WAGENINGEN
UNIVERSITY & RESEARCH

SEEA-EEA Experimental biodiversity account for the Netherlands

Patrick Bogaart[1,*)], Elze Polman[1)],
Richard Verweij[1)], Chris van Swaay[2)]

[1)]Statistics Netherlands [2)]Butterfly conservation
[*)]pw.bogaart@cbs.nl

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Availability:

- Biodiversity account:
  - https://www.cbs.nl/en-gb/background/2020/41/seea-eea-biodiversity-account-2006-2013
- Generic Natural Capital page (inc. all SEEA-EEA accounts):
  - https://www.cbs.nl/en-gb/society/nature-and-environment/natural-capital

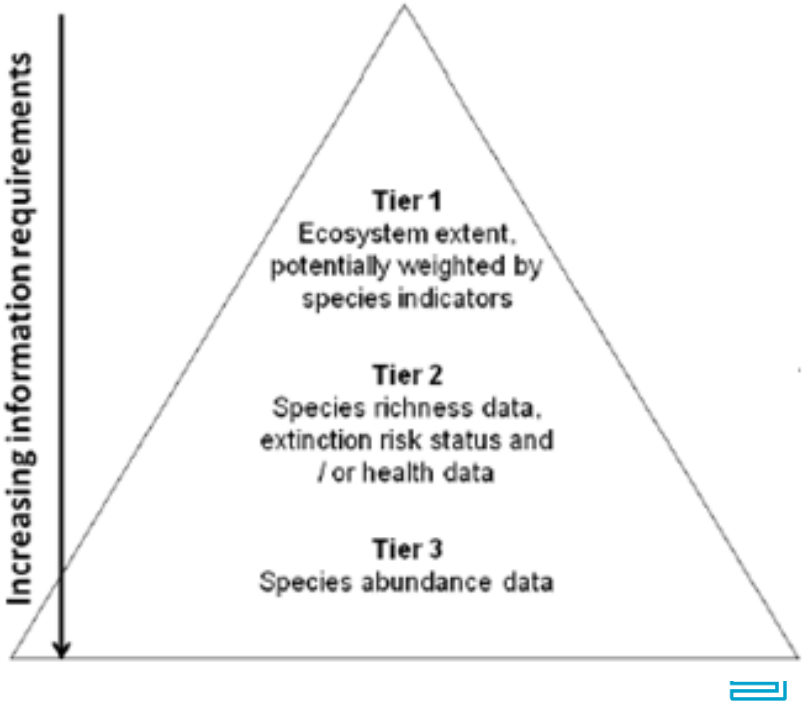
Biodiversity

"— the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems" (CBD)

"We start with the CBD definition that explicitly recognizes diversity at different levels of organization, and in different environments"

Biodiversity indicators (SEEA-EEA 2012)

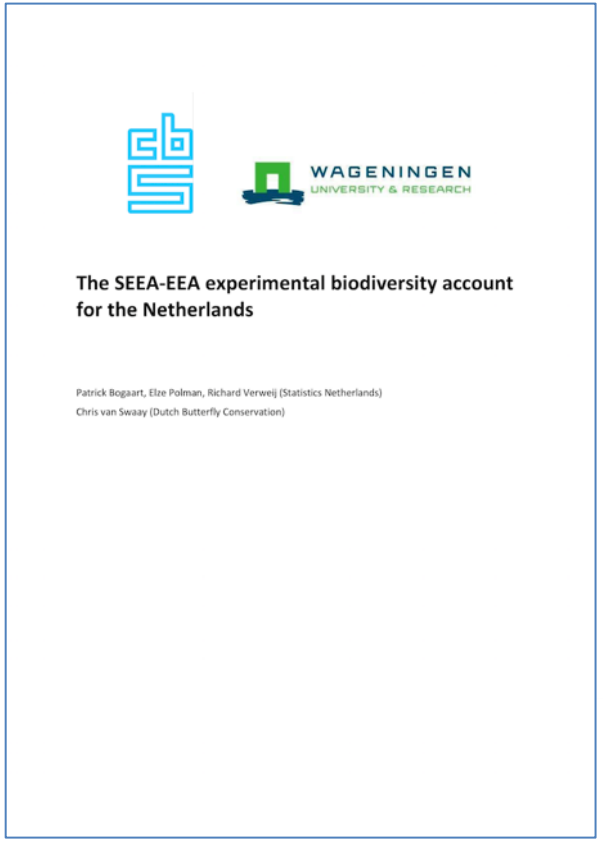
- Tier 1: ecosystem extent
  - CBD: Trends in extent of selected ecosystems
- Tier 2: species richness; extinction risk
  - CBD: Trends in status of threatened species
- Tier 3: species abundance
  - CBD: Trends in abundance and distribution of selected species



"In the 2012 SEEA –EEA handbook it is recognized that the amount of data will depend on the level considered. Most data will be available for ecosystem extent, lesser for species richness, and least for species abundance. This gave rise to a tiered approach. Note that the genetic level of biodiversity is not even mentioned in this diagram"

Structure of the NLD Biodiversity Account

- Ecosystem diversity
  - Extent ✓
  - (Shannon) diversity 🕓
- Species diversity
  - Threatened species (Red List) ✓
  - Abundance (LPI) ✓
  - Shannon diversity 🕓
- Genetic diversity ?
- Spatial diversity
  - Patterns in context ✓
  - Alpha/beta/gamma diversity 🕓
- Expenditure
  - protection and habitat restoration ?



"In the case of the Netherlands, we do have abundance data available, we were able to do all three tiers. We have yet to work on Shannon diversity indicators and alpha/beta/gamma components of diversity"

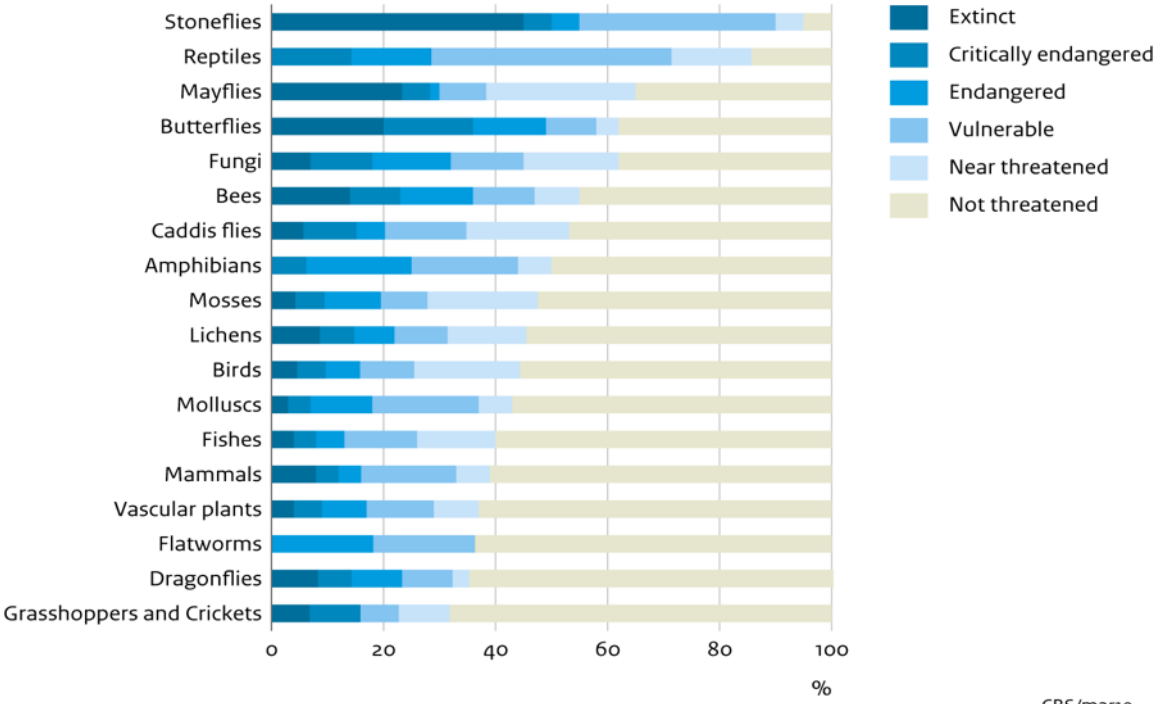
Data sources:

- Ecosystem extent:
  - Ecosystem type map
    - 1:10,000 topographic registry)
    - Nature management types
    - Agricultural parcel registry
- Species data:
  - Collected by NGO's (birds; butterflies; plants; etc)
  - Well-managed monitoring scheme
  - Quality control by Statistics Netherlands
  - *Additional: validated opportunistic citizen-science observations*

Ecosystem diversity: extent

							Dry nature					Agriculture		Urban			Other	
	Forest	(Semi) nat. Grassland	Heathland	Wetlands	Dunes (open)	Dunes (vegetated)	Salt marsh	Beach	Drift sand	Fresh water	Sea	Agriculture	Field borders	Built-up	Infra-structure	Public green space	Unpaved	unknown
Opening stock	**313,224**	**49,841**	**38,343**	**37,006**	**24,010**	**13,679**	**12,737**	**9,612**	**4,272**	**408,344**	**5,643**	**1,867,094**	**18,440**	**448,358**	**109,774**	**70,931**	**342,027**	**1,529**
Additions																		
From dry nature	4,634	4,063	6,501	5,186	2,541	4,034	158	605	569	3,140	2,407	19,681	5,284	3,496	1,659	1,536	11,752	71
From fresh wwater	227	536	167	570	1	0	0	0	194		59	667	71	1,045	296	177	1,196	136
From sea	0	0	0	0	357	0	614	2,511	1	1,160		0	0	47	74	0	857	22
From agricultural	8,423	19,955	732	8,418	16	0	1	0	119	6,095	0	5,516	22,644	18,860	7,027	1,828	83,738	178
From urban	2,665	805	156	442	54	1	0	6	126	2,227	16	11,428	321	6,275	2,332	2,132	22,939	57
From other	10,637	9,227	1,147	2,112	78	8	2	8	110	5,622	40	90,905	4,438	27,309	6,816	5,175	44	217
total additions	26,586	34,586	8,703	16,728	3,046	4,044	774	3,130	1,120	18,244	2,523	128,197	32,757	57,033	18,204	10,849	120,526	681
	8%	69%	23%	45%	13%	30%	6%	33%	26%	4%	45%	7%	178%	13%	17%	15%	35%	45%
Subtractions																		
To dry nature	6,343	5,126	4,042	4,150	4,464	2,278	649	233	1,005	1,695	3,483	34,588	3,076	1,849	617	1,789	23,219	109
To fresh water	605	1,158	143	866	140	38	1	12	178		1,160	5,720	375	1,097	652	479	4,426	1,197
To sea	0	0	0	3	140	4	445	1,812	2	59		0	0	4	12	0	28	12
To Agriculture	7,992	15,192	1,017	724	1	0	8	0	30	737	0	22,644	5,516	9,260	1,770	718	95,305	38
To urban	3,696	856	124	43	219	618	867	83	186	1,519	121	27,387	329	3,658	2,848	4,232	39,205	95
To other	5,921	4,304	228	280	44	497	402	39	108	1,332	879	82,591	1,325	13,597	5,879	3,520	217	44
Total subtractions	24,558	26,637	5,553	6,066	5,007	3,435	2,372	2,179	1,510	5,342	5,643	172,930	10,622	29,466	11,778	10,738	162,400	1,495
	8%	53%	14%	16%	21%	25%	19%	23%	35%	1%	100%	9%	58%	7%	11%	15%	47%	98%
Net change	2,028	7,949	3,150	10,663	-1,961	609	-1,598	951	-391	12,901	-3,120	-44,732	22,136	27,567	6,426	111	-41,875	-814
	1%	16%	8%	29%	-8%	4%	-13%	10%	-9%	3%	-55%	-2%	120%	6%	6%	0%	-12%	-53%
Closing stock	**315,252**	**57,790**	**41,493**	**47,669**	**22,049**	**14,288**	**11,138**	**10,563**	**3,882**	**421,246**	**2,523**	**1,822,362**	**40,576**	**475,925**	**116,200**	**71,042**	**300,153**	**715**

Threatened species



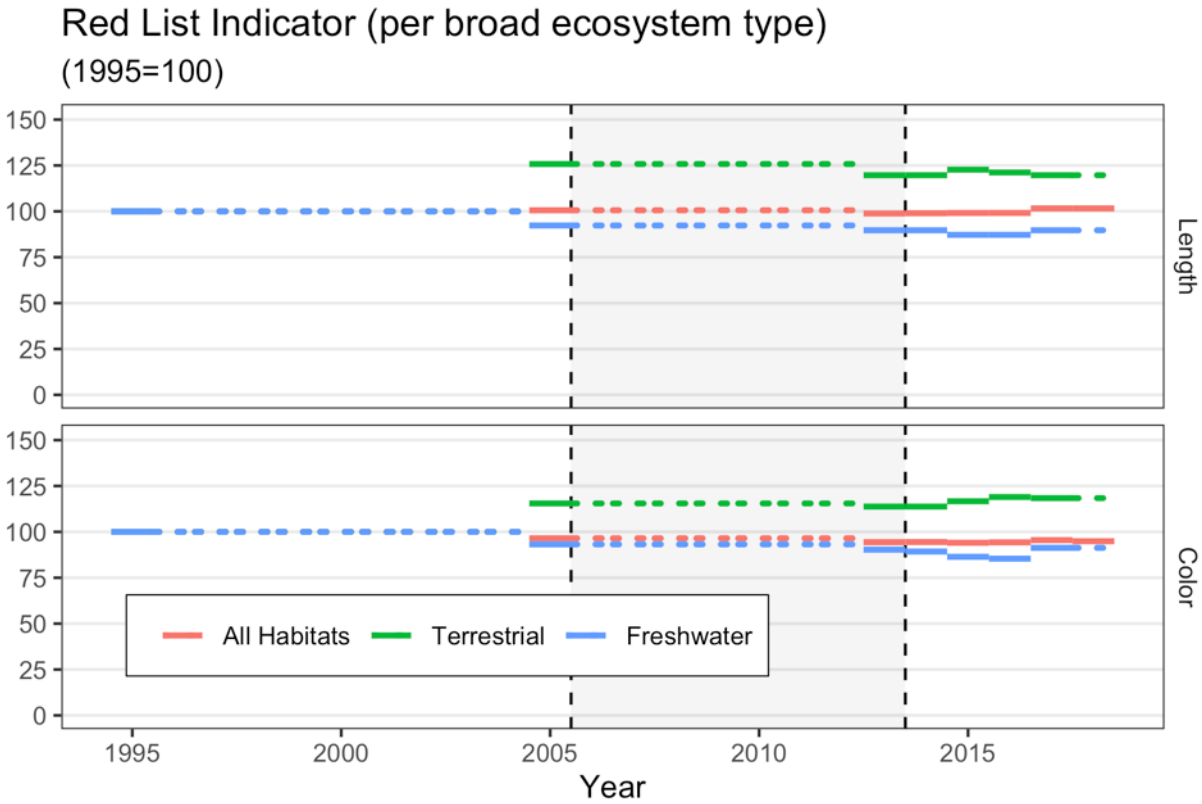
"In the Netherlands, we have Red Lists of threathened species for 14 groups of animals and 4 groups of plants and fungi"

