



Wildlife passages De-Fragmentation in the Netherlands How to evaluate their effectiveness?



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De-fragmentation in the Netherlands

- Long history in de-fragmentation processes
 - First badger tunnel in 1974
 - Now more than 500 tunnels for small fauna under and 10 ecoducts over motorways
 - Badger population increases 4x between 1980 - 2008

Netherlands = worst case



1990: Two important policy-plans

Nature Policy Plan and Transport Policy Plan



In both fragmentation of
habitats was recognised

In Transport Policy Plan:

- no further fragmentation
(new motorways)
- decrease existing
fragmentation

Nature Policy

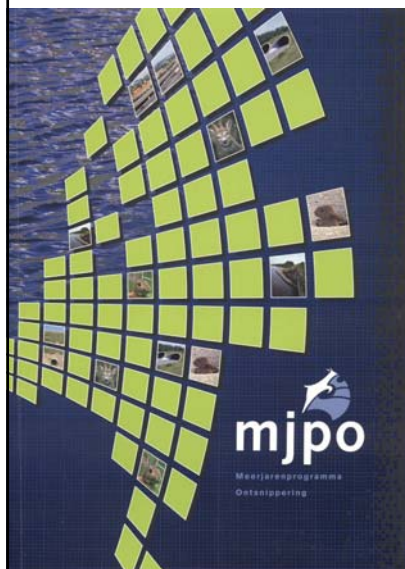
1990: Nature Policy Plan
introduction of National
Ecological Network

Goal: biodiversity

2002: Robust Corridors
added



Long Term De-Fragmentation Program



Rail

Roads

Waterways
(canals)

Existing national infrastructure

National government
Infra authorities
Provincial governments
NGO's
Water boards

Long Term De-Fragmentation program



Three ministers signed, accepted by parliament and now part of the policy plans of the 3 ministries → integration of policies

Area oriented

provinces has an important role to realise nature policy

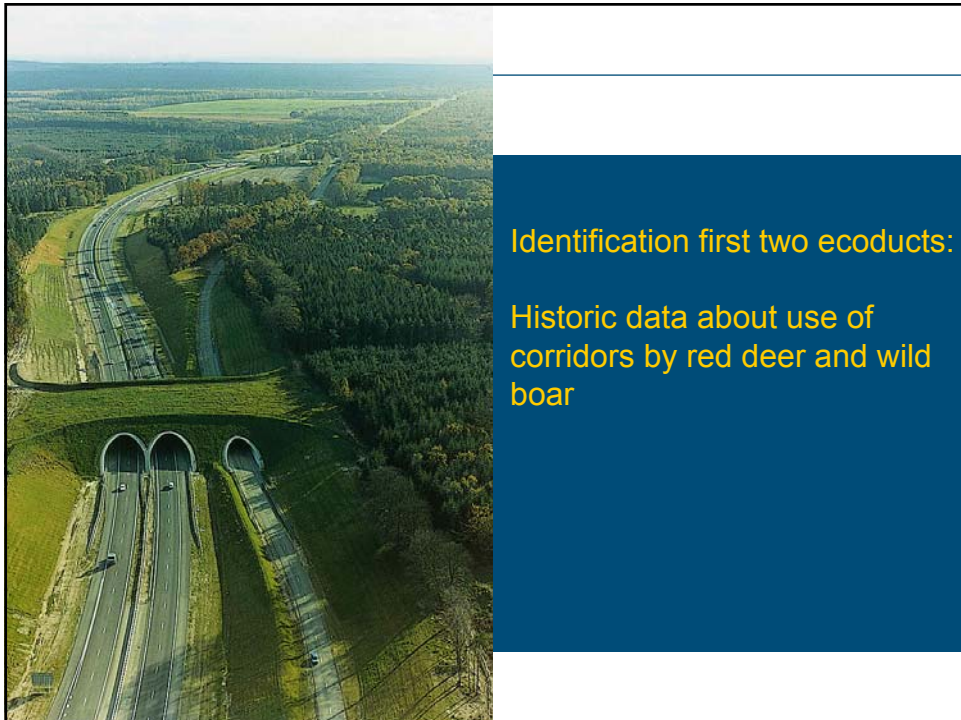
all kind of road levels

incorporating other interests (water management, drinking water, recreation, forestry, hiking,.....)

