

Long-term changes in species richness of flies (Diptera, Brachycera) in grassland communities of Engure Nature Park, Latvia

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Aim of the study

The study was performed in the framework of ILTER programmes:

- Effects of climate warming on biodiversity and ecosystems
- Ecosystem management as a tool for nature protection and sustainable development

What is ILTER?

- *The International Long-Term Ecological Research (ILTER) consists of networks of scientists engaged in long-term, site-based ecological and socio-ecological research. At present ILTER includes 43 member states in total, and its number increases continuously.*
- <https://www.ilternet.edu/>

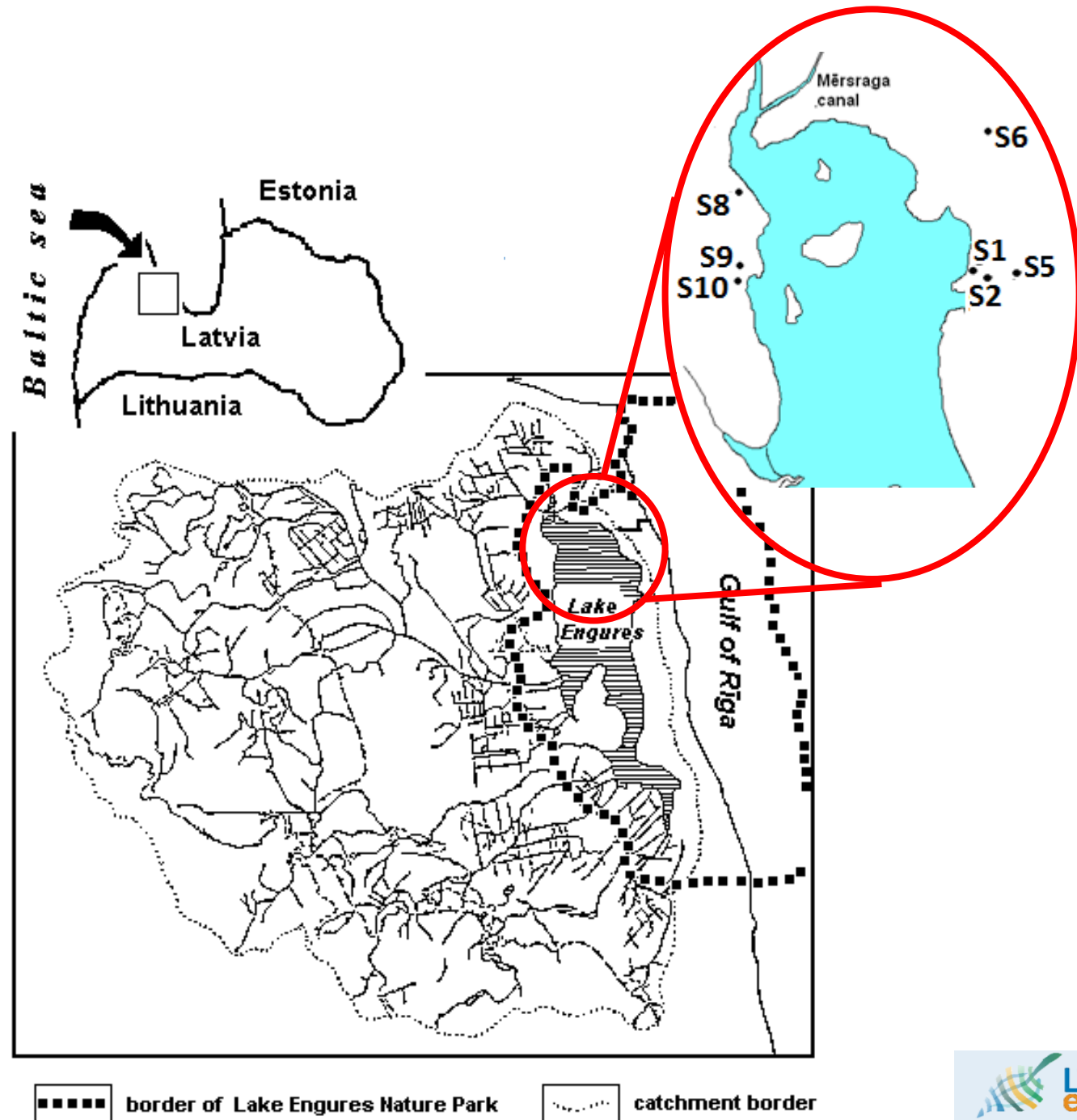
Since 2004 Latvia is a member state of ILTER network. The national LTER network includes 5 sites. Engure ecoregion (Engure LTSEr) - the drainage basin of Lake Engure is one of them. In 1995, 12 regular sample sites were created in various terrestrial habitats of the Lake Engure Nature Park. In 1995-2012 long-term studies of grass dwelling arthropods and vegetation were performed.

Seven sample sites were located in grassland habitats.

