**Additional file 6: Tables synthetizing key results of the studies included in the narrative syntheses**

**Table A1: Key results of the studies included in the narrative synthesis of the question 1: Do LTI verge management practices increase, decrease or have no effect on insect biodiversity?**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **[ref]** | **Reference** | **Country** | **Insect groups** | **LTI** | **LTI verge** | **Comparison** | **Key results** | **Grp.** |
| [1] | Fell et al., 2006 | United States of America | Macroinvertebrates | Waterway | Riparian marsh | - Untreated sites colonized with Phragmites- Treated sites: herbicide and mowing of *Phragmites australis* | The abundance of *Enochrus hamiltoni* in litter bags and the abundance of *Hydroporus sp.* and unidentified beetle larva (*Hydrophilidae*) in pit traps did not differ between treated and untreated sites (text p. 200-201). | a |
| [2] | Gollan et al., 2011a | Australia | Ants *(Hymenoptera)* | Waterway | Riparian vegetation | - Riparian unplanted grassland- Riparian young revegetation- Riparian older revegetation | Community composition did not significantly differ between unplanted grassland, young revegetation and older revegetation (tab. 3). | a |
| [3] | Hopwood 2008 | United States of America | Bees *(Hymenoptera)* | Road | Road verge | - Restored verges (reseeded with mix of native prairie forbs and grasses)- Weedy verges (non-native grasses) | The species richness and abundance of bees was significantly higher in restored verges than in weedy verges (text p. 2635 right column). The abundance of *Apis mellifera* did not significantly differ between restored and weedy verges (text p. 2636 top right column). | a |
| [4] | Samways and Sharratt 2010 | South Africa | *Odonata* | Waterway | Riparian corridor | - Alien plants un-cleared sites- Alien plants cleared sites | The species richness, abundance and taxonomic distinctiveness of *Odonata* were significantly higher in the cleared site than in the site with alien vegetation (tab. 1).The abundance of 8 speciesdid not differ between cleared site and site with alien vegetation, one specieswas significantly less abundant in the cleared site than in the site with alien vegetation, whereas 13 species were more abundant (tab. 1). | a |
| [5] | Snodgrass and Stadelbacher 1989 | United States of America | Ground beetles *(Coleoptera)* | Road | Road verge  | - (Tall fescue OR Bermudagrass), (with OR without) nitrogen addition- (Tall fescue OR Bermudagrass) + (crimson clover OR red clover OR white clover OR ball clover OR subterranean clover OR winter vetch) | The abundance, species richness, species diversity and species dominance of ground beetles did not significantly differ between the 16 treatments, nor the individual abundance of *Pterostichus chalcites, Agonum punctiforme* and *Stenolophus dissimilis* (text p 576 top right column).  | a |
| [6] | Wootton 2012 | United States of America | Aquatic invertebrates | Waterway | Riverbank | - Riverbank dominated by red alders- Replacement of alders with conifers  | The abundance of aquatic insects was significantly higher in riverbanks planted with conifers than in the riverbanks dominated by red alders (text p. 2 bottom right column). | a |
| [7] | Cavaillé et al., 2013 | France | *Carabidae (Coleoptera)* | Waterway | Riverbank | - Vegetal embankment- Mixed embankment (vegetal and mineral)- Mineral embankment | The number of aerial *Coleoptera* genera was significantly higher in mixed riverbank than in mineral riverbank, and in vegetal riverbank than in mineral riverbank, but did not significantly differ between mixed riverbank and in vegetal riverbank (tab. 2 and text p. 27).The number of invasive *Coleoptera* species did not significantly differ between mineral, mixed and in vegetal riverbank (tab. 2, fig. 6 and text p. 27). The frequency of invasive *Coleoptera* species was significantly higher in mineral riverbank than in mixed riverbank, and in mineral riverbank than in vegetal riverbank, but did not significantly differ between mixed riverbank and in vegetal riverbank (tab. 2 and text p. 27). | b |
|  [8] | Dymitryszyn 2014 | Poland | *Carabidae (Coleoptera)* | Road | Roadside partly covered by plants | Before and after roadsides reconstruction (replacement of the substratum and partial paving of the shoulders) | The number of carabid species and individuals, the Shannon diversity, the percentage of forest species and the percentage of forest individuals were not significantly influenced by the renovation of the highway (text p. 659 left column). | b |
