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22nd – 23rd March 2011

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How to measure Carrying Capacity in Baltic Nature Parks as a tool for managing visitor flow

Jesper Brandt and Esbern Holmes

Dept. of Environmental, social and spatial change (ENSPAC), Roskilde University, Denmark

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Outline:

1. How to understand the Carrying Capacity-concept. Who makes carrying capacity?
2. Historical background: Pressure on US National Parks. Discussions on common land and private property
3. History in areas of todays European Nature Parks. A Faeroese relict
4. Natura2000 as a European frame for carrying capacity-studies in Baltic nature parks
5. The Visitor Experience and Ressource Protection (VERP) Method
6. The close relation to visitor monitoring
7. The need of studies on management of local hot spots in the parks
8. Short overview of carrying capacity-works in the Baltic parks of Parks&Benefits

Carrying capacity problems of nature parks:

1) How many guests can be put into the park without spoiling the nature (man-nature-conflicts)

2) How many guests can be put together in a park before they spoil the experience for each other? (man-man-conflicts)

Carrying capacity is **not** a scientifically objectively determined measure.

Carrying capacity is a result of political decision processes among stakeholders, balancing use and protection preferably based on scientific and/or experiential cognition.

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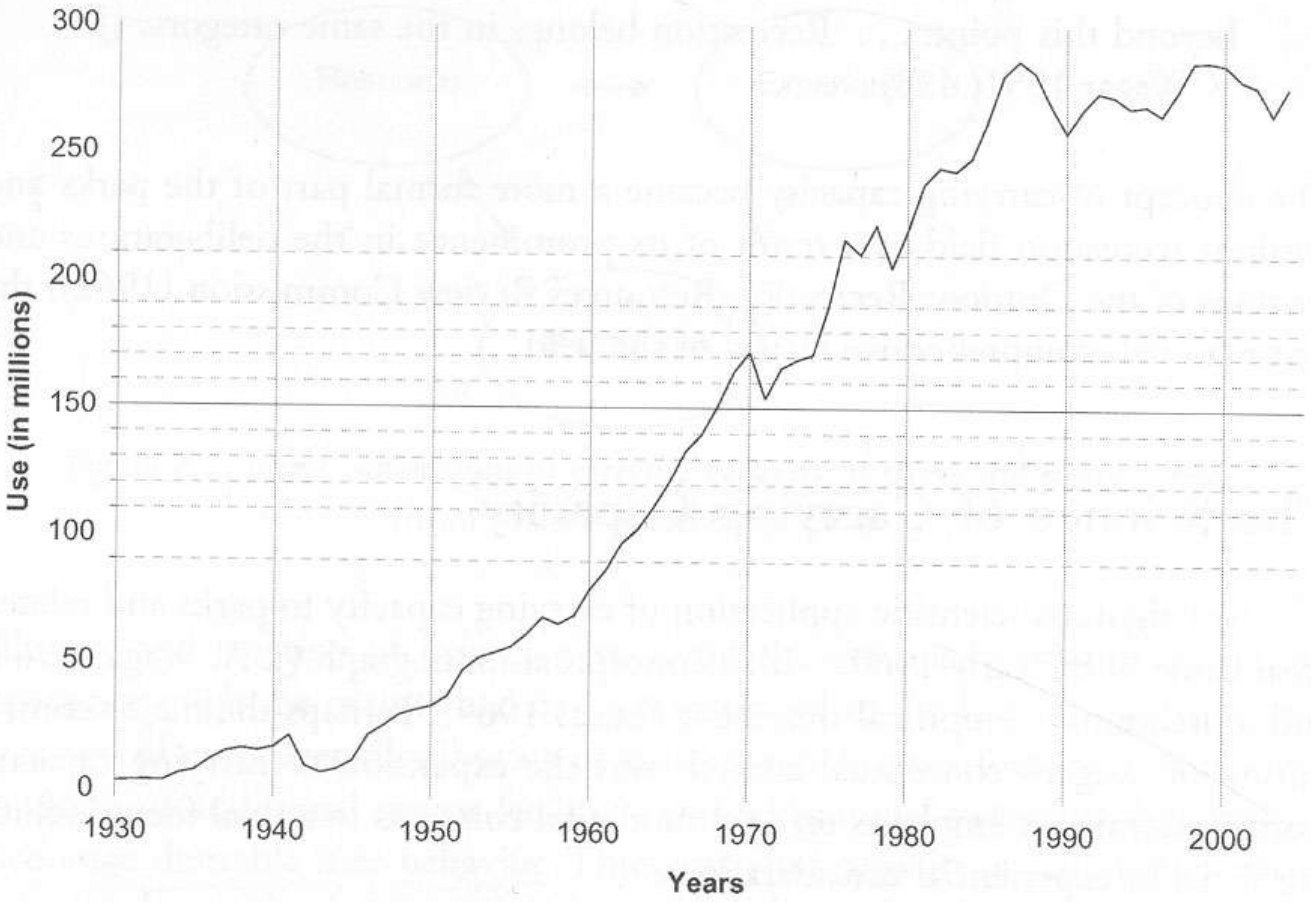

Figure 2.1. Recreation visits to the U.S. national park system.

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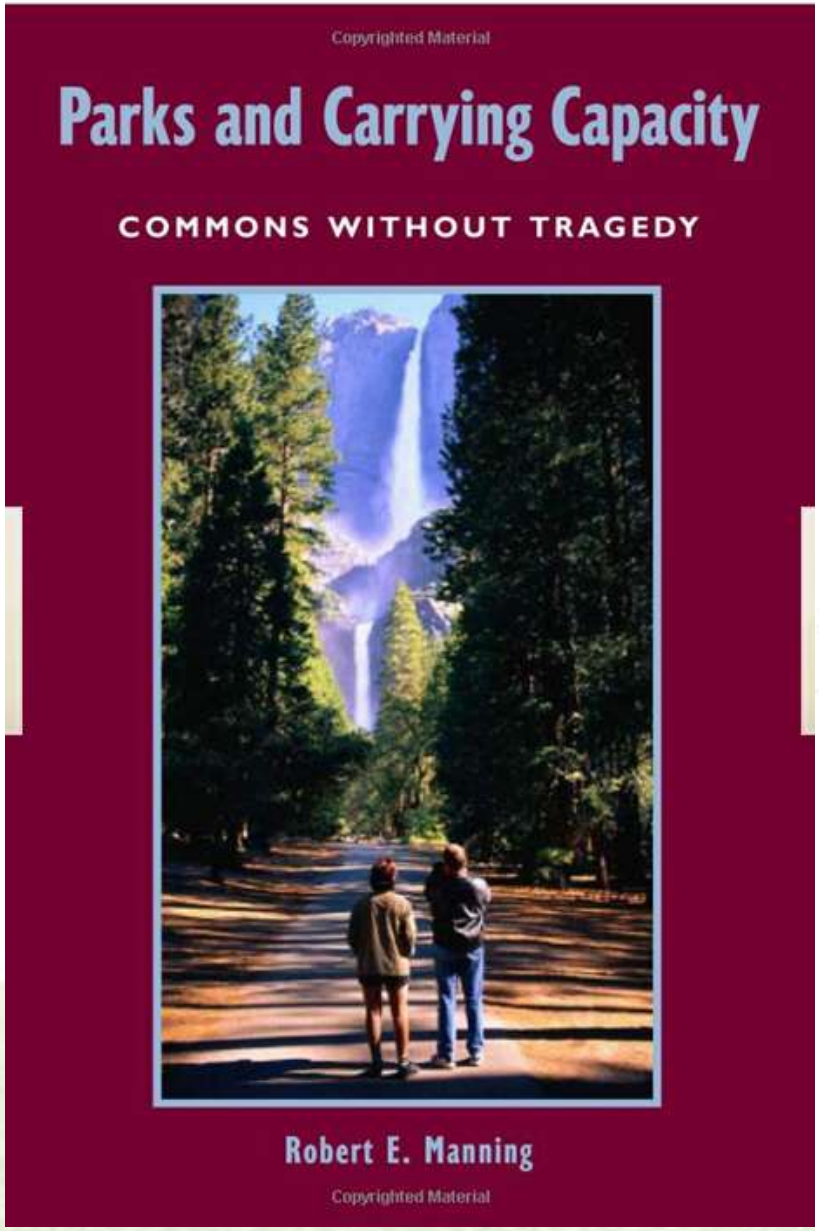

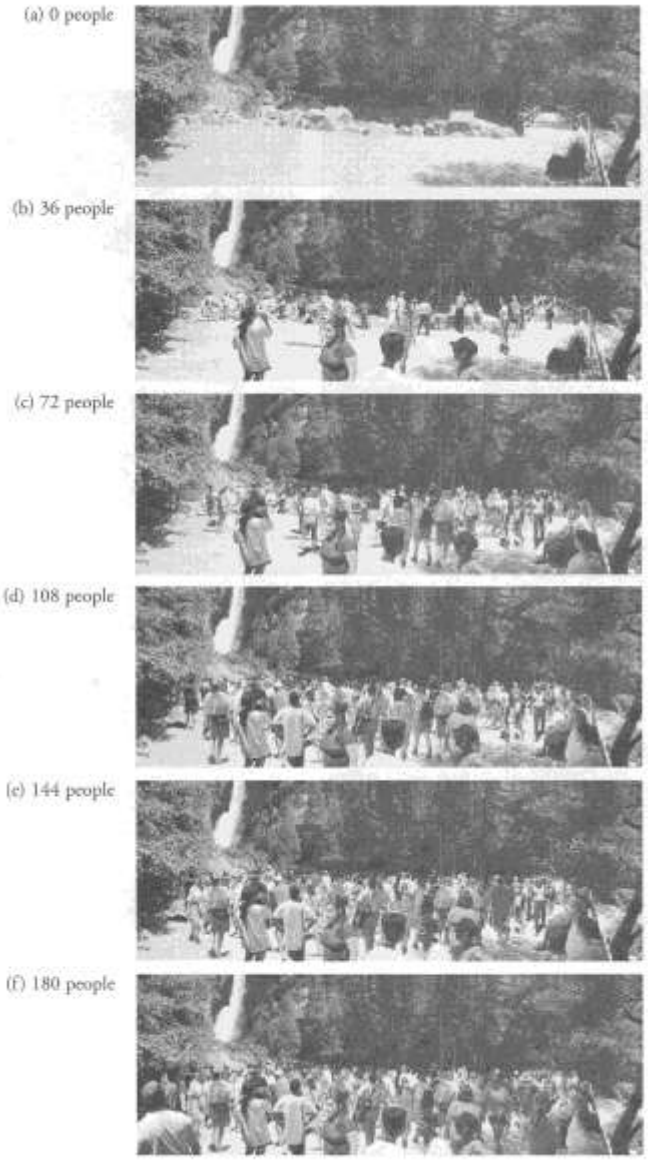

Figure 10.3. Study photographs for the base of Yosemite Falls.

Garrett Hardin:
The tragedy of the Commons.
Science, Vol. 162:pp.1243-48. 1968

Commons: Collectively owned goods

Reprinted in at least 100 anthologies on Environmental Management

Quoted more than 37000 times!

Standard defence for private property

Carrying capacity is not a new concept. It has been widely used in most pre-industrial societies, in Europe for at least 700 years in the widespread infield-outfield agricultural systems of medieval time.