Research sites

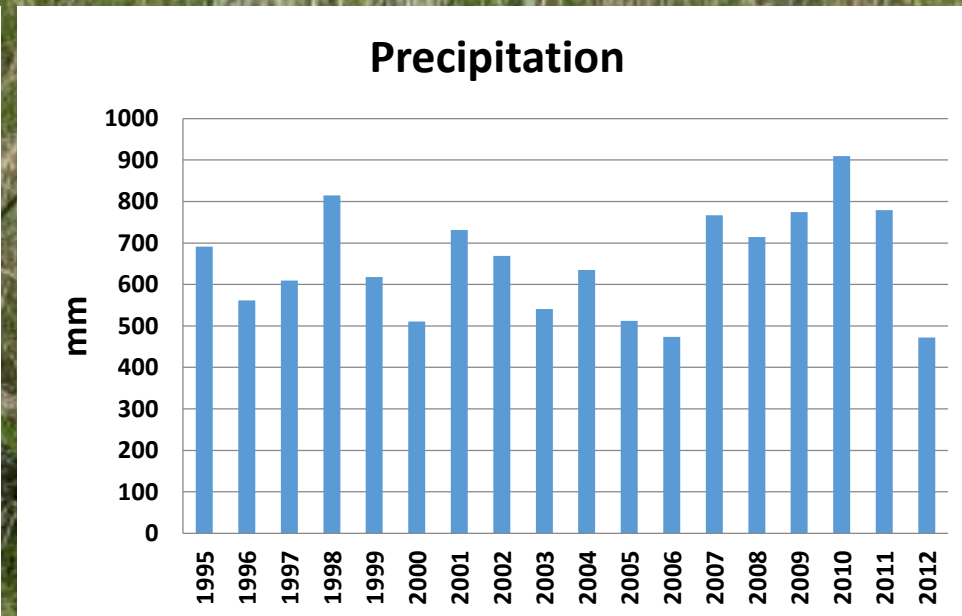
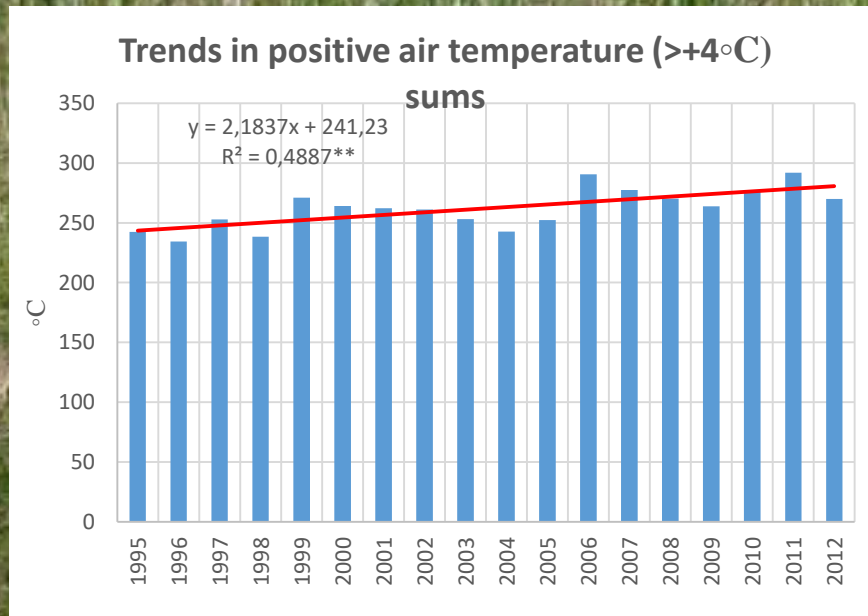
- Sample plots are located in the Lake Engure Nature Park.

S1 - Dry grasslands with sparsely standing trees
S2 – humid calcareous dune slack
S5 – white dune on the beach
S6 - humid coastal grassland
S8 – flood-plain calcareous fen
S9 – humid calcareous grassland
S10 – poor fen



Preliminary questions

- Whether climate warming affects abundance and species diversity of grassland flies?
- What are the effects of introduction of wild herbivores on grassland fly communities?



The methods

Insects were collected by sweep-net method. The collector was moving slowly by regular route through the sample plot (500-1000 m²), performing 100 strokes. Sampling was performed three times per season (end of June, mid-July, and beginning of August). Data from all the sampling periods were pooled, to eliminate possible effects of weather conditions on population dynamics as much as possible when year-to-year trends of population dynamics were analysed.



Diptera, Brachycera families recorded in the Lake Engure Nature Park

	Family	Species numbers	Family	Species numbers	Family	Species numbers
	Rhagionidae	4	Conopidae	2	Agromyzidae	29
	Tabanidae	2	Pallopteridae	2	Sphaeroceridae	0
	Stratiomyidae	7	Opetidae	1	Milichiidae	1
	Asilidae	7	Tephritidae	24	Heleomyzidae	7
	Therevidae	1	Ulitidae	4	Diastatidae	2
	Hybotidae	8	Chamaemyiidae	9	Drosophilidae	13
	Empididae	14	Lauxaniidae	21	Ephydriidae	42
	Dolichopodidae	63	Phaemyiidae	1	Scathophagidae	11
	Phoridae	0	Sciomyzidae	43	Anthomyiidae	0
	Syrphydae	1	Opomyzidae	2	Muscidae	2
	Pipunculidae	0	Chloropidae	77	Calliphoridae	7
	Lonchopteridae	0	Sepsidae	15	Sarcophagidae	6
	Micropezidae	1	Anthomyzidae	7	Tachinidae	2
	Psilidae	2	Asteiidae	1		

During the period of studies 1995-2012 411 species of flies from 41 families were recorded.

Material on Families in blue is not identified, still

Ecology of Diptera Brachycera

These are small to medium size flies (1.5-10 mm). Numerous families include species with a wide range of feeding habits. Larvae for the most part belong to the soil fauna. All feeding groups are represented. The main feeding groups are saprophages, phytophages and zoophages. Saprophages participate in decomposition of plant residues, dead animals and their excrements. Phytophages mostly are plant parasites. Zoophages include predatory species and animal parasites.



Ephidridae



Sciomyzidae



Dolichopodidae



Chloropidae



Hybotidae



Lauxaniidae



Sepsidae



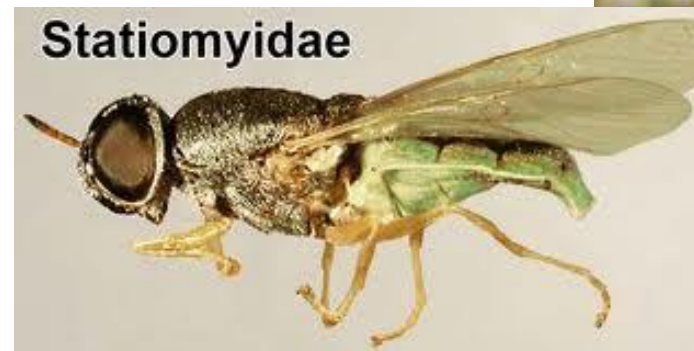
Tephritidae



Scatophagidae



Chamaemiidae



Statiomyidae



Drosophilidae

Some
representatives

Dry sites

Dry acidic grasslands alongside Lake Engure (S1)