|  [9] | Paetzold et al., 2008 | Switzerland and Italy | Ground beetles and large rove beetles *(Coleoptera)* | Waterway | Gravel bar riverbank | - Channeled river- Unchanneled river | The abundance and species richness of ground beetles did not significantly differ between unchanneled and channelized river (tab. 3).The species richness and abundance of rove beetles were significantly lower in unchanneled sites than in channelized sites in river with natural flow regime, but higher in river with hydropeaking flow regime (tab. 3, fig. 4 and text). | b |
|  [10] | Penone et al., 2012a | France | *Tettigoniidae (Orthoptera)* | Railway | Railway verge | - Vegetated railway verge- Paved railway verge | The total abundance, species richness and CSI of *Orthoptera*, and the abundance of mobile and sedentary species were significantly higher on vegetated railway edges than on paved ones (tab. 2).The abundance of *Tettigonia viridissima, Leptophyes punctatissima, Phaneroptera ssp.* and *Pholidoptera griseoaptera* were significantly higher on vegetated railway edges than on paved ones, and the abundance of *Ruspolia nitidula* did not significantly differ between the two (tab. 2). | b |
| [11] | Scher and Thièry 2005 | France | *Odonata* | Road | Highway storm water retention pond | - Natural bottom- Synthetic bottom | The species richness of all *Odonata, Zygoptera* and *Anisoptera* were significantly higher in ponds with natural bottom than in pond with synthetic bottom (tab. 5). | b |
| [12] | Noordijk et al., 2009a | The Netherlands | Pollinators | Road | Road verge | - No management- Mowing (once OR twice) a year (with OR without) hay removal | Globally, many comparisons of management regime were non-significant, it seems that hay removal did not affect insect abundance and flower visits in roadsides, and that insect abundance and flower visits were higher in roadsides mown twice than in roadsides non-mown and mown once a year (fig. 1). | c |
| [13] | Noordijk et al., 2010 | The Netherlands | Arthropods | Road | Road verge | - No management- Mowing (once OR twice) a year (with OR without) hay removal | Most of the comparisons of management regimes are non-significant for ground beetles, weevils and ants (tab. B2, B3, B4).Hay removal did not affect species richness of ground beetles and ants, but removal of hay sometimes increased the species richness of weevils.Mowing frequency did not consistently influence the species richness of weevils, mowing once a year seemed to favor ants species richness in comparison to non-mowing and mowing twice a year, whereas ground beetles species richness was higher in roadsides mown twice than in roadsides non-mown and mown once a year. | c |
| [14] | Russell et al., 2001b | United States of America | *Solenopsis invicta*. Ants *(Hymenoptera)* | Road | Highway right-of-way  | - Mown highways- Unmown highways | The number and vitality rating of *Solenopsis invicta* mounds and the abundance of *S. invicta* ants and non-*S. invicta* ants did not significantly differ between mown and unmown highways (tab. 1 and 2). | c |
| [15] | Skórka et al., 2015 | Poland | Butterflies *(Lepidoptera)* | Road | Road verge  | Mowing frequency | The butterfly roadkills blackspot sites had a significantly higher mowing frequency than non blackspot sites (tab. 2).The number of butterfly roadkills in blackspot and non blackspot sites significantly increased with mowing frequency (tab. 3). | c |
| [16]  | Ward and Mill 2005 | United Kingdom | *Calopteryx splendens (Odonata)* | Waterway | Riverbank | Cattle disturbance | The presence of *Calopteryx splendens* was significantly negatively affected by cattle disturbance (text p. 49 right column). | c |
| [17] | Wynhoff et al 2011 | The Netherlands | Ants *(Hymenoptera)* | Road | Road verge | - Early mowing- Late mowing- Partly mown- Mown and removed- Not mown- Flail cutting- Covered with dredged ditch sediment | The numerous results for the comparisons of the management regimes are detailed in fig. 5.Partly mowing of road verges was beneficial for ants abundance and specifically *Lasius flavus* and *Lasius niger* (detailed results in fig. 5).Late mowing favored ants abundance and specifically *Myrmica rubra* (detailed results in fig. 5). | c |

