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Landscape ecology of Mustelids in the IJssel River Valley, The Netherlands

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In 2009 a study commenced on the landscape ecology of Mustelids in the IJssel River Valley in the east of the Netherlands. It is aimed to be a longer term monitoring focused on gaining ecological knowledge of a community of Mustelids (badger, pine marten, stone marten, polecat, stoat, weasel and recently introduced otter) and other mesocarnivores in a fragmented cultural landscape. This knowledge is used to underpin the conservation ecology and support nature management actions for Mustelids.

Specific activities include:

- Yearly survey of Mustelids using remote cameras ('camera trapping'), den search, tracks & signs, tracking plates and life-trapping.
- Improvement of camera trapping techniques to enhance detection rate for Mustelids.
- Development of an individual recognition or 'passport' system for pine marten and stone marten. Collection of genetic material to determine population origins and better understand landscape genetics or meta-population ecology of pine martens.
- Gaining information on the reproduction and fecundity of martens.
- Determine bottlenecks in the landscape, such as black spots for badgers and martens along roads, so that well-tailored mitigation measures can be advised to infrastructure & transport management authorities and land-use planners.
- Gaining information on the landscape ecology of Mustelids, in particular meta-population ecology and dispersal mechanisms in fragmented forest and agricultural landscapes.
- Gaining more information on behavior and ecology of interacting Mustelids in the Dutch modified landscape and forest management context.
- Gaining information on interspecific or intra-guild relationships of Mustelids and other mesocarnivores present (fox and feral cat).
- Investigation into the decline or current conservation status of small Mustelids (common weasel, stoat and polecat), a species group receiving very little attention in the Netherlands at present.
- Consulting to forest and nature management organizations on habitat improvement and conservation measures for Mustelids.
- Educating the public on stone marten problems (car patrolling habits and other nuisances).



Study area



Scatology and collection of prey samples to study landscape genetics and feeding ecology



Stoat track

Cross section of landscape features

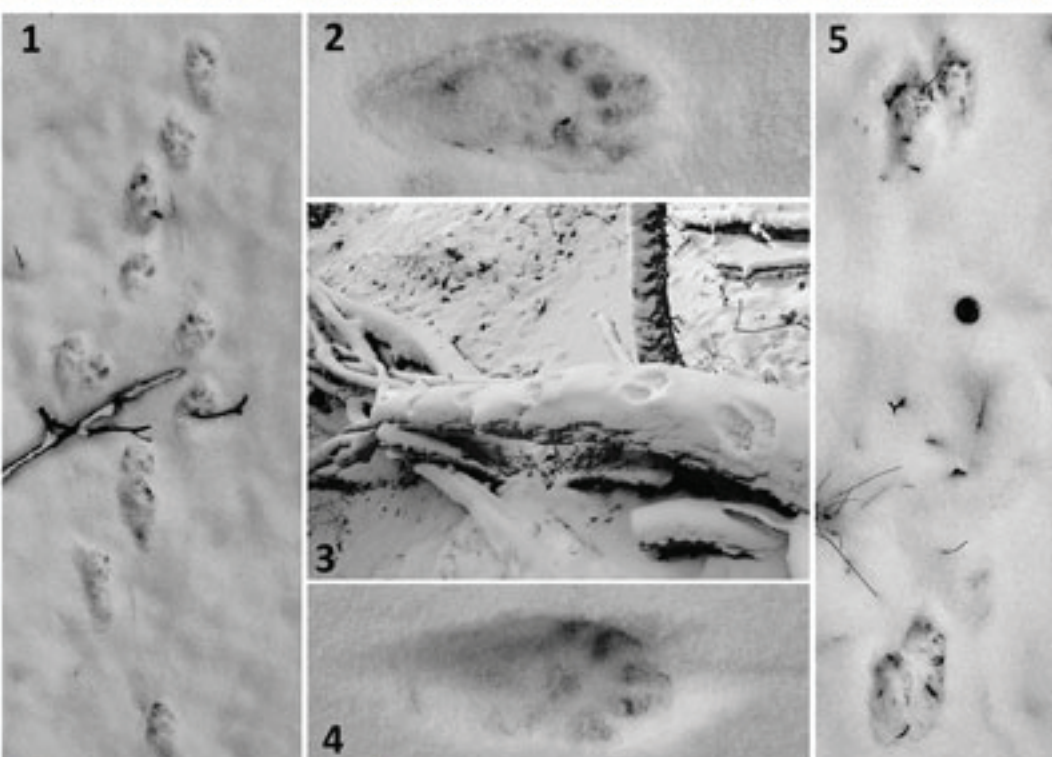
The study area is mainly composed of small tot larger forest areas, extensive to intensive agricultural areas, riparian habitats and scattered human habitations (cities and towns).