208 MJPO-points identified; all in the NEN, Program ready 2018

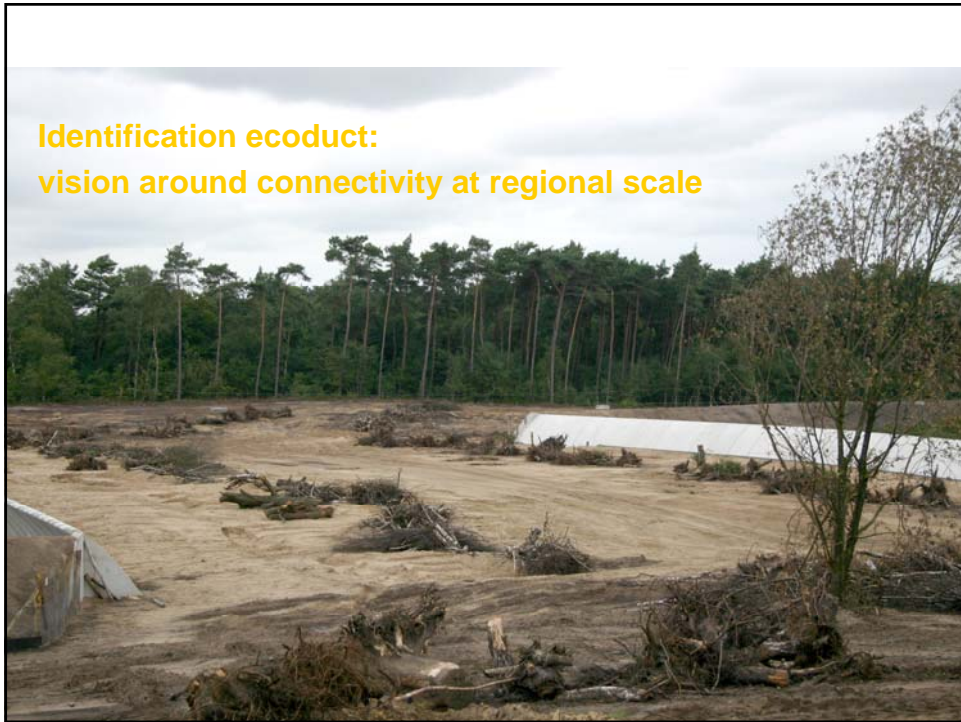
410 M€ from 2 ministries (Transport and Nature)







**Identification ecoduct:
vision around connectivity at regional scale**









Discussion: co use ecoduct with recreation

- Impact use
- Species
- Extra provisions
- Dogs / horses



Co use with water



Worldwide many wildlife passages in all forms/sizes, but....





Knowledge gap

Literature study van der Grift, van der Ree, et al

Most studies address use
Some studies address effectiveness...

But in most of them the effectiveness of
wildlife passages on population
persistence remains unclear!

Studying use is not useless!

However:

- Use \neq Effectiveness
- Use does not provide evidence for effects of wildlife passages on population persistence !



Use \neq Effectiveness

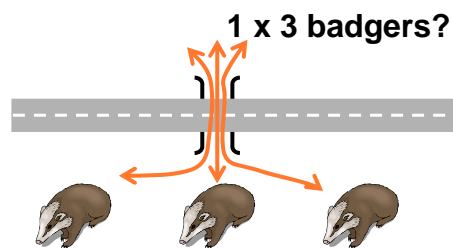
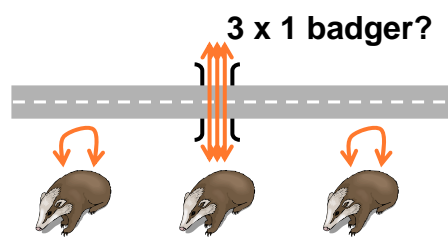


Research:

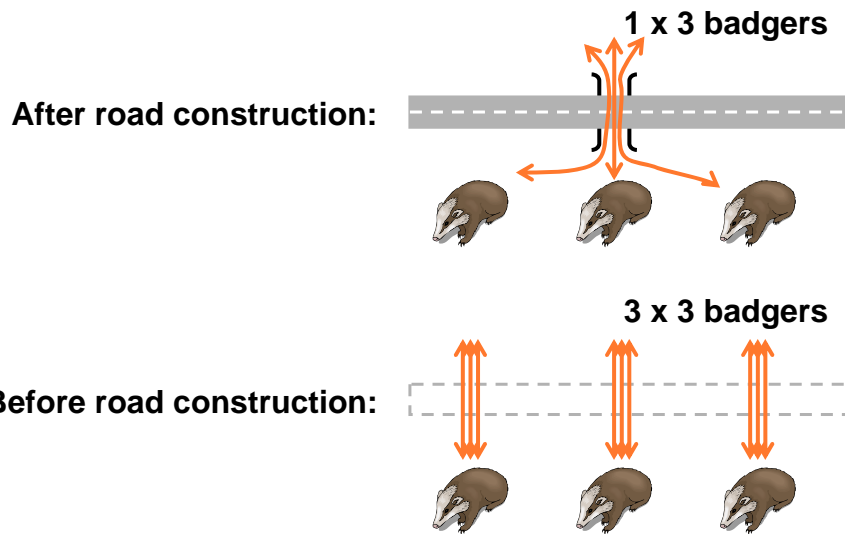
3 crossings of badger
per time period T



But: what does it mean?



