



Amphibians and roads - mitigation and compensation methods



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CONTENT



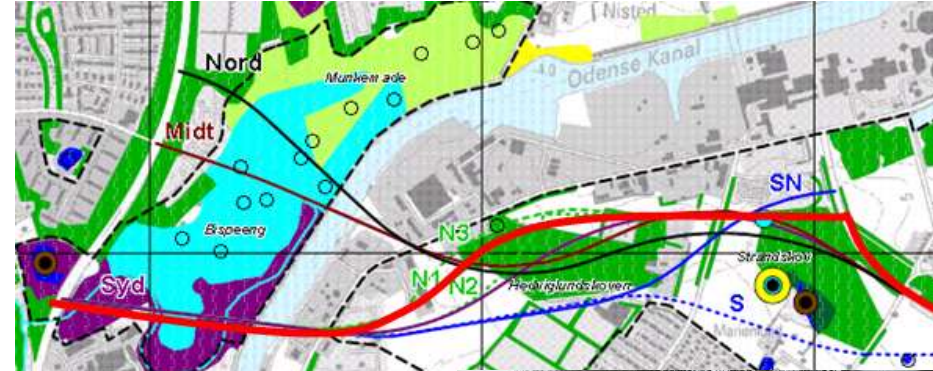
1. What negative impact have roads on amphibians
 - A. What and why amphibians are killed on the roads?
 - B. How high is a chance to cross the road?
 - C. How far amphibians migrate and what time of the day?
 - D. What kind of the barrier is a road?
2. How to counter-act?
 - A. Avoidance
 - B. Mitigation
 - C. Compensation

Why to care?



1. Legislation- national and international- permissions!
2. Requirements of funders- quality of EIA
3. Safety of road traffic
4. Duty to preserve natural heritage for the next generations

What negativ impact and how to contr-act?



What amphibians are killed on the roads?



Góry Stołowe:

2 species - 20.000 indiv. / 250m

Common species, mass migrating: eg. *Bufo bufo*, *Rana temporaria*, *Rana arvalis*

Important element in the food chain



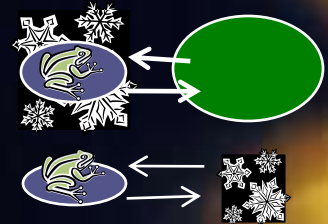
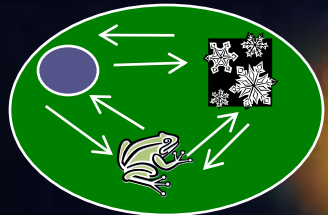
Suwałki-Budzisko:

9 species - >2-3.000 indiv. / 250m

Less common or rare species:

Triturus cristatus, *Bombina bombina*, *Bufo calamita*, *Bufo viridis*, *Pelobates fuscus*

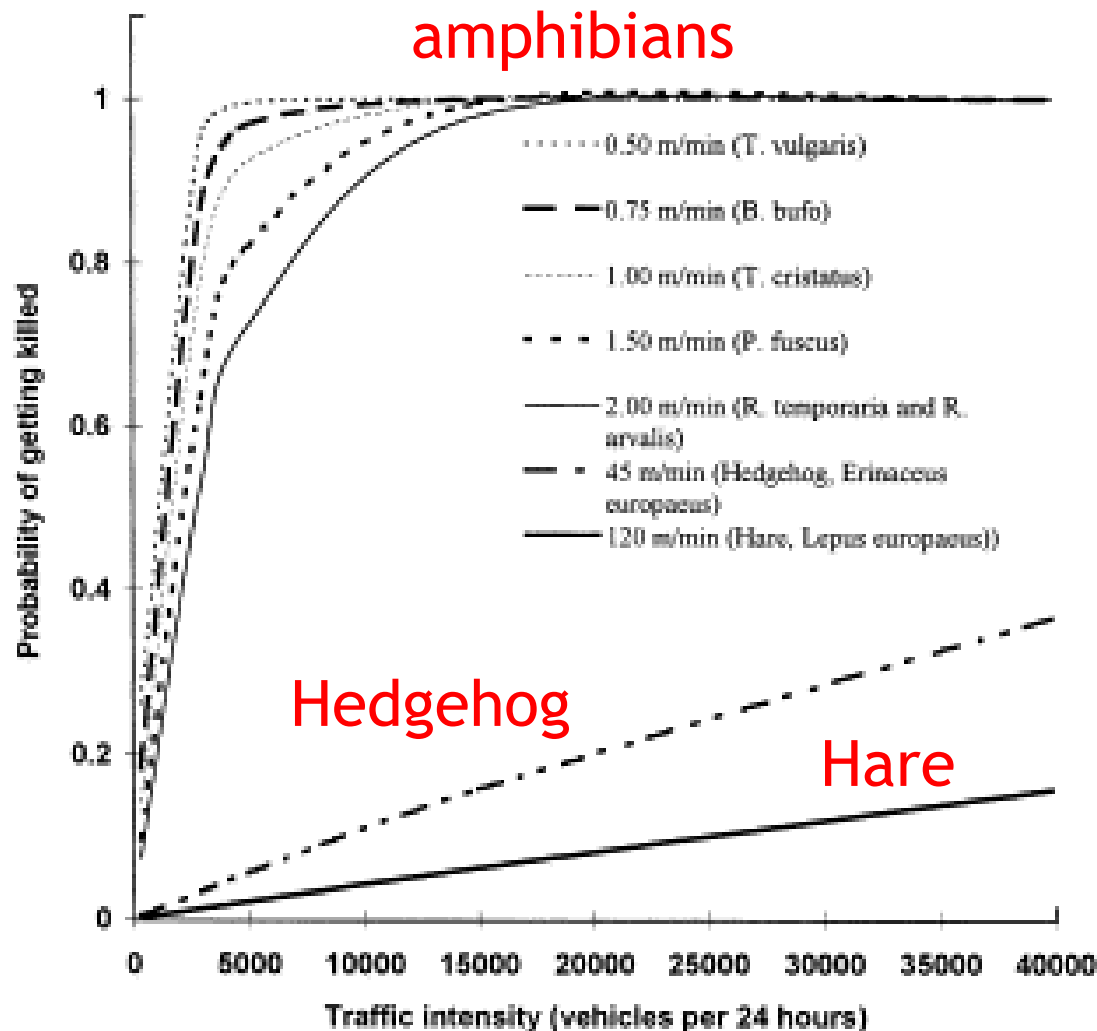
Why amphibians are killed on the roads?