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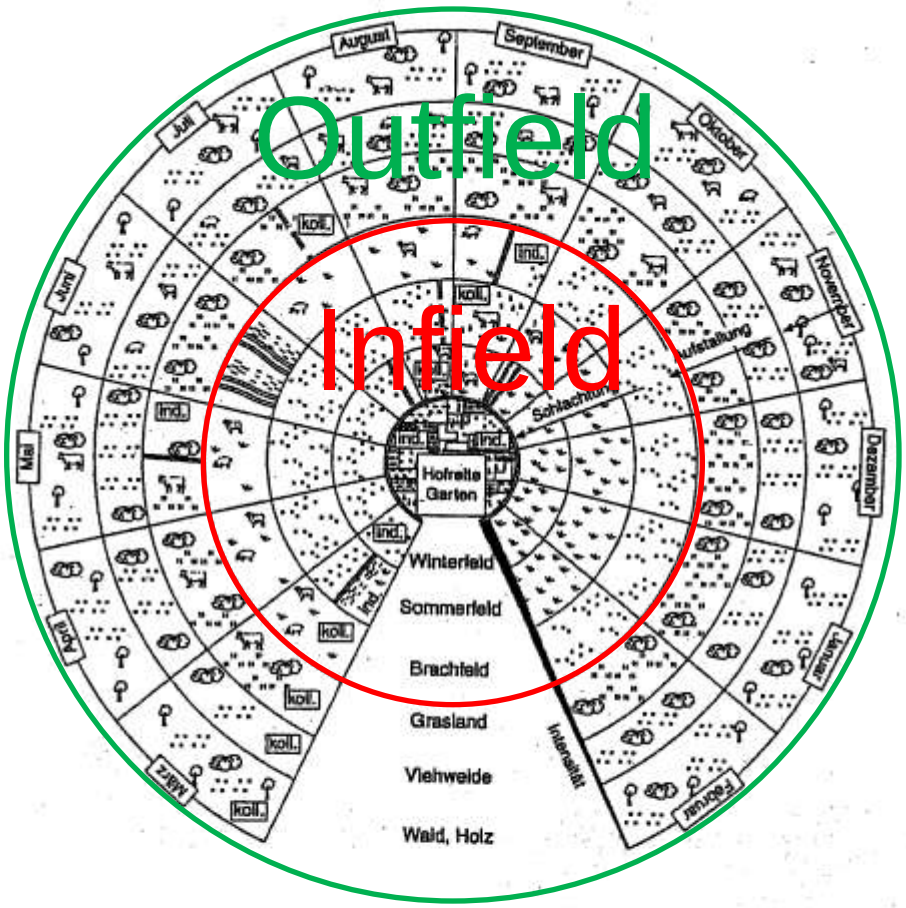

Infield-outfield system

Carrying capacity was kept for each types of animals at all grounds of the commons, and shared among the owners according to their share of the value of the village – often given in Marks

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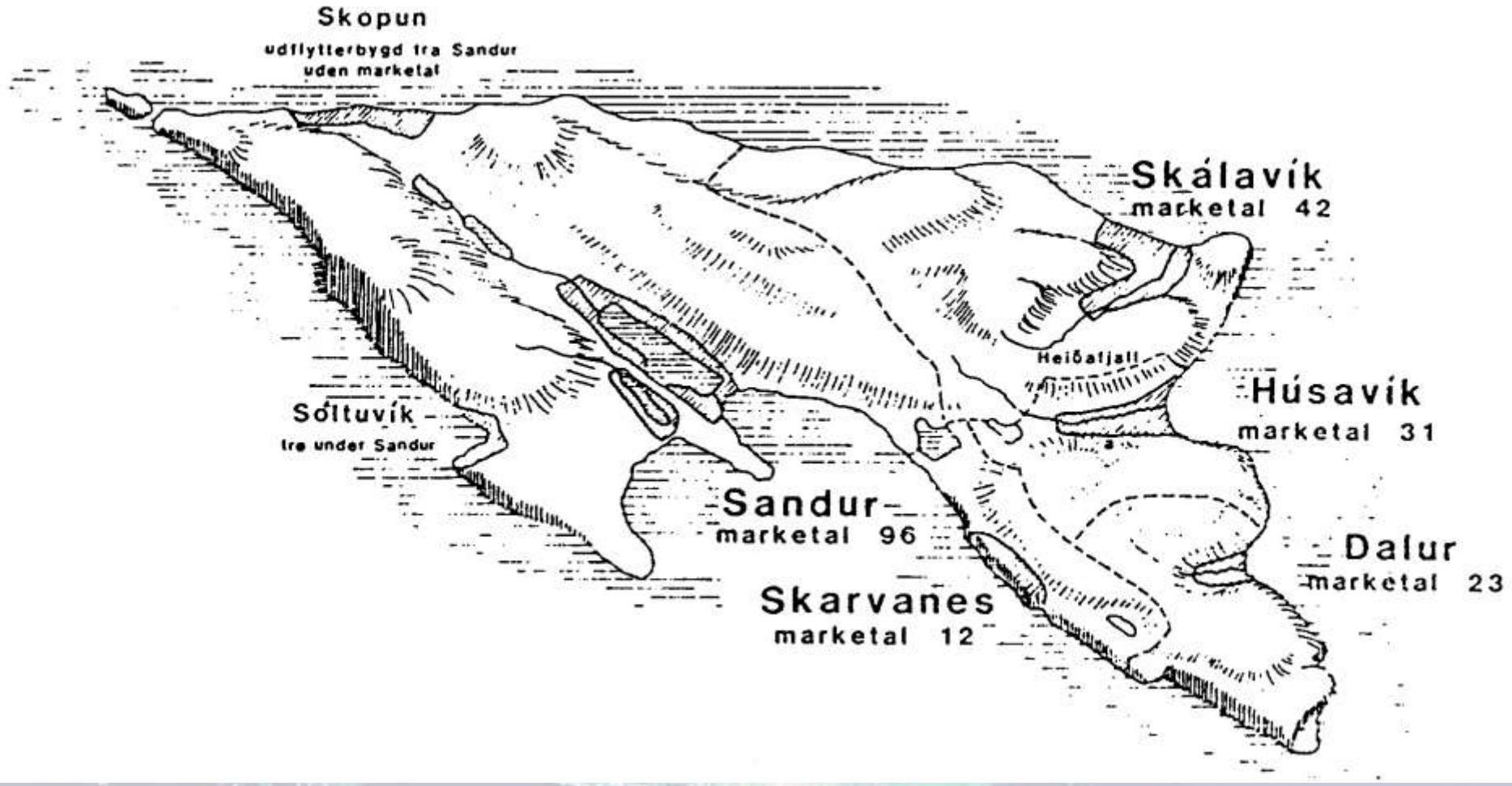

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Ownership of

1 mark in Húsavík (31 marks)

means:

1. Specific land parcels in the infield, equivalent to 1/31 of the production capacity
2. Rights to a number of sheep in the outfield, equivalent to 1/31 of the total skipan (kenning). From the 17th century: Rights to 1/31 of the output of the commen owned sheep (felag)
3. Rights to summer grazing for a certain number of cows corresponding to 1/31 of the grazing capacity of the nearest part of the outfields – the 'house-outfield'
4. Right to a share in other resources: peat, fowling chliffs, driftwood, seaweed for fertilizer, pilot whales, feitilendir (rich pastures for fattering rams) etc.
5. Right to keep a fixed number of horses and dogs

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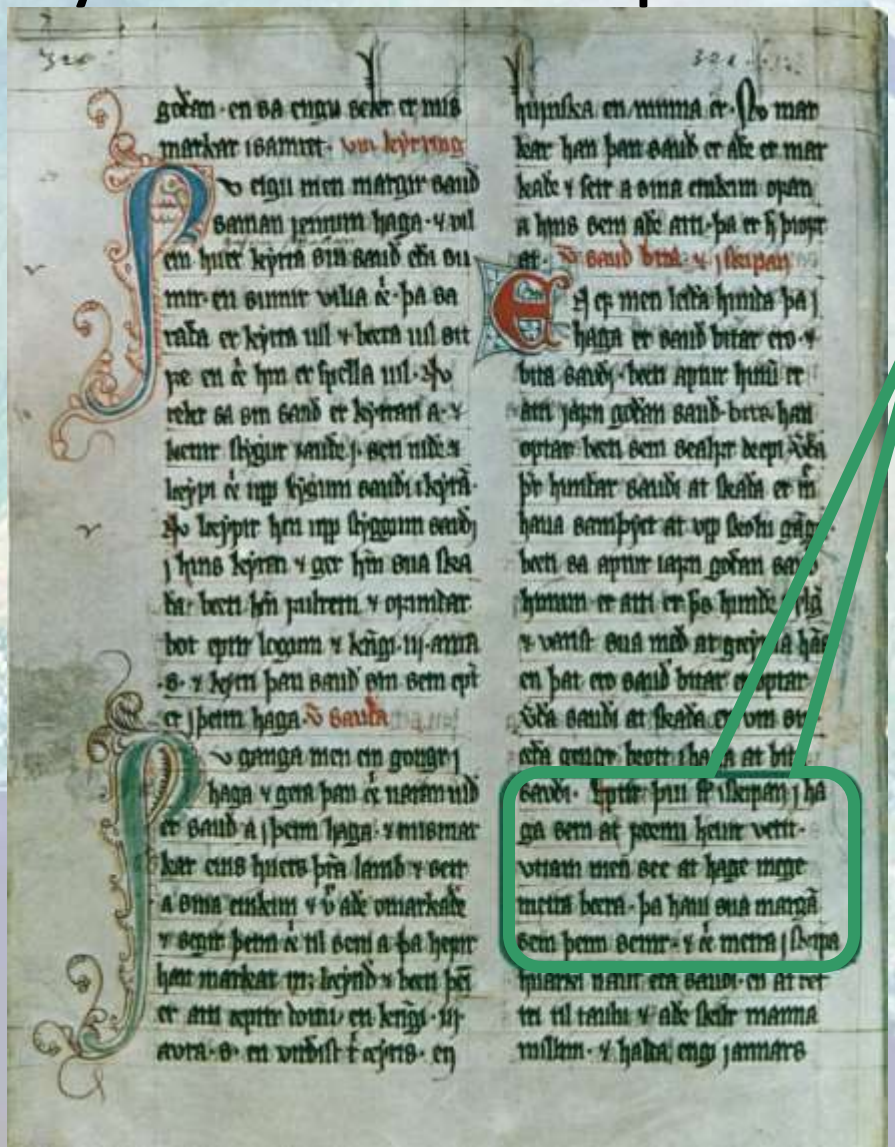
Seyðarbrevit – the sheep letter – a Faeroese law from 1298



’Skipan j haga’ - The number of sheep to be kept on an area of pasture land - shall remain the same as it was in previous time.

Skipan = the number of grazing animals within a given territory

(sheep-, cow-, horse-, dog-, geese-skipan)

(Skipan = shipping = carrying capacity)

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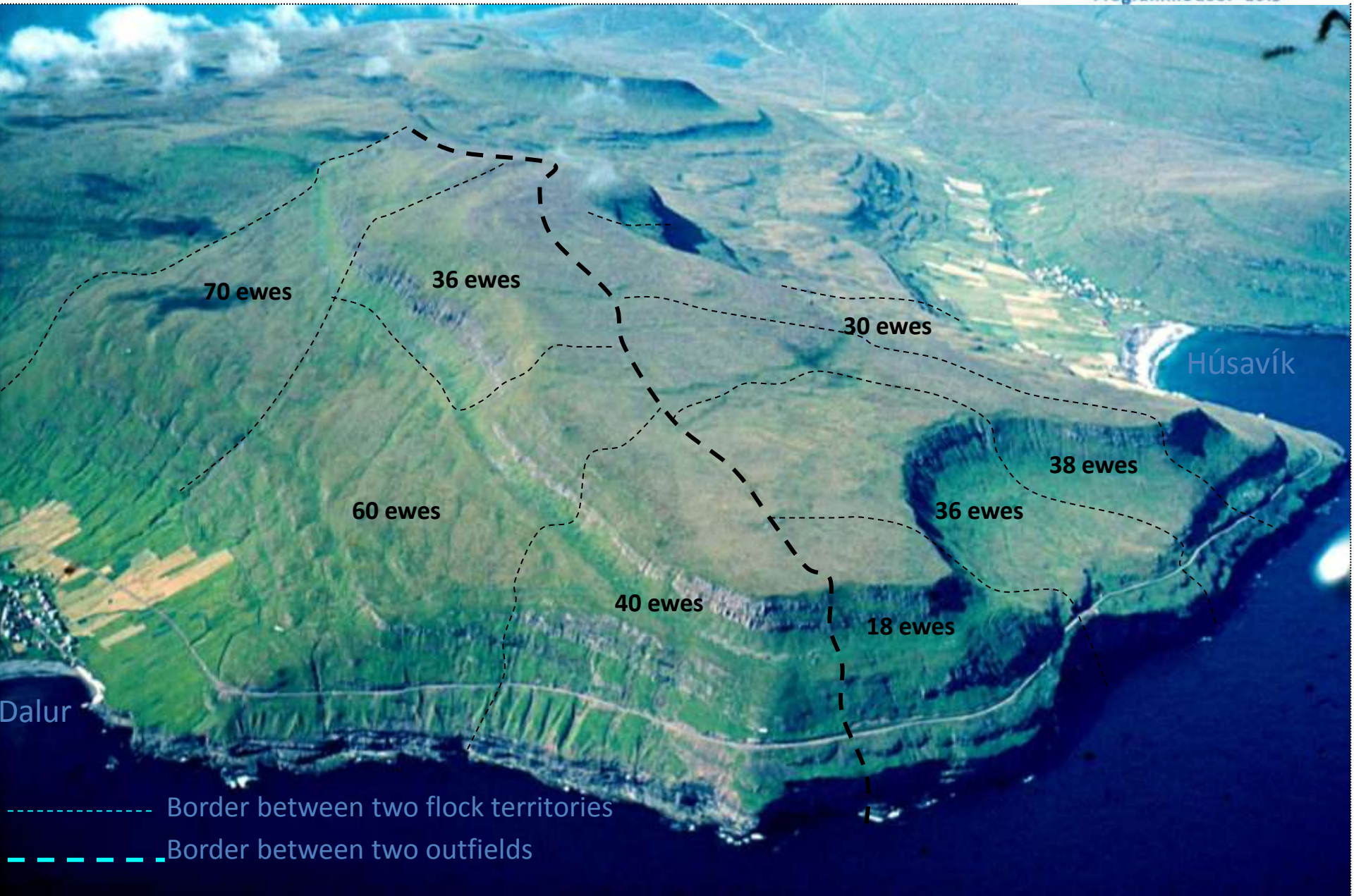