Cl. *Koelerio-Corynephoretea*

All. *Plantagini-Festucion*

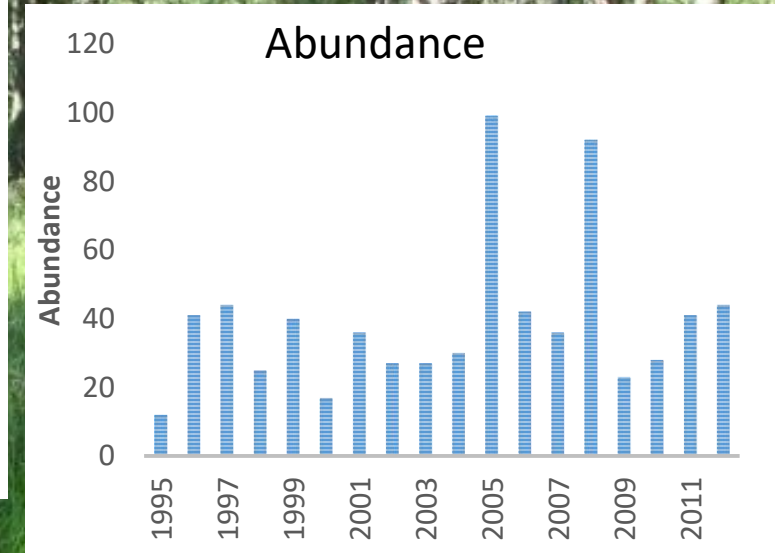
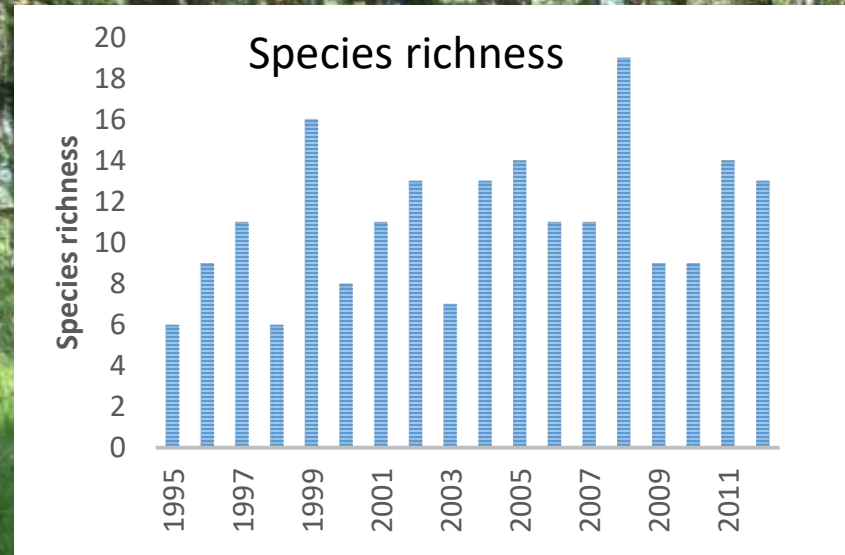
Deschampsia flexuosa-Melampyrum pratense
com.

Frequent species: *Deschampsia flexuosa*, *Melampyrum pratense*, *Luzula pilosa*, *Trientalis europaea*, *Anthoxanthum odoratum*, *Carex arenaria*, *Agrostis tenuis*

Changes observed in vegetation: Fluctuations

Total species abundance and richness of flies fluctuated irregularly and did not correlate with temperature and precipitation.

Only zoophagous species richness had statistically significant correlation with temperature (0.420).
Saprophagous species abundance correlated with precipitation (0.382)



Dry grasslands alongside Lake Engure (S1)

Cl. *Koelerio-Coryneporetea*

All. *Plantagini-Festucion*

Dry sites

White dune on the beach overgrowing with
perennial herbs S5

Cl. *Ammophiletea*

All. *Ammophilion*

Elymus arenarius-*Festuca arenaria* com.

Frequent species: *Elymus arenarius*, *Elytrigia repens*,
Honckenia peploides

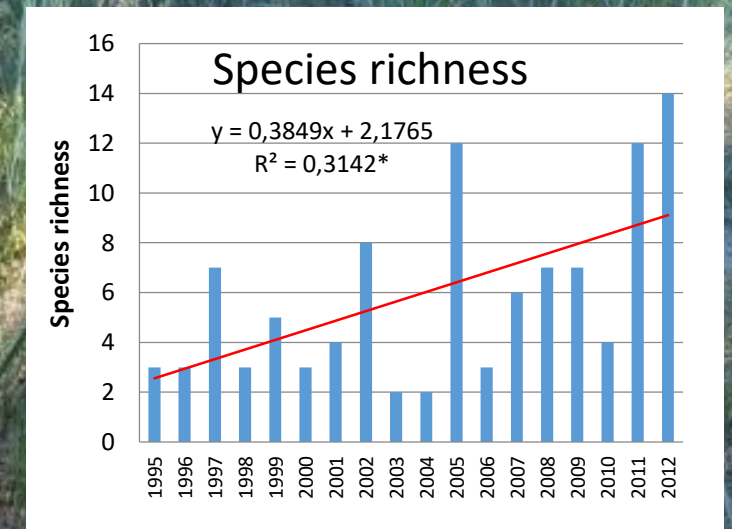
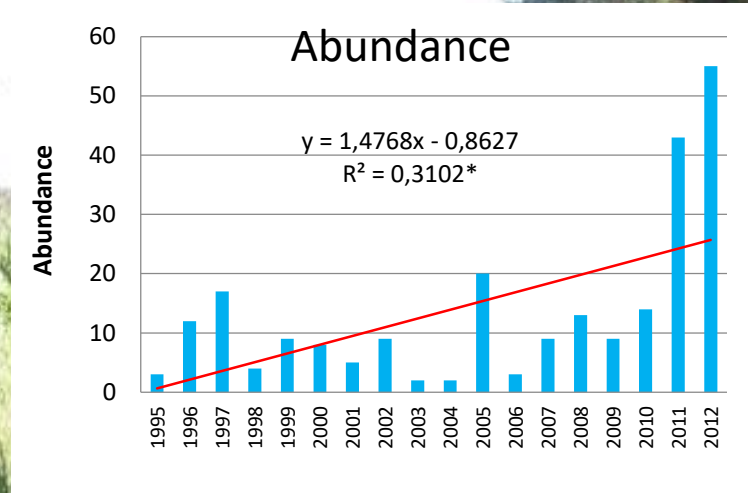
Changes observed in vegetation: Signs of succession,
fluctuations

Total species abundance and richness of flies showed statistically significant increase during the period of study

