

# SER 300 – Introdução ao Geoprocessamento

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## MÉTRICAS DE PAISAGEM APLICADAS À ANÁLISE DA URBANIZAÇÃO DISPERSA NO VALE DO PARAÍBA

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INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

Créditos da imagem: Pereira et al. (2005)



SEQUÊNCIA DE  
TRABALHO

# ROTEIRO

- CONTEXTUALIZAÇÃO DO FENÔMENO
- MATERIAIS E MÉTODOS
- RESULTADOS E DISCUSSÃO
- CONSIDERAÇÕES FINAIS

# DISPERSÃO URBANA

Burchell e Shad (1998; 1999) definem a dispersão como intrusão de baixa densidade de residências e outros usos não-residenciais na zona rural e áreas não desenvolvidas, constituindo-se em uma modalidade de consumo da terra de forma espraçada.

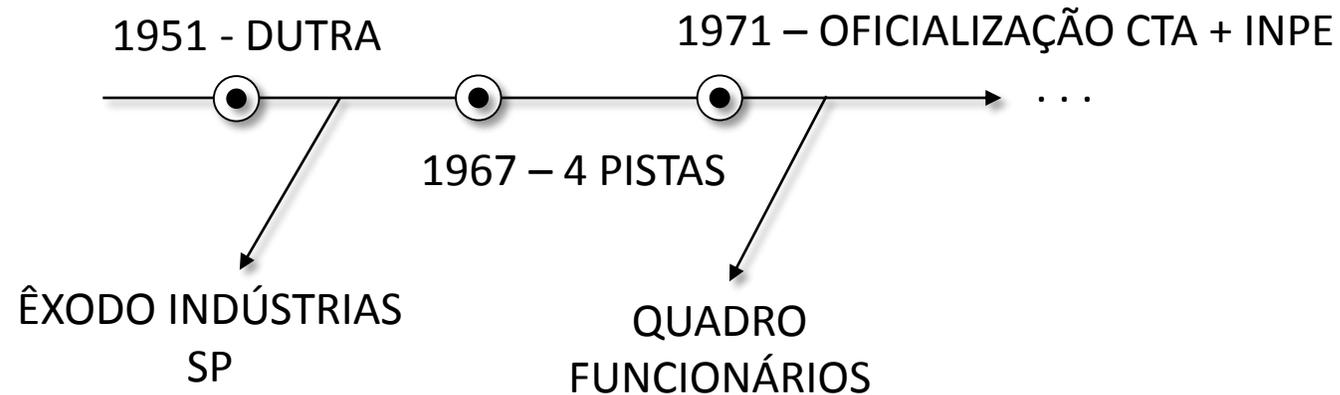
## AGENTES:

- Custos no transporte
- Rodovias
- Agilidade
- Telecomunicação
- Profissionais Liberais
- Condomínios Residenciais

CONTEXTUALIZAÇÃO DO  
FENÔMENO

# DISPERSÃO URBANA

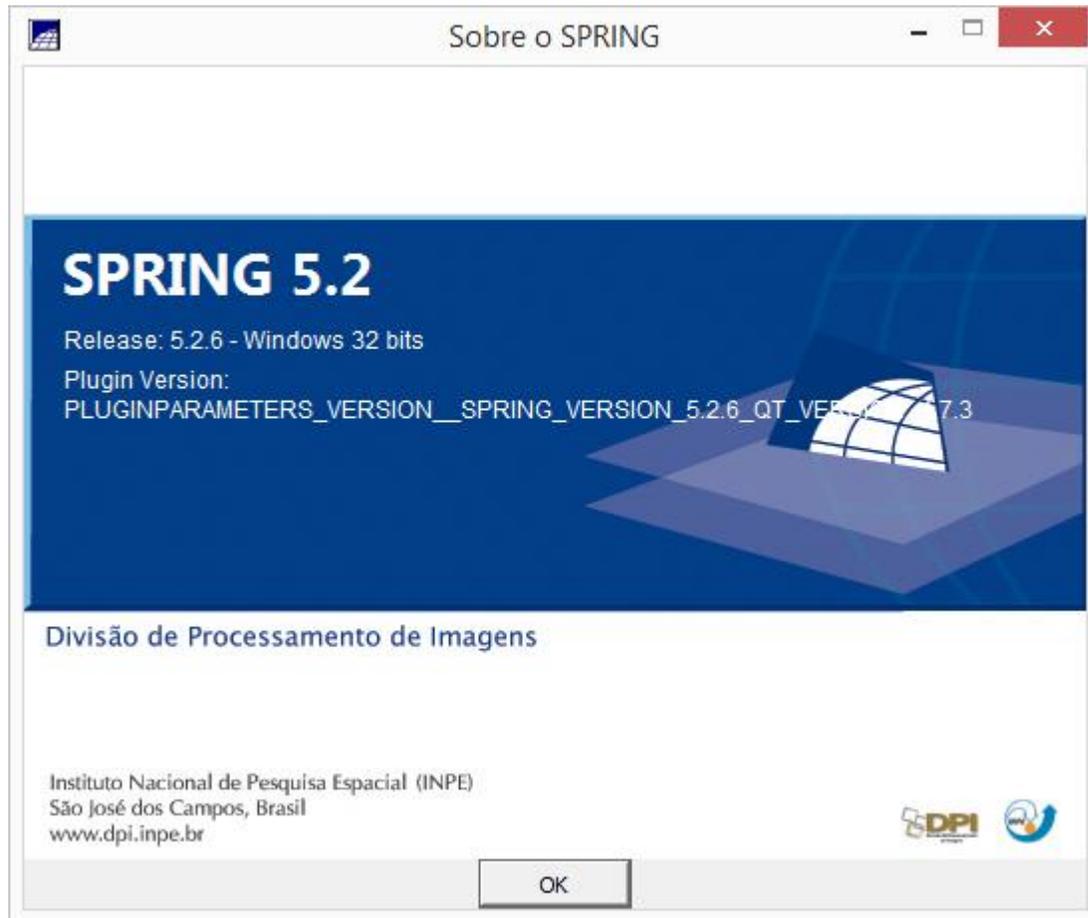
## NO VALE DO PARAÍBA

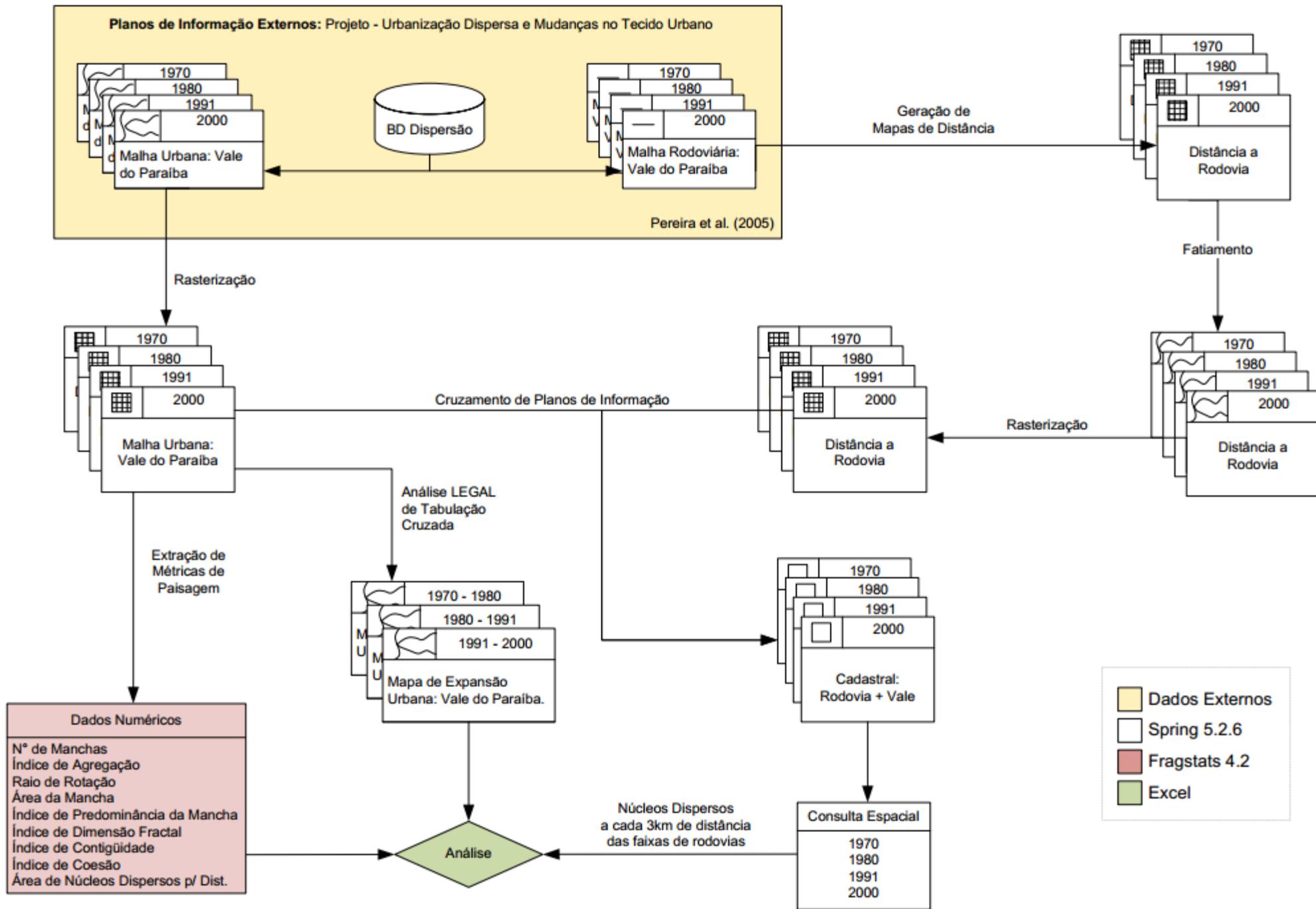


DISPERSÃO  
URBANA

# OBJETIVO

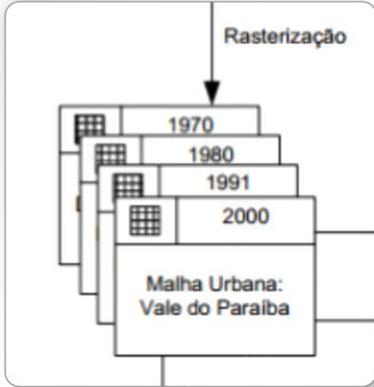
Compreender o comportamento do processo de dispersão do tecido urbano no Vale do Paraíba decorrente da urbanização, por meio de técnicas de geoprocessamento e análise das métricas de paisagem aplicadas aos dados obtidos.