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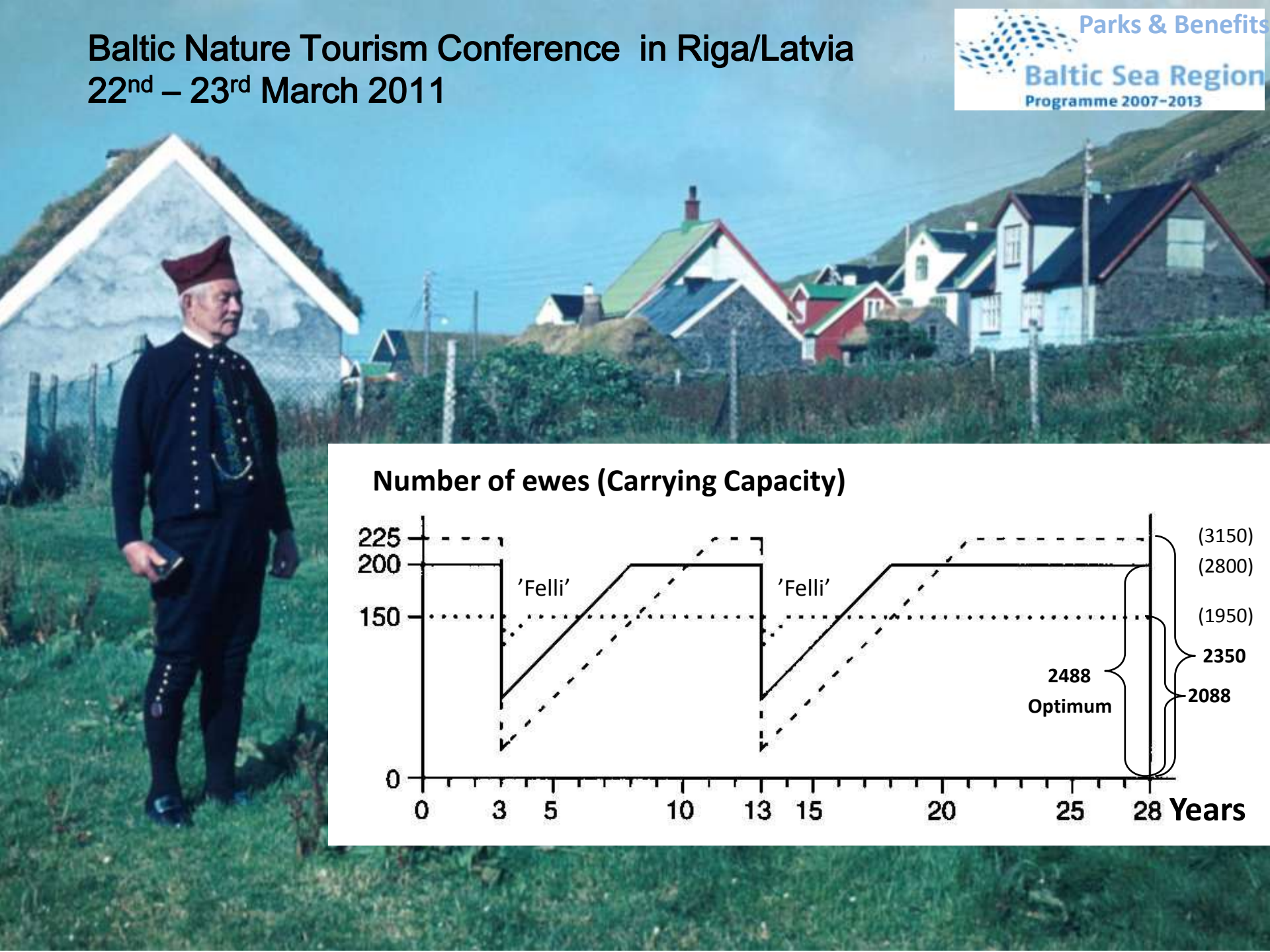

Number of ewes (Carrying Capacity)

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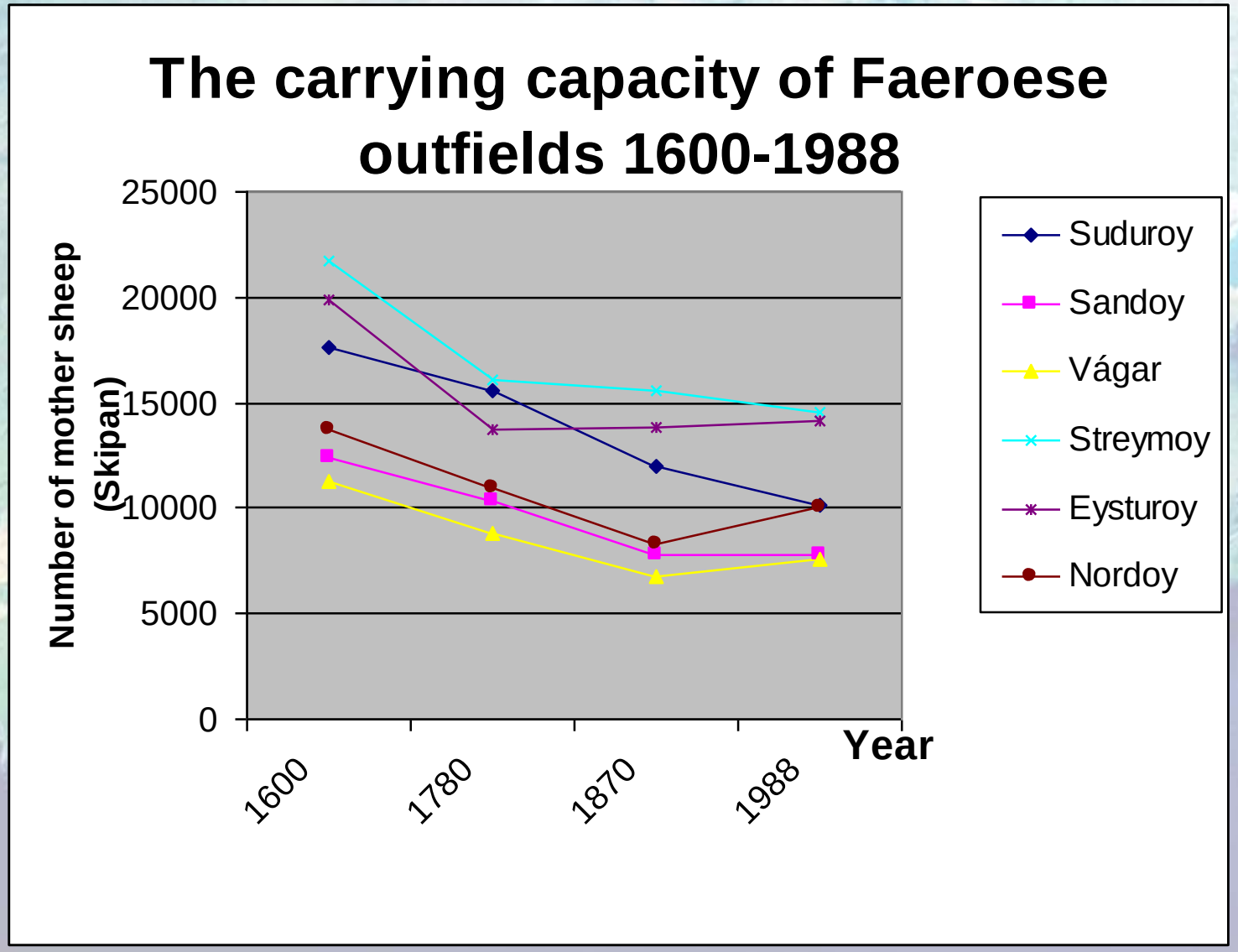
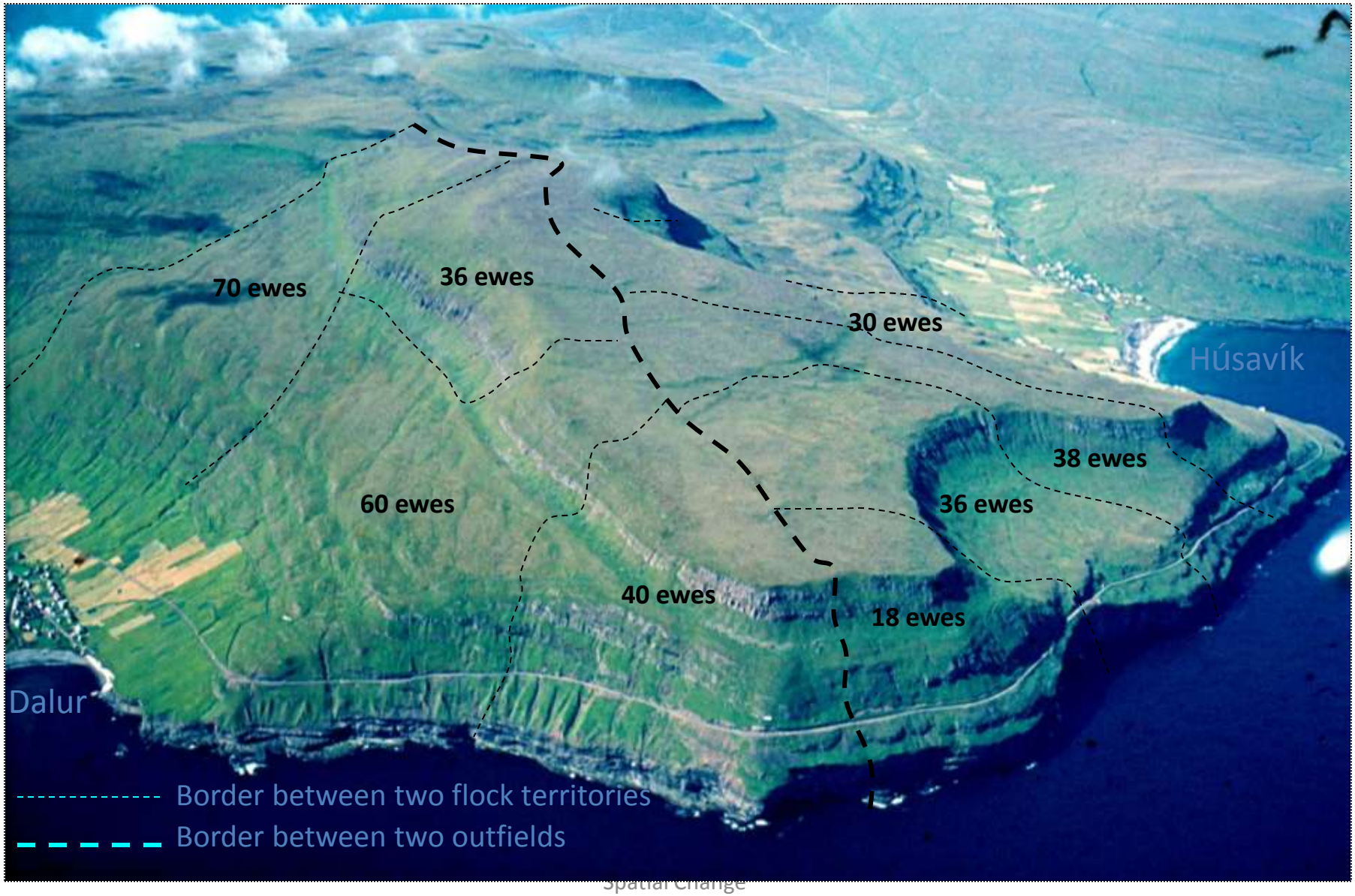
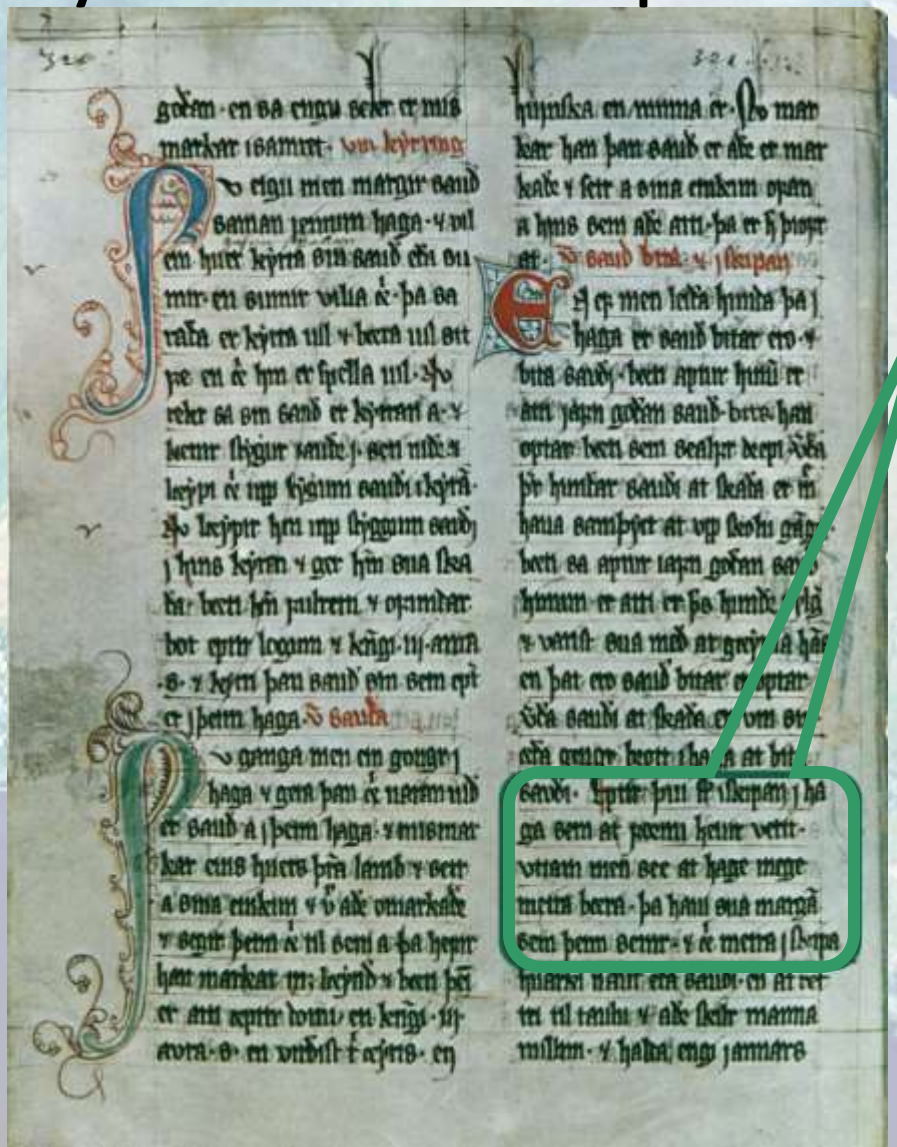