Threatened species

	Group name	1995	2005	2009	2015	2017	2018	2019
Animals	Stoneflies		●					
	Reptiles	●	●	●				
	Butterflies	●	●	●				●
	Mayflies		●					
	Bees		●				●	
	Caddis flies		●					
	Amphibians	●	●	●				
	Molluscs		●					
	Fishes (fresh water)	●	●		●			
	Mammals	●	●	●				
	Birds	●	●			●		
	Flatworms		●					
	Dragonflies	●	●		●			
	Grasshoppers and Crickets	●	●		●			
Plants	Macrofungi	●	●	●				
	Mosses		●		●			
	Lichens	●	●		●			
	Vascular plants		●		●			

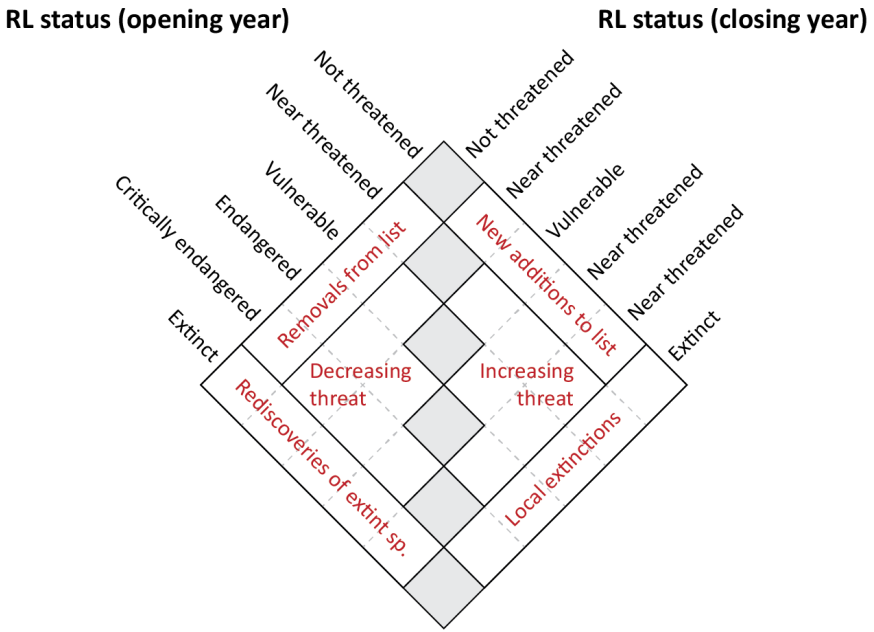
"Each of these lists are formally established by the ministry of nature. The're updated irregularly, but at StatNL abundance and distribution data is used to develop annual "virtual red lists" using the same methodology as used or the formal red list"

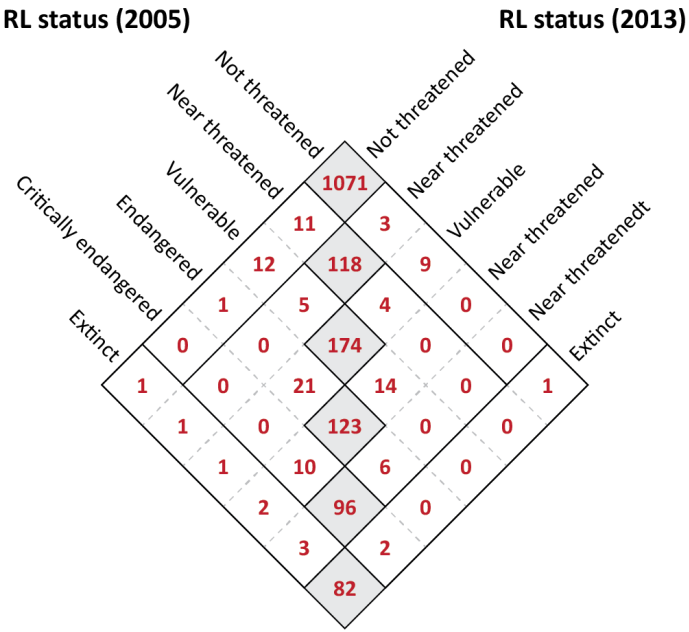
Threatened species (cont.)



"The Red List Indicator consists of two elements, measuring the total nr. of threatened species (red list length) or the aggregated threat severity (red list color)"

Threatened species account



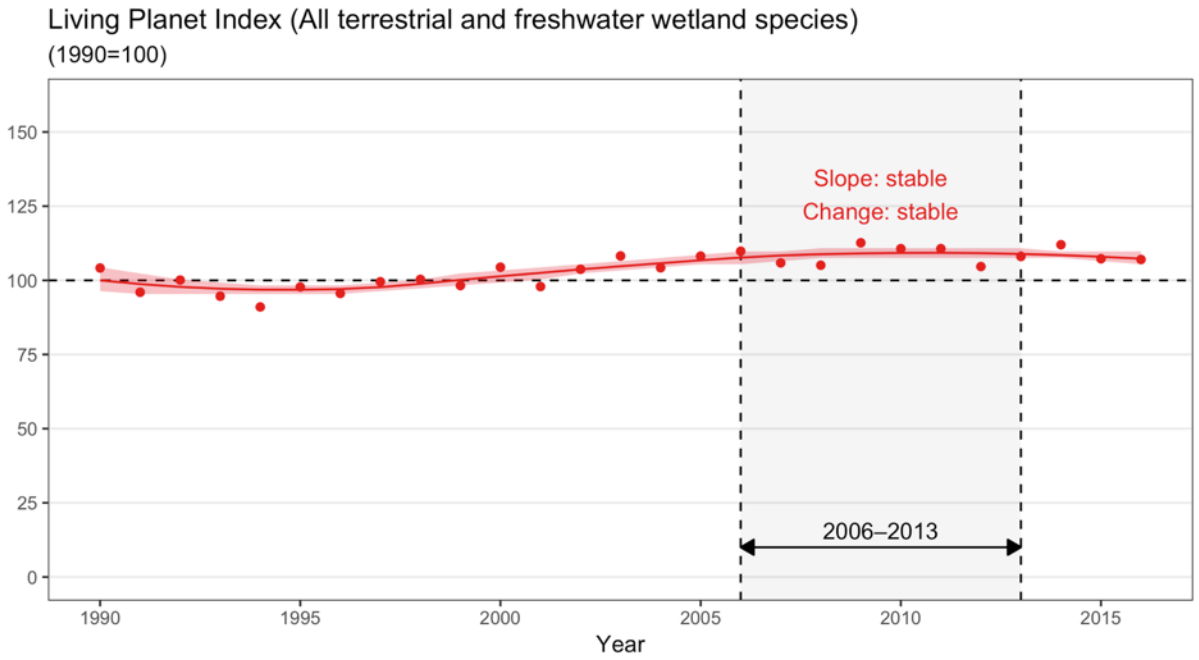


"Accounts are concerned with opening & closing stock; additions and subtractions. These can be linked to specific clusters in the Red List transition matrix"