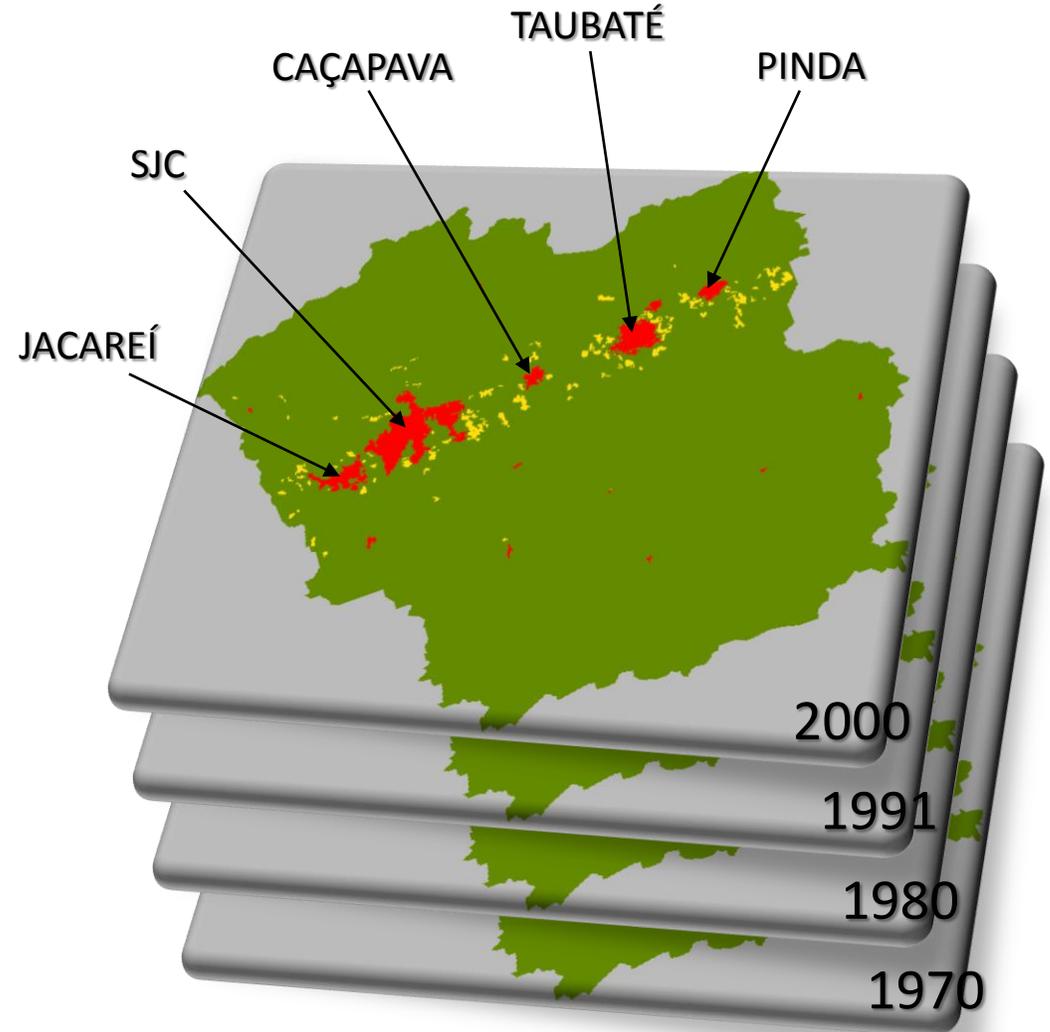
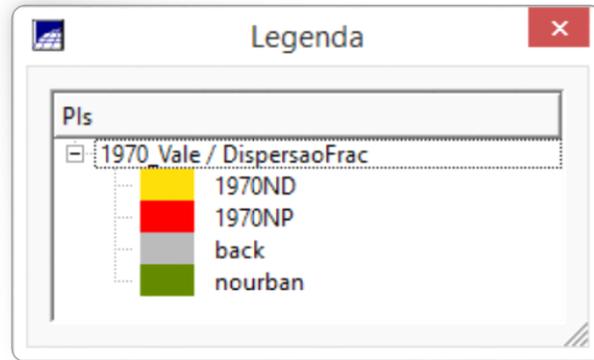
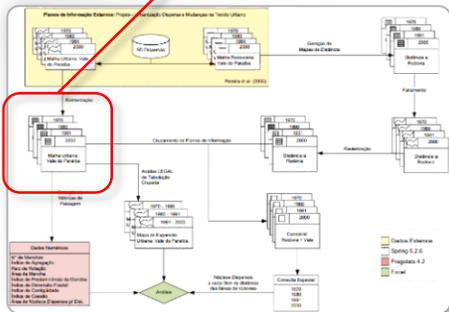


# RASTERIZAÇÃO

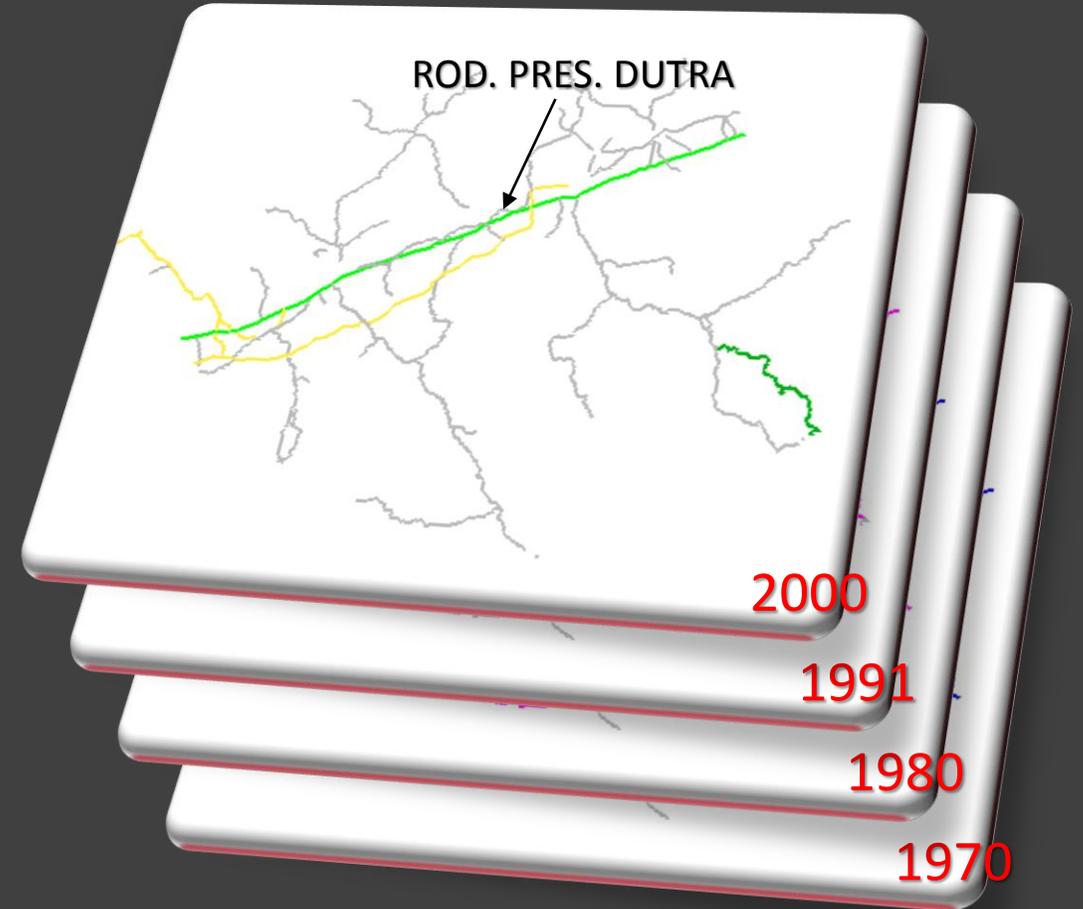
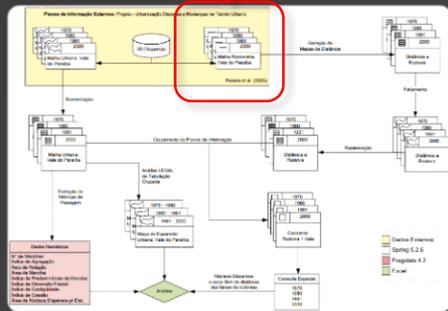
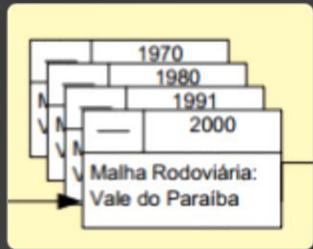
Pereira et al. (2005)



- NÚCLEOS PRINCIPAIS (NP)
- NÚCLEOS DISPERSOS (ND)



## VETORES DE DISPERSÃO



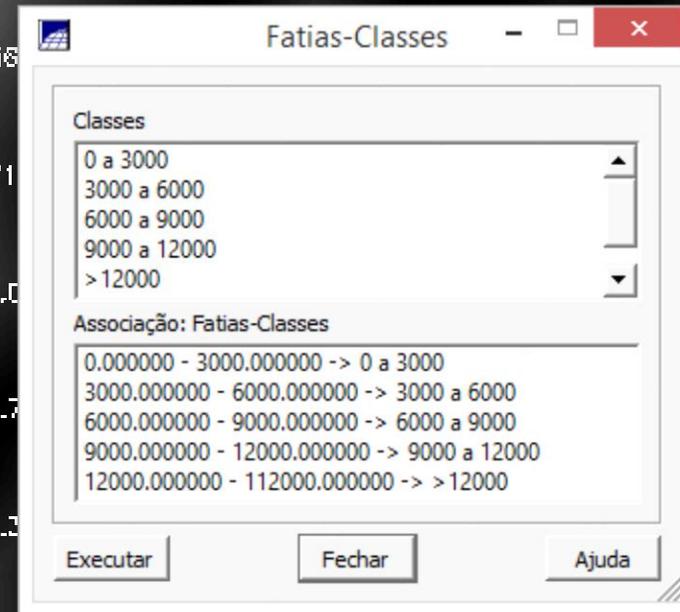
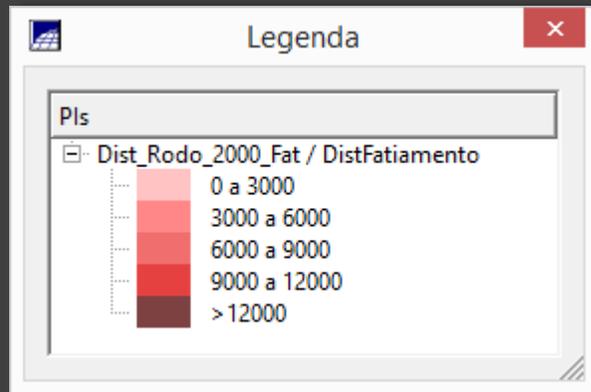
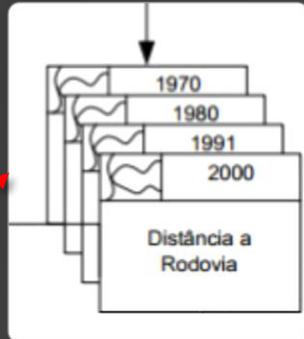
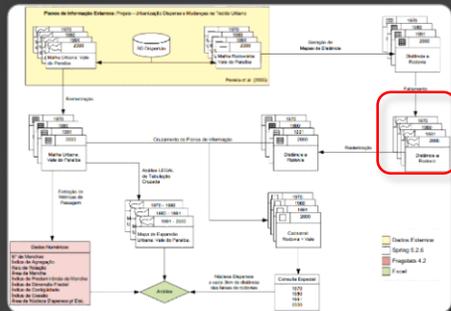