Use ≠ Effectiveness



Usually no monitoring “before”



Wildlife passage effectiveness

Definition effectiveness:

The extent to which the objectives (= desired effect)
for a wildlife passage are reached

no objective = no effectiveness

(And: no problem = no objective)



Working out a monitoring approach

- What are suitable research **species**?
- What are suitable research **sites**?
- What is the best **study design** (options)?
- Which research **methods** (surveys/analyses) are most promising?
- What **measurement schemes** should be used?
- What are the estimated **costs**?



Choose appropriate research species

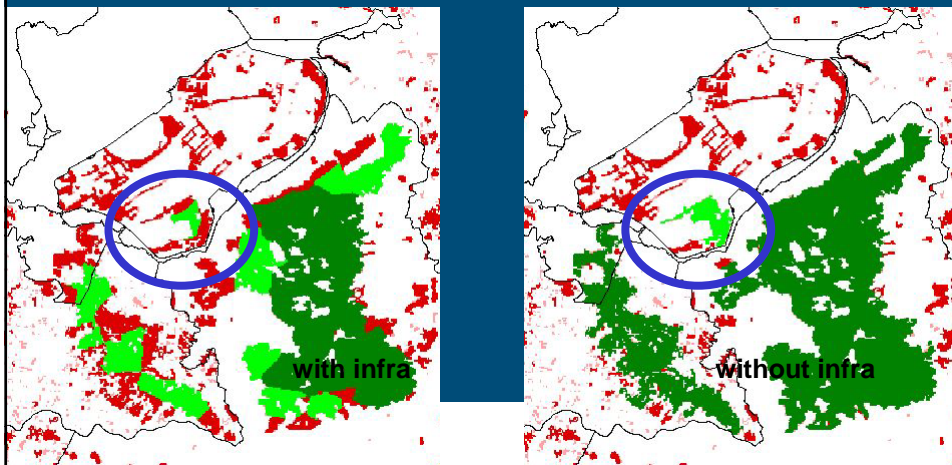
- Species is (highly) vulnerable for road impacts
- Proven use of wildlife passages
- Road impact is measurable
- Species allows for study design with high inferential strength (= high probability and low uncertainty that research result is true)



Choose appropriate research sites

Species X: ■ not viable ■ viable ■ highly viable



















Select locations where wildlife passages are expected to make a large difference (e.g. by modelling population viability)



Choose appropriate study design:

(B)BACI, BA or CI

(Roedenbeck et al., 2007)

	Before road construction		Before mitigation		After mitigation	
Impact						
Control 1						
Control 2						



Study design in literature review (n=123 studies):

- Before-After (BA) comparison approach: n=15
- Use of controls in <10 studies
- Most studies only survey of crossing structures after construction

In practice: trade-offs between perfect study design and reality!

- “Before” situation already in the past
- No controls, no replication
- Randomisation not feasible
- Limited budget
-



Do not **only** include the wildlife passage in your study design!

- Not measuring the population adjacent to road may result in **wrong conclusions** about wildlife passage performance

Example:

- Reduction in road kill does not necessarily mean the crossing structure is effective



Importance of population surveys

Effect	BEFORE	AFTER	
Example 1:			
Roadkill	10	5	50% ↓
Population size	100	20	15% ↑
Example 2:			
Roadkill	10	10	0%
Population size	100	200	50% ↓



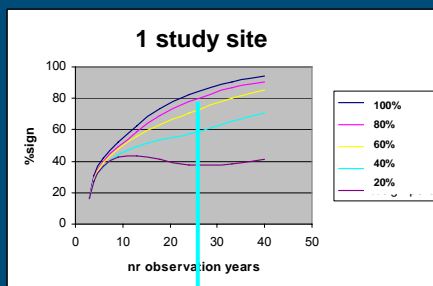
Appropriate measurement scheme

- Appropriate monitoring period
(review: 4 nights – 8 yrs)
- Appropriate frequency of measurements within period
(review: 1/day – 1/week)
- Appropriate number of impact and control sites