White dune on the beach S5

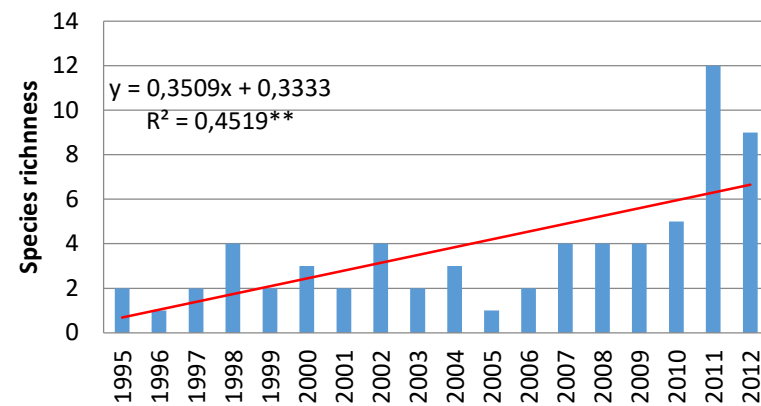
Cl. *Ammophiletea*

All. *Ammophilion*

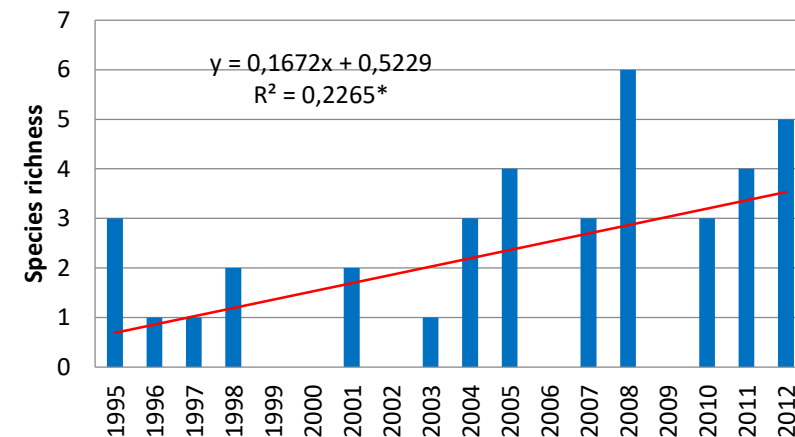


Zoophagous and
phytophagous
species richness
showed statistically
significant increase
during the period
of study

Zoophages



Phytophages

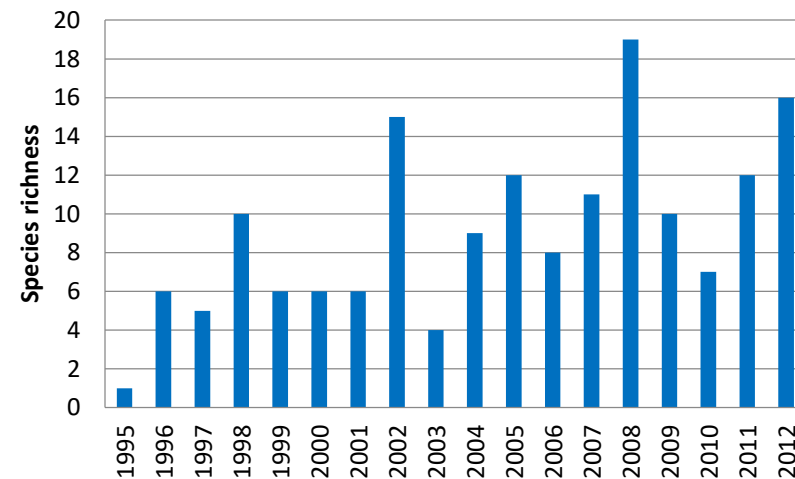


White dune on the beach S5

Cl. *Ammophiletea*

All. *Ammophilion*

Saprophages



Humid sites

Humid calcareous dune slack (S2)

Cl. *Scheuchzerio-Caricetea fuscae*

All. *Caricion davallianae*

Shoenus ferrugineus-Phragmites australis
com.

Frequent species: *Schoenus ferrugineus*, *Phragmites australis*, *Primula farinosa*, *Epipactis palustris*,

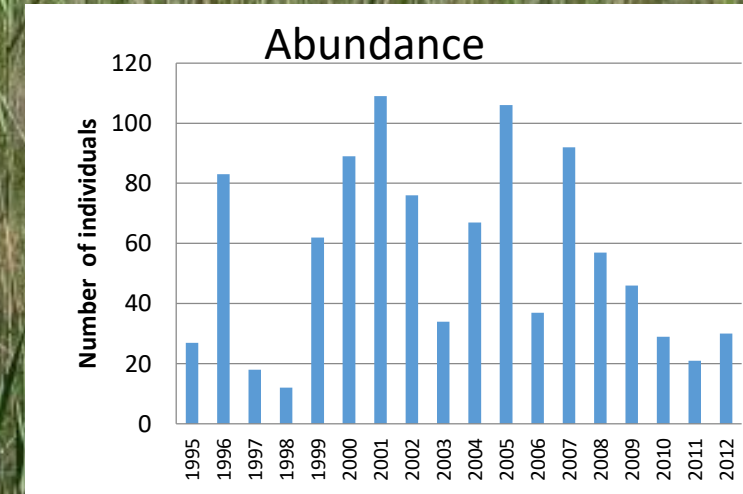
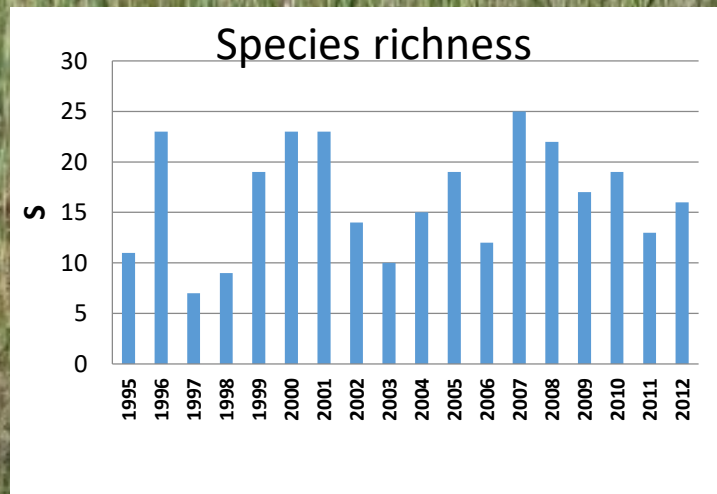
Changes observed in vegetation:
Fluctuations with signs of ecological
succession

Total species abundance and richness of flies fluctuated irregularly and did not correlate with temperature and precipitation.