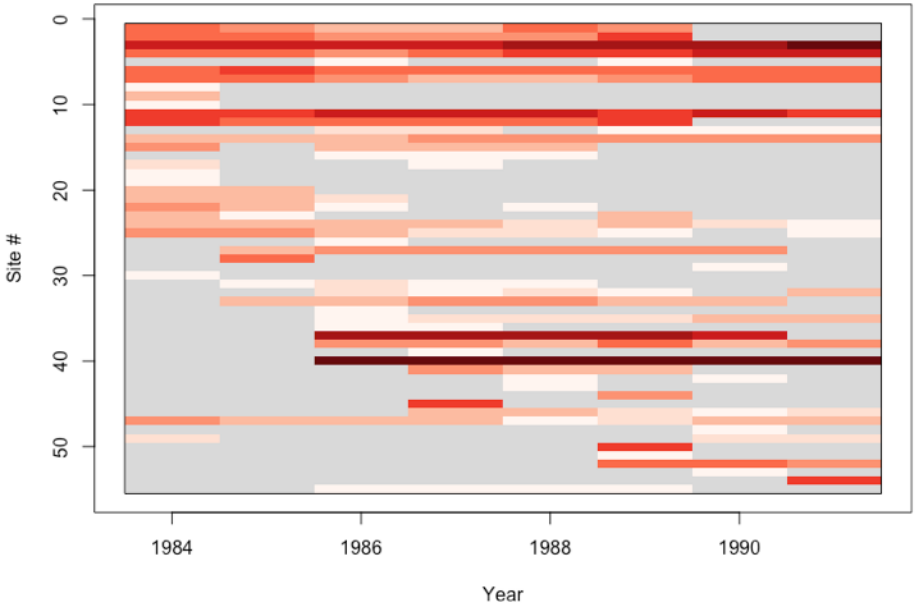
Threatened species account

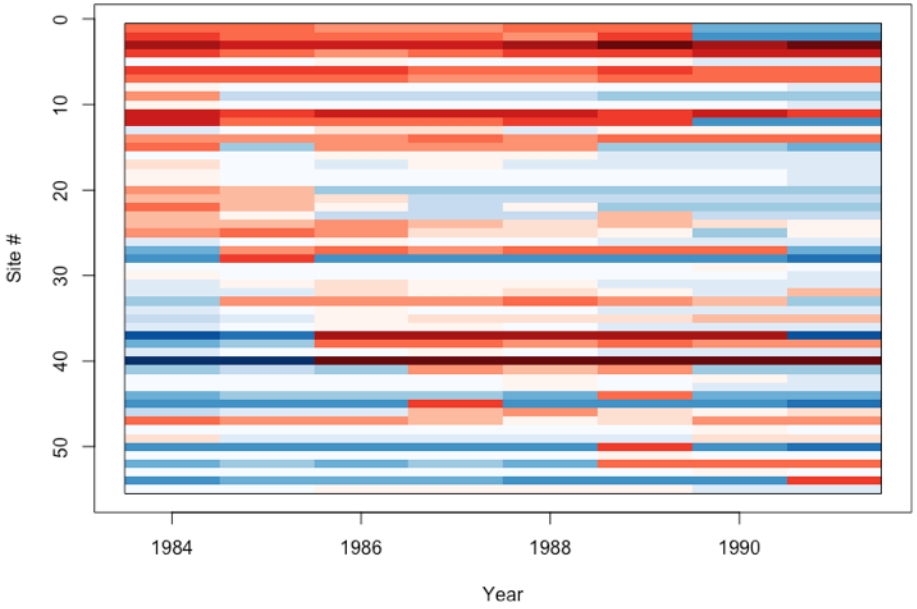
	Red List categories							
	Extinct	Critically endangered	Endangered	Vulnerable	Near threatened	**Total Red List**	Least concern	**Total**
Opening stock (2005)	90	108	151	205	133	**687**	1084	**1771**
Additions								
Local extinctions	3					**3**		**3**
Rediscoveries of local extinct species		3	2	1	1	**7**	1	**8**
From lower threat categories		6	14	4		**24**	0	**24**
From higher threat categories			10	21	5	**36**		**36**
New additions to list		0	0	9	3	**12**		**12**
Removals from list							24	**24**
Total additions	3	9	26	35	9	**82**	25	**107**
Reductions								
Local extinctions		2	0	0	0	**2**	1	**3**
Rediscoveries of local extinct species	8					**8**		**8**
To lower threat categories		10	21	5		**36**		**36**
To higher threat categories		0	6	14	4	**24**		**24**
New additions to list							12	**12**
Removals from list		0	1	12	11	**24**		**24**
Total reductions	8	12	28	31	15	**94**	13	**107**
Closing stock (2013)	85	105	149	209	127	**675**	1096	**1771**

Species abundance changes: LPI

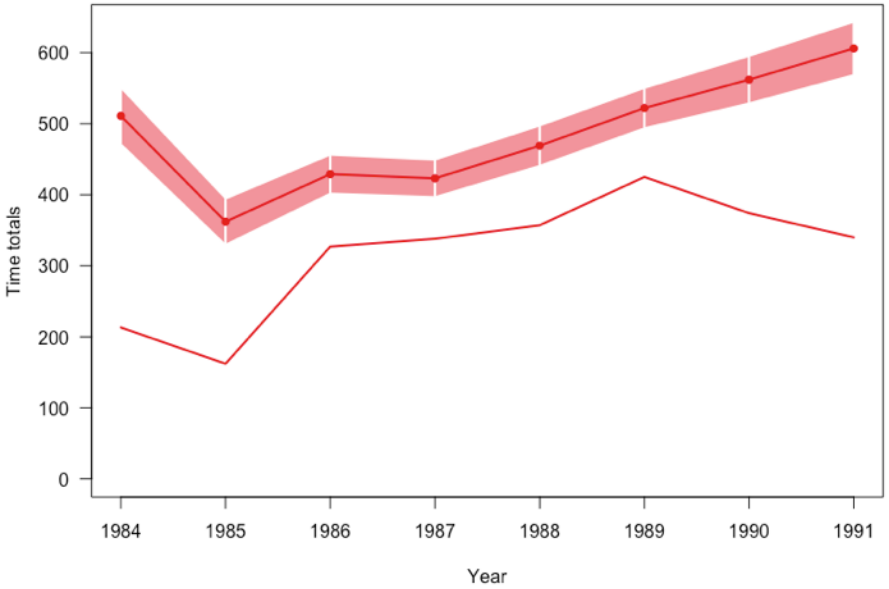


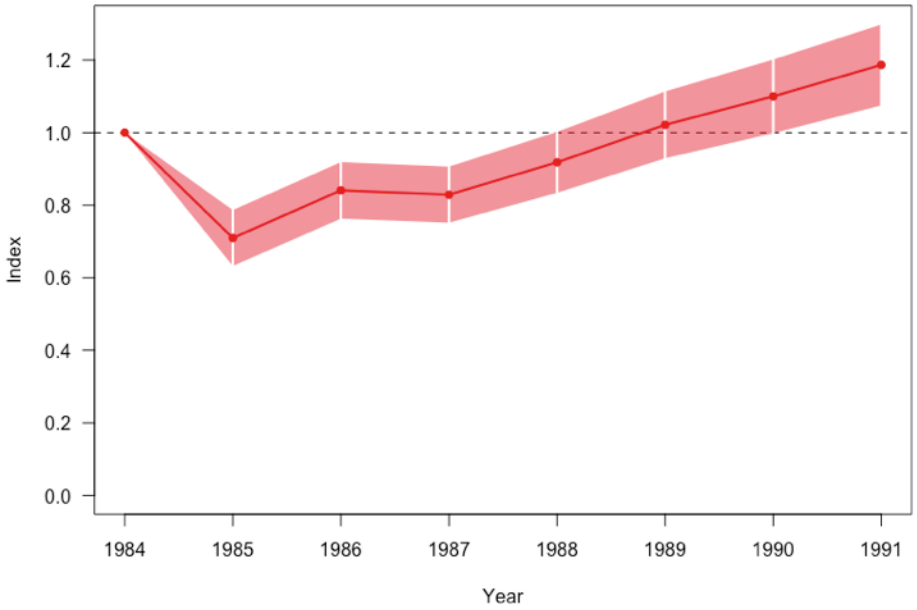
"The Living Planet Index is a widely used multi-species abundance indicator"