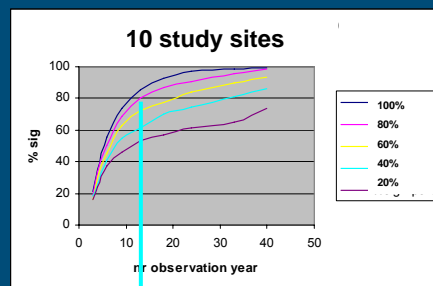


Appropriate measurement scheme

Monitoring changes in populations

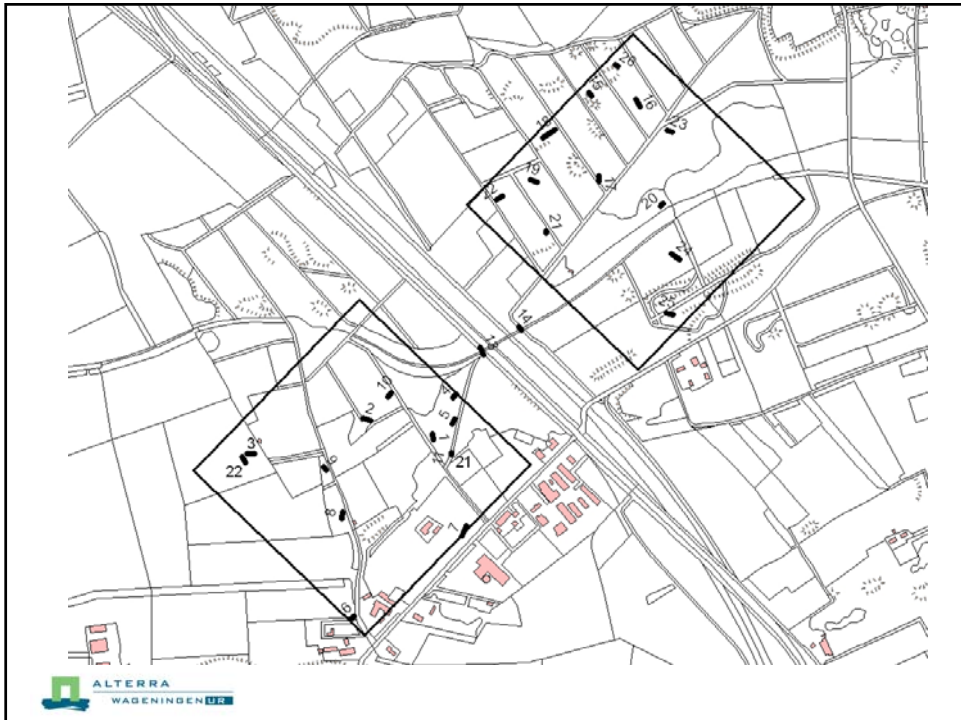


Survey: 26 years



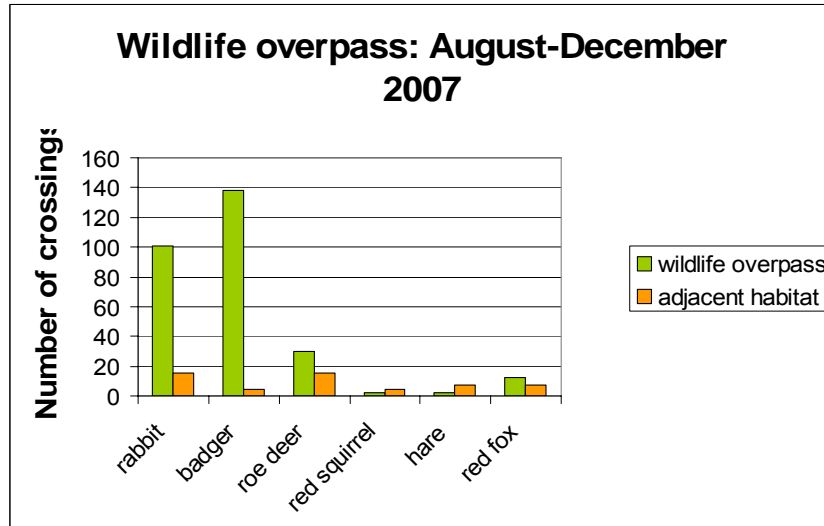
Survey: 12 years







Relate to abundance of animals in adjacent habitat



Select appropriate research methods





Review research literature:

- Tracking pads (n=74)
- Video / infra-red still cameras (n=36)
- Collection/identification scats (n=16)
- Direct observations (n=13)
- Trapping (n=12)
- Collection/identification hair (n=8)
- Radio-tracking (n=7)
- Trail monitors/wildlife counters (n=6)
- Other (including dusting with fluorescent pigment)



Select appropriate research methods

Go (sometimes) off the beaten track! EXPLORE!