1. Amphibians move/migrate/disperse
 - a) Every day- within their home ranges
 - b) Seasonal- between breeding, foraging & hibernation places
 - c) Irregular – to find new habitats- young as well as mature individuals, often long distances
2. React too slow (senses, neural system), are cold blooded, not developed motoric or use out-dated escape strategies, now deadly.



How high is a chance to cross the road?



100% killed if:

- app. 2.500 v./24h - *Triturus vulgaris*

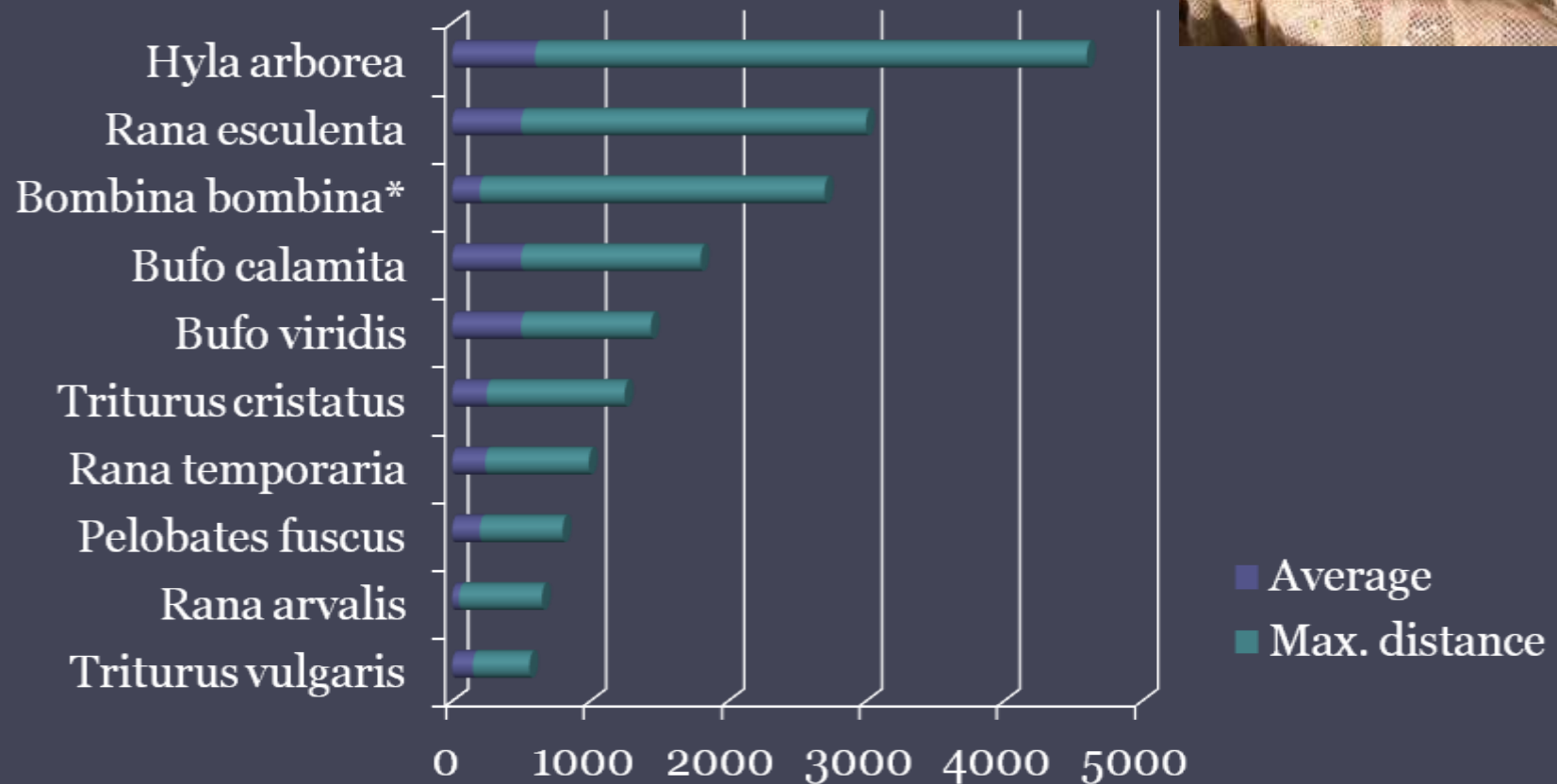
- app. 10.000 v./24h - *Bufo bufo*, *Triturus cristatus*