The carrying capacity of Faeroese outfields 1600-1988
Number of mother sheep (Skipan)
25000
20000
15000
10000
5000
0
1600
1780
1870
1988
Year
Suduroy
Sandoy
Vágar
Streymoy
Eysturoy
Nordoy


70 ewes
36 ewes
30 ewes
Húsavík
38 ewes
60 ewes
36 ewes
40 ewes
18 ewes
Dalur
Border between two flock territories
Border between two outfields

Seyðarbrevit – the sheep letter – a Faeroese law from 1298



’Skipan j haga’ - The number of sheep to be kept on an area of pasture land - shall remain the same as it was in previous time.

If they agree that it can accommodate more, then they can have as many (sheep) as they can agree upon, and every man can have as many sheep, as his share of the property can justify.

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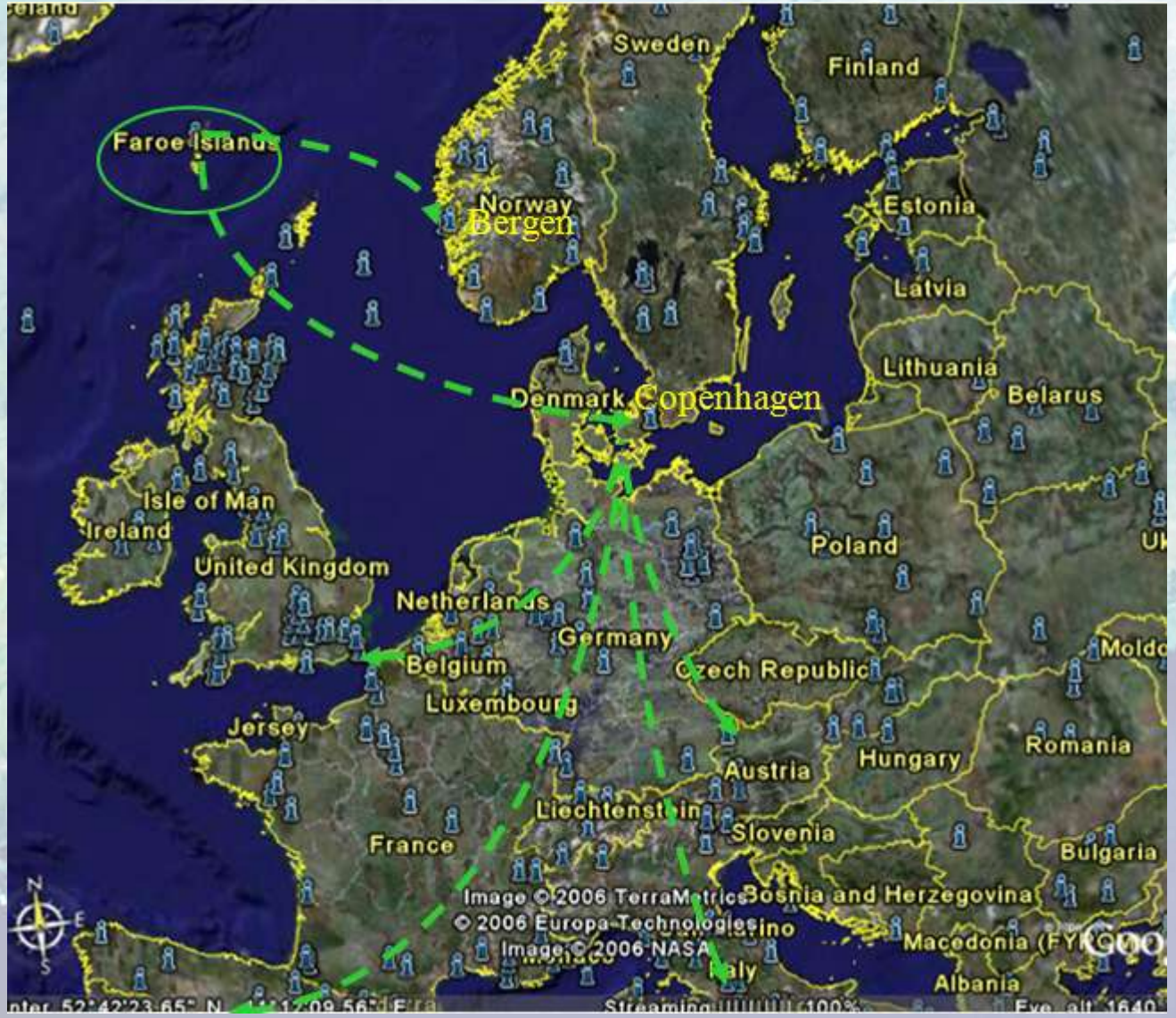

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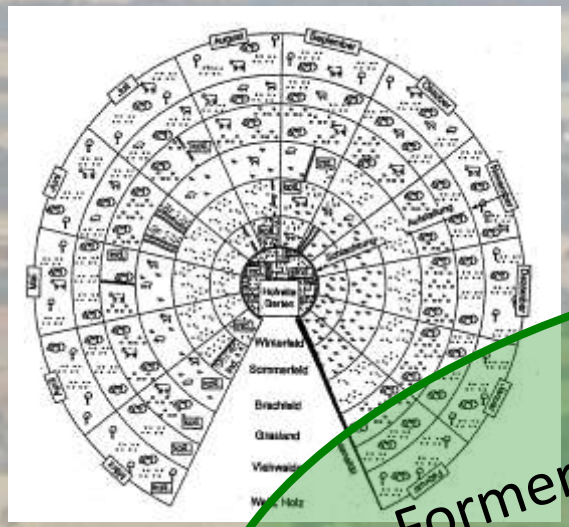
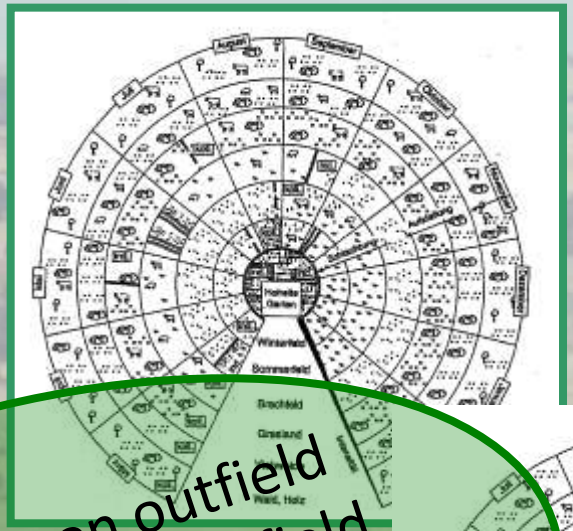


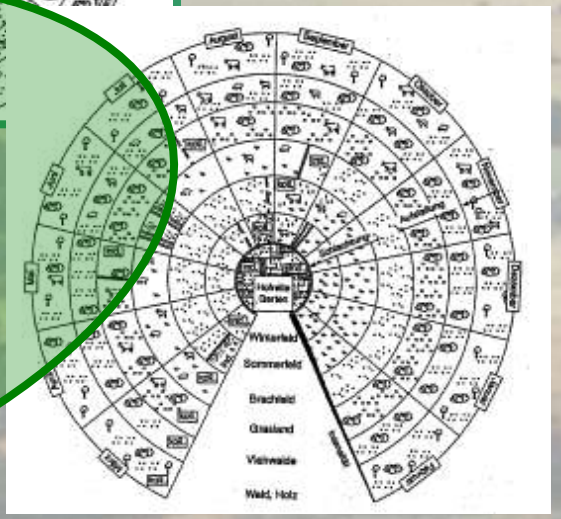


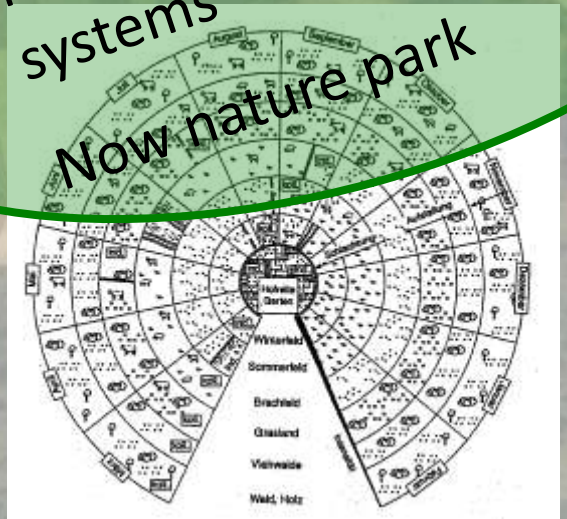
Nature parks are extremely heterogenious landscapes!