CLASSES POR  
DISTÂNCIA

# FATIAMENTO

Malha Rodoviária

1970

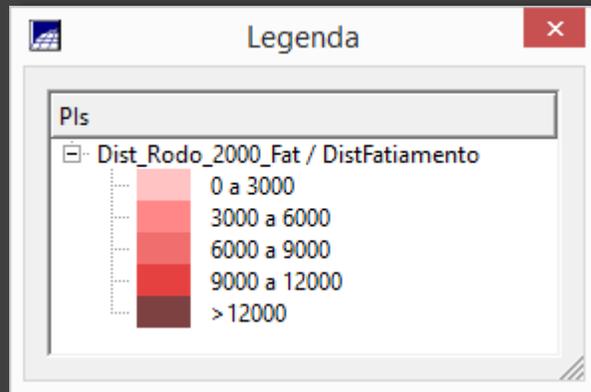
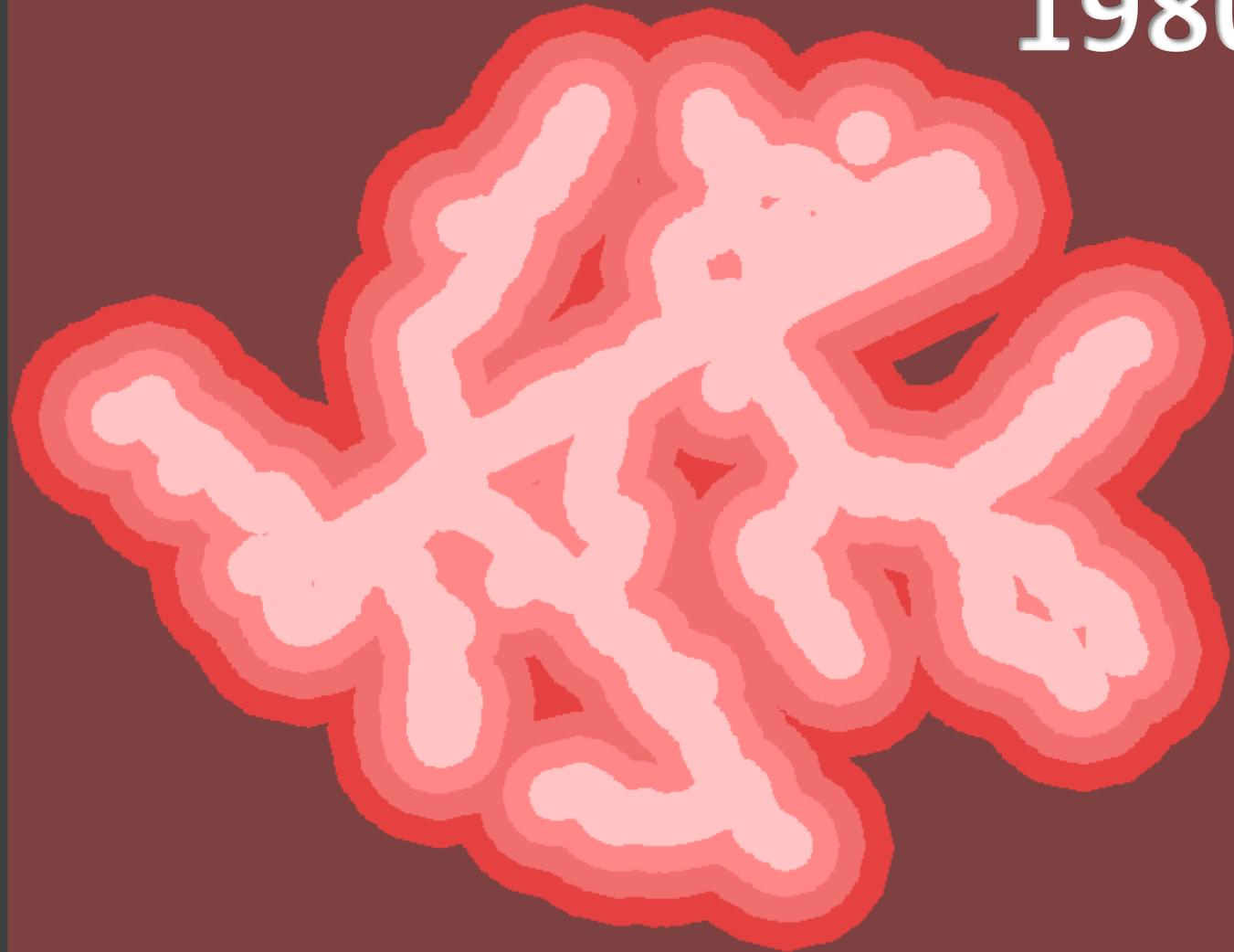
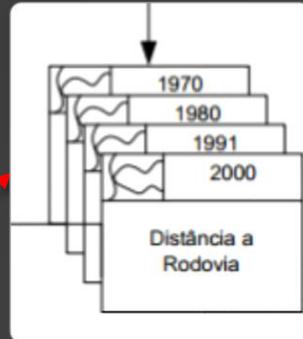
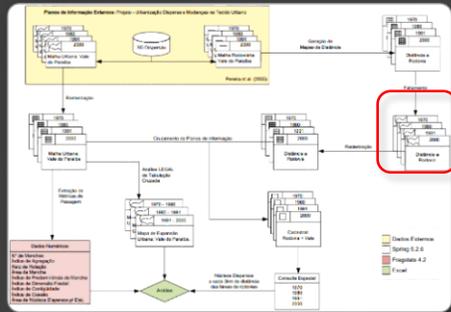


071	44196	39043	29033	19091	10443	10049	10085	18115	18838	14368	37478	108
681	31806	32505	22385	11684	2370.8	6515.4	2391.4	7270.0	6911.0	15729	25131	308
559	19418	20889	15158									
681	7036.1	10520	10971									
021	5174.6	681.1	7302.0									
809	14101	3683.7	1560.7									
948	20488	10952	7325.2									
817	26301	21285	13342	5403.7	13140	7671.8	1447.5	11174	21668	18788	17409	253
651	36222	30669	21946	17793	21608	14687	6807.9	10908	22659	29176	29799	346
620	48019	39343	33059	30183	32037	23899	19117	20477	28257	38268	42189	450

CLASSES POR  
DISTÂNCIA

# FATIAMENTO

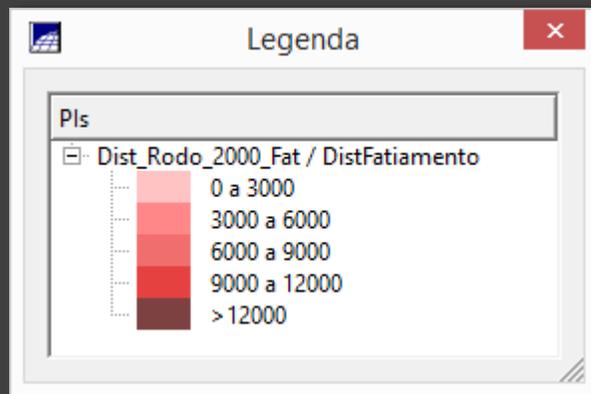
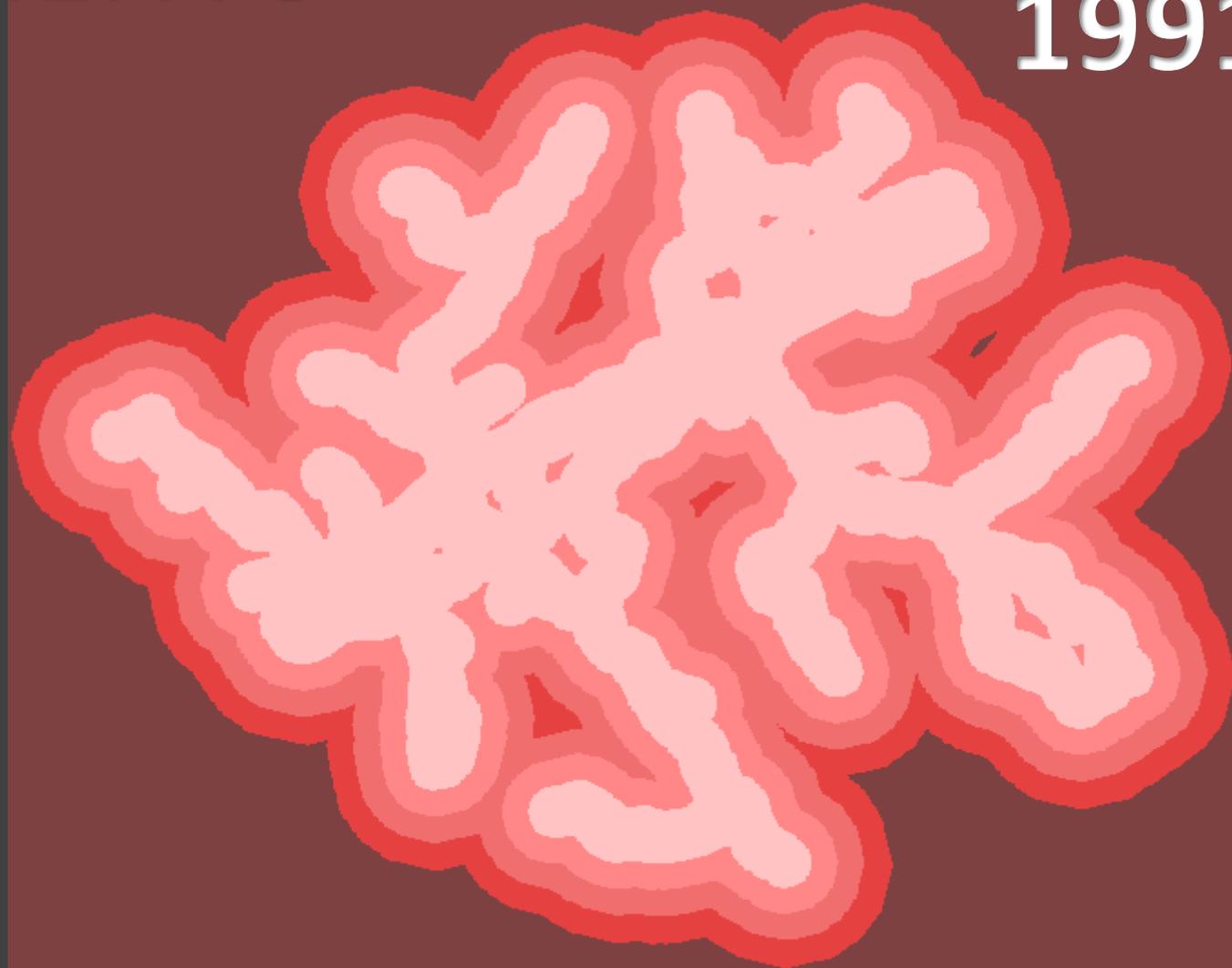
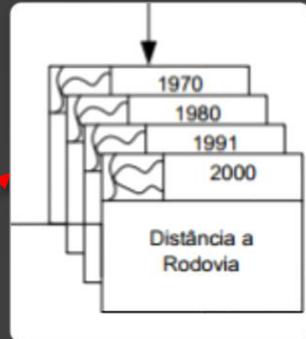
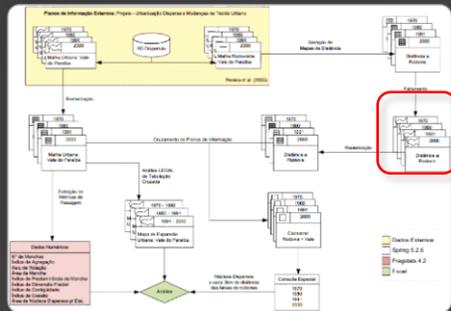
Malha Rodoviária  
**1980**



