9. Summary

Aims. The thesis focused on the investigation of consequences of urban habitat fragmentation for the biodiversity and mobility of epigeic beetles in woodland fragments. First, it was asked to what extent habitat fragmentation influences the biodiversity and species composition of epigeic beetles in woodland fragments compared with other environmental parameters. The investigations should also reveal whether urban habitat fragmentation influences less mobile species more than highly mobile species. Biocenotic changes are always preceded by changes in population dynamics and population genetics. For *Carabus nemoralis*, a species with reduced hindwings, it was assumed that the changes of the genetic structure of urban subpopulations due to habitat fragmentation differ from those in rural surroundings. Habitat corridors are regarded as landscape elements that can partly compensate for the negative impact of habitat fragmentation. Broader planting strips along streets might fulfill this function in cities such as Berlin. The movement behavior of individual beetles (again: *Carabus nemoralis*) was observed in a planting strip in the field using radio transmitters to estimate the contribution of such connecting elements to the dispersal of non-flying beetles. Finally, a laboratory study should reveal information about the bias due to the usage of radio transmitters in the field.

Location. Species richness and species composition was investigated in deciduous forest fragments along a rural-urban gradient in southeastern Berlin. For the population genetic studies, three rural woodland fragments located south of Berlin were added to the sampling sites. The movement behavior was investigated in a planting strip along a street near the city center.

Methods. The epigeic beetle fauna was sampled with pitfall traps for one year. In addition to the beetle fauna environmental parameter, in particular the density of woody debris and litter, also the humus thickness, habitat fragment size, core area, and sealing intensity were measured to analyze their correlation with

changes in species composition. Length polymorphism of microsatellite DNA-markers was used to estimate the genetic diversity and derive population genetic patterns. The land use of the sampled area was followed back to the 18th century to evaluate the influence of historical processes on the genetic patterns. The movement behavior of *C. nemoralis* was observed with small radio transmitters in the field. The beetles were caught in a small city park adjacent to the observation area, transmitters were glued to the elytrae of the beetles, and subsequently the beetles were released into a planting strip. The differences between the movement behavior of tagged and untagged beetles was observed in the laboratory using video recording.

Results. The proportion of silvicolous staphylinid species declined with increasing urbanization. In contrast to that, the overall species richness of epigeic carabids and staphylinids did not decline in that gradient. The rarity of wingless species in heavily isolated fragments and the reduction of faunistic identity between such fragments was interpreted as a result of the increased habitat isolation. Other faunistic changes along the rural-urban gradient could be attributed to habitat quality changes, for example, the varying content of woody debris on the forest floor. The genetic diversity of *C. nemoralis* was negatively correlated with the increase of built-up urban area in the vicinity of the sampled subpopulation. Woodland cover in the vicinity of the sampled subpopulation and woodland fragment size had smaller impacts on the genetic diversity. The overall genetic diversity was small compared to the genetic diversity of a population from a pleistocene refugium area in southern France. The genetic differentiation was comparably high (F_{ST}: 0.03-0.26). The genetic distance between urban subpopulations was slightly higher than that between rural subpopulations. Genetic distance was correlated with the number of streets between two subpopulations but it was not correlated with the topographic distance between two subpopulations. The influence of historical processes on the population genetic patterns was revealed by an example from the southern surroundings of Berlin. An allele gradient along four sampling sites could be observed, which

probably was the result of an afforestation 200 years ago. The mobility of *C. nemoralis* was comparable to that of other *Carabus*-species, although *C. nemoralis* is the smallest species from that genus observed up to now. No evidence for directed walking behavior of the beetles or a directing effect of the habitat form was found in the observed habitat strip. In contrast to a broad gravel path that was crossed frequently, the observed street never was crossed during the observation period. In the laboratory, beetles with radio transmitters show a directed walking behavior comparable to that of fleeing individuals. In the field, the opposite behavior was observed. Thus, this methodological bias did not seem to predominate the field results.

Conclusion. Flightless taxa of staphylinids and carabids are the species that reveal the impact of urban woodland fragmentation most clearly. Even common and comparably euryecous species such as *C. nemoralis* show the genetic impact of habitat fragmentation due to the urban infrastructure and urban built-up area. The benefit of narrow habitat strips as connecting elements should not be overestimated because the dispersal in such structures is not very effective.