from the point of view of animal numbers only. It might appear during further analyses in the project that SPLAs are as risky as DPLAs with regard to the introduction and spread of FMD virus. If an area, however, classifies as a DPLA for CSF, having more than 300 pigs/km², it should be considered a DPLA for FMD as well, since FMD is more contagious than CSF and pigs are considered to be the most dangerous species in spreading FMD, especially by airborne transmission.. In table 4 the density criteria for DPLAs and SPLAs for FMD (animals) and CSF (pigs) are presented.

Table 4. Density criteria for DPLAs and SPLAs for FMD (animals) and CSF (pigs).

	CSF	FMD
DPLA	> 300 pigs/km ²	> 300 pigs/km ² OR ≤ 300 pigs/km ² , but > 450 animals/km ²
SPLA	0-50 pigs/km ²	0-150 animals/km ²

Discussion

Although the decision for minimum and maximum density criteria for DPLAs and SPLAs, respectively, have been made on a rather arbitrary basis, it appeared to be the best criteria available. It should, however, be kept in mind that this decision has been based on the information available and that the cumulative percentages will change when density patterns in the EU would change. Because not all data of animal numbers were from the same year, the current situation in the EU will probably slightly differ from the figures presented.

Actually three problems were encountered with collecting the data of animal numbers on community level. The first is that not all countries perform surveys on animal numbers each year and if surveys are, for instance, only performed once in ten years the countries perform these surveys in different years. Secondly, the types of animals counted are not the same in each country. Belgium, for instance, only counts pigs places and no piglets and in Germany goats are not counted at all. Thirdly, not for all communities were data available due to privacy reasons.

The non-availability of goat numbers of German communities was considered a minor problem which will not have had major influences on the results. For most communities goat densities will have been close to zero. The non-availability of piglet numbers for Belgium has been solved by using a conversion. Because the average number of litters and the average number of piglets per litter is well known for intensive pig farming, it is assumed that the results of using of this conversion for piglet numbers was quite close to the real number of piglets in Belgium.

Although, because of non-availability of data, not all communities could be included into the analysis, it may be assumed that the large number of communities (> 18,000) that could be included was quite a good representation of all communities in the five member states for which the analysis was performed.

The DPLAs based on the minimum density criterion of more than 300 pigs/km² were compared to the DPLAs based on earlier criteria (e.g. 250 pigs/km²). What could be seen is that changing the minimum density criterion with 50 pigs upwards or downwards does not really change the areas in the five countries that classify as DPLA. What does change is the border of these areas: by increasing the minimum density criterion some communities at the outskirts of these areas no longer classify as DPLA. The major DPLAs appear to be in Brittany (France), West-Flanders (Belgium), Lower Saxony and the northern part of Northrhine-Westphalia (Germany), the Po Valley (Italy) and in the southern and eastern part of the Netherlands. These are exactly the regions that are usually considered by the EU as being very densely populated with livestock.