CLASSES POR  
DISTÂNCIA

# FATIAMENTO

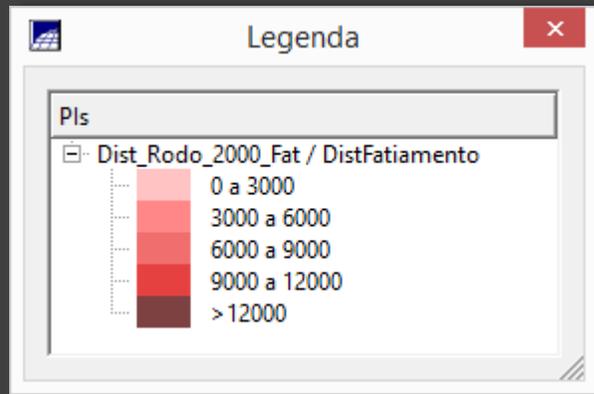
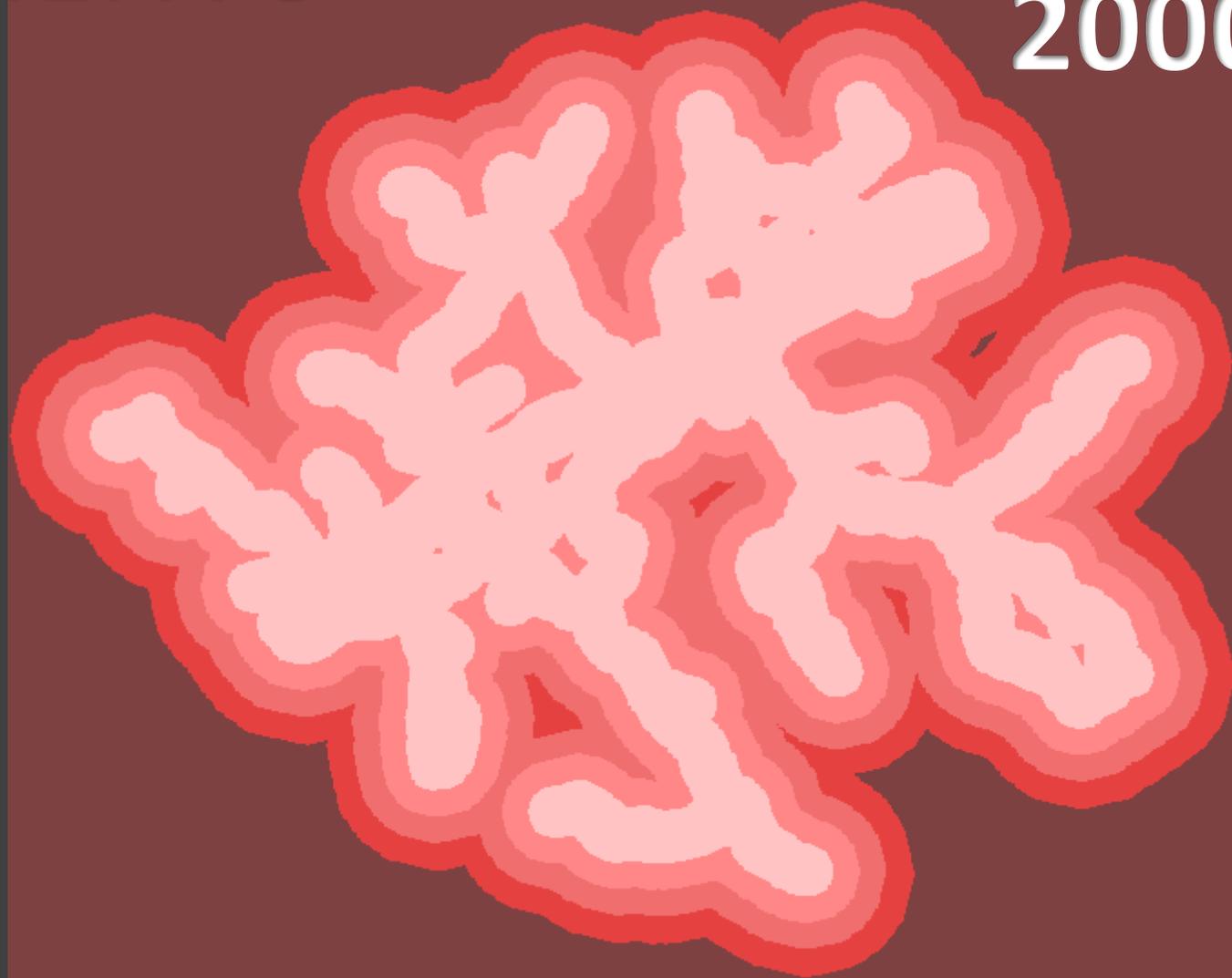
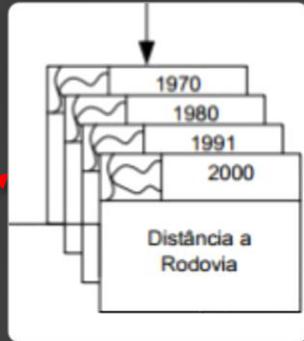
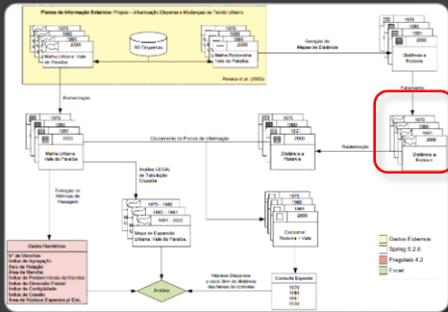
Malha Rodoviária  
**1991**



CLASSES POR  
DISTÂNCIA

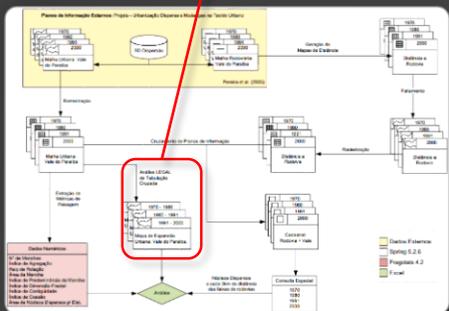
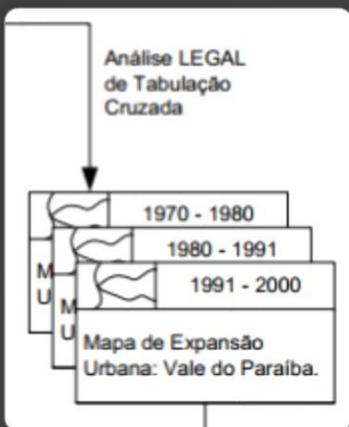
# FATIAMENTO

Malha Rodoviária  
2000



# TAB. CRUZADA

1970 : 1980

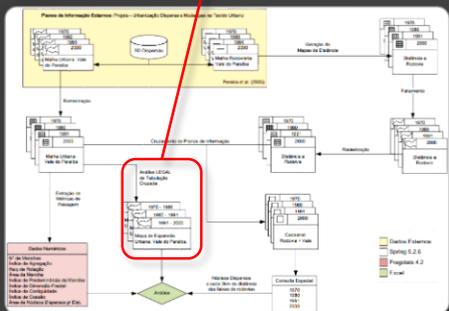
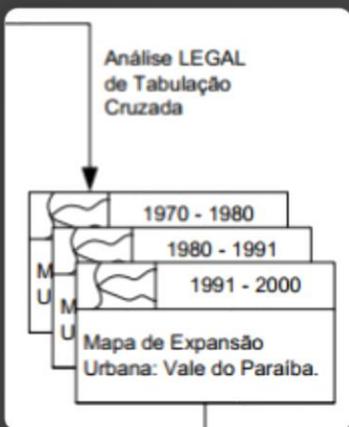


```
LEGAL
Programa LEGAL Executar
tabcruz_vale_70_80.alg | tabcruz_vale_80_91.alg | tabcruz_vale_91_00.alg |

1 {
2 //DECLARACAO TABCRUZ
3 Tematico vale70, vale80, result ("DispersãoFrac");
4
5 //INSTANCIACAO
6 vale70 = Recupere (Nome = "1970_Vale");
7 vale80 = Recupere (Nome = "1980_Vale");
8 result = Novo (Nome = "tabcruz_dispersao_70_80", ResX = 30, ResY = 30, Escala = 20000);
9
10 //OPERACAO
11 result = Atribua (CategoriaFim = "DispersãoFrac")
12 {
13 "bg_bg" : (vale70.Classe == "back" && vale80.Classe == "back"),//1 - 0;0
14 "nu_nu" : (vale70.Classe == "nourban" && vale80.Classe == "back"),//2 - 1;0 E
15 "bg_bg" : (vale70.Classe == "back" && vale80.Classe == "nourban"),//3 - 0;1 E
16 "nu_nu" : (vale70.Classe == "nourban" && vale80.Classe == "nourban"),//4 - 1;1
17 "np_np" : (vale70.Classe == "1970NP" && vale80.Classe == "nourban"),//5 - 2;1 E
18 "nd_nd" : (vale70.Classe == "1970ND" && vale80.Classe == "nourban"),//6 - 3;1 E
19 "nu_np" : (vale70.Classe == "nourban" && vale80.Classe == "1980NP"),//7 - 1;2
20 "np_np" : (vale70.Classe == "1970NP" && vale80.Classe == "1980NP"),//8 - 2;2
21 "nd_np" : (vale70.Classe == "1970ND" && vale80.Classe == "1980NP"),//9 - 3;2
22 "bg_bg" : (vale70.Classe == "back" && vale80.Classe == "1980ND"),//10 - 0;3 E
23 "nu_nd" : (vale70.Classe == "nourban" && vale80.Classe == "1980ND"),//11 - 1;3
24 "np_np" : (vale70.Classe == "1970NP" && vale80.Classe == "1980ND"),//12 - 2;3 E
25 "nd_nd" : (vale70.Classe == "1970ND" && vale80.Classe == "1980ND");//13 - 3;3
26 }
```

Erros de Sintaxe do Programa

1980 : 1991



```

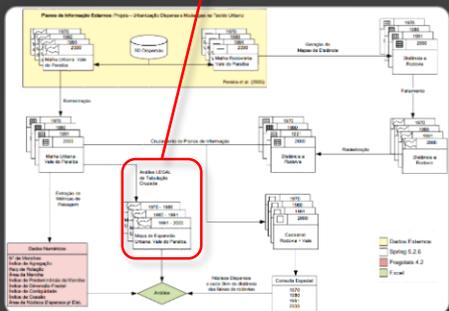
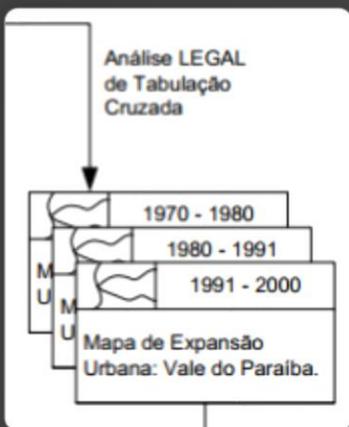
LEGAL
Programa EGA Executar
tabcruz_vale_70_80.alg | tabcruz_vale_80_91.alg | tabcruz_vale_91_00.alg

1 {
2 //DECLARACAO TABCRUZ
3 Tematico vale80, vale91, result ("DispersãoFrac");
4
5 //INSTANCIACAO
6 vale80 = Recupere (Nome = "1980_Vale");
7 vale91 = Recupere (Nome = "1991_Vale");
8 result = Novo (Nome = "tabcruz_dispersao_80_91", ResX = 30, ResY = 30, Escala = 20000);
9
10 //OPERACAO
11 result = Atribua (CategoriaFim = "DispersãoFrac")
12 {
13 "bg_bg" : (vale80.Classe == "back" && vale91.Classe == "back"),//1 - 0;0
14 "nu_nu" : (vale80.Classe == "nourban" && vale91.Classe == "nourban"),//2 - 1;1
15 "np_np" : (vale80.Classe == "1980NP" && vale91.Classe == "nourban"),//3 - 2;1 E
16 "nd_nd" : (vale80.Classe == "1980ND" && vale91.Classe == "nourban"),//4 - 3;1 E
17 "nu_np" : (vale80.Classe == "nourban" && vale91.Classe == "1991NP"),//5 - 1;2
18 "np_np" : (vale80.Classe == "1980NP" && vale91.Classe == "1991NP"),//6 - 2;2
19 "nd_np" : (vale80.Classe == "1980ND" && vale91.Classe == "1991NP"),//7 - 3;2
20 "nu_nd" : (vale80.Classe == "nourban" && vale91.Classe == "1991ND"),//8 - 1;3
21 "np_np" : (vale80.Classe == "1980NP" && vale91.Classe == "1991ND"),//9 - 2;3 E
22 "nd_nd" : (vale80.Classe == "1980ND" && vale91.Classe == "1991ND");//10 - 3;3
23 }
    
```