Large species over-represented in existing studies, partly because of chosen research methods

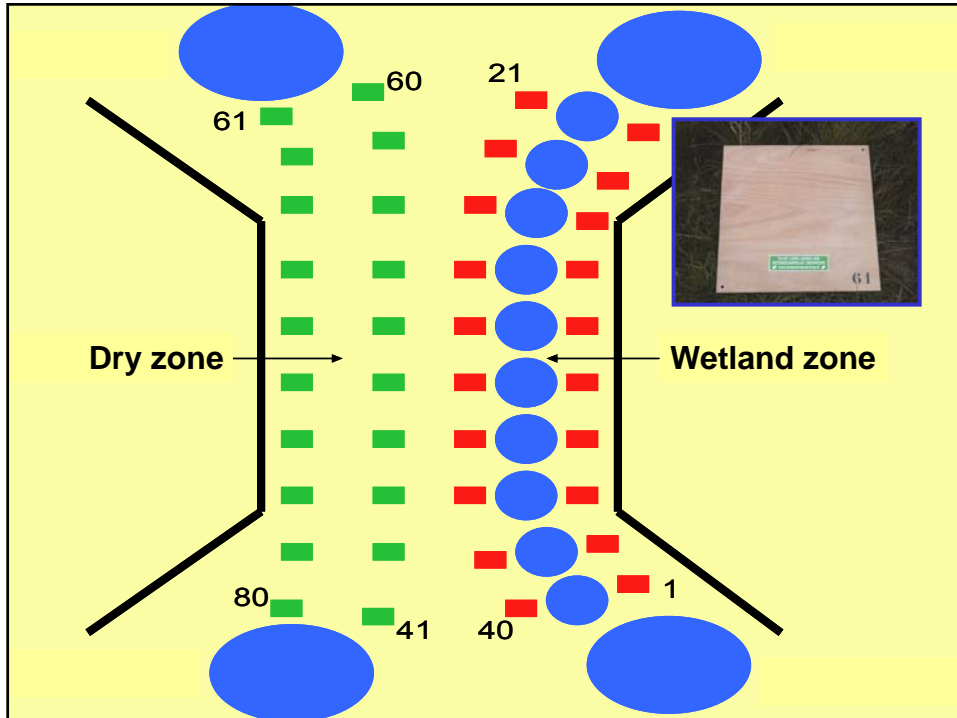
New techniques in development: e.g. PIT tags, GPS, genetic information (DNA), digital equipment, chips,....

Two examples:

1. monitoring amphibian at ecoduct Groene Woud
2. badger population, road victims and fauna passages



Example 1: Wildlife overpass "Groene Woud"

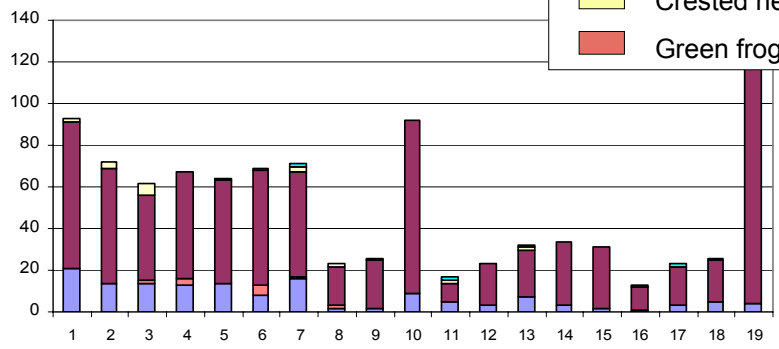




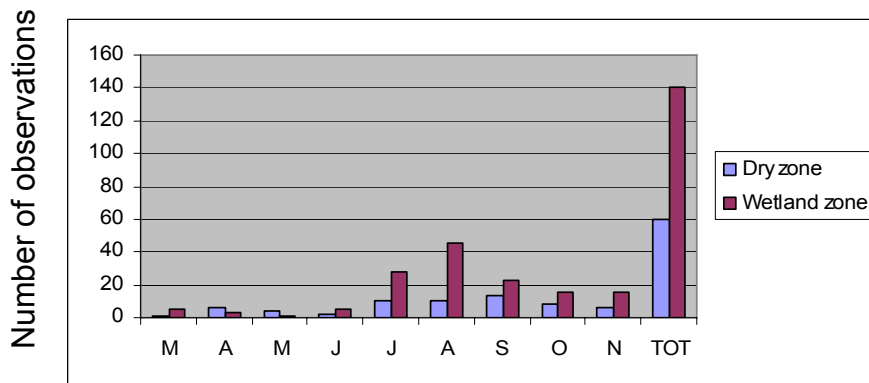
Distribution amphibians across overpass

Number of observations 2006-2007
adults/juveniles (n=968)