= varied and complex conflicts

Former common outfield for several infield-outfield systems

Now nature park





'Mediation among stakeholders is irrelevant, if it is based on ignorance of the integrated character of nature and people'

(Gunderson and Holling, 2002, p.8)

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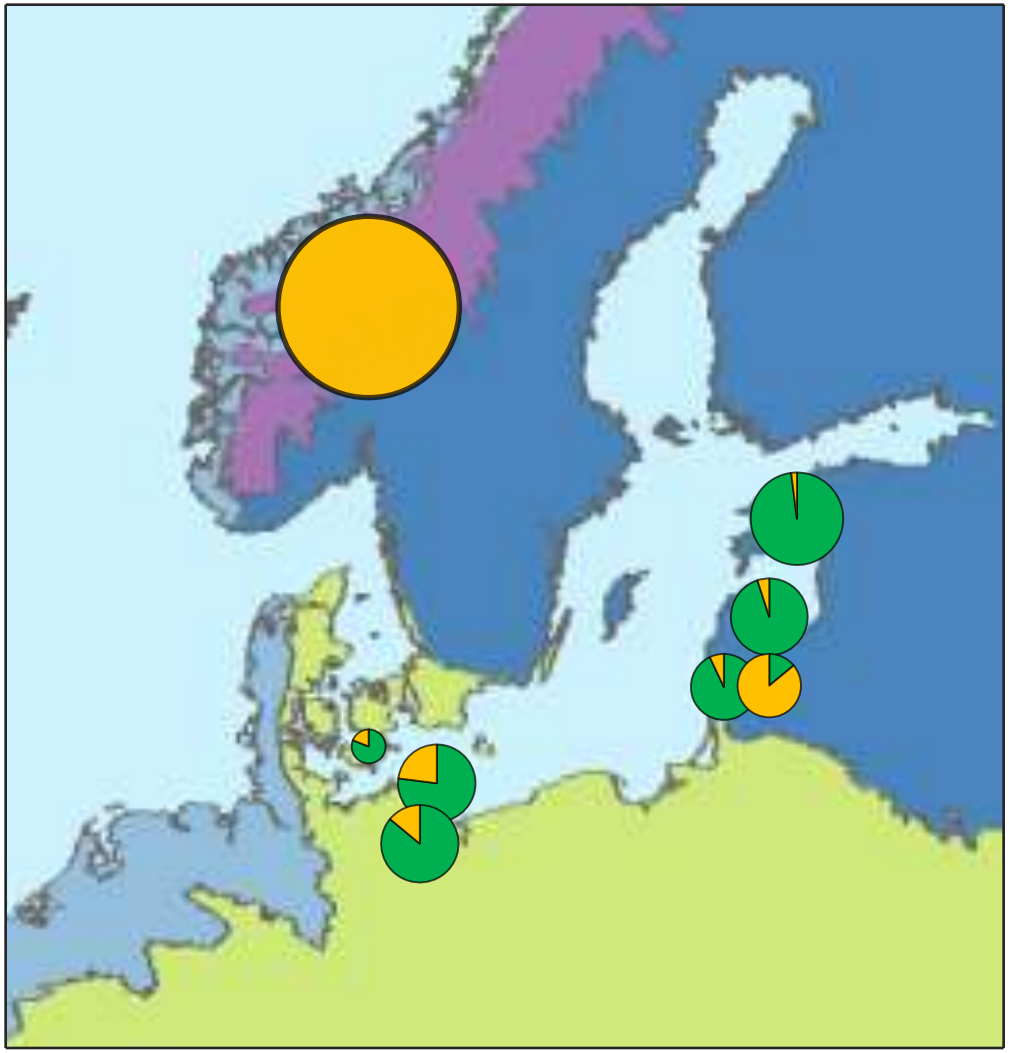

Source: Extraction from the EU Natura2000 Database for habitat sites overlapping the 7 EU-parks of Parks&Benefits. European Environmental Agency (EEA): Biogeographical regions, Europe 2001. http://www.eea.europa.eu/data-and-maps/figures/biogeographical-regions-europe-2001.
Dovrefjell, Norway is not part of EU, and therefore outside the Natura2000-system
The area of the circles are proportional to the size of the parks

Share of the park being Natura2000

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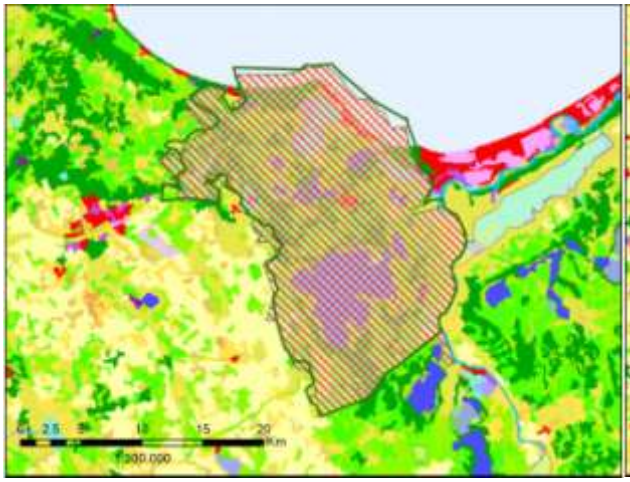
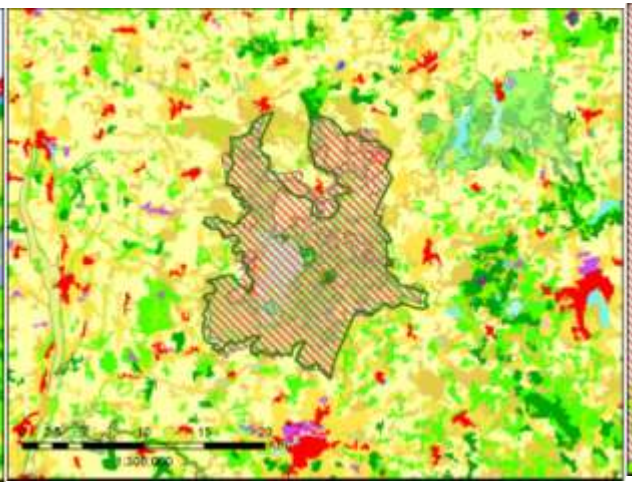
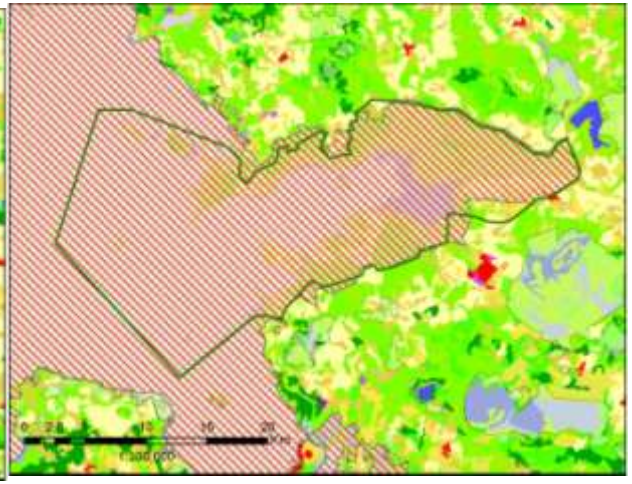
Map 3.2, 3.3, 3.4 and 3.5: Natura2000 sites overlapping the parks delineated along Natura2000-boundaries. All Natura2000 areas (delineated with a dark green stroke) have a semitransparent light green overlay. Habitat sites overlapping the park has been dark red shaded, Bird sites perpendicular Flamingo red.



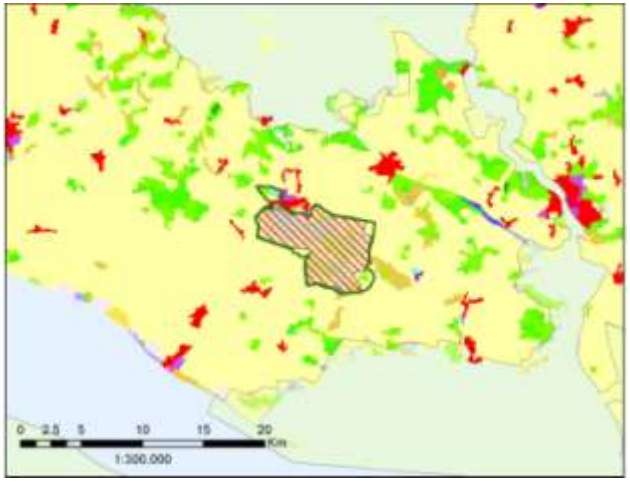
Ķemeri National Park – 95% Natura 2000



Žemaitija National Park – 93% Natura 2000



Matsalu National Park – 98% Natura 2000



Maribo Lakes Nature Park – 81% Natura 2000

Delineation along Natura 2000:

Ķemeri National Park – 5% not Natura200
Žemaitija National Park – 7% not Natura2000
Matsalu National Park – 2% not Natura2000
Maribo Lakes Nature Park – 19% not Natura2000

All Natura 2000-deliniations comprises both the Habitat Directive and the Bird Directive

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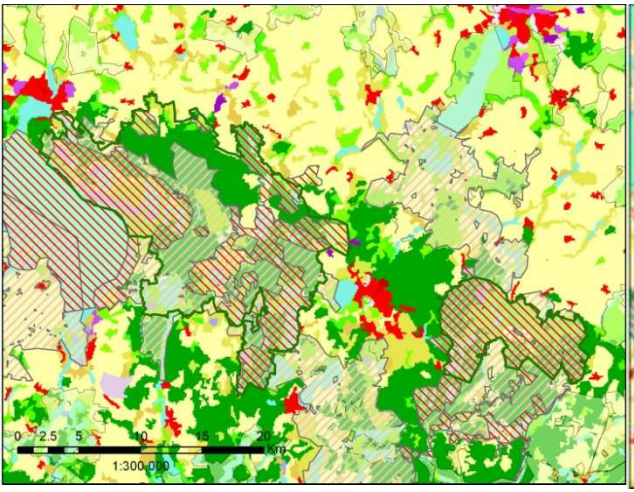
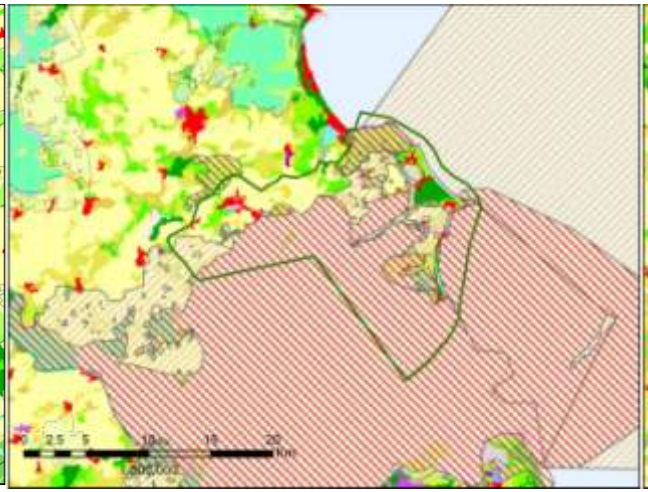
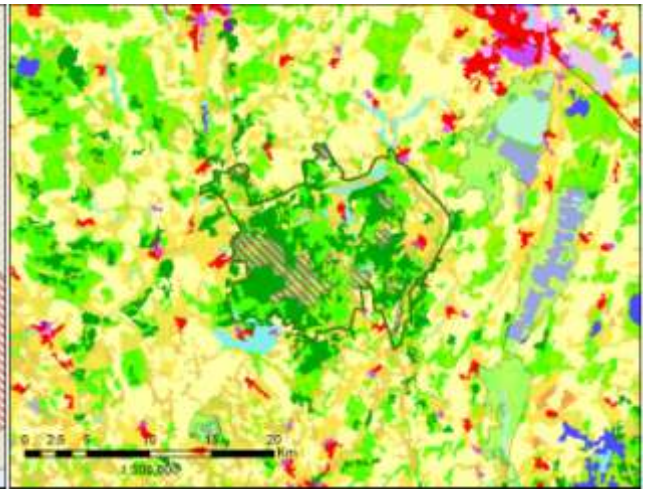
Map 3.1, 3.6 and 3.7: Natura2000 sites overlapping the parks, delineated independently of Natura2000-boundaries. All Natura2000 areas (delineated with a dark green stroke) have a semitransparent light green overlay. Habitat sites overlapping the park has been dark red shaded, Bird sites perpendicular Flamingo red.



Müritz National Park – 86% Natura 2000



Biosphere reserve South-East Rügen – 77% Natura 2000



Kurtuvenai Regional Park – 14% Natura 2000

Deliniation independently of Natura 2000:

Müritz National Park – 14 % not Natura2000
Biosphere Reserve South-East Rügen – 23% not Natura2000
Kurtuvenai Regional Park – 84% not Natura2000

Natura 2000-deliniations comprises a complicated spatial mixture of sites under the Habitat Directive and the Bird Directive

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Table 2.6: European listed priority habitat types within the park-related habitat sites (SACs or SCIs). Priority habitat types are the habitat types with the highest conservational priority at a European level.