Erros de Sintaxe do Programa

# TAB. CRUZADA

1991 : 2000



```
LEGAL
Programa EGA  Executar
tabcruz_vale_70_80.alg | tabcruz_vale_80_91.alg | tabcruz_vale_91_00.alg

1 {
2 //DECLARACAO TABCRUZ
3 Tematico vale91, vale00, result ("DispersãoFrac");
4
5 //INSTANCIACAO
6 vale91 = Recupere (Nome = "1991_Vale");
7 vale00 = Recupere (Nome = "2000_Vale");
8 result = Novo (Nome = "tab_cruz_dispersao_91_00", ResX = 30, ResY = 30, Escala = 20000);
9
10 //OPERACAO
11 result = Atribua (CategoriaFim = "DispersãoFrac")
12 {
13 "bg_bg" : (vale91.Classe == "back" && vale00.Classe == "back"),//1 - 0;0
14 "nu_nu" : (vale91.Classe == "nourban" && vale00.Classe == "nourban"),//2 - 1;1
15 "np_np" : (vale91.Classe == "1991NP" && vale00.Classe == "nourban"),//3 - 2;1 E
16 "nd_nd" : (vale91.Classe == "1991ND" && vale00.Classe == "nourban"),//4 - 3;1 E
17 "nu_np" : (vale91.Classe == "nourban" && vale00.Classe == "2000NP"),//5 - 1;2
18 "np_np" : (vale91.Classe == "1991NP" && vale00.Classe == "2000NP"),//6 - 2;2
19 "nd_np" : (vale91.Classe == "1991ND" && vale00.Classe == "2000NP"),//7 - 3;2
20 "nu_nd" : (vale91.Classe == "nourban" && vale00.Classe == "2000ND"),//8 - 1;3
21 "nd_nd" : (vale91.Classe == "1991ND" && vale00.Classe == "2000ND")};//9 - 3;3
22 }
```

Erros de Sintaxe do Programa



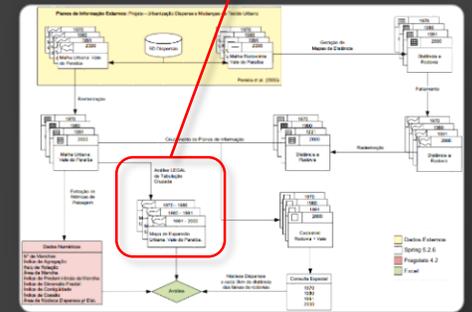
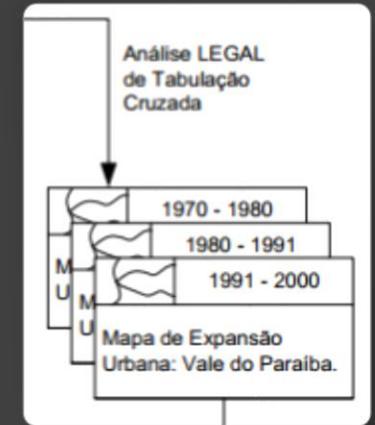
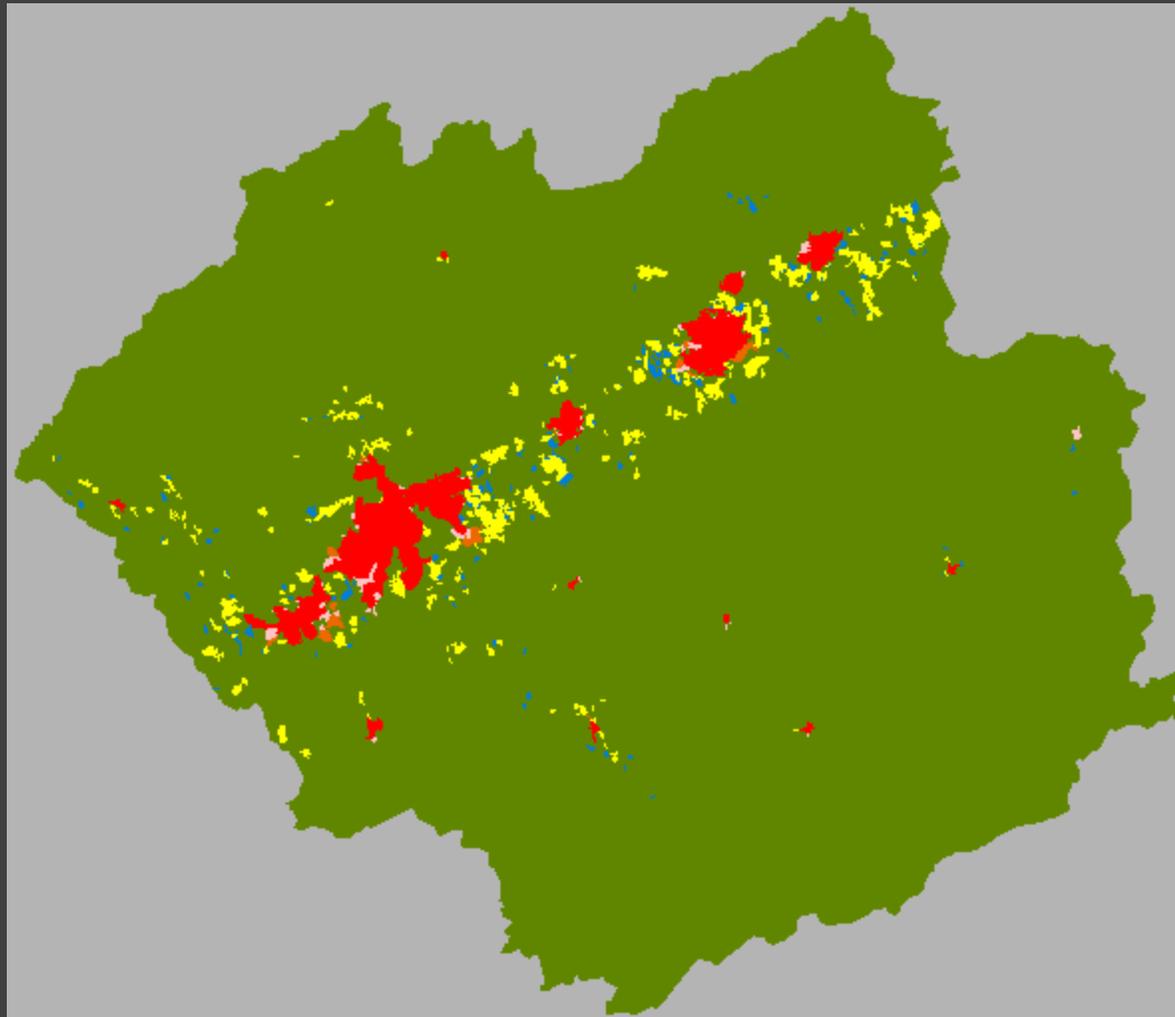


Legenda

Pls

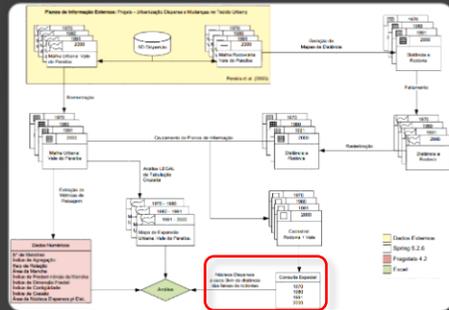
tab\_cruz\_dispersao\_91\_00 / DispersaoFrac

Grey	bg_bg
Yellow	nd_nd
Orange	nd_np
Red	np_np
Blue	nu_nd
Pink	nu_np
Green	nu_nu

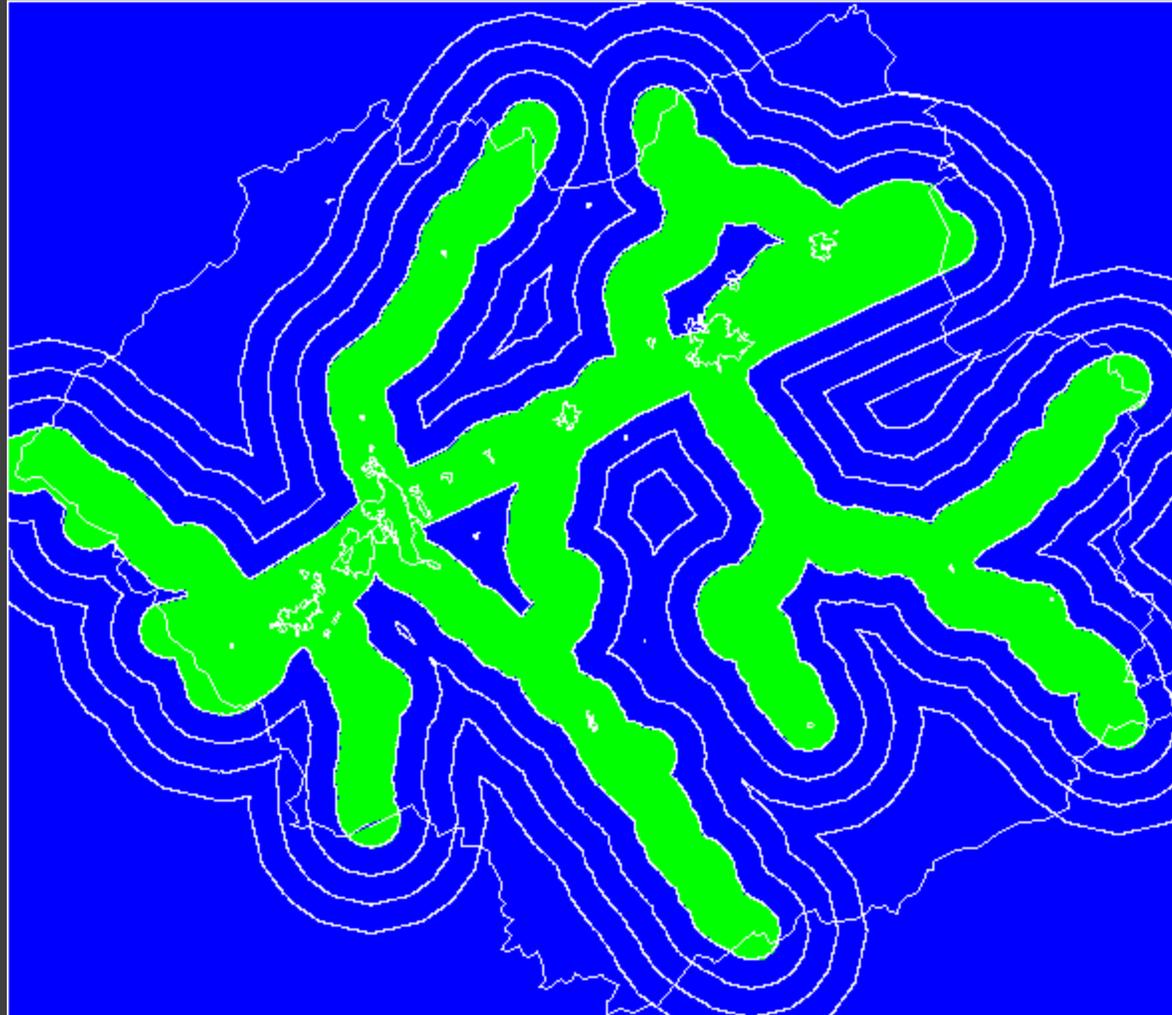




# ND's: DIST. RODOVIAS



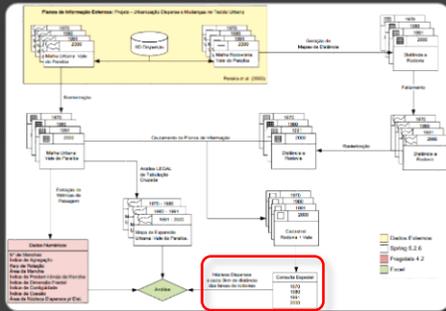
Núcleos Dispersos a cada 3km de distância das faixas de rodovias	Consulta Espacial
	1970
	1980
	1991
	2000