**Table A2: Key results of the studies included in the narrative synthesis of the question 2: Is the biodiversity of LTI verges equal to, higher, or lower than the biodiversity of habitats away from the LTI?**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **[ref]** | **Reference** | **Country** | **Insect groups** | **LTI** | **LTI verge** | **Comparison** | **Key results** | **Grp.** |
| [18] | Åström et al., 2013 | Sweden | *Poecilonota variolosa* (*Coleoptera*) | Road | Roadside | Closed forest, pasture, clear-cut | The number of exit holes was significantly higher in roadside than in closed forest (text p. 1149, bottom of right column). No statistical results for the other comparisons. | d |
| [8] | Dymitryszyn 2014 | Poland | *Carabidae* (*Coleoptera*) | Road | Roadside partly covered by plants | Forest, wetlands and arable fields | The number of carabid species and Shannon diversity index were significantly higher in roadside than in forest plots, whereas the number of individuals, the percentage of forest specialist species, and the percentage of forest specialist individuals were significantly lower (text p. 658 bottom of right column and tab. 1).None carabid index differ between roadside and meadow.The numbers of carabid species and the numbers of individuals were significantly higher in roadside than in wet habitats, whereas the percentage of forest specialist species was significantly lower, and the percentage of forest specialist individuals and the Shannon diversity index did not differ. | d |
| [19] | Knapp et al., 2013 | Czech Republic | Ground beetles and large rove beetles (*Coleoptera*) | Road | Boundary between the highway verge and neighbouring habitat | Open habitats (arable and meadow) and forest habitats | In many cases, there were no difference between road verge and open habitat (abundance and species richness of all ground-dwelling beetles and generalists, species richness of forest specialists, species richness of open specialists) and between road verge and forest habitat (abundance of all species, generalists and open specialists, tab. A4 and A5 in Appendix).The abundance of forest specialists was lower on road verge in comparison with both open and forest habitat, and species richness of forest specialists was lower on road verge than in forest habitat.The abundance of open specialists was higher on road verge than in open habitat, and the species richness of all species, open specialist and generalists were higher on road verge than in forest habitat. | d |
| [20] | Noordijk et al., 2008 | The Netherlands | Ground beetles (*Coleoptera*) | Road | Road verge with grey hair-grass vegetation | Adjacent nature reserves with comparable vegetation | The abundance, species richness and evenness of all ground beetles and poor disperser stenotopic ground beetles did not significantly differ between roadside verges and nature reserves (text p. 259 and 261 bottom of right columns).The abundance and evenness of stenotopic ground beetles did not significantly differ between roadside verges and nature reserves, but their species richness was significantly lower in roadside verges than in nature reserves (text p. 259 bottom of right column). | d |
| [21] | Noordijk et al., 2011 | The Netherlands | Ground and flying beetles (*Coleoptera*) | Road | Heathy roadside verge with nutrient-poor grassland | Heathland nature reserves, forest clearing and forests | The abundance of carabids in pitfall traps did not significantly differ between road verges and nature reserves, between road verges and forest clearings, and between road verges and forests (fig. 3).The abundance of carabids in window traps was significantly lower in road verges than in forest clearings, and higher in road verges than in forests, but did not significantly differ between road verges and nature reserve (fig. 3). | d |
| [22] | Rotholz and Mandelik 2013 | Israel | Ground beetles (*Coleoptera*) | Road | Road edge (shrubland) | Mediterranean shrubland | The species richness of beetles was significantly higher in the road edge than in shrubland (text p. 1022 bottom).The abundance of beetles did not significantly differ between road edge and shrubland (text p. 1023 top).The proportion of rare and endemic beetles was significantly lower in the road edge than in shrubland (text p. 1023 middle).The species composition of beetles was significantly affected by road edge / shrubland (tab. 1).The relative abundance of herbivores, predators and decomposers beetles did not significantly differ between road edge and shrubland (text p. 1025 top). | d |
| [23] | Silverman et al., 2008 | United States of America | *Carabidae* (*Coleoptera*) | Pipeline | Open corridor | Xeric ridge-top forest  | The total abundance of carabids did not significantly differ between pipeline and forest interior (fig. 2).The species richness of carabids and the abundance of *Harpalus pensylvanicus, Selenophorus opalinus* and *Galerita bicolor* were significantly higher in pipeline than in forest (fig. 2 and tab. 1).The abundance of *Synuchus impunctatus, Carabus goryi* and *Pterostichus trinarius* were significantly lower in pipeline than in forest (tab. 1). | d |
| [24] | Le Viol et al., 2009 | France | *Odonata, Heteroptera* and *Coleoptera* | Road | Highway stormwater retention pond | Pond away from highway | The family richness of Coleoptera, Odonata and Heteroptera did not significantly differ between highway pond and surrounding pond (tab. 2).The abundance did not significantly differ between highway pond and surrounding pond for 14 families (Coleoptera, Odonata and Heteroptera), were higher in highway pond than in surrounding pond for 8 families, and lower for 4 families (tab. 4, test non-adjusted). | d, g |
| [25] | Major et al., 1999 | Australia | *Carabidae* (*Coleoptera*), Ants (*Hymenoptera*) | Road | Strip of woodland on roadside | Forest | The abundance and species richness of ants did not significantly differ between road and forest, as well as the abundance of 7 species or morphospecies (text p. 615). The abundance of 3 species or morphospecies was higher on road than in forest (text p. 615). There was a significant difference between the ant communities on road and forest at the species level (text p. 615), but not at the genus level (text p. 617).The abundance and species richness of beetles did not significantly differ between road and forest, as well as the abundance of 8 species or morphospecies (text p. 617-618). The abundance of one morphospecies was higher on road than in forest, whereas the abundance of 2 morphospecies were lower (text p. 617). There was a significant difference between the beetle communities on road and forest at the genus level, but not at the species level (text p. 617). | d, g |