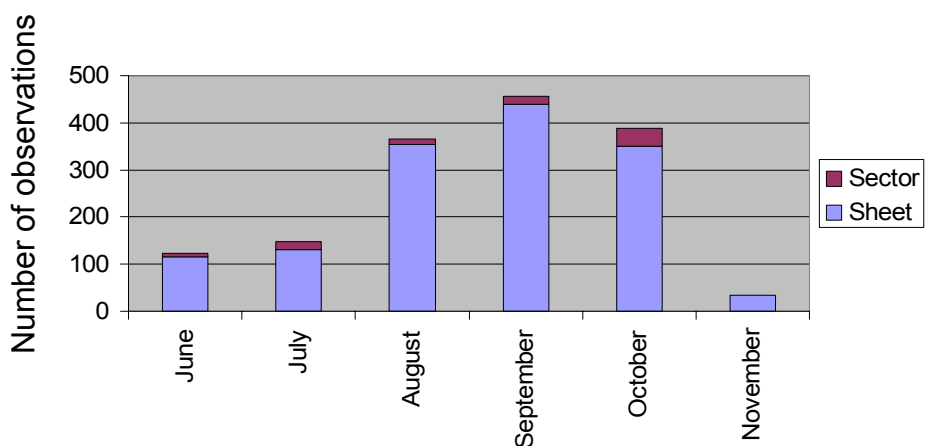
- Common toad
- Common frog
- Smooth newt
- Crested newt
- Green frog



Significant more amphibians in wetland zone


















Efficiency method “artificial refugia”





Crested newts: Belly patterns

					
8 april 2006	17 mei 2006	2 juni 2006	29 juli 2006	21 augustus 2006	21 augustus 2006
					
4 september 2006	4 september 2006	17 september 2006	2 oktober 2006	19 oktober 2006	19 oktober 2006
			<p>Identification of individuals and individual movements across the overpass</p>		
19 oktober 2006	19 oktober 2006	19 oktober 2006			