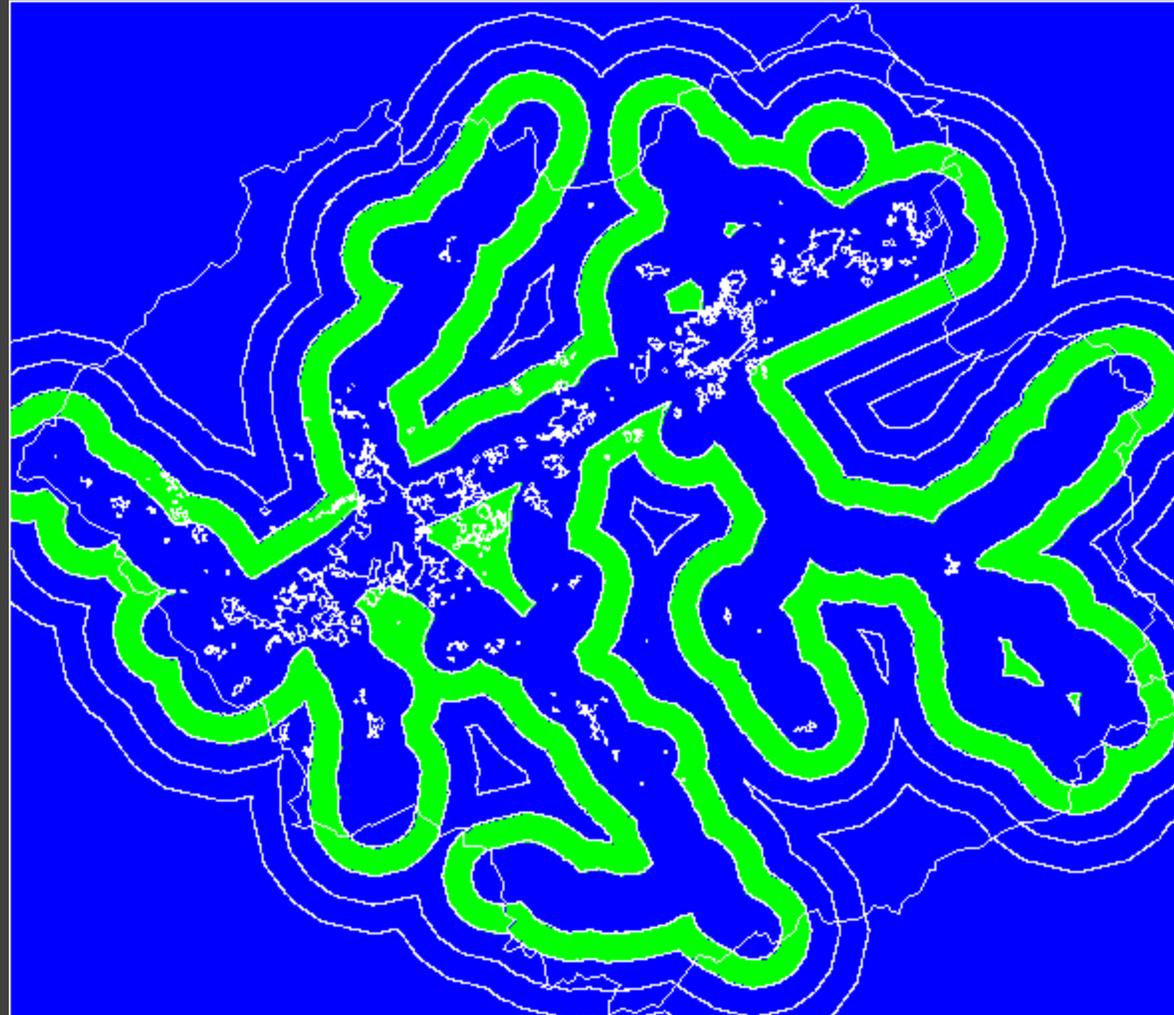
0 a 3km

Ano	N°
1970	20
1980	273
1991	371
2000	505

# ND's: DIST. RODOVIAS



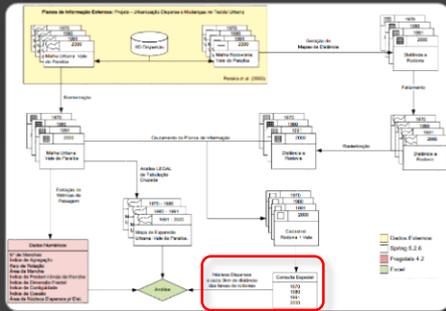
Núcleos Dispersos a cada 3km de distância das faixas de rodovias	Consulta Espacial
	1970
	1980
	1991
	2000



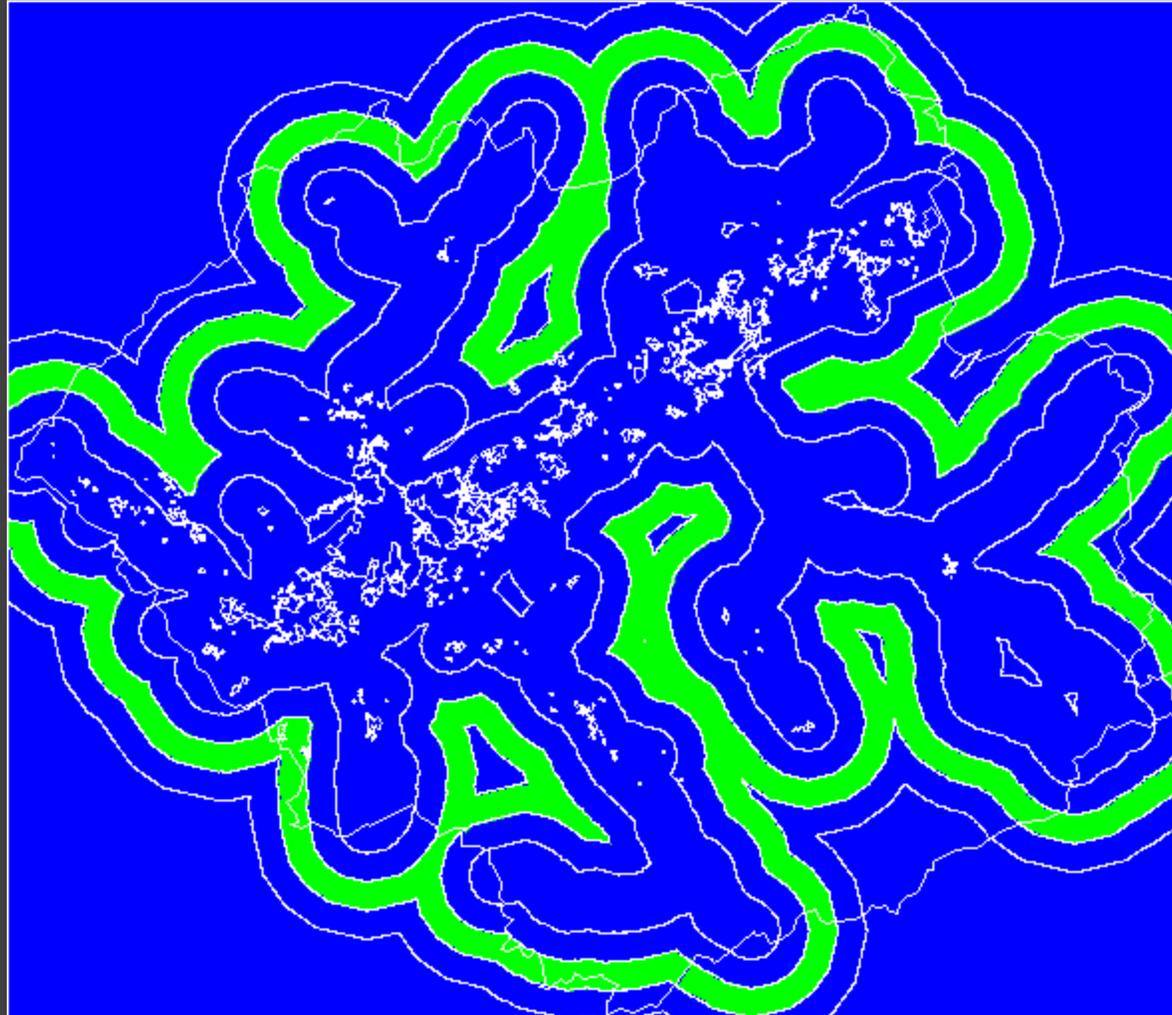
## 3 a 6km

Ano	N°
1970	1
1980	59
1991	45
2000	65

# ND's: DIST. RODOVIAS



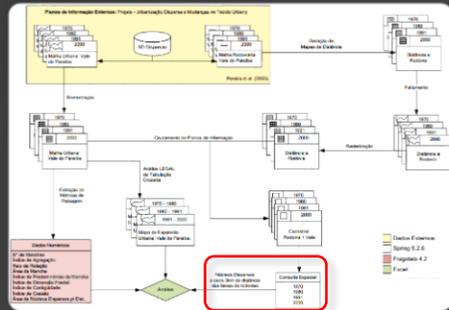
Núcleos Dispersos a cada 3km de distância das faixas de rodovias	Consulta Espacial
	1970
	1980
	1991
	2000



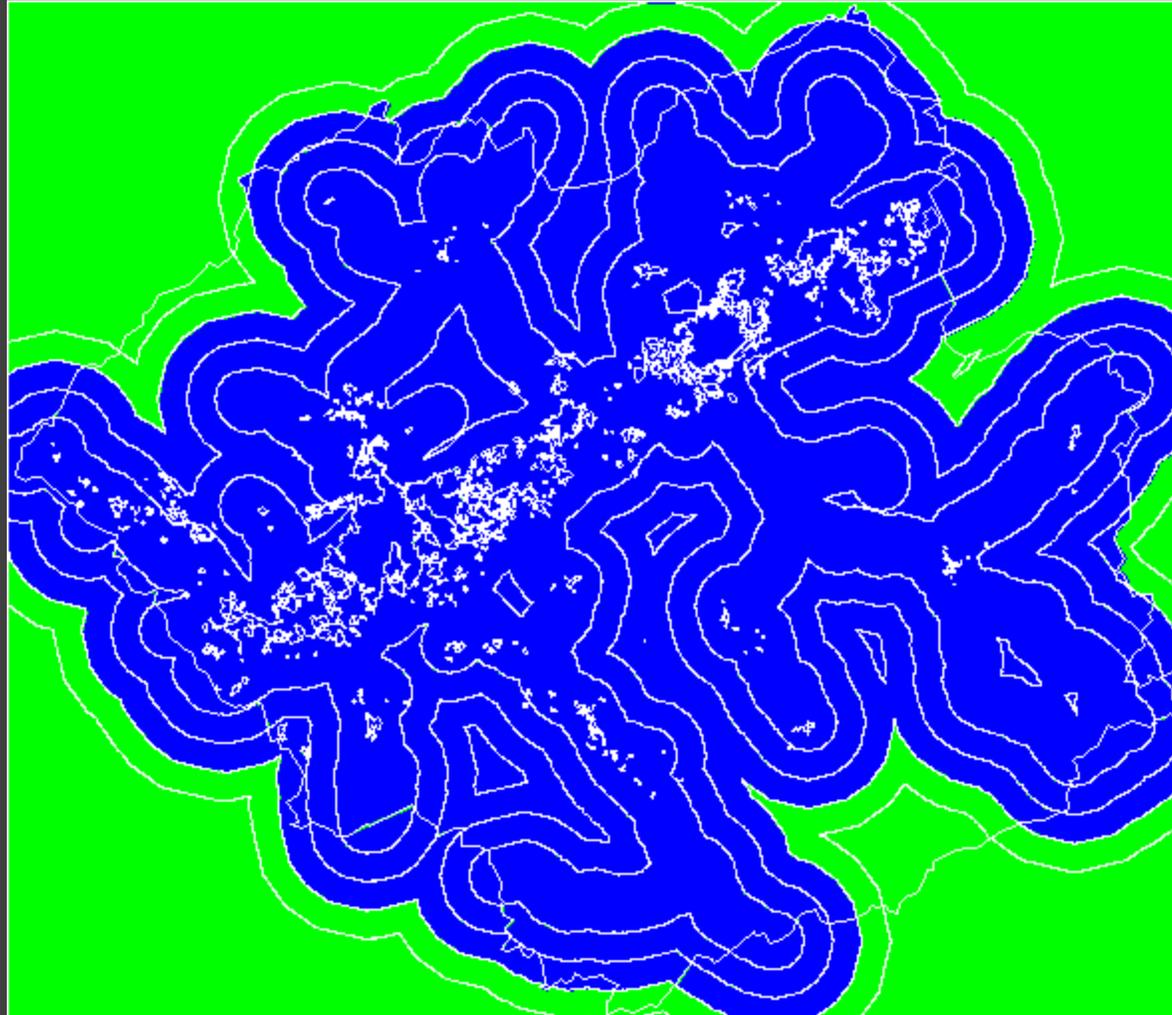
6 a 9km

Ano	N°
1970	0
1980	12
1991	6
2000	7

# NDs: DIST. RODOVIAS



Núcleos Dispersos a cada 3km de distância das faixas de rodovias	Consulta Espacial
	1970
	1980
	1991
	2000



