Clonal growth enables plant to replicate rooting units (i.e. ramets), adding another hierarchical level to plant modularity. Clonal growth is very common, at least in the temperate flora, and widespread over the angiosperm phylogenetic tree. Different clonal growth forms have specific sets of clonal traits that determine their performance in response to environmental conditions and under competition. Clonal integration is one of the important clonal traits and is associated with a number of other clonal functions. Integrated ramets can translocate resources and signals by connecting clonal organs, such as horizontal stems or roots. Such integration is particularly important for young developing ramets, but it may persist and help developed ramets cope with environmental heterogeneity. Clonal integration at both early and later stages of ramet development may be an important factor affecting plant competition and has been shown to promote expansion into vegetated areas in some species. However, competition is complex and differs aboveground and belowground. Translocation of carbon and nutrients under competition may differ accordingly, but very little is known about this. The costs and benefits of clonal integration have been predicted by theoretical models. However, there is considerable variability in the observed benefits of clonal integration between species. This variability may be caused by different mechanisms of and requirements for translocation of different resources, or by different translocation strategies across species. As part of the plant economics, resource translocation may respond to a gradient of habitat productivity, showing conservative patterns where resource availability is low and competitive patterns where competition is high.

My aim here was to contribute to the understanding of the role of clonal integration in plant performance and how it relates to plant competition. Specifically, I asked (i) whether the benefits of resource translocation for the growth of a clonal plant match theoretical predictions, (ii) how resources are translocated under light heterogeneity simulating aboveground competition and how translocation changes during ramet ontogeny, (iii) whether patterns of resource translocation differ among species in predictable ways, and (iv) how clonal growth form affects species performance in communities.

To answer the first three questions, I used an experimental approach and investigated resource sharing under heterogeneous light and nutrients by growth and labelling experiments. In my first paper, I performed a growth experiment on a model clonal grass, *Agrostis stolonifera*, under different patterns of nutrient heterogeneity to test theoretical predictions of the benefits of resource sharing. I found that the benefits for daughter ramets were unexpectedly higher at higher levels of nutrient availability. In my second and third papers, I traced labelled carbon and nitrogen in both directions (i.e. acropetally and basipetally) and across multiple ontogenetic stages in *A. stolonifera* and two closely related Rosaceae species. I demonstrated the transition of resource sharing patterns through the plant ontogeny under light heterogeneity, and the presence of different translocation patterns in the species studied. I also formulated a conceptual model of possible translocation strategies in the third paper. Subsequently, in my fourth paper, I focused on the interspecific comparison of nitrogen translocation in six stoloniferous species under nutrient heterogeneity to test the hypothesis that differences in

resource sharing may be determined by the level of competition typically experienced by the species. The results did not confirm the hypothesis, but again showed the presence of distinct translocation patterns across species. In my last paper, I addressed the fourth question by analysing the performance of species with different clonal growth forms in plant communities using data from the long-term biodiversity experiment in Jena. The results suggested that species with different growth forms complement each other in their resource use strategies and that clonality thus affects mechanisms of plant coexistence.

My main contributions here are to the mechanistic understanding of carbon and nitrogen translocation between ramets, and to the understanding of the role of clonal integration in the context of plant communities and real-life interactions. My results confirmed the expected universal support of developing young ramets, which clearly form strong sinks for both carbon and nitrogen. Ramet relative size seemed to be a promising predictor of later nitrogen translocation pattern across species, which was surprisingly not affected by nutrient heterogeneity. In contrast, carbon translocation was driven by external availability in light, although different species differed in their willingness to send carbon to older ramets. I showed that differences between resources and possible adaptive strategies of resource translocation should be considered to better understand clonal integration and its role in competition.

Key words: clonal plants, physiological integration, nutrients, nitrogen, carbon, resource translocation, environmental heterogeneity, competition, stable isotopes, pulse labelling, stolons, rhizomes, ramets, clonal growth form