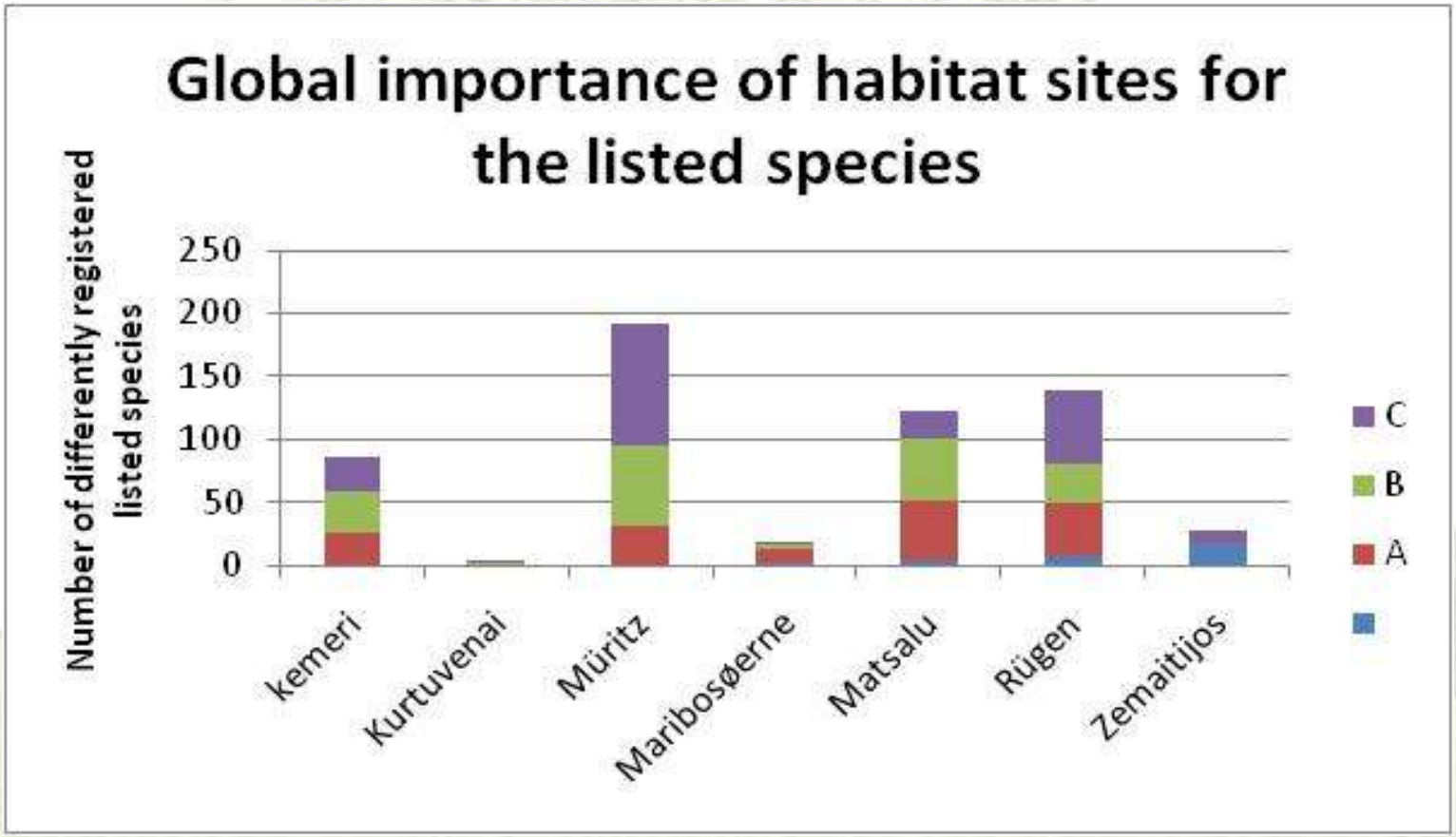
	BR SE Rügen	NLP Zemaitija	NP Maribo	NLP Müritz	NLP Matsalu	NLP Kemeri	NLP Kurtuvenei	Total
Size of the park (km2)	**259,12**	**211,49**	**47,15**	**326,78**	**509,66**	**391,94**	**192,04**	**1.938,18**
Numbers of NATURA2000 listed habitat types represented in each park	27	15	16	20	23	26	14	55
Priority habitat types (hectars):	**2.331**	**563**	**307**	**778**	**15.203**	**7.670**	**403**	**27.254**
Active raised bogs						3817	15	3832
Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	18	27	192	39		382		658
Bog woodland	125	364	38	392		1909	231	3.059
Boreal Baltic coastal meadows					6.081			6.081
Calcareous fens with Cladium mariscus and species of the Caricion davallianae		15	38	341	253	19	10	677
Coastal lagoons	2.103				760			2.863
Fennoscandian deciduous swamp woods		73			3.041	763	7	3.883
Fennoscandian hemiboreal natural old broad-leaved deciduous forests (Quercus, Tilia, Acer, Fraxinus or Ulmus) rich in epiphytes					1.267	8		1.275
Fennoscandian lowland species-rich dry to mesic grasslands					507	0		507
Fennoscandian wooded meadows					507			507
Fixed coastal dunes with herbaceous vegetation ("grey dunes")	27					8		34
Inland salt meadows			38					38
Nordic alvar and precambrian calcareous flatrocks					2.027			2.027
Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	30	11						41
Tilio-Acerion forests of slopes, screes and ravines	28							28
Western Taïga		73			760	765	141	1.738
Xeric sand calcareous grasslands				6				6
Numbers of priority habitat types represented in each park:	**6**	**6**	**4**	**3**	**9**	**9**	**5**	**17**

Listed Natura2000 Habitat types in Europe in all: 231. 55 (24% are represented in the 7 parks)

Listed Natura2000 Priority habitat types in Europe in all: 75. 17 (23% are represented in the 7 parks)

Sources: European Environmental Agency (EEA): Natura 2000 data – the European network of protected sites. http://www.eea.europa.eu/data-and-maps/data/natura-2000. For a description of habitat types, see: European Environmental Agency (EEA): Natura2000, 2007. Interpretation manual of European Union habitats. EUR 27. European Commission DG Environment. Nature and biodiversity. http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/2007_07_im.pdf

Figure 2.5: Number of differently registered listed species, and the global importance of the overlapping Natura2000 sites for the protection of the species. A (red): Excellent value, B (green): good value, C (lilac): significant value, (Blue colour): no information on global assessment, since the Natura2000-sites are judged to have a non-significant representativity for the species. Since different habitat sites can be evaluated to have different quality for a species, a species count for each different quality assessment for a species has been made. Therefore the species-numbers for each park exceeds the total species number that can be counted together from table 6a and 6 b. Nevertheless the figure gives a rather precise impression of the quality of the habitats for the amount of listed species expressed by the global importance.



Source: Extraction from the EU Natura2000 Database for Natura2000 sites overlapping the 7 EU-parks of Parks&Benefits.

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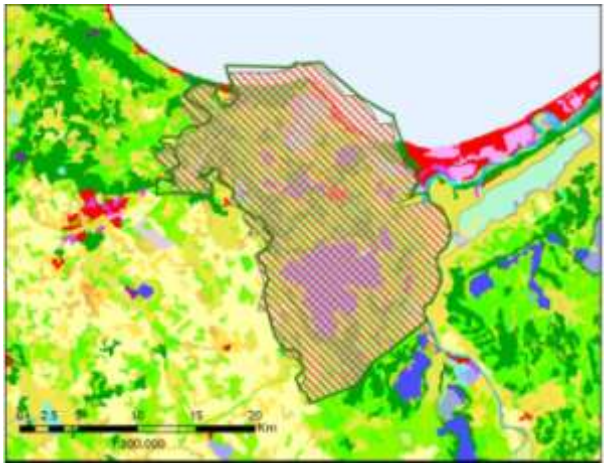
Eksample of information on human impacts on Natura2000-sites overlapping a park territory.

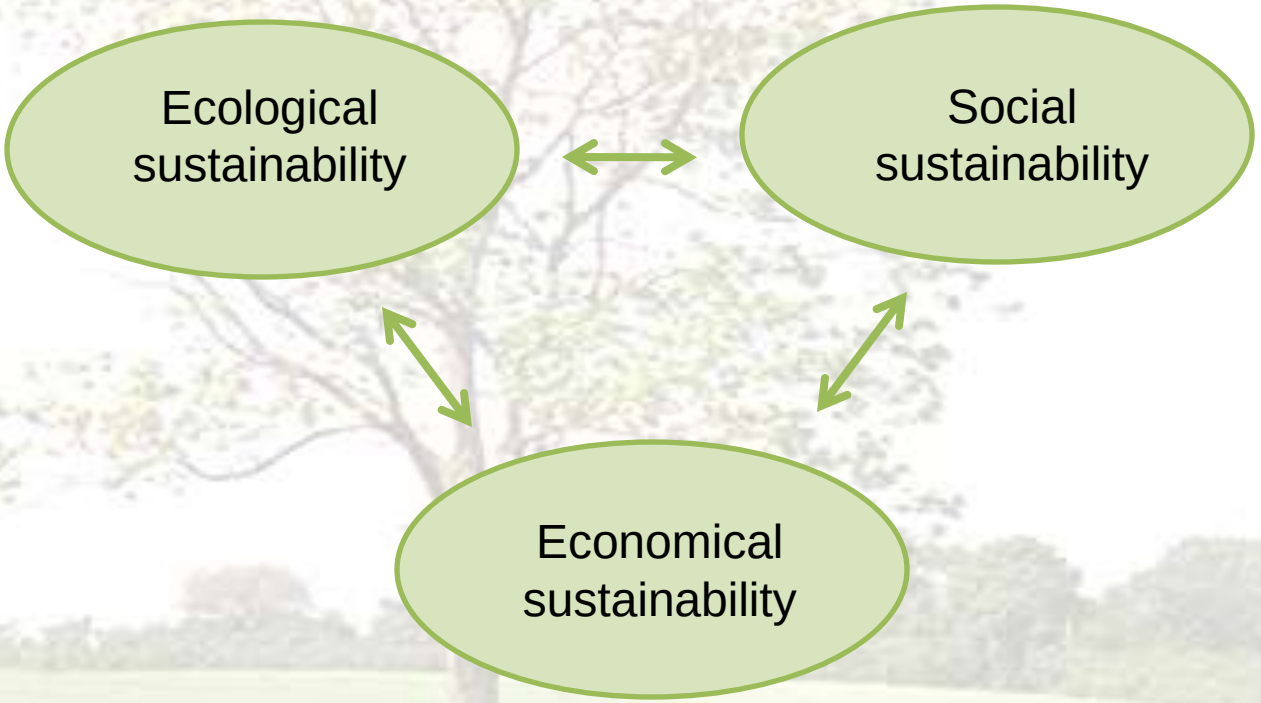
Name	inOut	intensity	influence	pct	activity	SITECODE_1
kemeri	I	B	0	1	dispersed habitation	LV0200200
kemeri	I	B	0	1	paths, tracks, cycling tracks	LV0200200
kemeri	I	C	0	1	railway lines, TGV	LV0200200
kemeri	I	C	0	1	electricity lines	LV0200200
kemeri	I	B	0	1	pipe lines	LV0200200
kemeri	I	B	0	4	Urbanised areas, human habitation	LV0200200
kemeri	I	B	0	5	roads, motorways	LV0200200
kemeri	I	B	0	6	Leisure fishing	LV0200200
kemeri	I	B	0	25	walking, horseriding and non-motorised vehicles	LV0200200
kemeri	O	B	-	0	disposal of household waste	LV0200200
kemeri	O	B	-	0	disposal of industrial waste	LV0200200
kemeri	I	B	-	1	forestry clearance	LV0200200
kemeri	I	C	-	1	disposal of industrial waste	LV0200200
kemeri	I	B	-	1	Other pollution or human impacts/activities	LV0200200
kemeri	I	B	-	1	Trampling, overuse	LV0200200
kemeri	I	C	-	2	abandonment of pastoral systems	LV0200200
kemeri	I	A	-	2	management of water levels	LV0200200
kemeri	I	B	-	3	water pollution	LV0200200
kemeri	I	B	-	5	motorised vehicles	LV0200200
kemeri	I	B	-	5	eutrophication	LV0200200
kemeri	I	B	-	21	removal of dead and dying trees	LV0200200
kemeri	I	B	-	24	Drainage	LV0200200
kemeri	I	B	-	35	Hunting	LV0200200
kemeri	I	B	-	50	disposal of household waste	LV0200200
kemeri	I	C	+	4	mowing / cutting	LV0200200