Humid calcareous dune slack (S2)

Cl. *Scheuchzerio-Caricetea fuscae*

All. *Caricion davallianae*



Humid sites

Humid coastal grassland S6

Cl. *Molinio-Arrhenatheretea*

All. *Calthion*

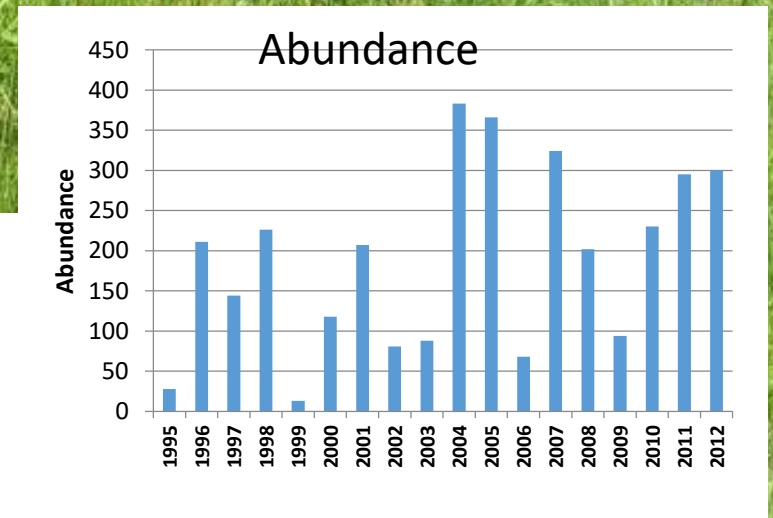
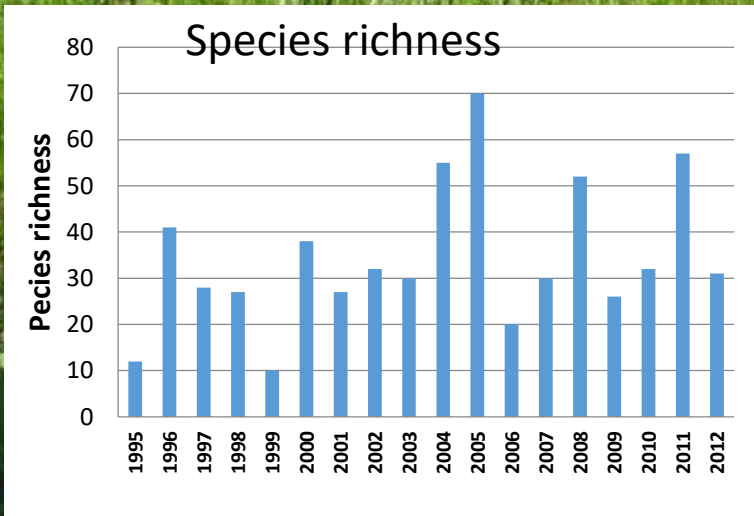
Anthoxanthum odoratum-*Carex nigra*
com.

Frequent species: *Anthoxanthum odoratum*, *Carex nigra*,
Angelica sylvestris, *Ranunculus acris*, *Hydrocotyle vulgaris*,
Trifolium pratense, *Potentilla anserina*

Changes observed in vegetation: Continuous
increase of species richness, ecological succession

Total species abundance and richness of flies fluctuated irregularly and did not correlate with temperature and precipitation.

Humid coastal grassland S6
Cl. Molinio-Arrhenatheretea
All. Calthion



Humid sites

Flood-plain calcareous fen S8

Cl. *Scheuchzerio-Caricetea fuscae*

All. *Caricion davallianae*

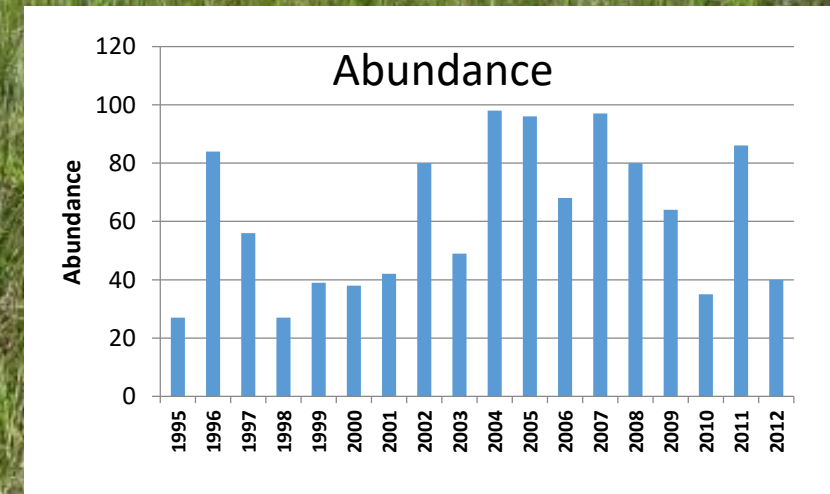
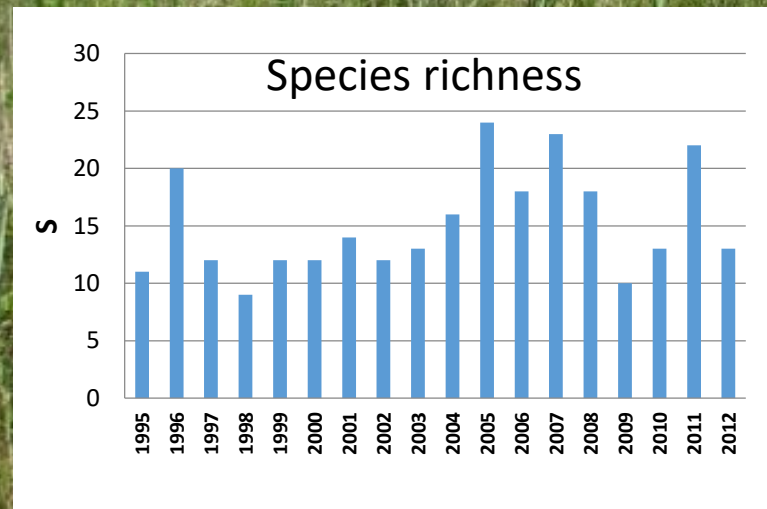
Schoenus ferrugineus-Menyanthes trifoliata
com

Frequent species: *Phragmites australis*, *Schoenus ferrugineus*, *Cladium mariscus*, *Myrica gale*, *Menyanthes trifoliata*

Changes observed in vegetation: Continuous increase of species richness, ecological succession

Total species
abundance
and richness of flies
fluctuated irregularly
and did not correlate
with temperature and
precipitation.