Crested newts: Belly patterns

Identification of individuals and individual movements across the overpass

Example 2: Road kill badgers

Highways, county and local roads

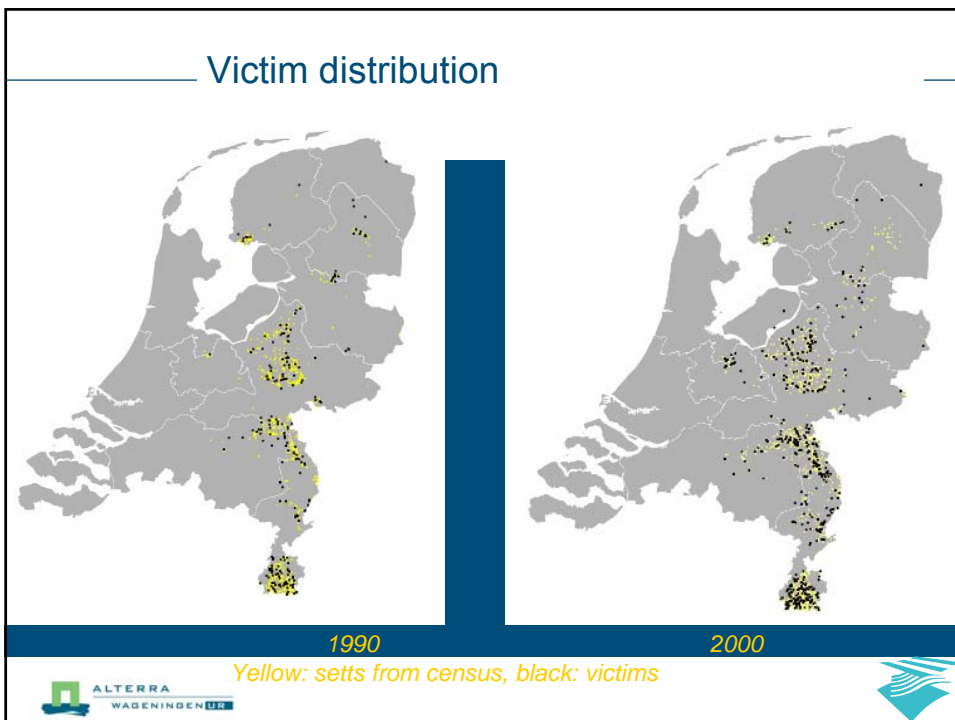
Data:
1990-
2006

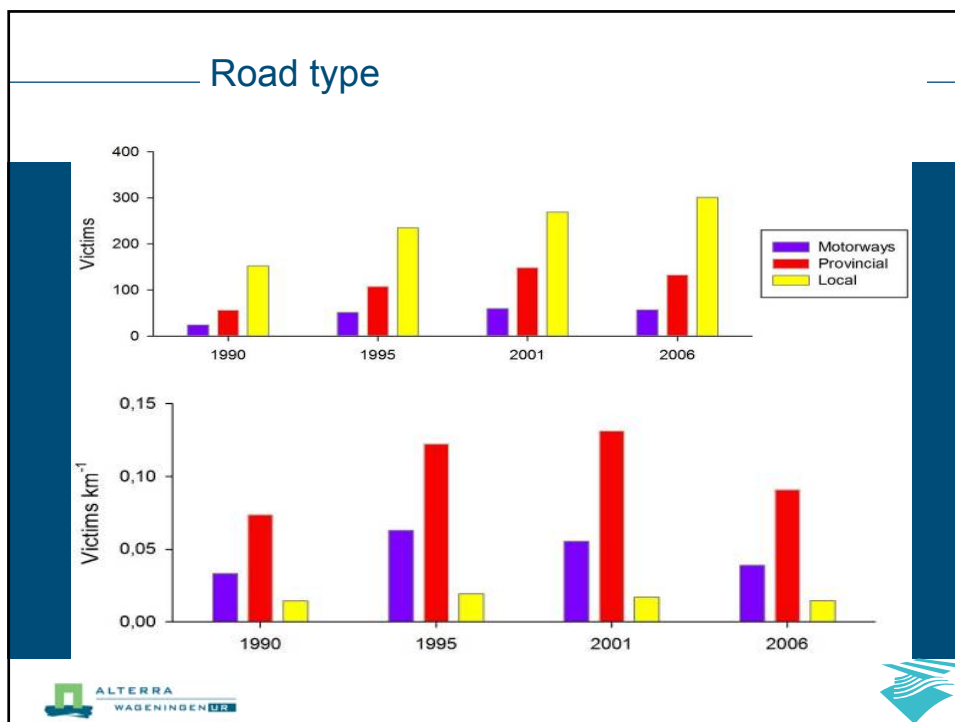
contract

Victim numbers (direct and indirect)



Victim distribution





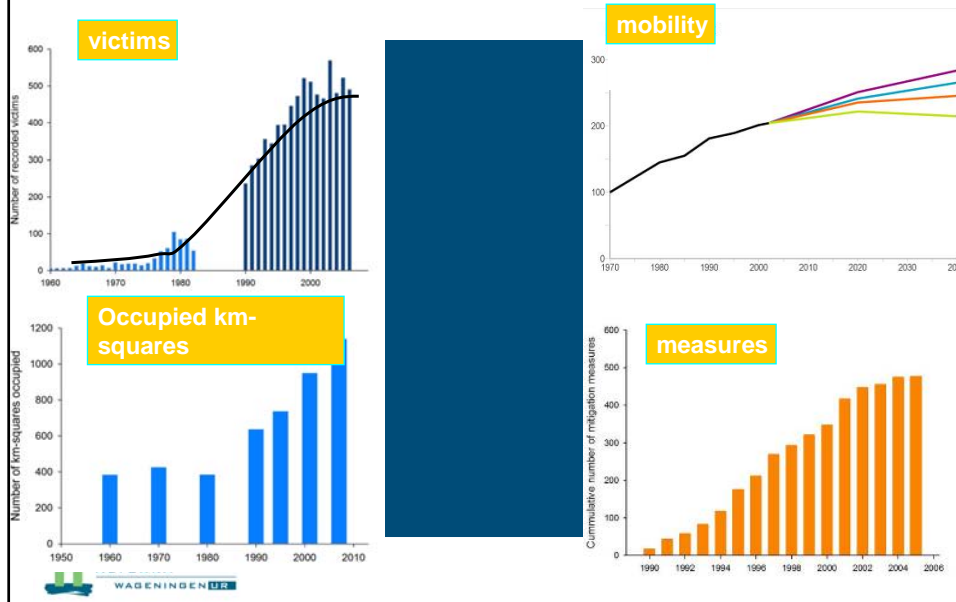
Tunnels & fences

Are they “effective”?