- app. 15.000 v./24h - *Pelobates fuscus*

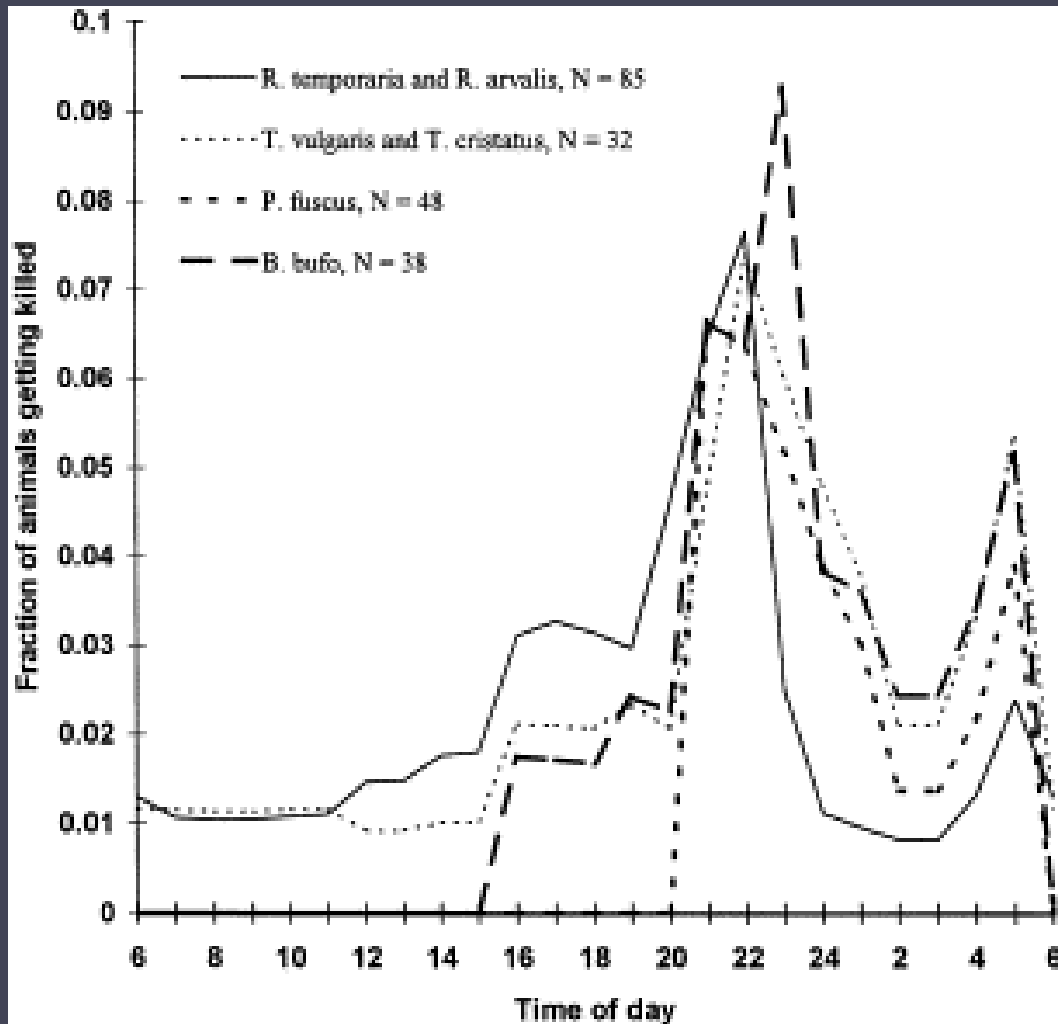
- ok. 17.000 v./24 h - brown frogs

Hels & Buchwald, 2001, The effect of road kills on amphibian populations

How far amphibians migrate?



What time of the day amphibians are killed?