Flood-plain calcareous fen S8
Cl. Scheuchzerio-Caricetea fuscae
All. Caricion davallianae



In 2005, wild herbivores were introduced into two humid grassland areas where sample sites S9 and S10 are located.

Konik horses



Wild cows



Grasslands were subjected to strong grazing, tapping of topsoil and flooding with animal faeces.

Humid
sites, effects of
introduction of
large herbivores

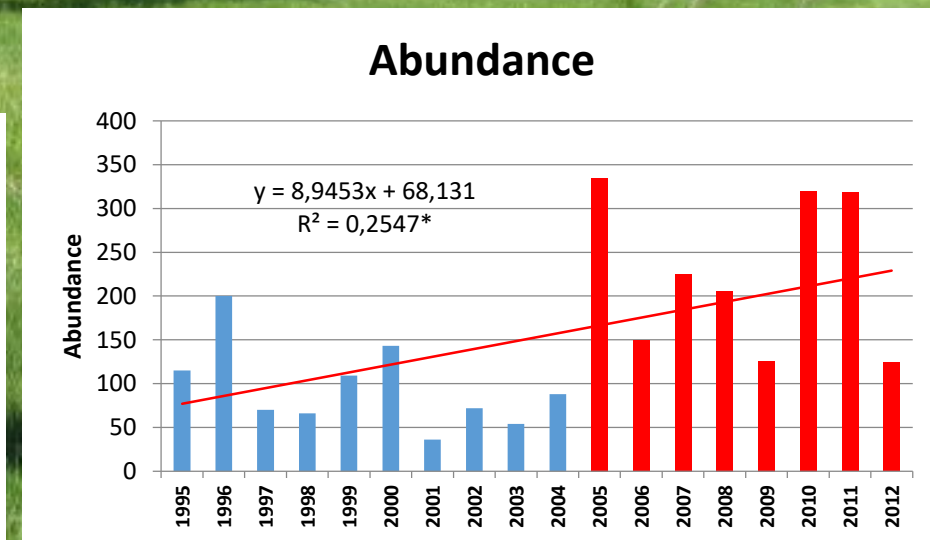
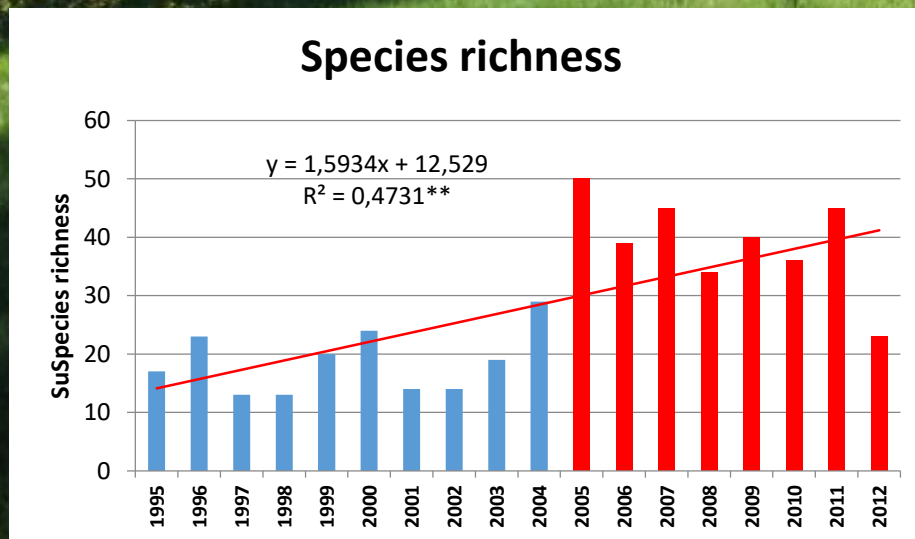
Humid calcareous grassland S9
Cl. *Molinio-Arrhenatheretea*
All. *Molinion*

Frequent species: *Sesleria caerulea*, *Carex nigra*, *C. panicea*, *C. flaca*, *Thalictrum simplex*, *Potentilla erecta*, *Peucedanum palustre*

Changes observed in vegetation: Since introduction of wild herbivores monitoring of vegetation was interrupted