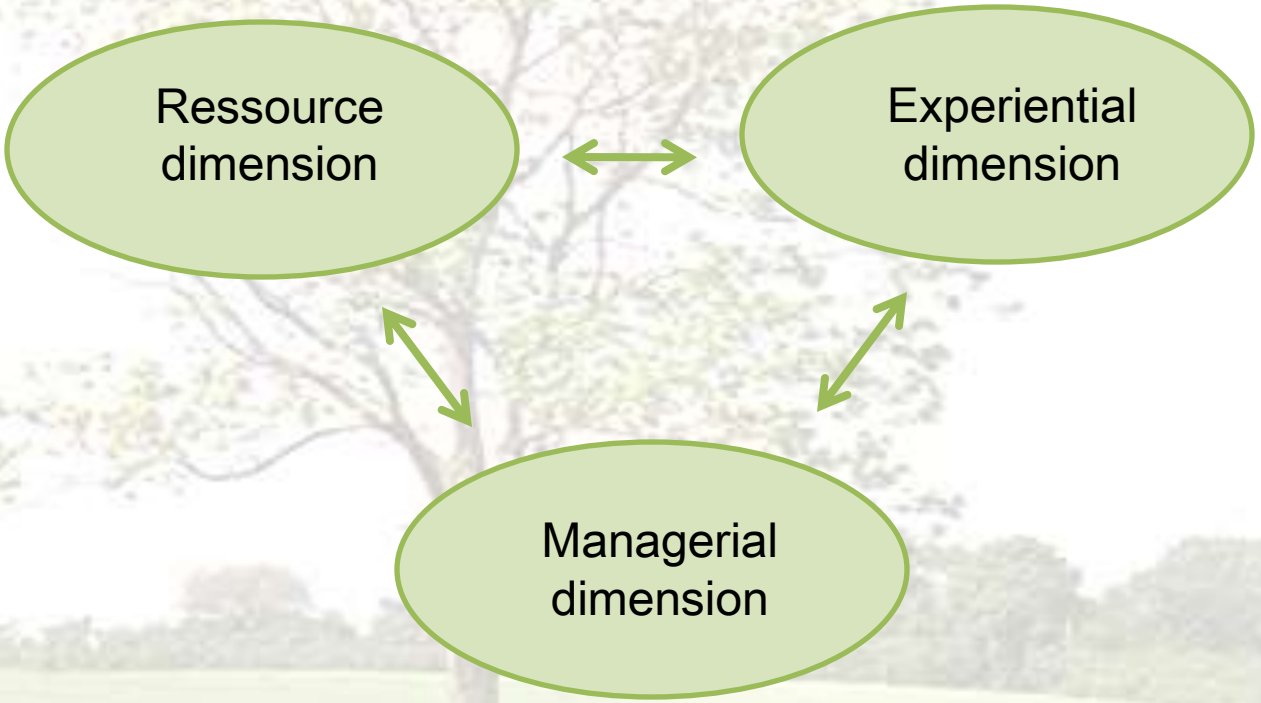
inOut: acitivity within (I) or outsite (O) the site with impact on the site
Intensity: A-high influence, B-medium influence, C-low influence
Influence: indicate if the influence is positive (+), negative (-) or newtral (0)
pct: Percentage of the site affected by the activity
Activity: Human activity or induced natural process influencing the conservation and management of the site
SITECODE_1: The natura2000-site code.

Source: European Environmental Agency (EEA): Natura 2000 data – the European network of protected sites. http://www.eea.europa.eu/data-and-maps/data/natura-2000

Three dimensions of sustainability following the Brundtland Report on sustainable development, 1986



Three dimensions of carrying capacity of parks and related areas (Manning & Lime 1996)



Source: Manning, R. and D. Lime 1996. Crowding and Carrying Capacity in the National Park System: Towards a Social Science Research Agenda. Wroding and Congestion in the National Park System: Guidelines for Management and Research. St. Paul. University of Minnesota Agricultural Experiment Station Publication 86, 27-65

VERP: Visitor Experience and Ressource Protection I

1. Establish management objectives/desired conditions and associated indicators and standards.
2. Monitor indicator variables.
3. Apply management practices to ensure that standards are maintained

Manning, R. (2004): Recreation Planning Frameworks. *Society and Natural Resources: A Summary of Knowledge*. Jefferson, MO: Modern Litho, 83-96

VERP: Visitor Experience and Ressource Protection II

Management goals/desired conditions. Broad descriptions of the state and qualities, being desired to maintain in and around the park.

Indicators: More specific, measurable variables, reflecting the essence of or the meaning of the management objectives.

Standards: The minimum acceptable values of the indicators

Manning, R. (2004): Recreation Planning Frameworks. *Society and Natural Resources: A Summary of Knowledge*. Jefferson, MO: Modern Litho, 83-96

What is a good indicator? – an evaluation matrix

Potential indicators	Criteria for good indicators								
	Specific	Objective	Reliable and repeatable	Related to visitor use	Sensitive	Manageable	Efficient and effective to measure	Integrative or synthetic	Significant
Indicator 1									
Indicator 2									
Indicator 3									
Indicator 4									
Indicator 5									
Indicator . . .									

Source: Manning, R. E., 2007: Parks and Carrying Capacity. Commons without tragedy. Island Press. P. 30

A good indicator should be:

- Specific
- Objective
- Reliable and repeatable
- Related to visitor use
- Sensitive
- Manageable
- Efficient and effective to measure
- Integrative or synthetic
- Significant

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Table 2.1: Population within and around the 8 nature parks and estimations of visitors and overnight stay capacity.

	Dovre-fjell	Kemeri	SE-Rügen	Kurtu-venei	Maribo-søerne	Matsalu	Müritz	Zemaitija
Population within the park, in 1000[1)]	No data	7	12	3	2	1	2	6
Population within 50 km from the park, in 1000[1)]	No data	1.142	395	456	191	106	676	484
Estimated number of day tourists per year (in 1000)								
Estimated number of overnight tourists (guest-arrivals) per year (in 1000)			1.300					
Estimated number of visitors per year (in 1000)	30 (?)				20 (?)			
Number of accommodation spaces within the park			64.000 (?)		997			
Number of accommodation spaces within 5 km from the park (incl. the park)					1.471			
Number of guest overnight stays pr. Year (in 1000)			7.000					

Source: [1)] is based on distribution of population from EUROSTAT according to the CORINE land cover classification. The rest is based on information from local accomodations (Maribo), the park authorities or judgements based on their information. A lot of comparable quantitative data is missing.

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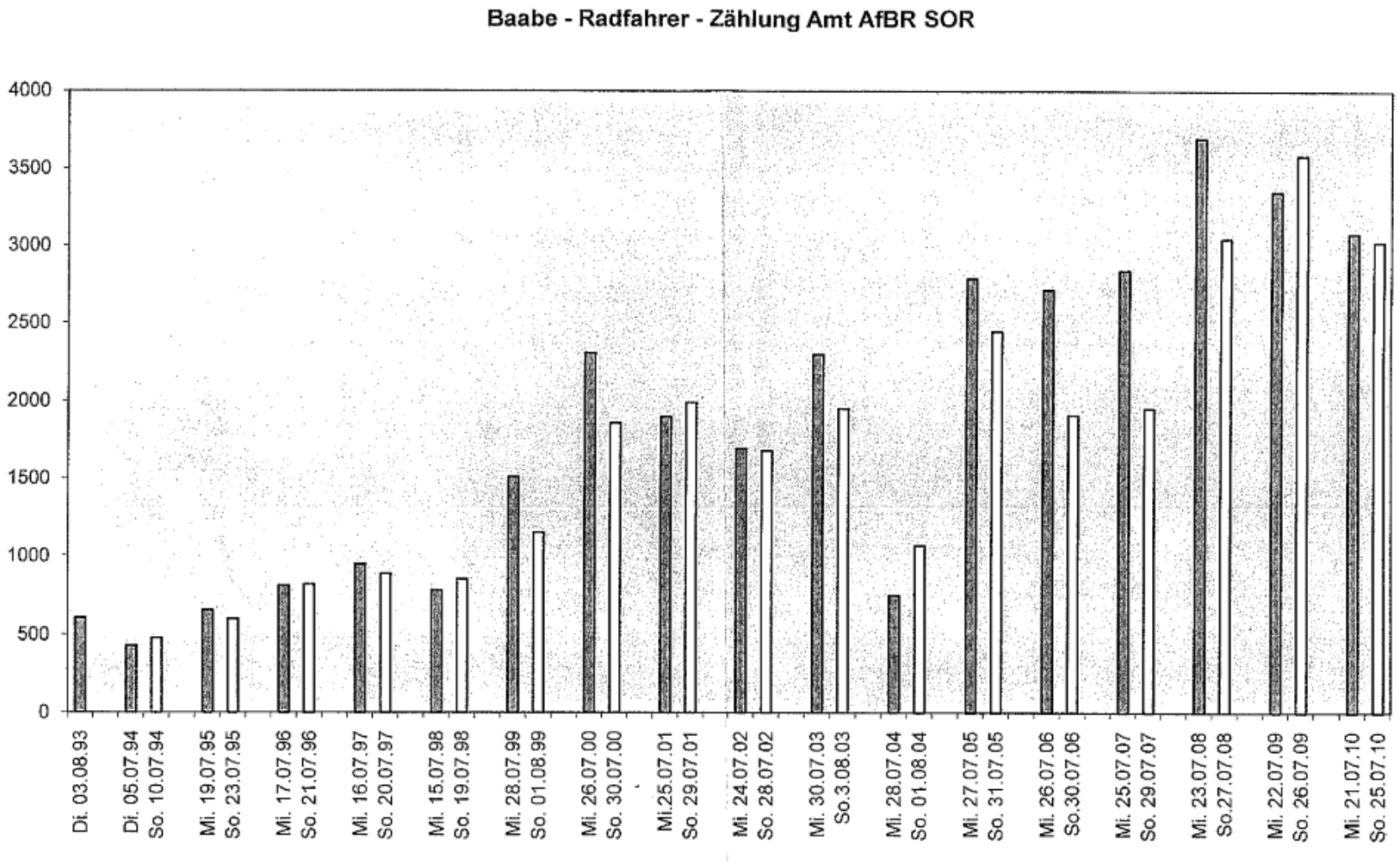
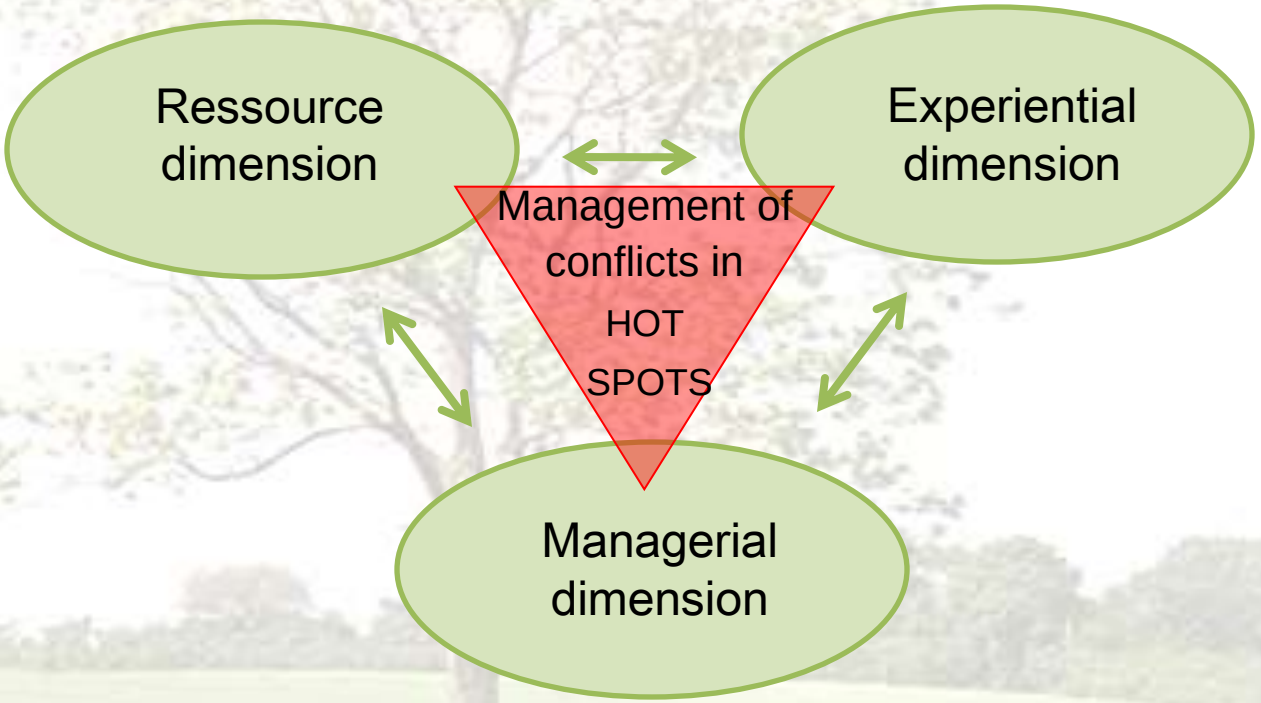


Registrations of bycicles at Tor von Baabe on two days in the end of July every year since 1993

Three dimensions of carrying capacity of parks and related areas (Manning & Lime 1996)



Source: Manning, R. and D. Lime 1996. Crowding and Carrying Capacity in the National Park System: Towards a Social Science Research Agenda. Wroding and Congestion in the National Park System: Guidelines for Management and Research. St. Paul. University of Minnesota Agricultural Experiment Station Publication 86, 27-65

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Inductive analysis of carrying capacity conflicts:

1.Søholt bay: Waterfoul observation, pike fishery

2.Western shore of Søndersø: Nesting of White-tailed Eagle, lake experience

3.Bøndersvig enge: Sub-urban rich meadows (orchids).