Depends on distribution of migration & transportation intensity during day/night.

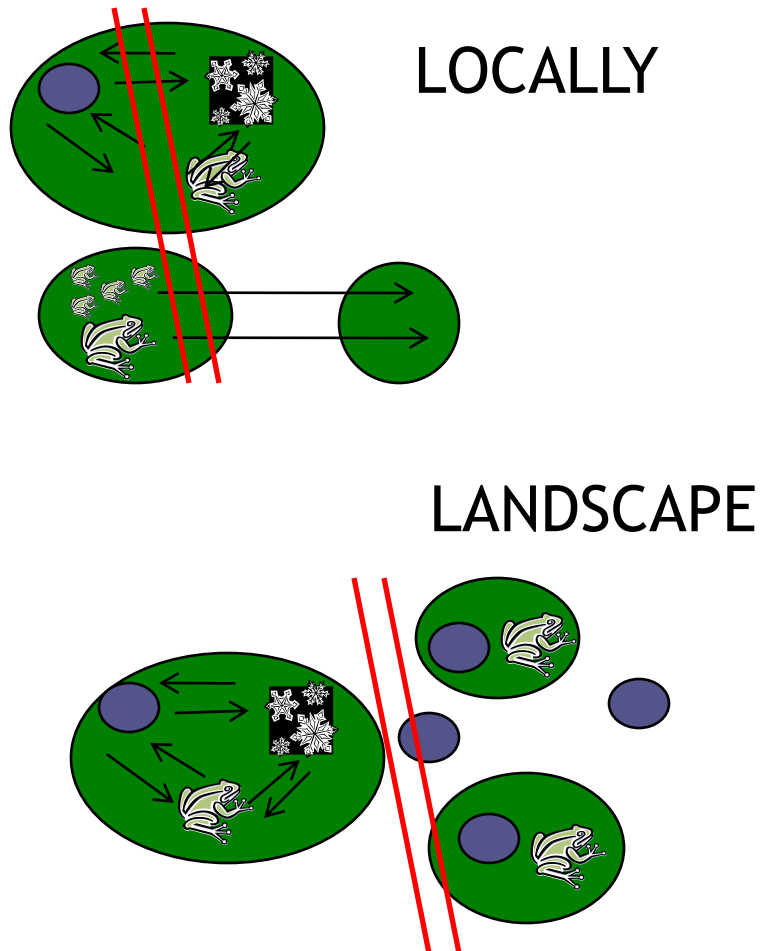
1. All species- highest mortality between 20-23.00 and 5.00,

a) Brown frogs, salamanders- during day and night,

b) Pelobates- after 20.00 and app. 3.00;

What kind of barrier is road?

Cut or decrease movement/migration/dispersal:



1. Between habitats – isolating breeding, foraging, hibernation habitats and lead to fragmentation (decreasing size or isolation of available habitats).

2. Divides meta-population causing isolation of populations and loss of their genetic material, can cause distinction of local populations

Conclusion:

When assessing road impact it is necessary to collect information about:

1. What species occur in the area influenced by the road and how big are their populations?
2. What is the structure of amphibian meta-populations? How many pond clusters, how far from each other, which ponds are important for breeding (centres), where are hibernation sites, where are foraging habitats?
3. Where are conflict 'road sections'?

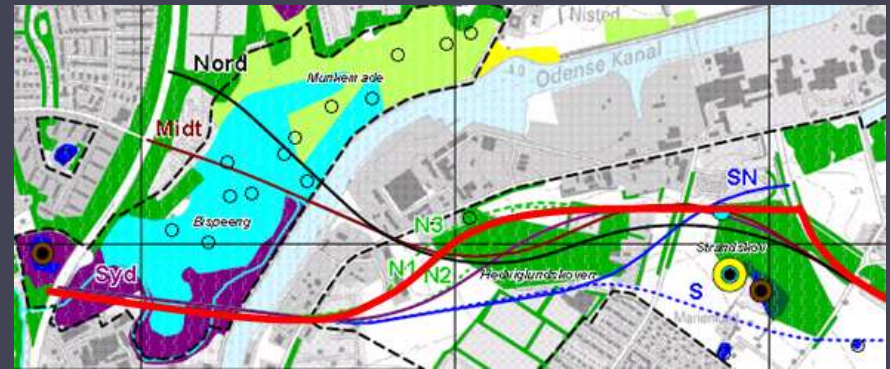
What negativ impact and how to contr-act?