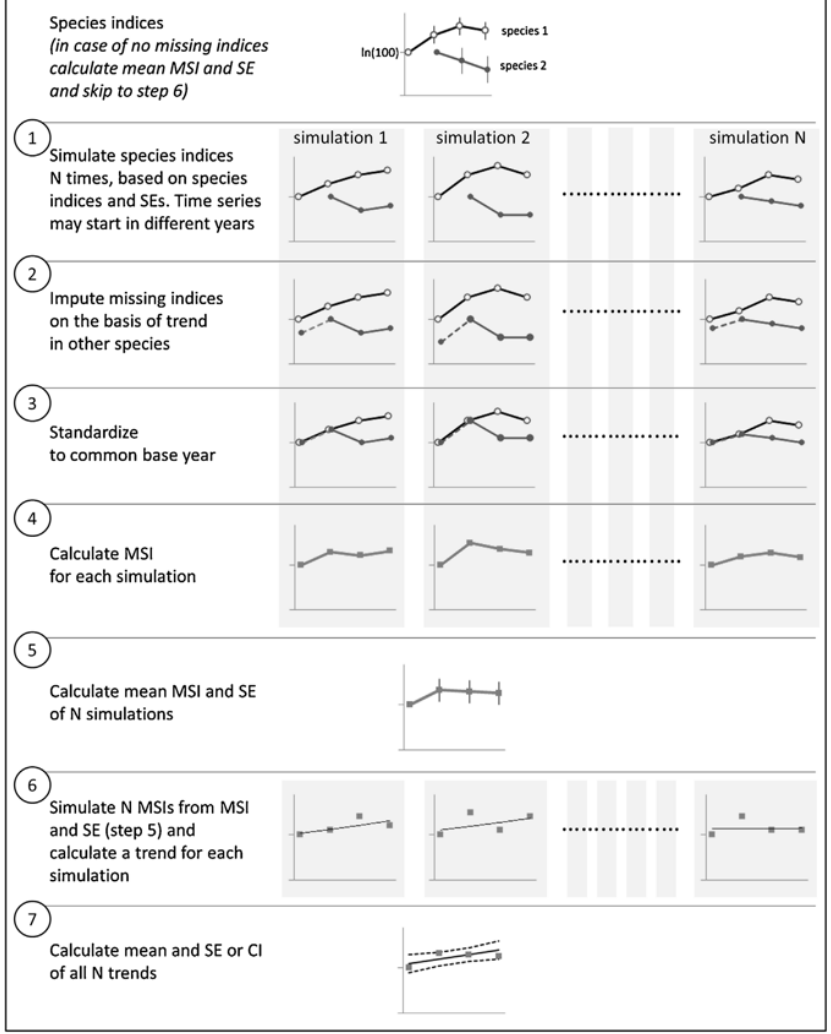


"Construction steps: 1) abundance data per year/site/species; 2) model based imputation to get rid of missing observations (using the StatNL developed software (R) package rtrim), …"



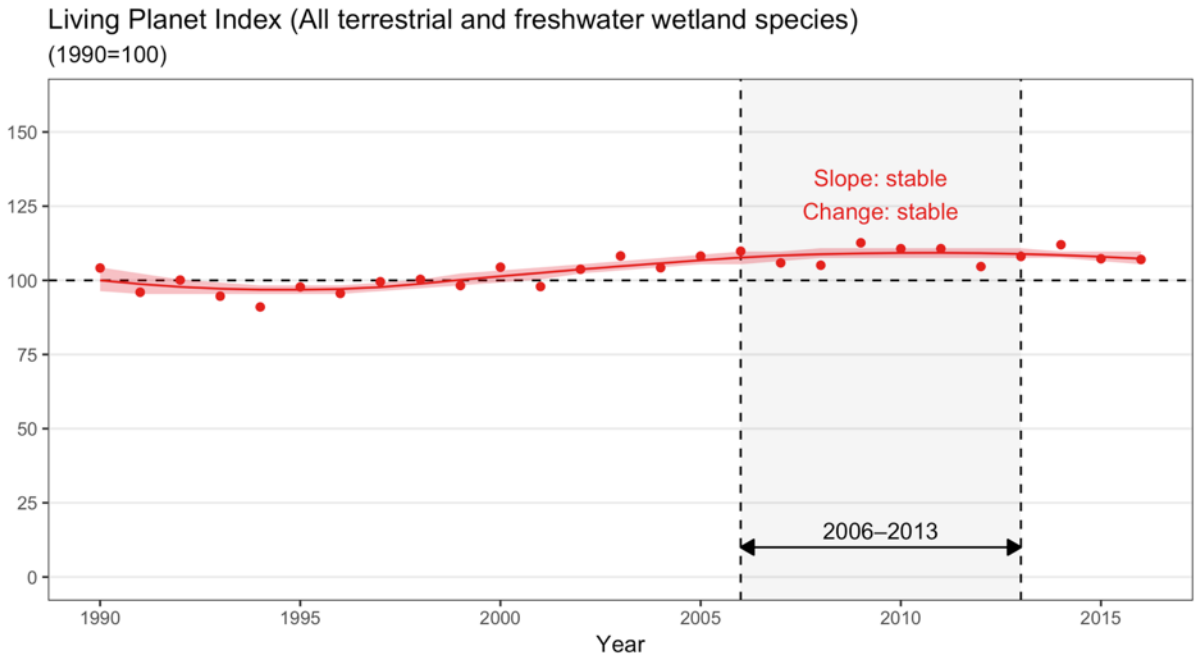


"Construction steps: …, 3) determination of totals across sites (per species) 4) conversion to index trend (per species), … "