Methodology includes: 1) mapping and numbering of hollow trees for pine marten dens 2) snow tracking 3) use of volunteers 4) collection of scats and prey samples



Pine marten nesting habitat in hollow trees (beech and oak are favorite)



Pine marten snow tracks



Volunteers helping out

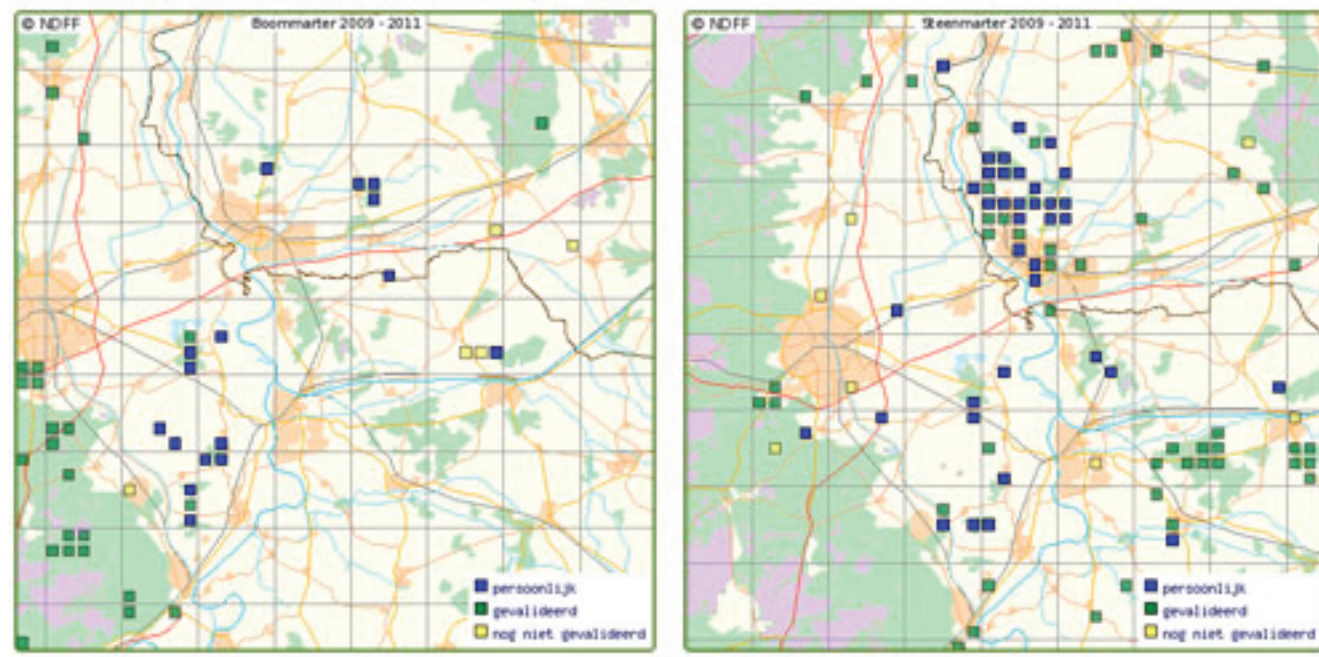


Stone marten chasing red squirrel

Preliminary results reveal the following:

- Many new locations with pine martens and stone martens revealed in the eastern part of the Netherlands. Pine martens, traditionally thought of as a climax forest species in the Netherlands occupy many small forest fragments as well, previously not documented, including small isolated forest lots (<20 ha) in intensive agricultural areas. Other day hideouts (possibly underground dens and woodpiles) other than hollow trees may be important in these areas.
- Camera trapping allows the identification and monitoring of individual stone martens and pine martens, and features (including throat pattern, body condition and behavior) obtained using video takes can be stored in a 'passport' system with data and photo collation for each individual. This allows individuals to be followed over the years and may provide information on survival and age structure and more.
- Video images obtained provide glimpses of interesting ecology and behavior of martens, including movement of individual animals, neighbor visitation, interactions with other species.
- Camera trapping also provides information on reproduction in the situation where a nesting place could not be found.
- Pine martens reproduce in the fragmented forest network, but thus far only found in larger forest areas.
- Stone and pine martens appear to co-exist well with very similar ecology in the same forest and in small-scale landscape habitats (niche overlap). Other Mustelids detected in the habitats of both martens include pole cat and badger. However, the detection of pole cat is very incidental. Weasel and stoat have not yet been detected with a camera trap despite specific lure trials, including glands.
- Stone and pine martens show clear avoidance behavior toward foxes. Stone martens occupy old towns and cities in the region and may stabilize their population after an initial colonization period, during which people experience a lot of nuisance behavior from stone martens, that appears to lessen after stabilization.
- Stone martens also live and reproduce in forest areas and may exchange with their urban counterparts, or may be distinct ecotypes (further research needed).
- Pine martens show consistency with secondary meta-population dynamics in the fragmented agri-forest landscape, showing temporary occupation of patches with more widely dispersing young males often in the forefront, longer-term occupation with reproduction in larger forest areas, extinction with some areas taking a long time for recolonization.
- Busy roads are formidable barriers and effective mortality sinks for martens and badgers. Weasels and stoats are rarely found as road kill, and this may indicate their low abundance.
- Weasel and stoat have so far been very rarely encountered and may be rare relative to their larger cousins. There is a clear concern for the conservation status for these species in the Netherlands, and further study using novel detection means for these notoriously difficult to monitor species is needed to learn more about their current ecology in the Dutch landscape.

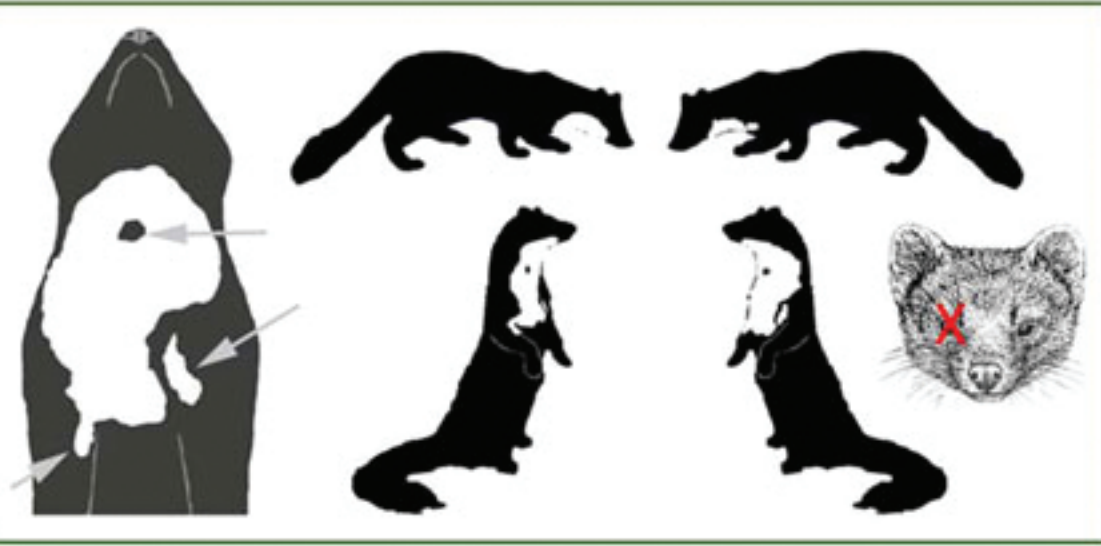
Observations and occupancy of pine marten (left) and stone marten (right) so far detected and in the areas covered in the IJssel Valley 2009-2011. Blue squares are detections of martens within the project.