9 a 12km

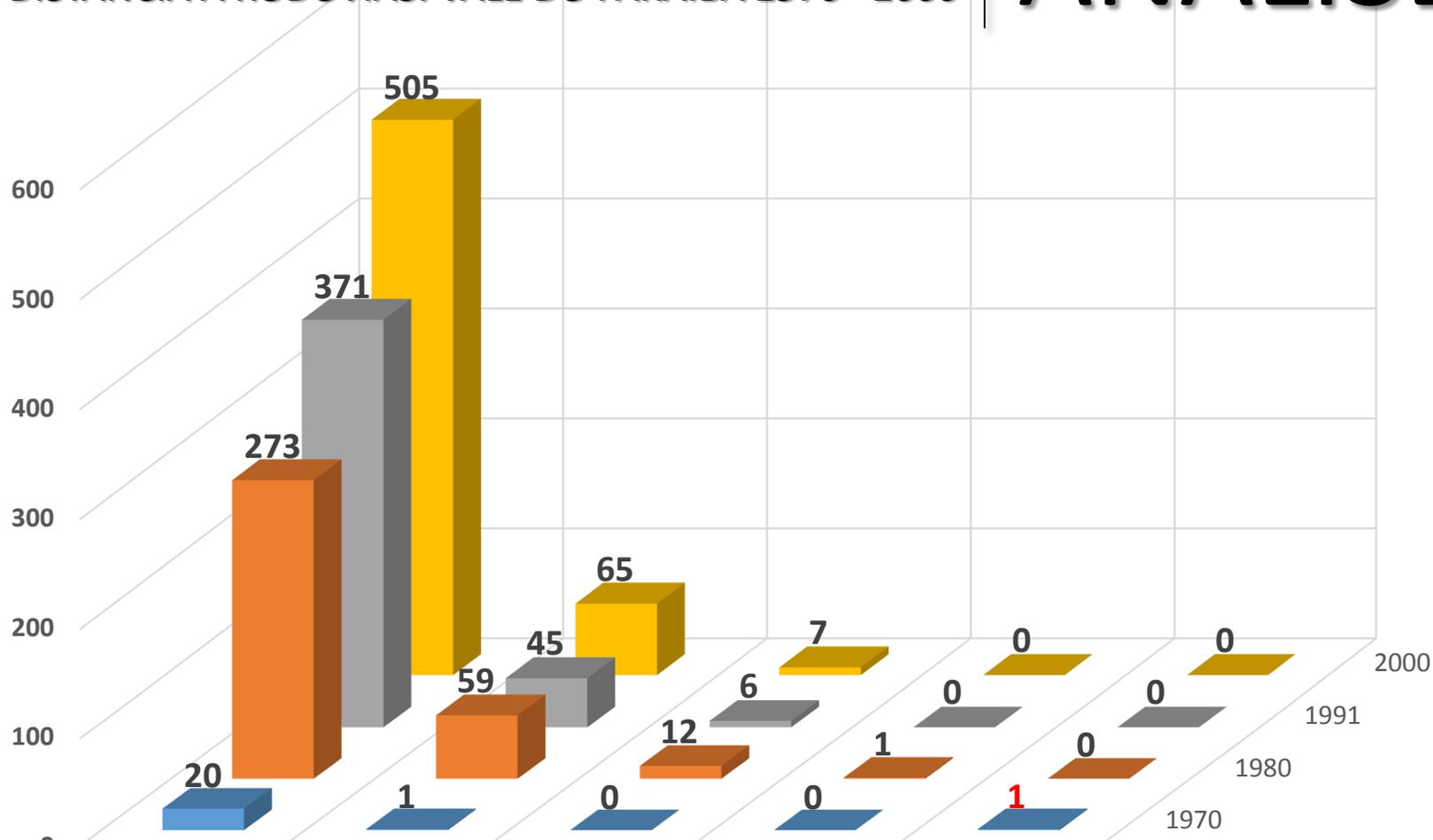
Ano	N°
1970	0
1980	1
1991	0
2000	0

>12km

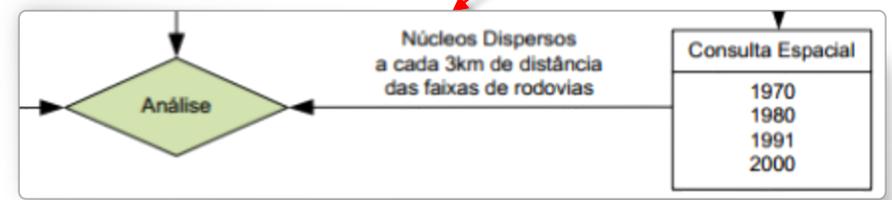
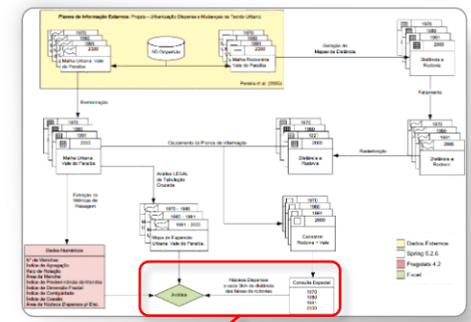
Ano	N°
1970	1
1980	0
1991	0
2000	0

# DISTRIBUIÇÃO DE NÚCLEOS DISPERSOS POR FAIXA DE DISTÂNCIA À RODOVIAS: VALE DO PARAÍBA 1970 - 2000

# ANÁLISE DE CONSUTA



	0 a 3km	3 a 6km	6 a 9km	9 a 12km	acima de 12km
1970	20	1	0	0	1
1980	273	59	12	1	0
1991	371	45	6	0	0
2000	505	65	7	0	0



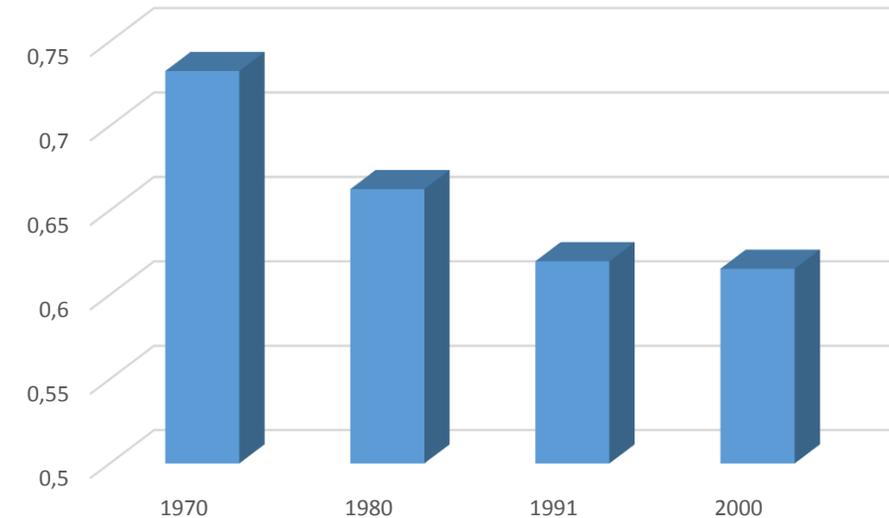
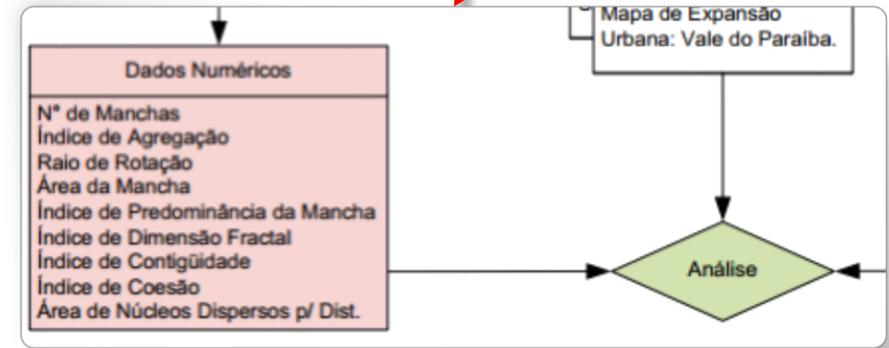
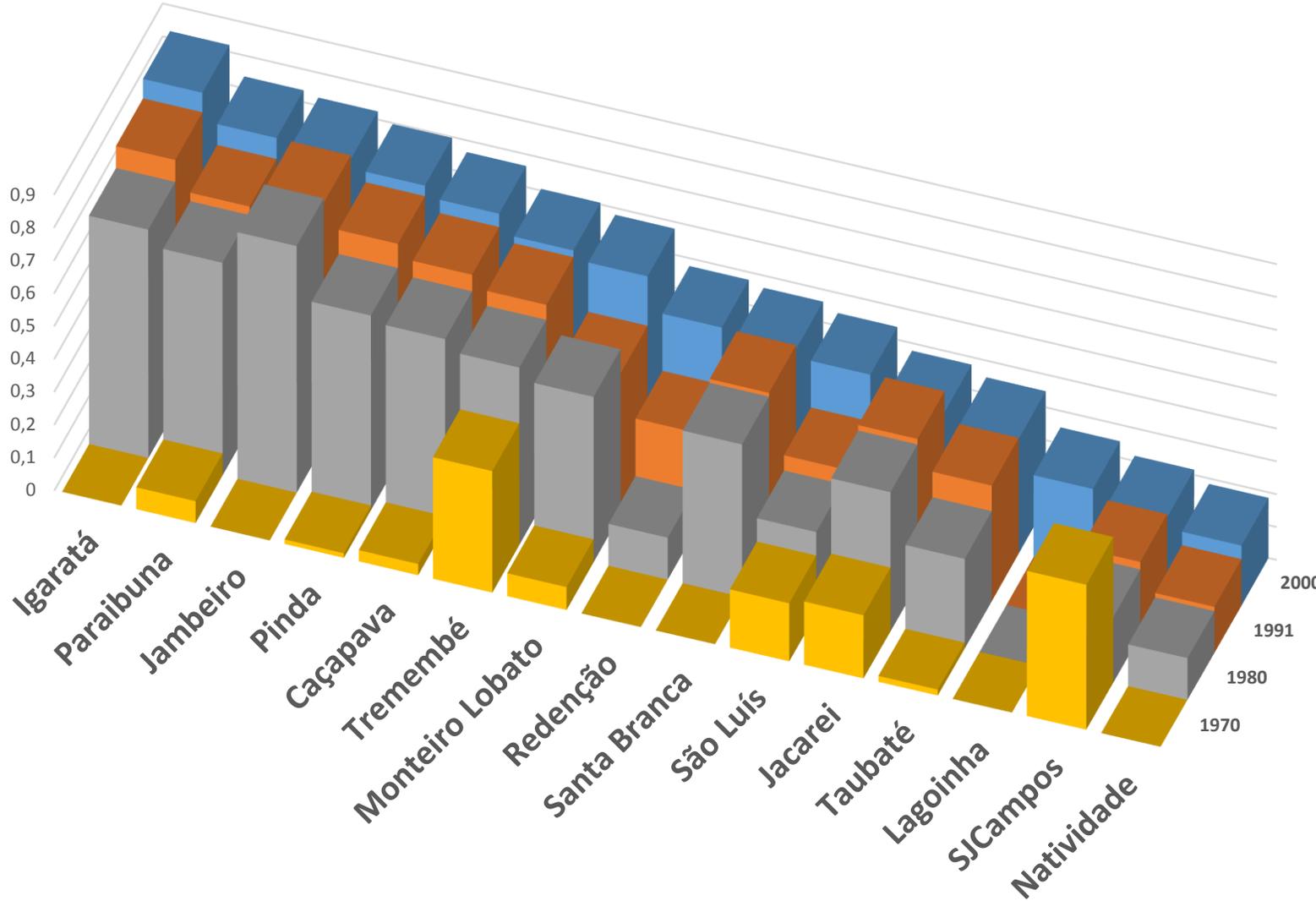
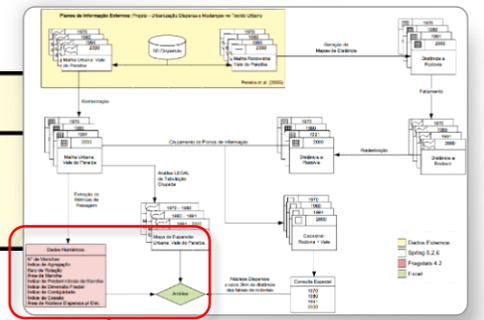
# ANÁLISE DE MÉTRICAS