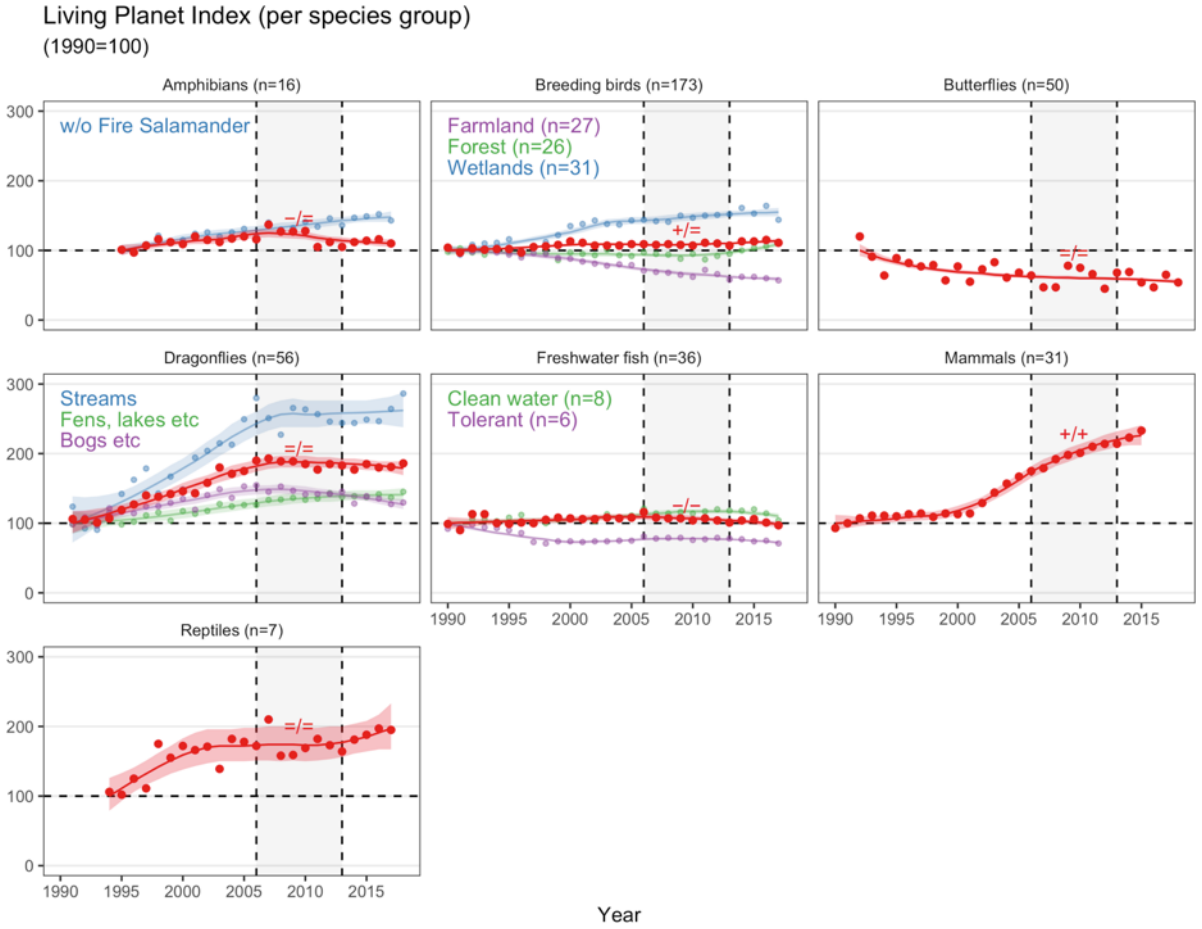
"Construction steps: …, 5) combination of trends per species to a single multi-species trend."

Species abundance changes: LPI

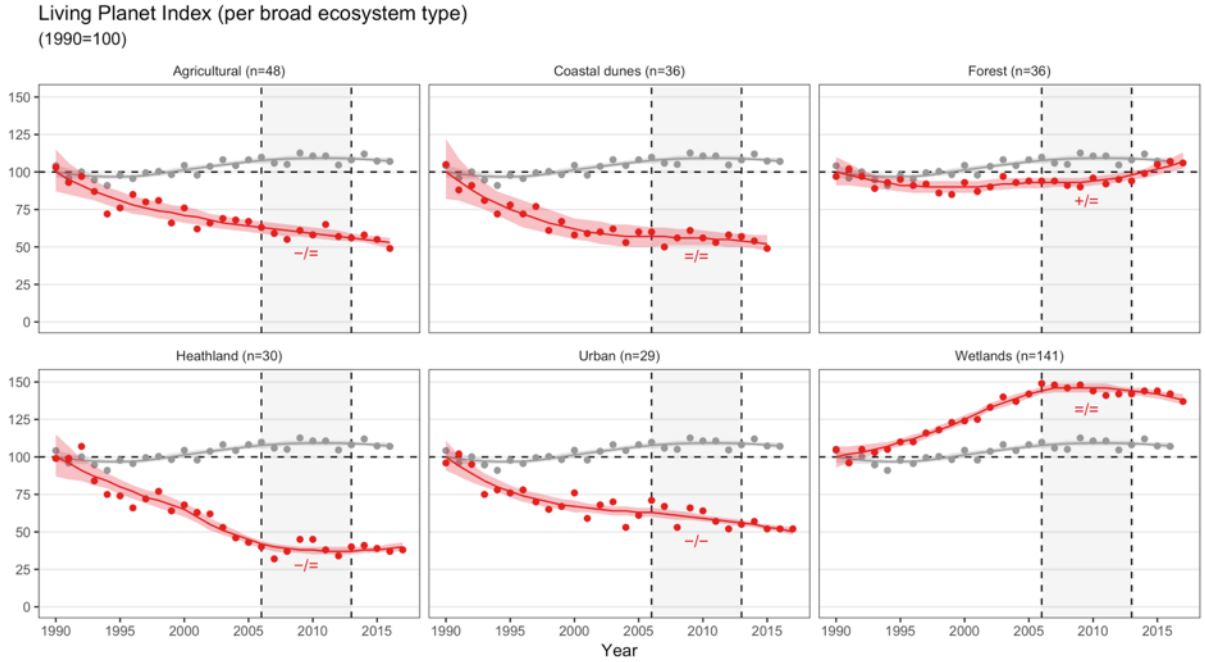


"LPI values are annual; it is not advised to compare these directly. Instead; a smoother is applied first, and changes within this smoothed trend are interpreted; taking into account the smoothing uncertainty."