Contr- acting: avoidance

Avoidance of conflict situations:

- - during planning- different variants of the road trace,
- - during construction- avoiding of creation of temporary water bodies, filling in ponds outside of breeding- hibernating season



Contr- acting: mitigation



Mitigation of negativ impact:

- - during construction: collecting eggs, larvies, individuals, temporary fencing

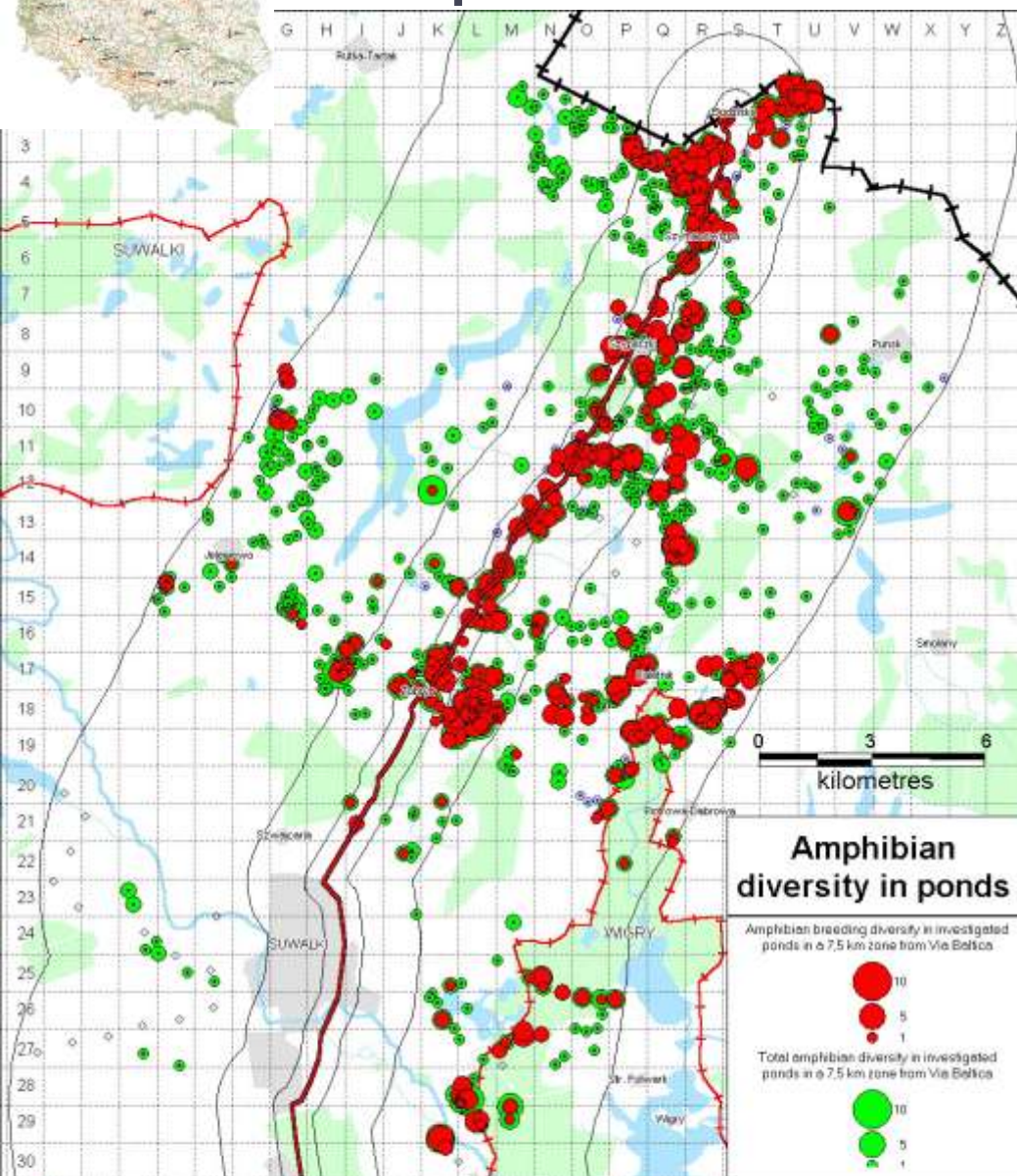


- -building amphibian/fauna passage systems together with guiding structures





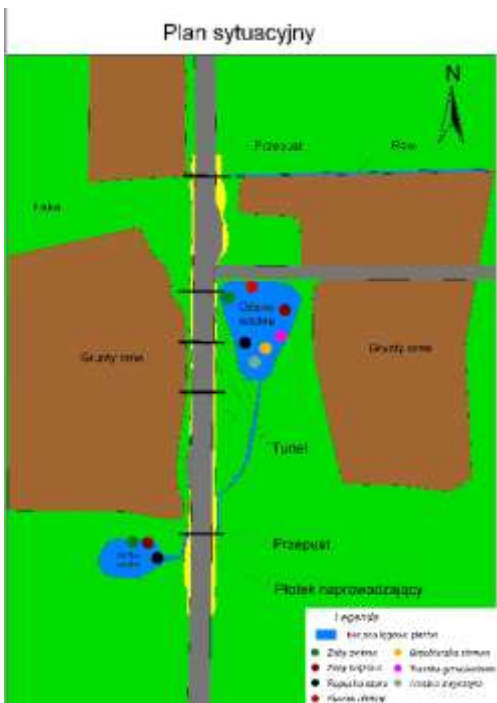
Express road S8 Suwałki Budzisko