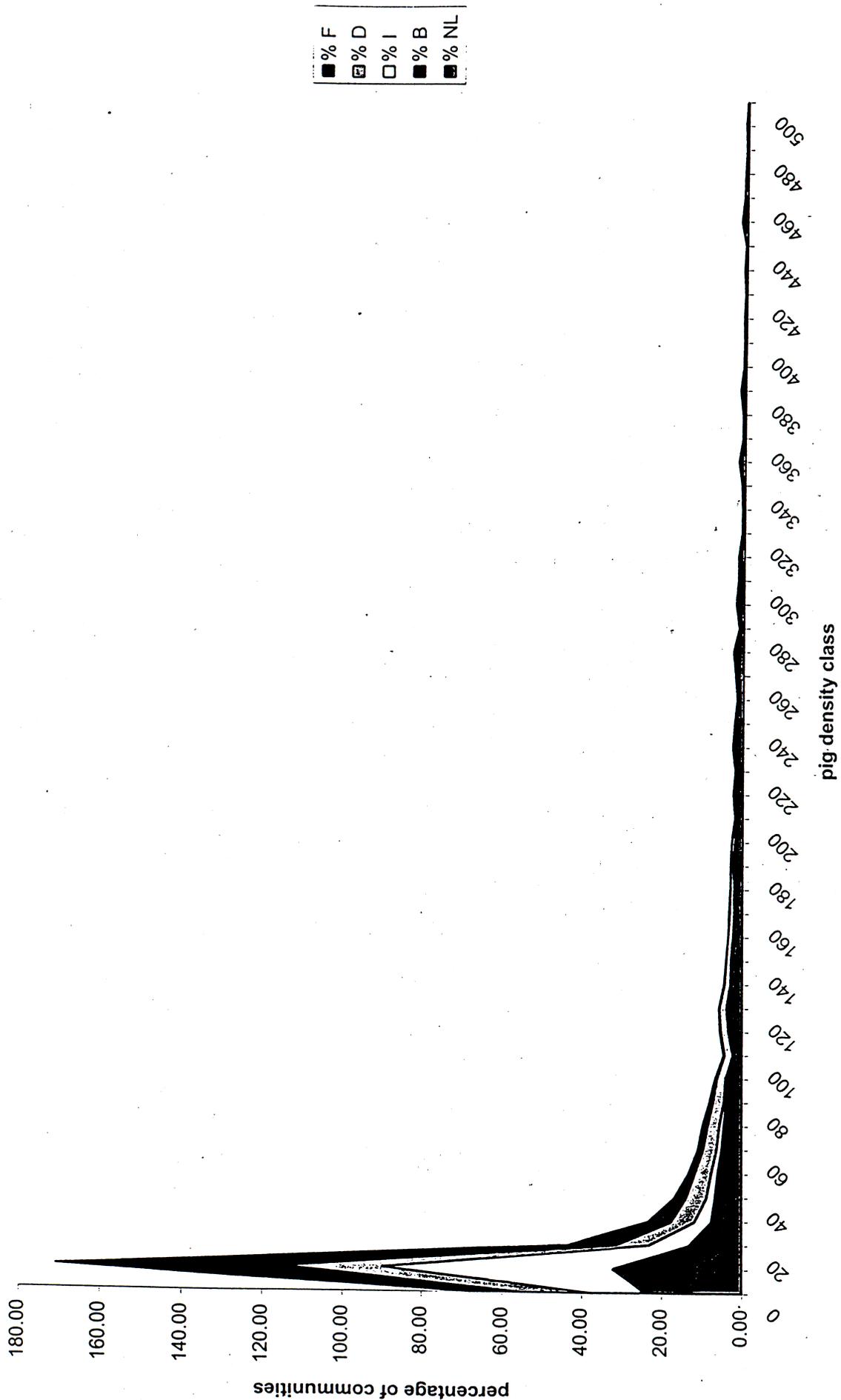


Figure 1. The percentage of communities in each pig density class per country (figures for each country add up to 100%).

ANNEX I

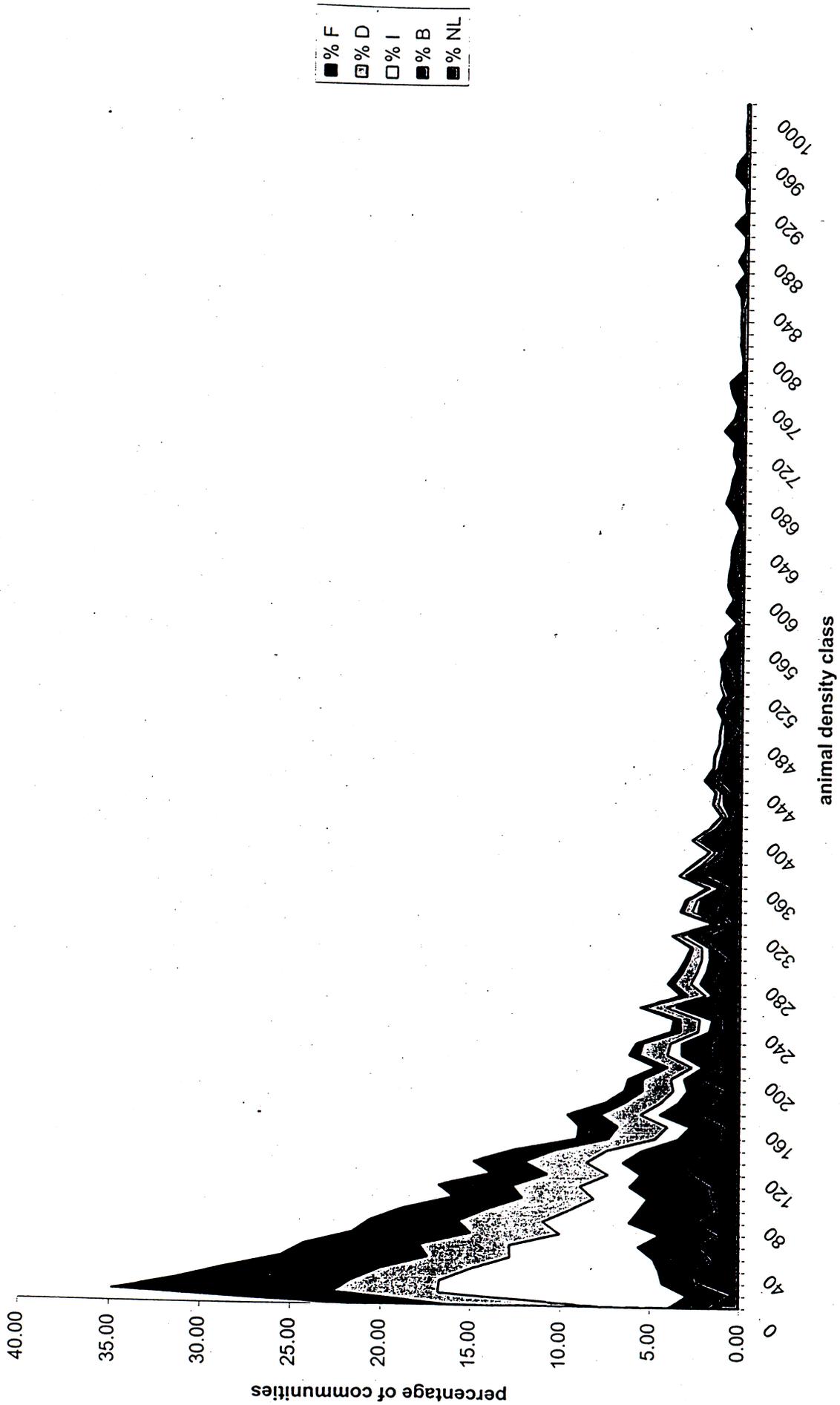


Figure 2. The percentage of communities in each animal density class per country (figures for each country add up to 100%).