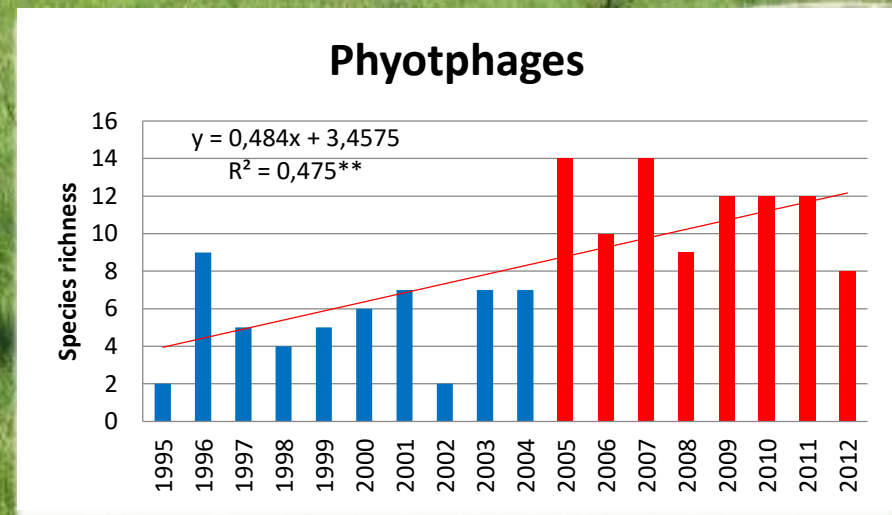
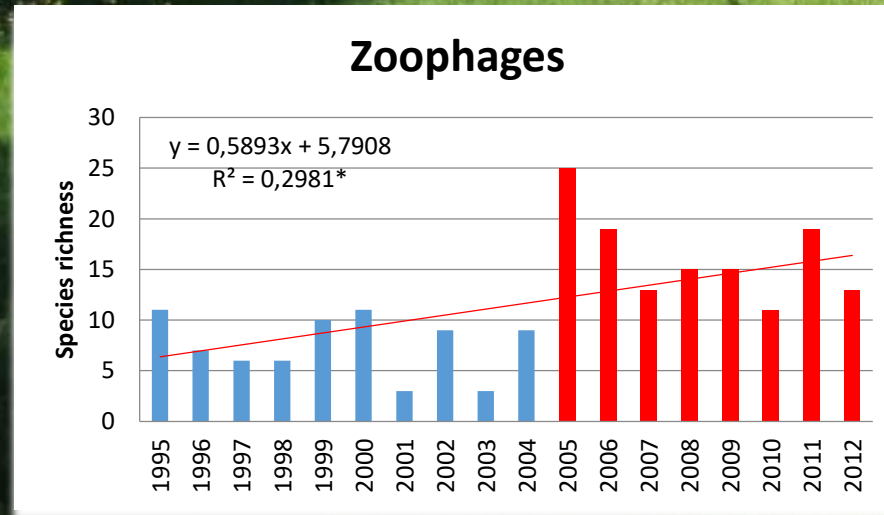
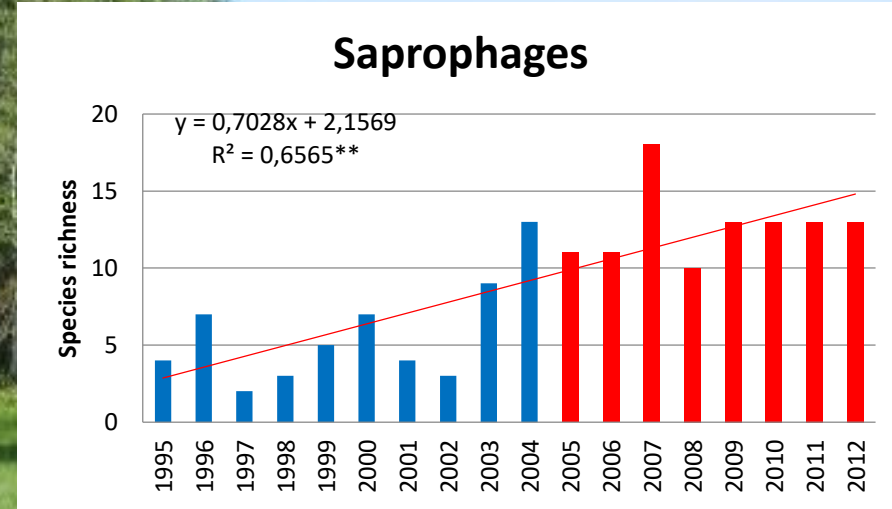
Total species abundance and richness of flies showed statistically significant increase after the introduction of wild herbivores in 2005.

Humid calcareous grassland S9
Cl. Molinio-Arrhenatheretea
All. Molinion



All the main trophic groups of flies were positively affected by Introduction of wild herbivores in 2005

Humid calcareous grassland S9
Cl. *Molinio-Arrhenatheretea*
All. *Molinion*



Humid
sites, effects of
introduction of
large herbivores

Poor fen S10

Cl. *Scheuchzerio-Caricetea fuscae*

All. *Caricion fuscae*

Frequent species: *Carex nigra*, *Comarum palustre*,
Naumburgia thyrsiflora, *Calamagrostis neglecta*

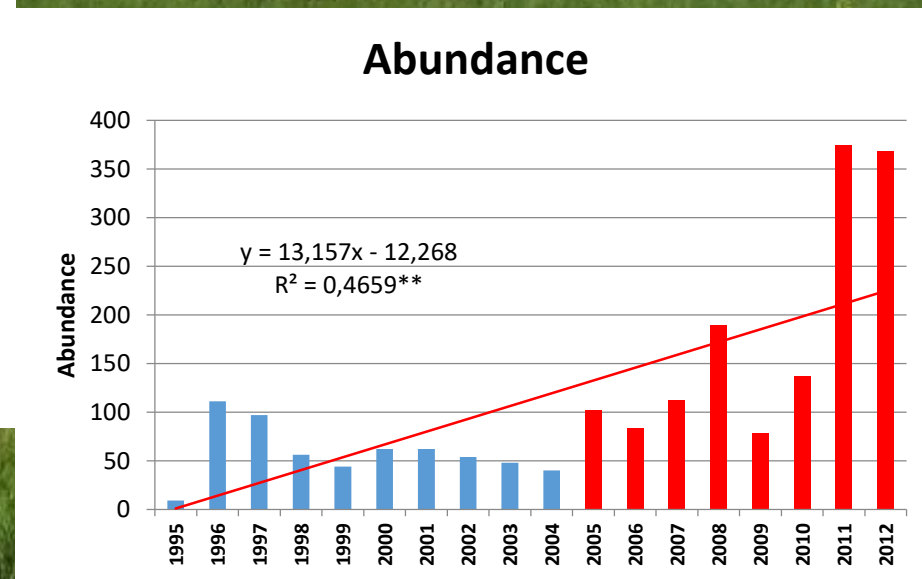
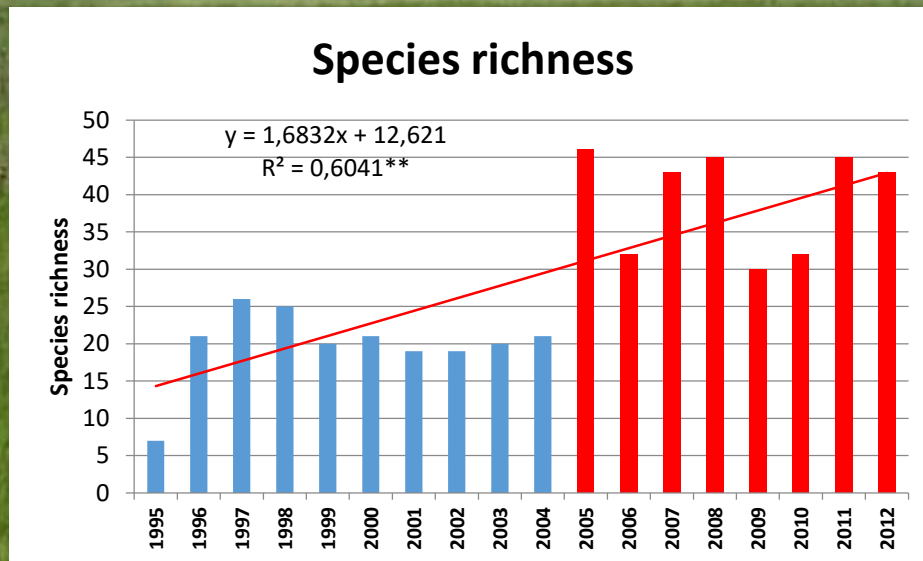
Changes observed in vegetation: Since introduction of
wild herbivores monitoring of vegetation was
interrupted