# AREA

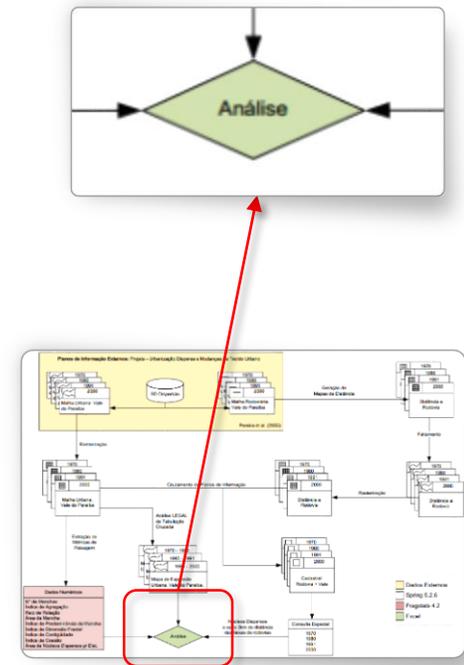
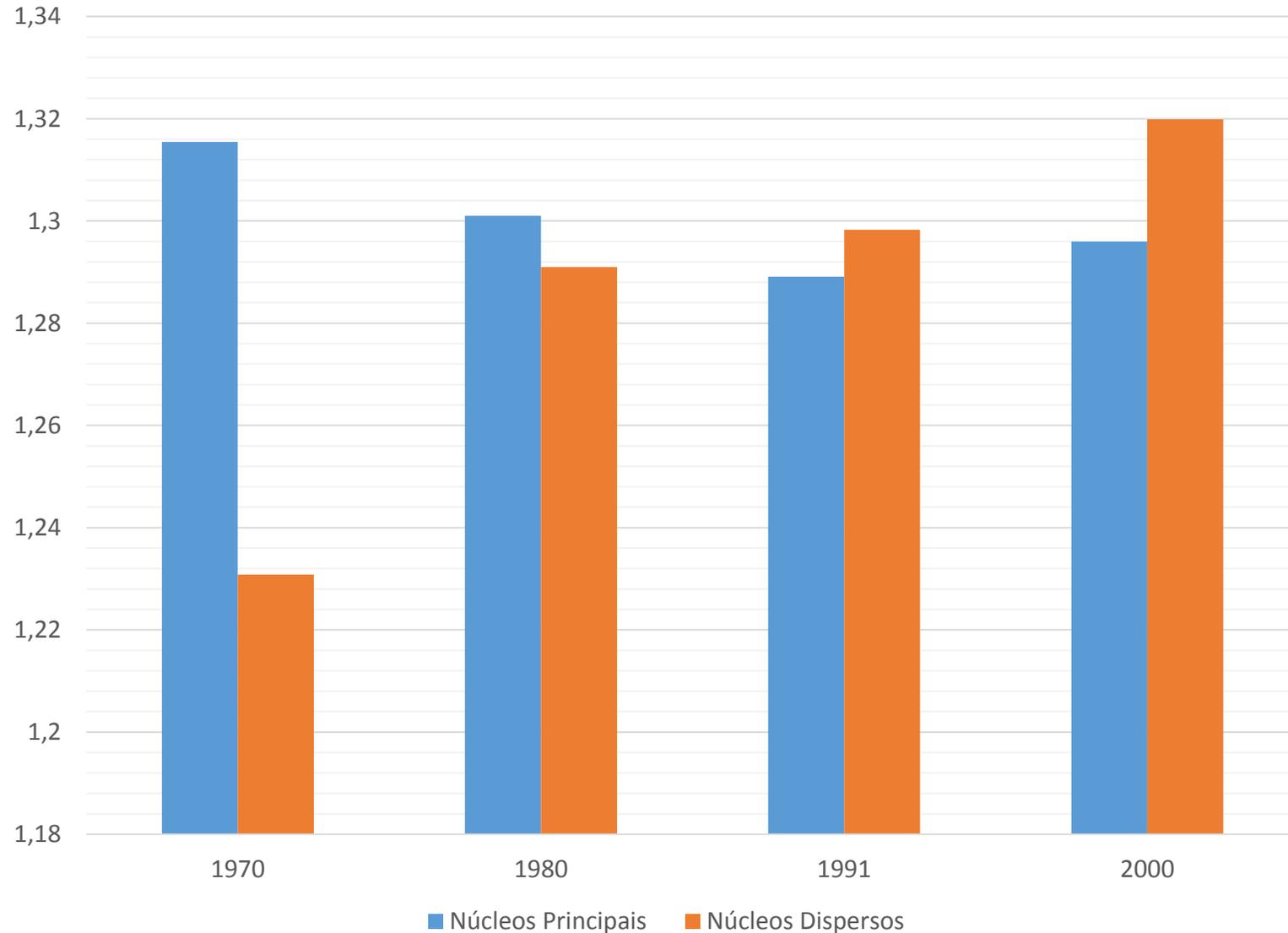
(P1) Area

$$AREA = a_{ij} \left( \frac{1}{10,000} \right)$$

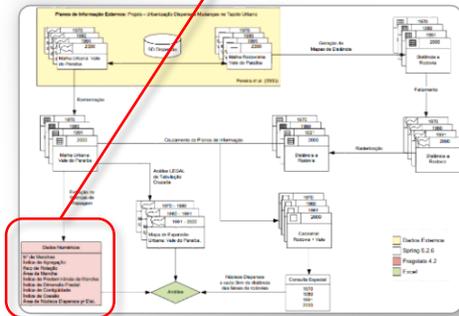
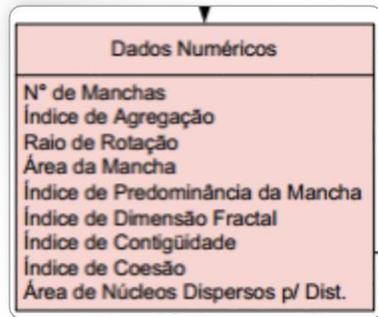
$a_{ij}$  = area (m<sup>2</sup>) of patch ij.



# COMPLEXIDADE DA MANCHA

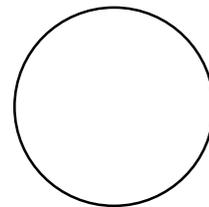


## Fractal Dimension Index (Índice de Dimensão Fractal)



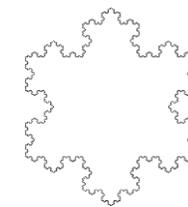
$$FRAC = \frac{2 \ln (0,25 p_{ij})}{\ln a_{ij}}$$

$p_{ij}$  = perímetro em (m) da mancha  $ij$ .  
 $a_{ij}$  = área em (m<sup>2</sup>) da mancha  $ij$ .



Geometria euclidiana

$$1 \leq FRAC \leq 2$$



Geometria não-euclidiana

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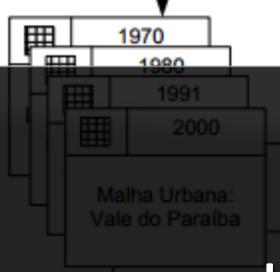
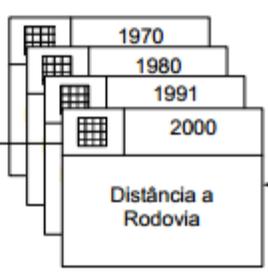
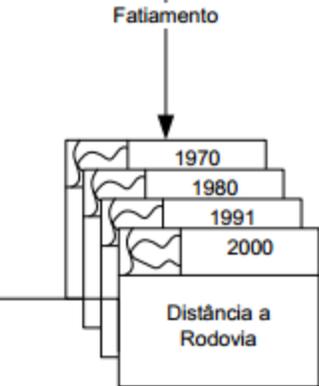
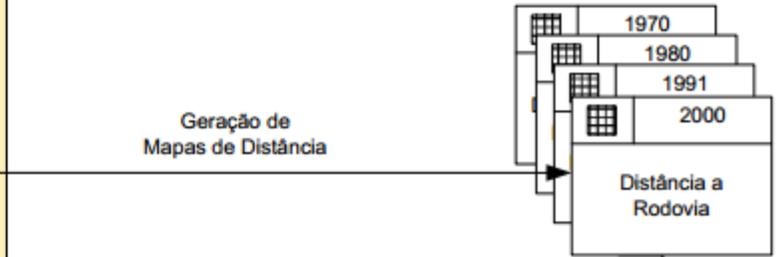
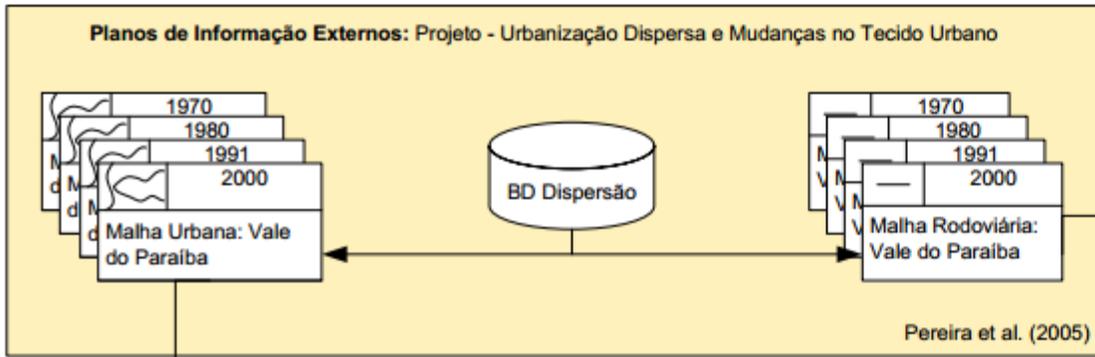
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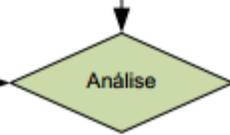
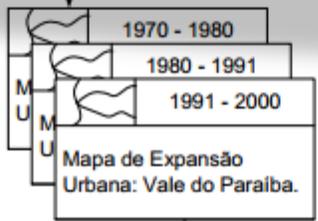


**Obrigado!**

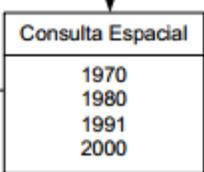
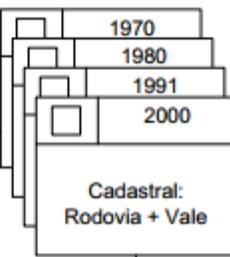
<davidgmf@dsr.inpe.br>



- Dados Numéricos**
- Nº de Manchas
  - Índice de Agregação
  - Raio de Rotação
  - Área da Mancha
  - Índice de Predominância da Mancha
  - Índice de Dimensão Fractal
  - Índice de Contigüidade
  - Índice de Coesão
  - Área de Núcleos Dispersos p/ Dist.



Núcleos Dispersos a cada 3km de distância das faixas de rodovias



- Dados Externos
- Spring 5.2.6
- Fragstats 4.2
- Excel