For each hot spot (conflict management area):

- Describe the conflict

- Describe main measures to counteract trends of exceeding the carrying capacity of the local hot spot!

- Are there possible indicators for the conflict?

- Are there possible standards for these indicators, below which the conflict can be expected to be controlled?

Possible overall carrying capacity:

A. Related to visitor use from land

B. Related to visitor use from water

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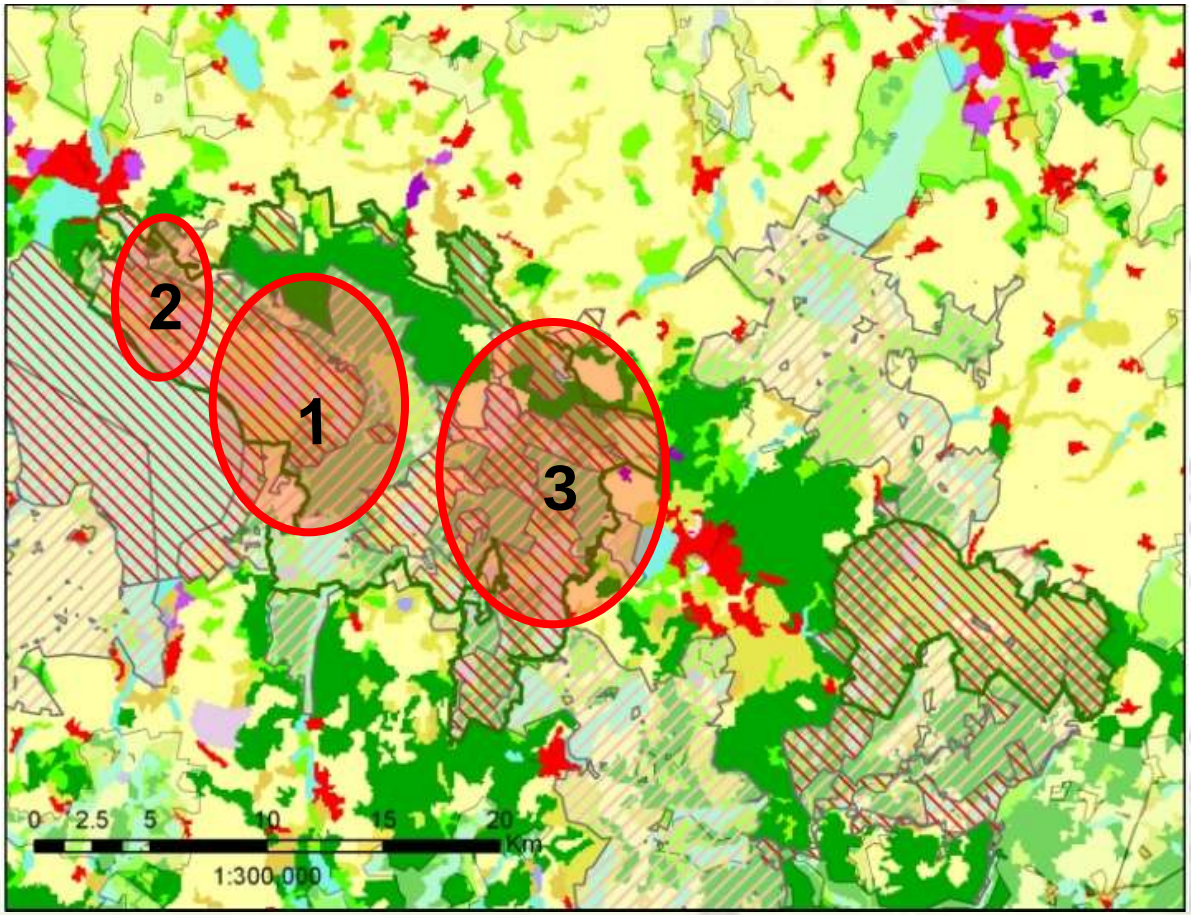
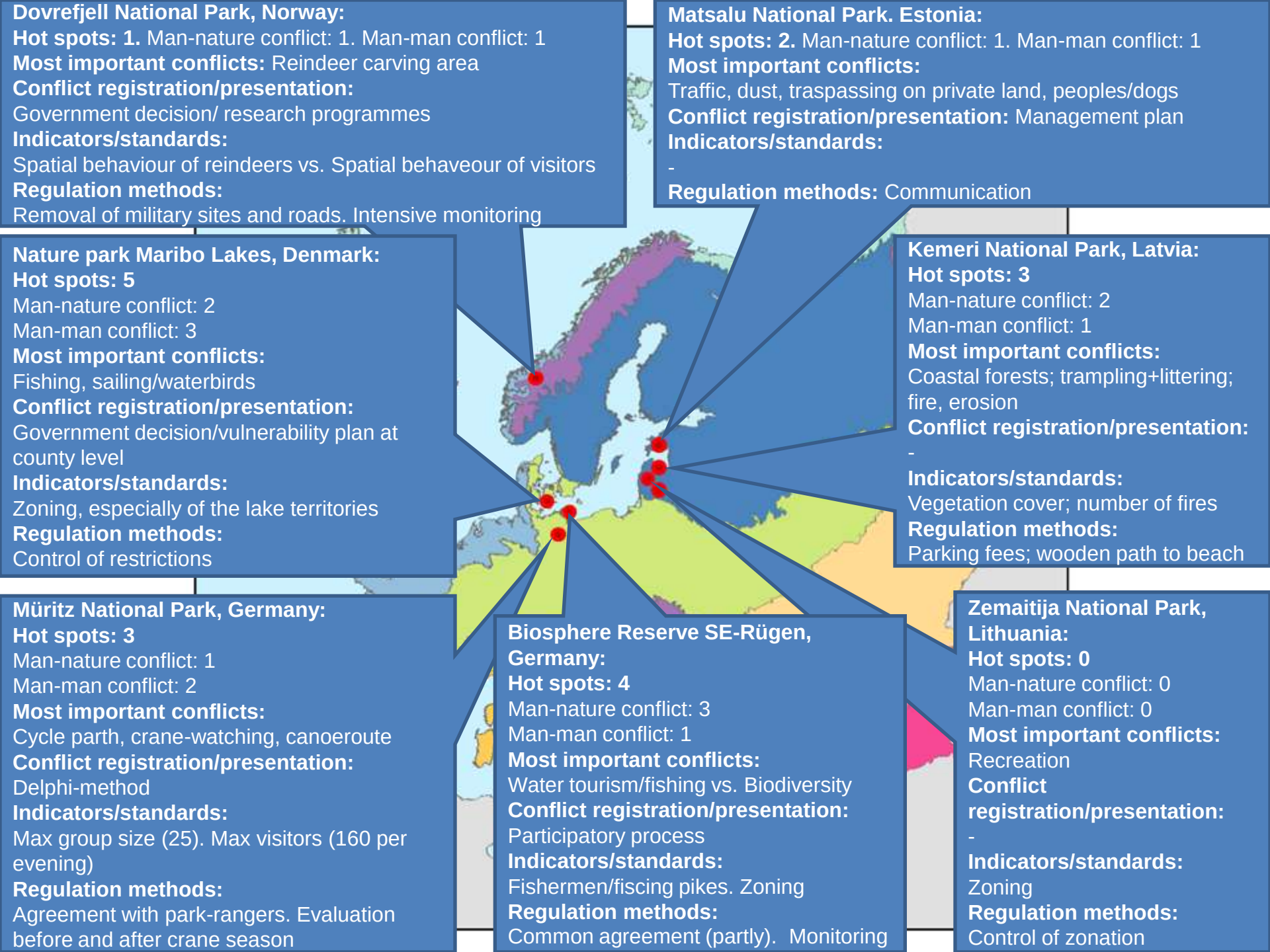


Natura2000 sites overlapping Müritz National Park. All Natura2000 areas (delineated with a dark green stroke) have a semitransparent light green overlay. Habitat sites overlapping the park has been dark red shaded, Bird sites perpendicular Flamingo red.

1. Lake Müritz cycle path
2. Rederangsee – resting area for cranes
3. Canoe route Havel river


Dovrefjell National Park, Norway:
Hot spots: 1. Man-nature conflict: 1. Man-man conflict: 1
Most important conflicts: Reindeer carving area
Conflict registration/presentation:
Government decision/ research programmes
Indicators/standards:
Spatial behaviour of reindeers vs. Spatial behaveour of visitors
Regulation methods:
Removal of military sites and roads. Intensive monitoring
Matsalu National Park. Estonia:
Hot spots: 2. Man-nature conflict: 1. Man-man conflict: 1
Most important conflicts:
Traffic, dust, traspassing on private land, peoples/dogs
Conflict registration/presentation: Management plan
Indicators/standards:
-
Regulation methods: Communication
Nature park Maribo Lakes, Denmark:
Hot spots: 5
Man-nature conflict: 2
Man-man conflict: 3
Most important conflicts:
Fishing, sailing/waterbirds
Conflict registration/presentation:
Government decision/vulnerability plan at county level
Indicators/standards:
Zoning, especially of the lake territories
Regulation methods:
Control of restrictions
Kemeri National Park, Latvia:
Hot spots: 3
Man-nature conflict: 2
Man-man conflict: 1
Most important conflicts:
Coastal forests; trampling+littering; fire, erosion
Conflict registration/presentation:
-
Indicators/standards:
Vegetation cover; number of fires
Regulation methods:
Parking fees; wooden path to beach
Müritz National Park, Germany:
Hot spots: 3
Man-nature conflict: 1
Man-man conflict: 2
Most important conflicts:
Cycle parth, crane-watching, canoeroute
Conflict registration/presentation:
Delphi-method
Indicators/standards:
Max group size (25). Max visitors (160 per evening)
Regulation methods:
Agreement with park-rangers. Evaluation before and after crane season
Biosphere Reserve SE-Rügen, Germany:
Hot spots: 4
Man-nature conflict: 3
Man-man conflict: 1
Most important conflicts:
Water tourism/fishing vs. Biodiversity
Conflict registration/presentation:
Participatory process
Indicators/standards:
Fishermen/fiscing pikes. Zoning
Regulation methods:
Common agreement (partly). Monitoring
Zemaitija National Park, Lithuania:
Hot spots: 0
Man-nature conflict: 0
Man-man conflict: 0
Most important conflicts:
Recreation
Conflict registration/presentation:
-
Indicators/standards:
Zoning
Regulation methods:
Control of zonation

Summing up:
Visitor carrying capacity of nature parks should deal with visitor satisfaction in a broad and wise universal/ existential way.

It differs from a general sustainability strategy by being more focused on estimating the number and behavior of visitors in a concrete spatial context in the balance with the number and behavior of the other species with whom we are living together.

Carrying capacity is **not** a scientifically objectively determined measure, but a result of political decision processes among stakeholders, balancing use and protection preferably based on scientific and/or experiential cognition.

The management of carrying capacity of visitors is an instrument to optimise the experience of visitors (including minimising conflicts between them) and at the same time protect the nature ressources giving rise to the experience.

FINITO