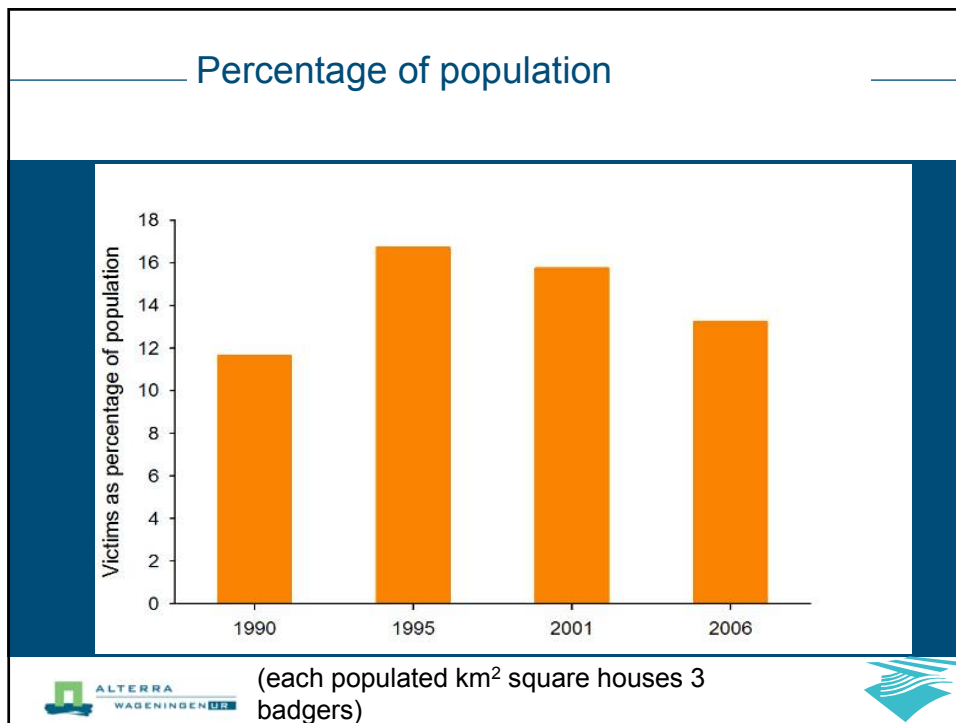
Are the number of victims lower after realization than before placement?



Tricky to get conclusions



Percentage of population



Conclusions

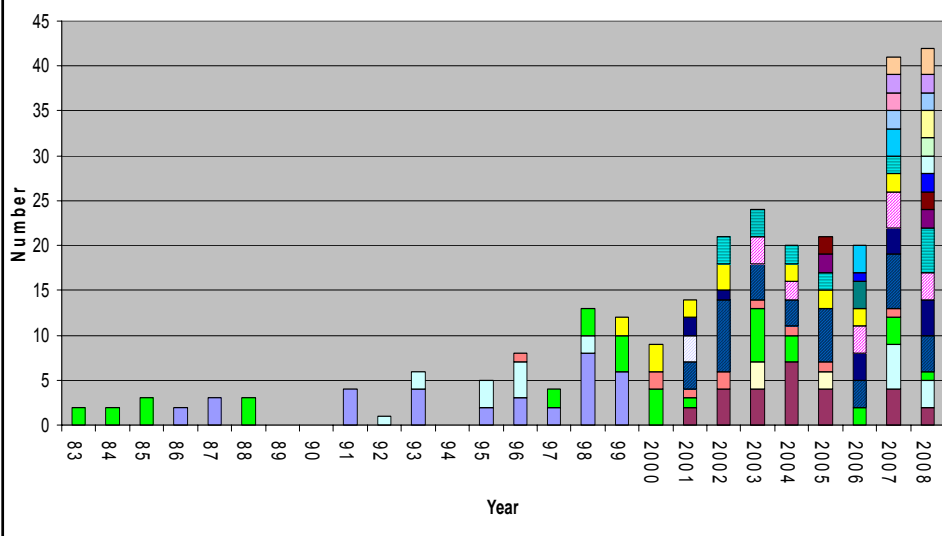
- Victim number stabilized or even decline;
- Most victims reported from provincial roads;
- Mitigation measures seem to have positive effect at population;
- Studies at regional scale are needed for better understanding of effects of mitigation measures.

Thanks to Sil Westra for GIS analyses!



Increase from Einde Gooi

Badger Reproduction (observed juveniles)



Thanks for your attention