| [26] | Major et al., 2003 | Australia | *Heteroptera* (*Coleoptera*), Ants (*Hymenoptera*) | Road | Narrow strip of woodland on roadside | Interior area of large forests | The species richness of ants, beetles and insects did not significantly differ between road and forest interior (text p. 41 left column). | d, g |
| [27]  | ASF 2012 | France | Butterflies (*Lepidoptera*) | Road | Roadside | Various habitats (not detailed) | The species richness and abundance of butterflies did not significantly differ between roadside and other habitats (text between tab. 14 and fig. 11, fig. 13). | e |
| [28] | Bailey 2014 | France | Bees and bumblebees (*Hymenoptera*) | Powerline | Edge between forest and powerline | Edge between forest and oilseed rape | The total abundance of bees did not significantly differ between powerline and oilseed rape field in period 1 and 2, and was significantly lower in powerline than in oilseed rape field in period 3 (tab. 21).The results for the abundance of females and males species or morphospecies tested depended on the period, most of the comparisons are non-significant (all comparisons in period 1) but both positive and negative comparisons were found (tab. 21). | e |
| [29] | Collins and Foré 2009 | United States of America | Pollinators | Road and powerline | Powerline, Road (open habitats) | Forest edge, forest | The number of visits and the species richness of visitors did not significantly differ between road, forest edge and forest, nor between powerline, forest edge and forest (text p. 463, right column). | e |
| [30] | Hanley and Wilkins 2015 | United Kingdom | Bumblebees (*Hymenoptera*) | Road | Roadside | Adjacent field margin | The total abundance of bumblebees and the abundance of *Bombus terrestris, B. hortorum* and *B. pratorum* was significantly higher on roadside than on field margin (text p. 71 left column and tab. 1), whereas the abundance of *B. pascourum* and *B. lapidarius* did not significantly differ (tab. 1). | e |
|  [31] | Mallard 2014b | France | Butterflies (*Lepidoptera*) | Road and railway | Trees on roadside, railway side | Forest | Given the confidence intervals overlapping (fig. 191 to 200), it seems that: Butterflies abundance did no differ between road verge and forest 500 m away in the three cases.Butterflies species richness did no differ between road verge and forest 500 m away in two cases and was higher in one case.Butterflies diversity did no differ between road verge and forest 500 m away in one case, was higher in one case and lower in the last case.Butterflies abundance, diversity and species richness did no differ between railway verge and forest 500 m away in one case and were higher in one case. | e |
|  [32] | Moron et al., 2014 | Poland | Bees, bumblebees, hoverflies (*Hymenoptera*) | Railway | Railway embankment | Extensively managed grassland or recently abandoned grassland | The abundance and species richness of bees, butterflies were significantly higher on railway embankments than in grasslands, whereas the abundance and species richness of hoverflies and the number of unique bees, butterflies and hoverflies species did not significantly differ (text p. 4 right column).The bee and butterfly community composition were significantly different between railway embankments and grasslands, whereas the hoverfly community composition did not significantly differ (text p. 4 right column).The abundance of 21 bee species, 32 butterfly species and 8 hoverfly species did not significantly differ between railway embankments and in grasslands. The abundance of 3 bee species, 4 butterfly species and one hoverfly species were significantly higher on railway embankments than in grasslands (tab. S1).  | e |
| [33] | Osgathorpe et al., 2012 | United Kingdom | Bumblebees (*Hymenoptera*) | Road | Highway verge | Silage, fallow, pasture, cattle grazed pastures, winter grazed pastures, track edges | In Outer Hebrides, the abundance of long-tongued and short-tongued bees did not significantly differ between roadsides and arable habitats, between roadsides and fallows, between roadsides and pastures, between roadsides and tracks and between roadsides and winter grazed pastures (tab. 3 and text p. 117 top of right column).In Somerset Levels, the abundance of long-tongued bees did not significantly differ between roadsides and tracks edges in June, July and August (tab. 4 and text and text).In Somerset Levels, the difference between roadsides and other habitats for the abundance of short-tongued bees depended on habitats and showed inconsistent results along the season (tab. 4 and text). | e |
| [34] | Russell et al., 2005 | United States of America | Bees (*Hymenoptera*) | Powerline | Powerline corridor with dense scrub | Grassland | The species richness of bees, of cavity nesting bees, of ground nesting bees and the abundance of cavity nesting bees and of parasitic bees was significantly higher on powerlines sites than in grassland sites (tab. 3, text p. 140-141).The abundance of bees, of ground nesting bees, of non-parasitic bees and the turnover and Jaccard Similarity indices did not significantly differ between powerlines sites and grassland sites (text p. 139 and 141). | e |
| [35] | Alten et al., 2000 | Turkey | Mosquitoes\*, 6 species (*Diptera*) | Road | Roadside | Openfield, village, woodland | The relative abundance of total catches did not significantly differ between road edge, open field, village and wooded area (tab. 3). | f |
| [36] | Braun and Flückiger 1984 | Switzerland | *Aphis pomi\** (*Hemiptera*) | Road | Central reservation and verge on *Crataegus ssp.* | Control site on *Crataegus ssp.* | The number of *Aphis pomi* per shoot tip and per leave tip was significantly higher in central reservation than in control and in motorway verge than in control (at least for some dates, the other being non-significant, fig. 1 and 2). | f |