LPI per species group



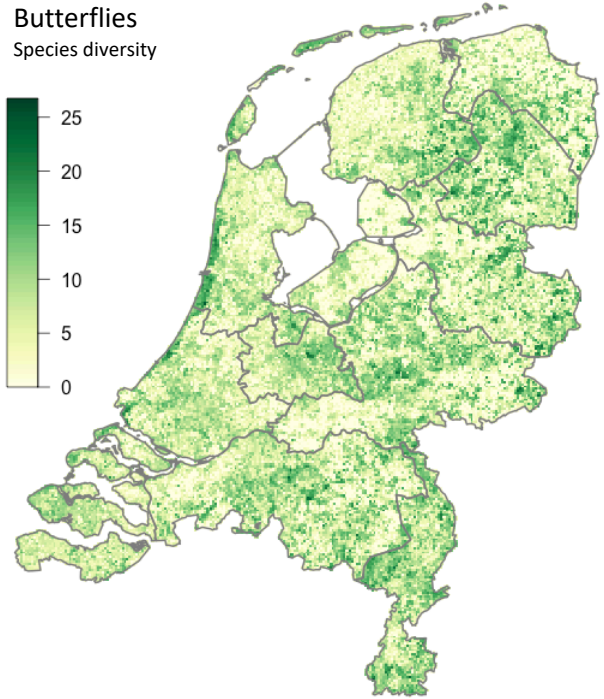
LPI per ecosystem type

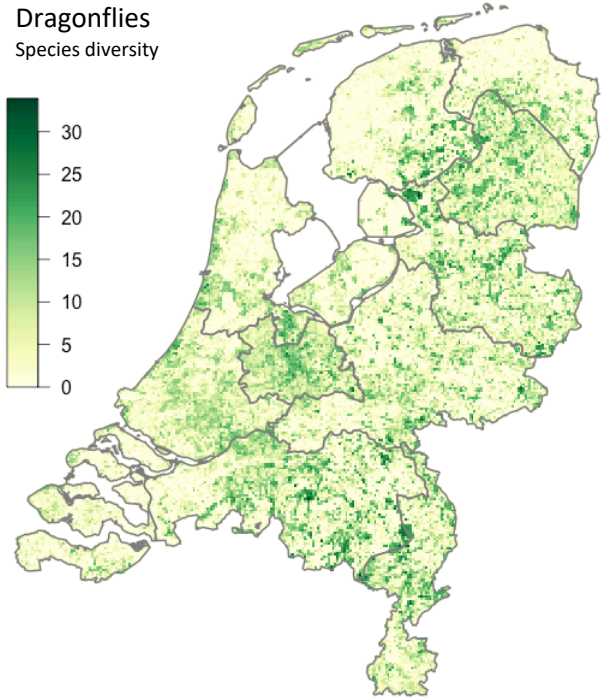


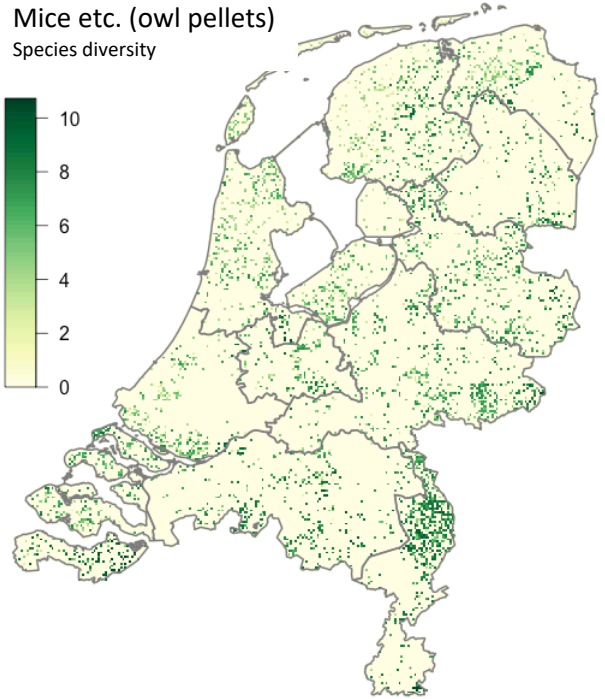
LPI account

Ecosystem (sub)type	CLO	Living Planet index 2006	Living Planet index 2013	Change in LPI Absolute	Change in LPI Relative	Assessment
All Terrestrial and Freshwater	1569	107.7	108.9	1.21	1%	Stable
Terrestrial	1579	85.0	87.0	2.0	2%	Stable
Terrestrial nature	1581	59.0	60.0	1	2%	Stable
Forest	1162	93.0	98.0	5	5%	Increasing
Open nature	1586	39.0	38.0	-1	-3%	Stable
Heathland	1134	42.0	37.0	-5	-12%	Decreasing
Coastal Dunes	1123	57.0	54.0	-3	-5%	Stable
Freshwater and wetlands	1577	144.0	144.0	0	0%	Stable
Agricultural	1580	63.0	56.0	-7	-11%	Decreasing
Urban	1585	63.0	56.0	-7	-11%	Decreasing

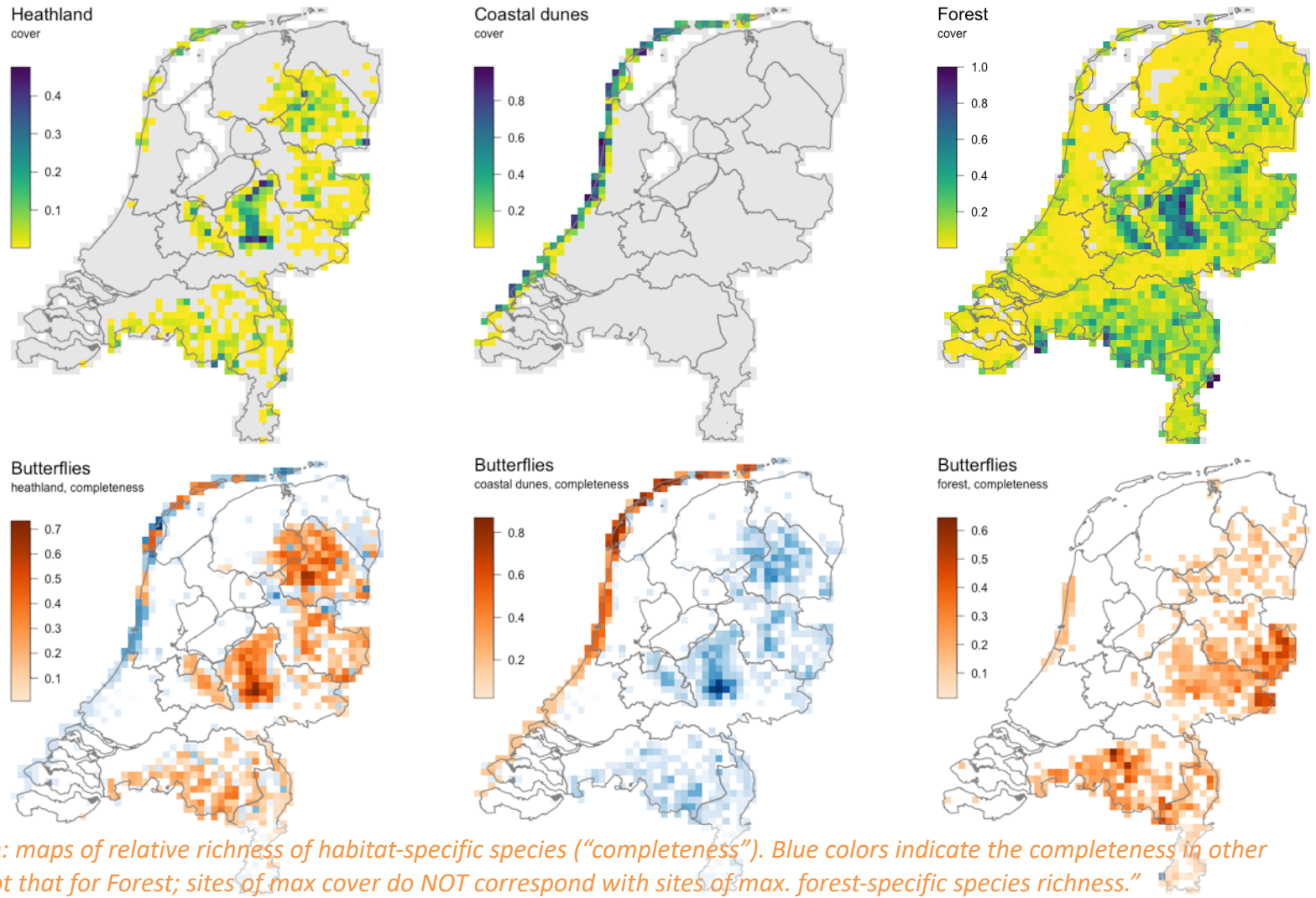
Biodiversity: occupancy modelling





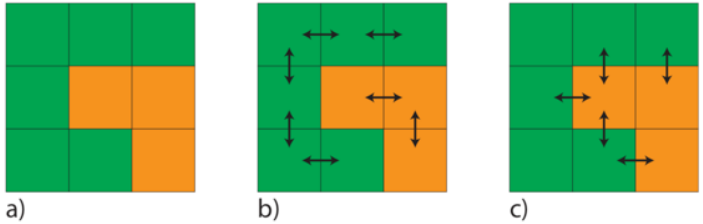


"Occupancy modelling to have maximum spatial coverage based on observations (and taking both presence and detectability into account)"



"Application: maps of relative richness of habitat-specific species ("completeness"). Blue colors indicate the completeness in other habitats. Not that for Forest; sites of max cover do NOT correspond with sites of max. forest-specific species richness."