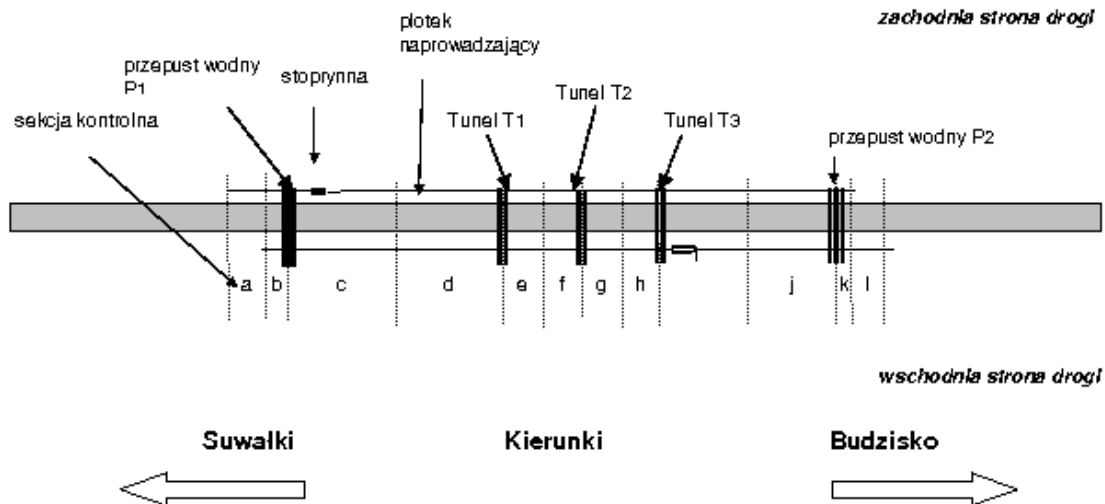
- Inventory of 30km, in zone up to 7,5 km from the road 1999-2000
- 1.812 ponds investigated, majority with Annex IV species of Habitat Directive



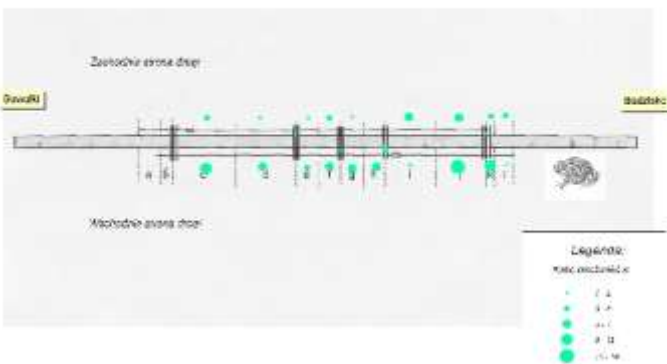
Express Road S8 Suwalki-Budzisko (Andrzejewo)



Wyniki obserwacji grzebiuszki ziemnej (*Pelobates fuscus*) w poszczególnych częściach systemu przejac - osobniki dojrzałe.



Wyniki obserwacji grzebiuszki ziemnej (*Pelobates fuscus*)
w poszczególnych częściach systemu przejazd - osobniki młodociane.

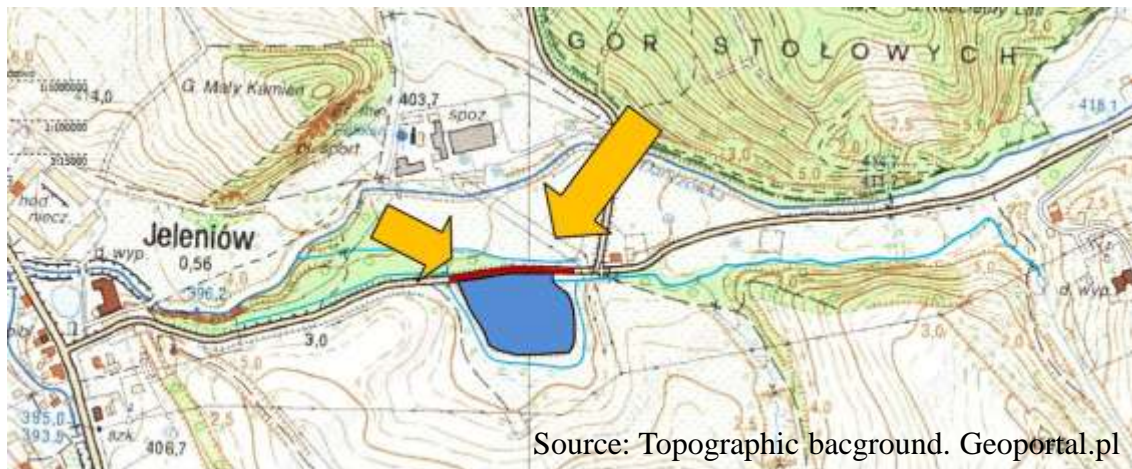


Mitigations:

- Investor: GDDKiA O/Bialystok,
- 3 amphibian tunnels connected by fences
- Monitoring after mitigations



Local road 45120, Jeleniów- Kudowa Zdrój, National Park of Stołowe Mountains, Poland



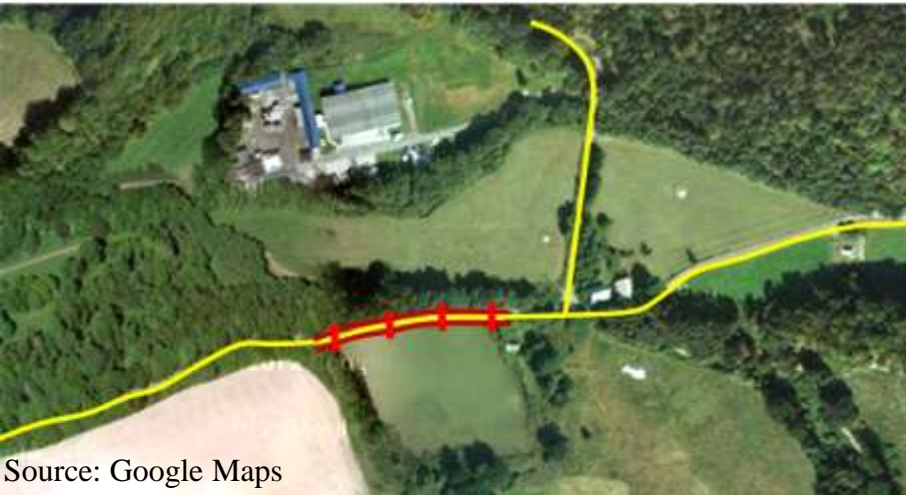
-1998 inventory of breeding sites and 'hot spots' of road kill - 8 sp. of amphibians, 2.000 killed on 220m of existing road (*R.temporaria* and *B.bufo*);

-1999-2002: monitoring with drift fences
23.000 amphibians /year on 220m during III-IV
(12.000 *R.temporaria*, 10.000 *B.bufo*, 1000 *Triturus* sp.)



What was done?

Jeleniów (road 45120), National Park of Stołowe Mountains, Poland



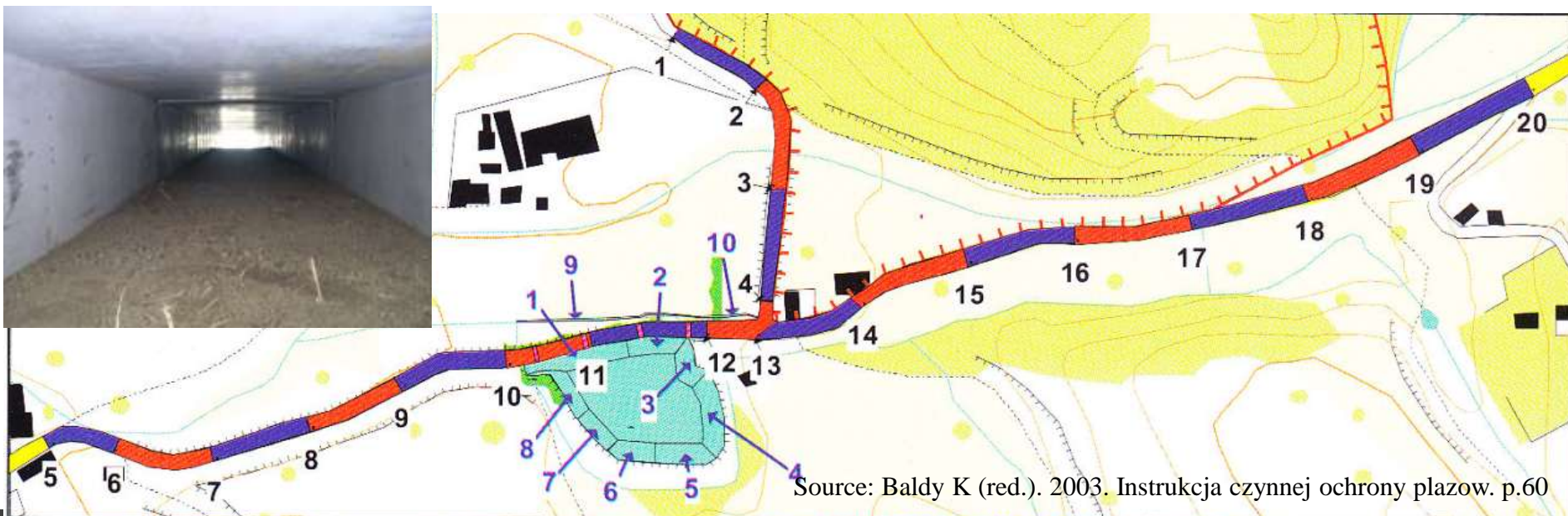
Source: Google Maps

2002:
4 tunnels (8-12 m long)
connected by C-shaped concrete
fence on both sides of the road
(2x225m)