| [37] | Kline 1989 | United States of America | *Culicoides spp.\** (*Diptera*) | Road | Road ditch bank and ditch bottom | Spartina and juncus vegetation | The number of *culicoides* larvae was significantly lower in road ditch bank than in spartina, in road ditch bank than in juncus A, and in road ditch bank than in juncus B (tab. 1).The number of *culicoides* larvae was significantly lower in road ditch bottom than in spartina, in road ditch bottom than in juncus A, but did not significantly differ between road ditch bottom and juncus B (tab. 1). | f |
| [38] | Loch and Zalucki 1996 | Australia | *Ceroplastes rubens*\* (*Hemiptera*) | Road | Umbrella trees on roadside | Umbrella trees in garden | The density of *Ceroplastes rubens* was significantly higher on roadside positions than in gardens (text p. 606). | f |
| [39] | Mueller and Baum 2014 | United States of America | *Lespesia archippivora* (*Diptera*) | Road | Linear roadside prairie | Managed prairie | The proportion of monarch butterflies infected by *Lespesia archippivora* did not significantly differ between roadside and prairie (text p. 850 bottom of left column). | f |
| [40] | Russell et al., 2001a | United States of America | *Solenopsis invicta\**. Ants *(Hymenoptera*) | Road | Highway right-of-way | Grassland pastures | The numbers and vitality rating of *Solenopsis invicta* mounds did not significantly differ between highway and adjacent pasture (tab. 4-5), and the abundance of *Solenopsis invicta* ants and non-*Solenopsis invicta* ants did not significantly differ between highway and adjacent pasture (tab. 6). | f |
| [41] | Vogt 2009 | United States of America | *Solenopsis invicta\**. Ants (*Hymenoptera*) | Road | Road edge | Landside berm | The mound density was significantly higher in road edge (= landside slope) than in landside berm (text p. 82 top). | f |
| [42] | Ditsworth et al., 1982 | United States of America | Arthropods | Powerline | Powerline corridor  | Pynion-juniperus woodland | The abundance of *Cicadellidae, Aphididae, Lepidoptera* and *Thysanoptera* was higher in powerline than in control (fig. 3).The abundance of *Coccoidea* was lower in powerline than in control (fig. 4). | g |
| [43] | Freitag et al., 2008 | Switzerland | *Formica pratensis*. Ants (*Hymenoptera*) | Road | Road bank | Other open habitats (not detailed) | In the random stratified sampling, significantly more *Formica pratensis* mounds were found in road banks than in other open habitats (text p. 58 top). | g |
| [44] | Itzhak 2008 | Israel | Ground nesting Ants (*Hymenoptera*) | Road | Roadside with shrubs | Bata (shrub steppe) and open maquis (shrubland) | The number of species and the Shannon index did not differ between road verges and bata (shrub steppe), and between road verges and open maquis (text p. 78-79).The distance between neighbouring nests (negatively related to nest density) of *Messor semirufus* was significantly lower in road verges than in bata, and lower in road verges than in open-maquis (text p. 78).The proportion of nests of *Tapinoma israele* and of *T. erraticum* was higher in roadside than in bata, and higher in roadside than in open maquis (text p. 78). | g |
| [45] | Larson and Harman 2003 | United States of America | Insects in cavity made by *Megacyllene robiniae* | Road | *Robinia pseudoacacia* on roadside | *Robinia pseudoacacia* in strip-mine and old field pasture | The mean number of nitidulid larvae and odiniid larvae did not differed between roadsides and old field pastures, and between roadsides and strip-mines (text p. 111 bottom of right column).  | g |
| [46] | Martinez and Wool 2006 | Israel | Aphids inducing galls on *Pistacia* trees (*Hemiptera*) | Road | Pistacia trees on roadside | Pistacia trees in shrubland | The number of galls of *Forda riccobonii* and *Smynthurodes betae* per shoot and the probability of *Pistacia atlantica* to be galled by any *Fordini* species and by *Forda riccobonii, Smynthurodes betae, Geoica sp.* were significantly higher on roadside than away from road (fig. 1, tab. 3). The number of galls of *Slavum wertheimae* and *Geoica sp.* and the probability of *Pistacia atlantica* to be galled by *Slavum wertheimae* did not differ significantly differ. In the north sites, the number of galls of *Baizongia pistaciae* per shoot of *Pistacia palaestina* was significantly higher on roadside than away from road, whereas it did not differ for *Paracletus cimiciformis, Forda marginata, Forda formicaria* and *Geoica wertheimae*. In the south sites, the number of galls these 5 species were significantly higher on roadside than away from road (tab. 5). | g |
| [47] | Samways et al., 1997 | South Africa | Ants (*Hymenoptera*) | Road | Highway verge | Grassland savanna | Diversity and evenness did not significantly differ between road verges and away (text). | g |
| [48] | Wilkaniec et al., 2015 | Poland | Aphids (*Hemiptera*) | Road | Rural roadside with trees and shrubs | Shrub habitat | The Shannon Weaver index was higher in roadside than in the shrubs (tab. 7). | g |
| [49] | Fleishman et al., 1999 | United States of America | Butterflies (*Lepidoptera*) | Waterway | Undisturbed riparian habitat along a river | Artificial riparian habitat along irrigation ditches | Butterflies species richness was significantly higher in river than in ditches in 1996, but did not significantly differ in 1997 (text p. 212, right column).Butterflies abundance and similarity were significantly lower in river than in ditches in 1996 and 1997, whereas butterflies evenness was significantly higher (text p. 212-213).  | h |
| [50] | Houston et al., 2015 | Australia | *Isoptera* | Waterway | Riverbank with riparian forest | Pasture and woodland | The species richness of termites was significantly higher in riparian forest than in pasture, but did not significantly differ between riparian forest and woodland (text p. 226 bottom of left column).The incidence of encountering termites was significantly lower in riparian forest than in pasture, and lower in riparian forest than in woodland (text p. 226).The community composition differ between riparian forest and pasture, and between riparian forest and woodland (tab. 2 and text p. 227). | h |
|  [51] | Schipper et al., 2008 | The Netherlands | Terrestrial arthropods | Waterway | Floodplain vegetation | Naturally vegetated sites in the hinterland | The abundance of *Coleoptera* and *Diptera* were significantly higher in floodplain than in hinterland (tab. 3).The abundance of *Caelifera, Heteroptera, Homoptera, Hymenoptera, Lepidoptera* and *Siphonaptera* did not significantly differ between floodplain and hinterland (tab. 3). | h |