Landscape spatial structure

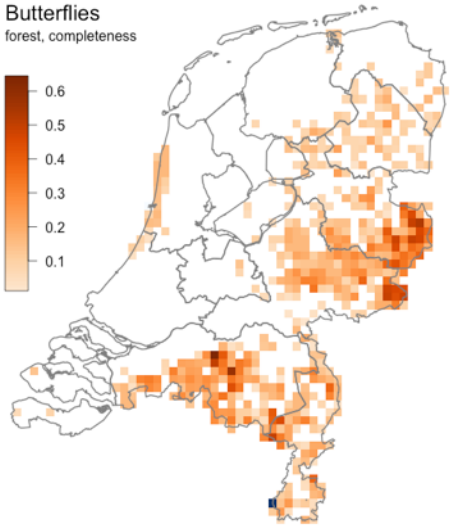


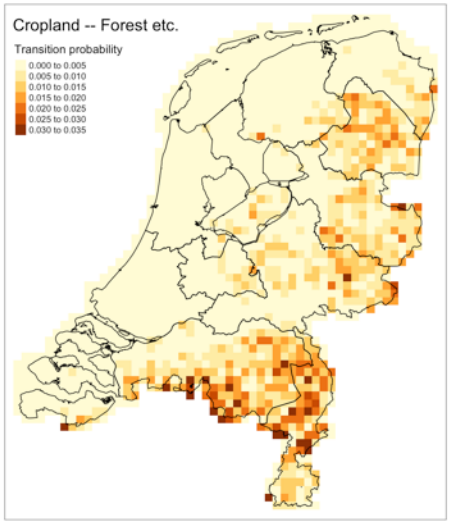
d)

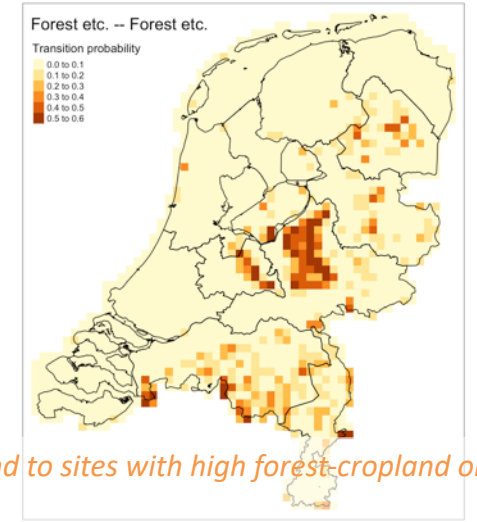
	A	B
A	10/24	5/24
B	5/24	4/24

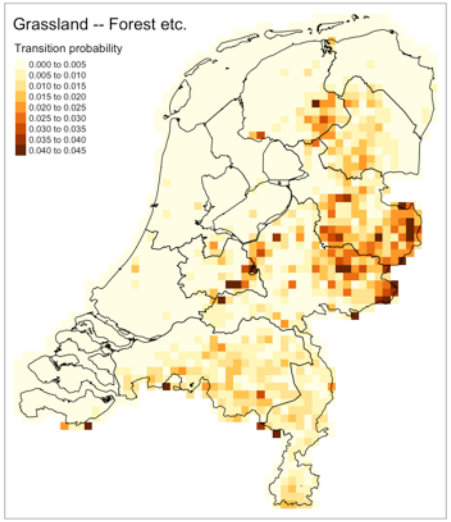
"Simple way to measure spatial structure of landscapes, by counting border types."

Ex. 1: forest



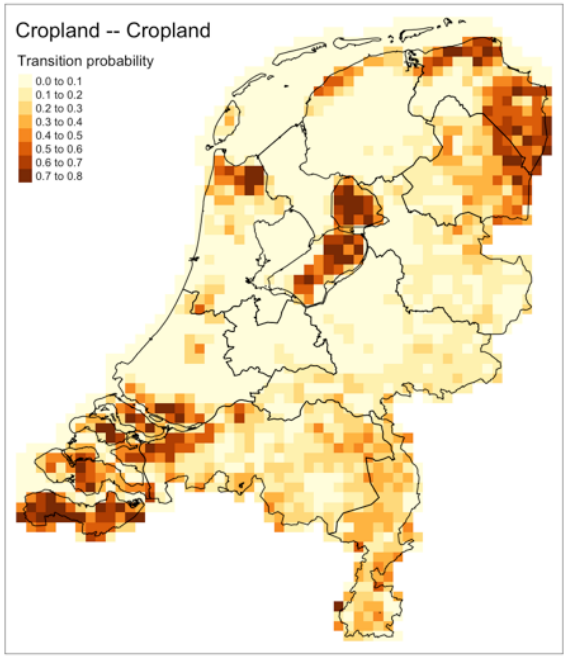


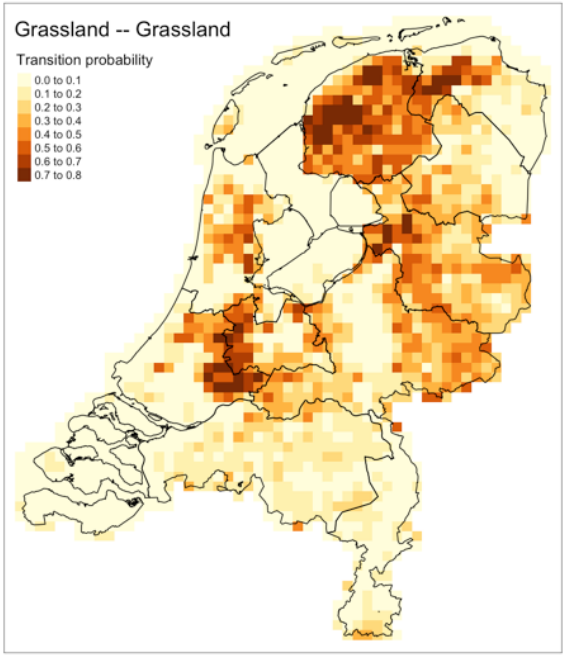


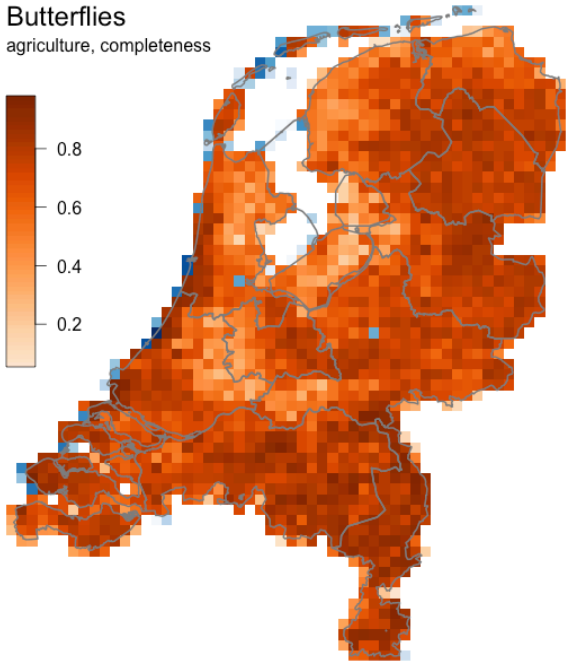


"Sites of max forest-specific species richness correspond to sites with high forest-cropland or grassland transition (e.g. bocage landscape with many forest borders)."

Ex. 2: agricultural ecological ‘deserts’



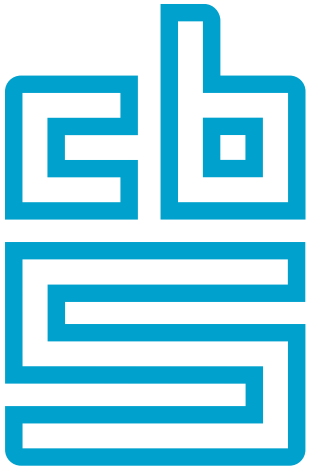




“Most (but not all) regions with high monocultures of agricultural grasslands ot croplands correspond to areas with low agriculture-specific butterfly species richness”

Conclusion

- SEEA-EEA **extent accounting** enables tier 1 biodiversity accounting (*extent*)
- **Expert-knowledge and some data** allows tier 2 biodiversity accounting (*species diversity; extinction risk*)
- Intensive (volunteer-driven) **monitoring programs** allow tier 3 accounting (*abundance trends*)
  - …but not for all ecosystem types or corresponding detail.
- **Dense monitoring + modelling** allow hi-res spatial analysis.



Facts that matter