Monitoring of function of amphibian passages (2003)

Jeleniów (road 45120), National Park of Stołowe Mountains, Poland



No road-killed amphibians in the section with fences

Tunnels:

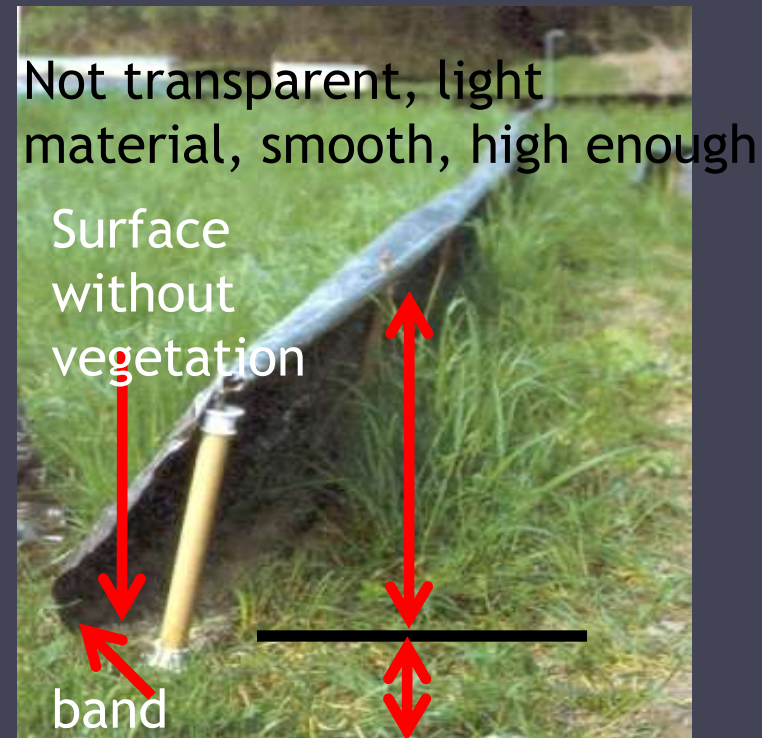
19.III- 30.IV through tunnels: 15.639 *R.temporaria*, 2.248 *B.bufo*

Road:

1,9 km (21 sections of 100m)- 1.076 indiv. 57% road killed, mainly *B.bufo* (442 indiv.)

Mitigation- temporary fencing

- temporary structures,
- special shape,
- different materials, plastic or metal net gives a lot of problems!



Landesanstalt für Umweltschutz
Baden-Württemberg (Hrsg.)(2000):
Baumaterialien für den
Amphibienschutz an Straßen. -
Fachdienst Naturschutz, Artenschutz
3:1-158.

Mitigation: Tunnels

Does lenght/shape/size of the tunnel matter?

Lenght: as short as possible

Shape: as big as possible surface to walk, vertical walls max 90 degrees: speed of the movements.

Round shape limited walking surface: diameter 1,5m but 20-30cm surface available to walk



Too big opening
- increased
wind speed =
dessication



Construction type	<20m	20-30m	30-40m	40-50m
Rectangular (open bottom!)	1,0m x 0,75m	1,5m x 1,0m	1,75m x 1,25m	2,0m x 1,5m
Culvert (diamiter)	1,0m	1,4m	1,6m	2,0m
Half round	1,0m x 0,7m	1,4m x 0,7m	1,6m x 1,1m	-

Mitigation: Tunnels:

Does water presence matters?



**Most species will not use,
cannot be used instead of
proper tunnels**



**Used by all species,
moist soil bottom**

Usage of the tunnel by *Pelobates* has increased from 40 to 80% after covering the bottom of the tunnel with 50mm of sand (John, 2003).

Mitigation: Tunnels. Does material matter?



What to do to improve existing structures?



Mitigation: Guiding structures



plastic



metal



polymer-concrete



wood

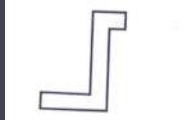
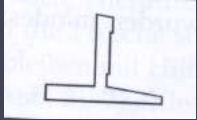


concrete

1. Durable (30-50 years), UV resistant, low maintenance cost = concrete
2. Shape!
3. Elements well connected, as few mountings as possible,
4. Stable basis, build in in the road side, difficult to go under

Mitigation: Guiding structures

concrete



Mitigation: Side roads



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Baden-Württemberg (Hrsg.)(2000):
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3:1-158.

Maintenance!!!!



Even best designed systems fail because of low quality of construction or lack of maintenance



Compensation

When other ways impossible - compensation of negative impact

Destroying habitats = recreation of habitats (important time aspect!)

Recreation of breeding sites- ecological requirements of different species

Compensation of loss of connection between populations

Result- change of spatial organisation of meta-population/migration and dispersal

Thanks for your attention!



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