The incorporation of images into an individual recognition or 'passport' system allows the monitoring of individual pine and stone martens. The development of software to analyze throat markings from videos of multiple individuals may facilitate this method considerably in the near future.

Example of a 'Passport' or record sheet for pine marten

Species	Martes martes
Code	BM0004
Gender	♀
Given name	'Izolda'
Location	Voorstonden estate, Tonden (GLD), Netherlands



Stone marten ecology and behavior in urban and forest habitats



Interactions with other mesocarnivores (feral cat and fox)



Camera trapping produces variable results. It soon became apparent that the detection rate is a function of the technology (reliability, speed of the camera, non-disturbance to animals), the number of cameras in one area, duration of placement, and the individual character of the animal. Some individuals are 'trap shy', whilst others 'trap happy', the latter often returning to a bait station and overrepresented for the actual population. Current remote cameras on the market have many shortcomings with respect to the study of Mustelids and other wildlife. This is an important issue when trying to detect extremely fast animals like weasels.



Male-female interactions and territorial behavior pine marten

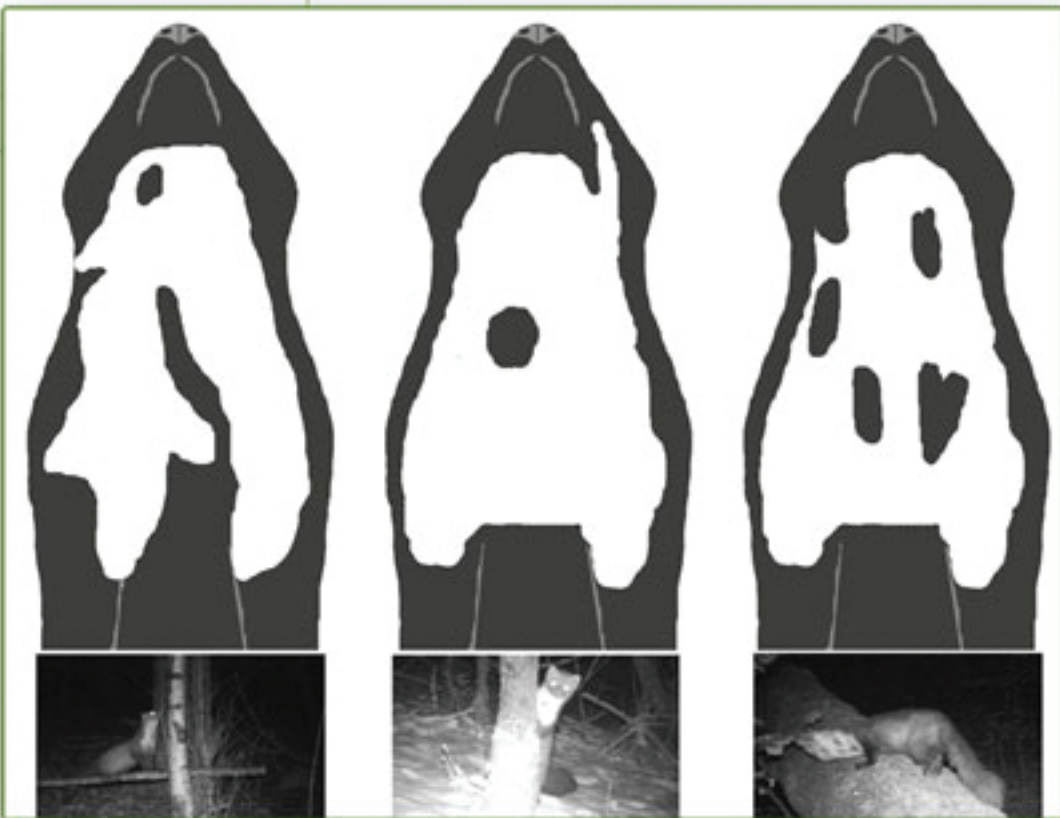


Co-existence of Mustelids

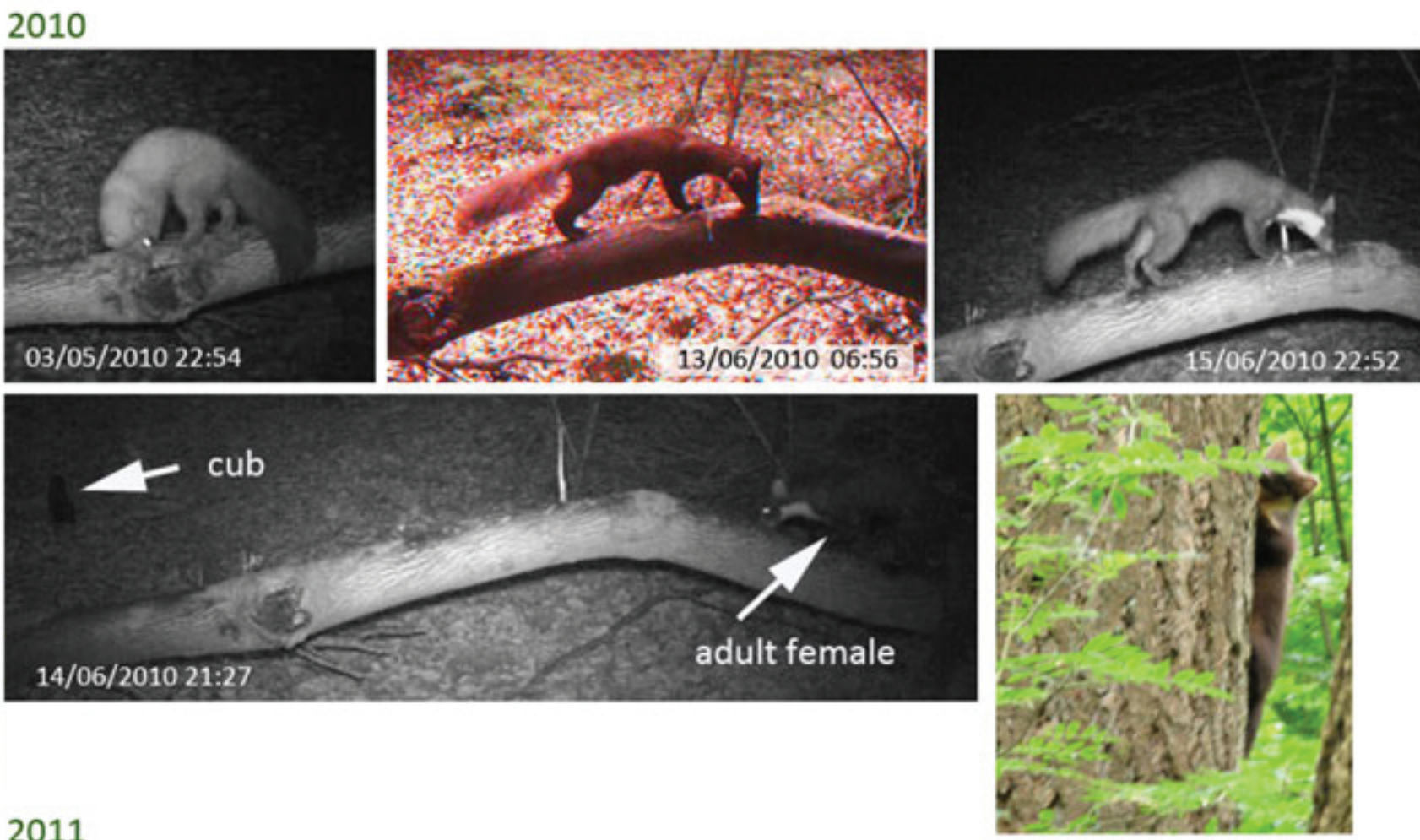
Year	2010	2011	2012+
Observer (code)	E. van Maanen (EVM)	EVM	
Type of observation:	F	F	
Signaling (S)			
Photo (P)			
Found dead (D)			
Co-ordinates (X-Y)			
1st observation of the year	03/05	04/06	
Physical features and condition	Slim; right eye is blind; good condition; active	Slim, complex gular pattern; right eye is blind; good condition; active	
Length indication (body + tail)	Not determined	70-75 cm	
Behaviour	Loves peanut butter; often returning to feed; not camera shy	Loves peanut butter; often returning to feed; not camera shy	
Rest and nesting place(s)	Not found	Not yet found	
Offspring?	2 cubs	Yet to be determined	
Peculiarities	Right eye is blind	Right eye is blind	
DNA material collected?	No	No	
yes/no			
Age (years)	2+	3+	
Cause of death if applicable			
Traffic (T)			
Unknown/other (O)			
Cross reference		BM0005 (♂)	