\* Indicated ‘Unwanted species’ (pest, exotic, invasive)

We highlight articles that included comparison(s) of LTI verge with dissimilar habitats away from the LTI by underlining text in the ‘Comparison’ column.

**Table A3: Key results of the studies included in the narrative synthesis of the question 4:** **Is insect dispersal on LTI verges equal to, higher, or lower than their dispersal in habitats away from the LTIs?**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **[ref]** | **Reference** | **Country** | **Insect groups** | **LTI** | **LTI verge** | **Comparison** | **Key results** |
|  [52] | Brunzel et al., 2004 | Germany | *Tyria jacobaeae* (*Lepidoptera*) | Road | Valley with road | Valley without road | The presence of a road (situation C) significantly increased the risk of *Tyria jacobaeae* infestation in comparison with similar conditions without road (situation B) (table 2). |
|  [53] | Vermeulen 1994 | The Netherlands | Ground beetles, 3 species (*Coleoptera*). | Road | Poor sandy roadside verge | Open area of drift sand | The rate of movements of *Pterostichus lepidus* was significantly lower in road verge (point 4) than in open area (point 1) (text p. 343 bottom of right column). |

**Table A4: Key results of the studies included in the narrative synthesis of the question 5:** **Is the insect biodiversity of LTI verges dependent on the surrounding landscape?**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **[ref]** | **Reference** | **Country** | **Insect groups** | **LTI** | **LTI verge** | **Comparison** | **Key results** | **Grp.** |
| [10] | Penone et al., 2012 | France | *Tettigoniidae* (*Orthoptera*) | Railway | Railway verge | % urban surfaces in 200 m radius | The total abundance, species richness and CSI of *Orthoptera*, and the abundance of mobile and sedentary species in railway verges significantly decreased with urban surfaces in 200 m (table 3).The abundance of *Tettigonia viridissima, Leptophyes punctatissima, Phaneroptera ssp., Pholidoptera griseoaptera,* and *Ruspolia nitidula* in railway verges significantly decreased with urban surfaces in 200 m (table 3). | i |
| [11] | Scher et Thièry 2005 | France | *Odonata* | Road | Motorway stormwater retention pond | Surface of adjacent unfragmented land | The species richness of all *Odonata, Zygoptera* and *Anisoptera* significantly increased with the surface of adjacent unfragmented land (table 5). | i |
| [54] | Tagwireyi et al., 2015 | United States of America | Ants (*Hymenoptera*) | Waterway | Riverine habitats | Landscape: developed, agricultural and mixed reaches in 500 m radius | The density and species richness of ants were significantly higher in agricultural reaches than in both developed and mixed reaches (text p. 8). Ants diversity was significantly lower in agricultural reaches than in both developed and mixed reaches. The Menhinick's Index and community similarity did not differ between reaches. | i, j |
|  [55] | Munguira et Thomas 1992 | United Kingdom | Butterflies (*Lepidoptera*) | Road | Road verge and central reservation | Adjacent land: intensive agricultural and urban areas or semi-natural biotopes | The abundance, species richness and Shannon-Weaver diversity index of butterflies did not differ significantly with the nature of the adjacent land (table 4). | i, j, k |
|  [56] | Verboven et al., 2014) | Belgium | Bees and hoverflies (*Hymenoptera*) | Waterway | Riverbank | Landscape: rural agricultural sites, rural natural sites or urban sites in 100 to 2000 m radius | The abundance, species richness, Shannon, Sorensen indices of hoverflies and the species richness of bees were significantly lower in urban sites than in rural natural sites. The abundance, Shannon and Sorensen indices of bees did not differ between of urban sites with rural natural sites (figure 3a, 4a, 4b, 5).All comparisons of urban sites with rural agricultural sites are non-significant for bees and hoverflies biodiversity indices (abundance, species richness, Shannon and Sorensen indices), without the case of the Sorensen index of hoverflies, which was significantly higher in urban sites than in rural agricultural sites.The abundance, species richness, Shannon, Sorensen indices of hoverflies and abundance, Sorensen index of bees did not differ between of rural agricultural sites and rural natural sites. The species richness and Shannon index of bees were lower in rural agricultural sites than in rural natural sites. | i, j, k |
|  [32] | Moroń et al., 2014 | Poland | Bees, bumblebees and hoverflies (*Hymenoptera*) | Railway | Railway embankment | % woodland, % grassland, % settlement, % water in 200 m radius | The species richness of bees, hoverflies and butterflies significantly increased with the proportion of woodland in 200 m (table 3).The species richness of hoverflies significantly increased with the proportion of grassland in 200 m (table 3).The abundance of bees significantly decreased with the proportion of woodland, grassland and settlement in 200 m (table 3).The abundance of hoverflies was not significantly influenced by landscape metrics (table 3).The abundance of butterflies significantly decreased with the proportion water reservoir in 200 m (table 3). | i, k, l |
|  [57] | Dallimer et al., 2012 | United Kingdom | Butterflies (*Lepidoptera*) | Waterway | Riparian corridor | % seal surface, % tree cover, density of human population, distance to the city center in 250 m grid square | The species richness of butterflies was negatively influenced by seal surface and tree cover calculated in 250 m grid square (table 1 in appendix S4), positively influenced by habitat diversity (table 1 in appendix S4), and not influenced by water (variable not selected, table 1 in appendix S4). The species richness of butterflies peaked at intermediate density of human population calculated in 250 m grid square (table 1 in appendix S4).The species richness of butterflies showed various and contradictory effects with the distance to the city center (text p. 748 top of left column). | i, l |
|  [28] | Bailey 2014 | France | Bees (*Hymenoptera*) | Powerline | Edge between forest and powerline corridor | % oilseed rape fields in 1000 m radius | The proportion of oilseed rape fields in 1000 m radius did not significantly affect the abundance of males and females species and morphospecies tested (text p. 204). | j |
|  [58] | Magierowski et al., 2012 | Australia | Macroinvertebrates | Waterway | Riverbank | % crops, % grazing, % forestry, % protected area in 1000 m radius and at the catchment scale | The ETP richness significantly decreased with the proportion of crops and grazing at the catchment scale, and increased with the proportion of forestry and protected area at the catchment scale (table 3).The % ETP richness significantly decreased with the proportion of crops and grazing at the catchment scale, and increased with the proportion of forestry and protected area at the catchment scale (table 3).The % ETP did not significantly vary with the proportion of crops, of forestry, of protected area and of grazing the local scale (table 6). | j, k, l |