Total species abundance and richness showed statistically significant increase after the introduction of wild herbivores

Poor fen S10

Cl. *Scheuchzerio-Caricetea fuscae*

All. *Caricion fuscae*

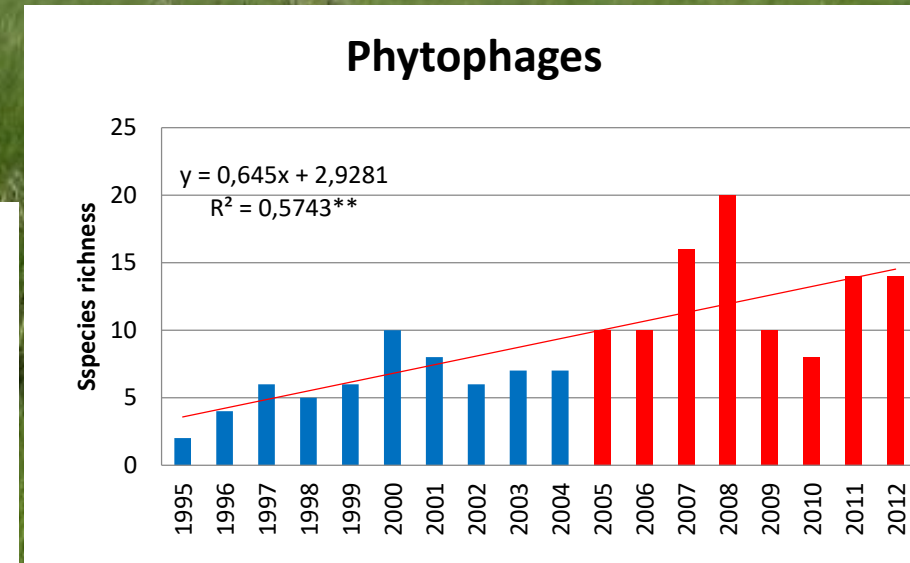
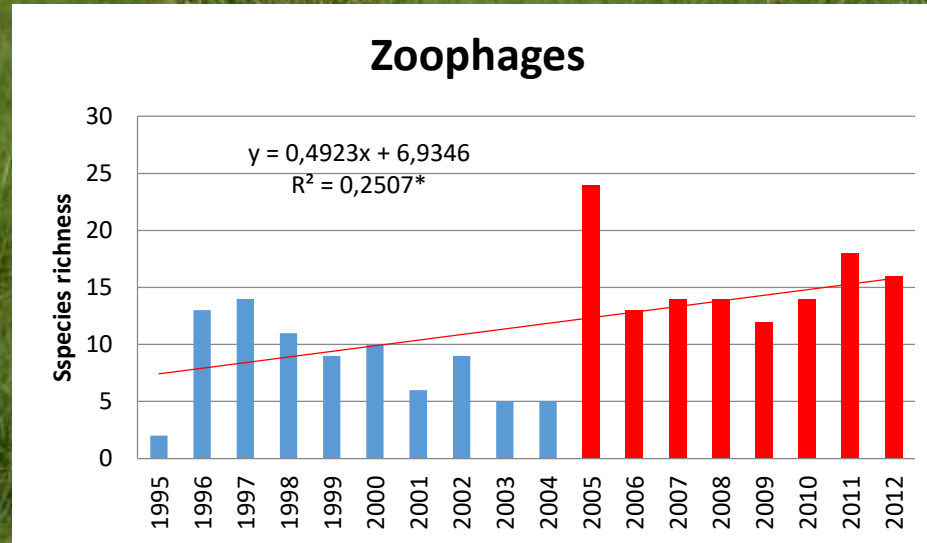
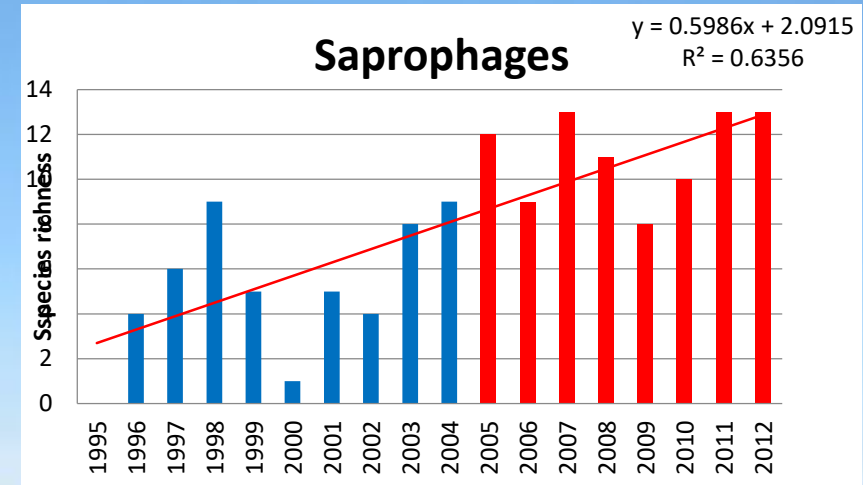


All the main trophic groups of flies were positively affected by Introduction of wild herbivores

Poor fen S10

Cl. Scheuchzerio-Caricetea fuscae

All. Caricion fuscae



Conclusions

- No statistically significant trends or correlations with positive temperature sums were found in abundance and species richness of flies of humid grassland habitats
- Some statistically significant correlations with temperature and positive trends of increase in abundance and species richness were found only in dry grassland habitats, however effects of ecological successions could not be excluded
- Introduction of wild herbivores caused sharp increase in species richness in all the main trophic groups of flies

For more detailed information see: Melecis, V., Karpa, A., Vilks, K. 2014. Increase in abundance and species richness of flies (Diptera, Brachycera) in the Lake Engure Nature Park, Latvia: effects of climate warming? *Proc. Latvian Acad. Sci. Section B*, 68, 1/2 (688/689), 46-67.

Thank you for attention!