Worn tail a sign of motherhood?



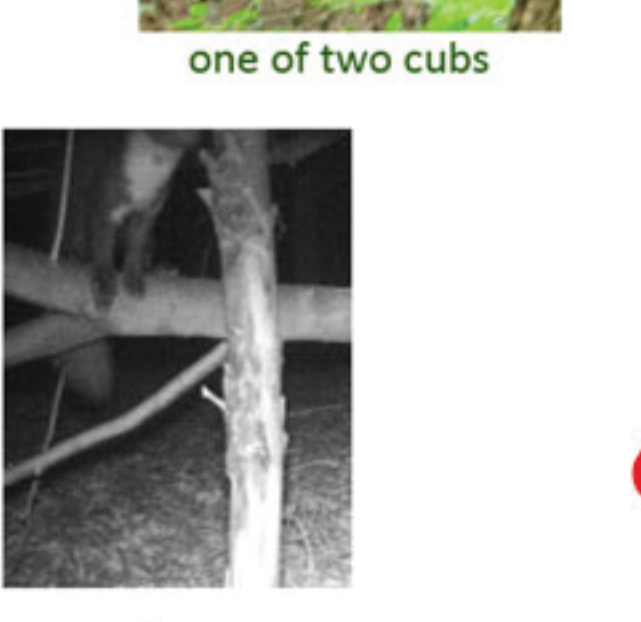
Variable or easily distinguishable throat or gular pattern of three stone martens



2010



2011



one of two cubs

Coverage in 2010

24 forest areas
50 mustelids detected:

Stone marten (23+)
Pine marten (10)
Badger (8); several sets found
Pole cat (4)
Stoat (1)
Weasel (2)

32 animals were detected with camera traps
66 surveillances (7750 hours of camera trapping)



Country roads are formidable barriers for small mustelids and important mortality sinks for martens and badgers



Monitoring nesting trees of pine martens



The project takes place within the framework of the Pine Marten Working Group and the Small Mustelid Working Group under the Dutch Mammal Society and receives financial support from nature management organizations like the Dutch Nature Monument Association (Natuurmonumenten) and the Dutch Forest Service.