**References**

1. Fell PE, Warren RS, Curtis AE, Steiner EM. Short-term Effects on Macroinvertebrates and Fishes of Herbiciding and Mowing Phragmites australis-dominated Tidal Marsh. Northeast Nat. 2006;13:191–212.

2. Gollan JR, Bruyn LL de, Reid N, Smith D, Wilkie L. Can ants be used as ecological indicators of restoration progress in dynamic environments? A case study in a revegetated riparian zone. Ecol Indic. 2011;11:1517–25.

3. Hopwood JL. The contribution of roadside grassland restorations to native bee conservation. Biol Conserv. 2008;141:2632–40.

4. Samways MJ, Sharratt NJ. Recovery of Endemic Dragonflies after Removal of Invasive Alien Trees. Conserv Biol. 2010;24:267–77.

5. Snodgrass GL, Stadelbacher EA. Effect of different grass and legume combinations on spider (Araneae) and ground beetle (Coleoptera: Carabidae) populations in roadside habitats in the Mississippi Delta. Environ Entomol. 1989;18:575–81.

6. Wootton JT. River Food Web Response to Large-Scale Riparian Zone Manipulations. PLoS ONE. 2012;7:e51839.

7. Cavaillé P, Dommanget F, Daumergue N, Loucougaray G, Spiegelberger T, Tabacchi E, et al. Biodiversity assessment following a naturality gradient of riverbank protection structures in French prealps rivers. Ecol Eng. 2013;53:23–30.

8. Dymitryszyn I. The effect of the construction and renovation of a highway bypass in Central Poland on the carabid beetle fauna (Coleoptera: Carabidae). Eur J Entomol. 2014;111:655–662.

9. Paetzold A, Yoshimura C, Tockner K. Riparian arthropod responses to flow regulation and river channelization: Riparian arthropod responses to river regulation. J Appl Ecol. 2008;45:894–903.

10. Penone C, Kerbiriou C, Julien J-F, Julliard R, Machon N, Le Viol I. Urbanisation effect on Orthoptera: which scale matters? Insect Conserv Divers. 2012;6:319–27.

11. Scher O, Thièry A. Odonata, Amphibia and Environmental Characteristics in Motorway Stormwater Retention Ponds (Southern France). Hydrobiologia. 2005;551:237–51.

12. Noordijk J, Delille K, Schaffers AP, Sýkora KV. Optimizing grassland management for flower-visiting insects in roadside verges. Biol Conserv. 2009;142:2097–103.

13. Noordijk J, Schaffers AP, Heijerman T, Boer P, Gleichman M, Sýkora KV. Effects of vegetation management by mowing on ground-dwelling arthropods. Ecol Eng. 2010;36:740–50.

14. Russell SA, Thorvilson HG, Phillips SA. Red imported fire ant populations in Texas highway roadsides and rest areas. Southwest Entomol. 2001;26:63–71.

15. Skórka P, Lenda M, Moroń D, Martyka R, Tryjanowski P, Sutherland WJ. Biodiversity collision blackspots in Poland: Separation causality from stochasticity in roadkills of butterflies. Biol Conserv. 2015;187:154–63.

16. Ward L, Mill PJ. Habitat factors influencing the presence of adult *Calopteryx splendens* (Odonata: Zygoptera). Eur J Entomol. 2005;102:47–51.

17. Wynhoff I, van Gestel R, van Swaay C, van Langevelde F. Not only the butterflies: managing ants on road verges to benefit Phengaris (*Maculinea*) butterflies. J Insect Conserv. 2011;15:189–206.

18. Åström M, Pettersson LB, Öckinger E, Hedin J. Habitat preferences and conservation of the marbled jewel beetle *Poecilonota variolosa* (Buprestidae). J Insect Conserv. 2013;17:1145–54.

19. Knapp M, Saska P, Knappová J, Vonička P, Moravec P, Kůrka A, et al. The habitat-specific effects of highway proximity on ground-dwelling arthropods: Implications for biodiversity conservation. Biol Conserv. 2013;164:22–9.

20. Noordijk J, Schaffers AP, Sỳkora KV. Diversity of ground beetles and spiders in roadside verges with grey hair-grass vegetation. Eur J Entomol. 2008;105:257–265.

21. Noordijk J, Schaffers AP, Heijerman T, Sýkora KV. Using movement and habitat corridors to improve the connectivity for heathland carabid beetles. J Nat Conserv. 2011;19:276–84.

22. Rotholz E, Mandelik Y. Roadside habitats: effects on diversity and composition of plant, arthropod, and small mammal communities. Biodivers Conserv. 2013;22:1017–31.

23. Silverman B, Horn DJ, Purrington FF, Gandhi KJK. Oil Pipeline Corridor Through an Intact Forest Alters Ground Beetle (Coleoptera: Carabidae) Assemblages in Southeastern Ohio. Environ Entomol. 2008;37:725–33.

24. Le Viol I, Mocq J, Julliard R, Kerbiriou C. The contribution of motorway stormwater retention ponds to the biodiversity of aquatic macroinvertebrates. Biol Conserv. 2009;142:3163–71.

25. Major RE, Smith D, Cassis G, Gray M, Colgan DJ. Are roadside strips important reservoirs of invertebrate diversity? A comparison of the ant and beetle faunas of roadside strips and large remnant woodlands. Aust J Zool. 1999;47:611–24.

26. Major RE, Christie FJ, Gowing G, Cassis G, Reid CA. The effect of habitat configuration on arboreal insects in fragmented woodlands of south-eastern Australia. Biol Conserv. 2003;113:35–48.

27. ASF. Evolution de la biodiversité des dépendances autoroutières. Etude comparative 1995 – 2009. CERA Environnement; 2012.

28. Bailey S. Quelle est la contribution des lisières forestières à la structuration des assemblages d’abeilles sauvages dans les paysages agricoles ? Chapitre 6. Université d’Orléans; 2014. https://tel.archives-ouvertes.fr/tel-01203346/. Accessed 8 Nov 2016.

29. Collins B, Foré S. Potential role of pollinators in microhabitat structure within a large population of *Echinacea laevigata* (Asteraceae). J Torrey Bot Soc. 2009;136:445–56.

30. Hanley ME, Wilkins JP. On the verge? Preferential use of road-facing hedgerow margins by bumblebees in agro-ecosystems. J Insect Conserv. 2015;19:67–74.

31. Mallard F. Développement d’une méthode d’évaluation quantitative des effets des projets d’infrastructures de transport terrestre sur les milieux naturels. Chapitre 4-3. Ecole Centrale de Nantes (ECN); 2014. https://tel.archives-ouvertes.fr/tel-01006355/. Accessed 12 Jan 2017.

32. Moroń D, Skórka P, Lenda M, Rożej-Pabijan E, Wantuch M, Kajzer-Bonk J, et al. Railway Embankments as New Habitat for Pollinators in an Agricultural Landscape. PLoS ONE. 2014;9:e101297.

33. Osgathorpe LM, Park K, Goulson D. The use of off-farm habitats by foraging bumblebees in agricultural landscapes: implications for conservation management. Apidologie. 2012;43:113–27.

34. Russell KN, Ikerd H, Droege S. The potential conservation value of unmowed powerline strips for native bees. Biol Conserv. 2005;124:133–48.

35. Alten B, Bellini R, Caglar SS, Simsek FM, Kaynas S. Species composition and seasonal dynamics of mosquitoes in the Belek region of Turkey. J Vector Ecol. 2000;25:146–154.

36. Braun S, Flückiger W. Increased population of the aphid *Aphis pomi* at a motorway: Part 1—field evaluation. Environ Pollut Ser Ecol Biol. 1984;33:107–20.

37. Kline DL. Seasonal and Spatial Abundance of *Culicoides spp.* larvae in Roadside Salt Marsh Areas at Yankeetown, Florida. Fla Entomol. 1989;72:111–7.

38. Loch AD, Zalucki MP. Spatial distribution of pink wax scale, *Ceroplastes rubens* Maskell (Hemiptera: Coccidae), on umbrella trees in south-eastern Queensland: The pattern of outbreaks. Aust J Zool. 1996;44:599–609.

39. Mueller EK, Baum KA. Monarch–parasite interactions in managed and roadside prairies. J Insect Conserv. 2014;18:847–53.

40. Russell SA, Thorvilson HG, Phillips SA. Red imported fire ant (Hymenoptera: Formicidae) populations in Texas highway rights-of-way and adjacent pastures. Environ Entomol. 2001;30:267–273.

41. Vogt JT. Nature and Severity of Imported Fire Ant (Hymenoptera: Formicidae) Infestations on the Mississippi River Levee. Midsouth Entomol. 2009;2:78–83.

42. Ditsworth TM, Butt SM, Beley JR, Johnson CD, Balda RP. Arthropods, Plants, and Transmission Lines in Arizona: Community Dynamics during Secondary Succession in a Pinyon-Juniper Woodland. Southwest Nat. 1982;27:167–81.

43. Freitag A, Dischinger C, Cherix D. *Formica pratensis* (Hyménoptères: Formicidae) dans le canton de Vaud: état des peuplements et importance des talus de routes comme milieu de substitution. Bull Société Vaudoise Sci Nat. 2008;91:47–68.

44. Itzhak MJ-J. Seed harvester and scavenger ants along roadsides in Northern Israel. Zool Middle East. 2008;44:75–82.

45. Larson KA, Harman DM. Subcortical cavity dimension and inquilines of the larval locust borer (Coleoptera: Cerambycidae). Proc Entomol Soc Wash. 2003;105:108–19.

46. Martinez J-JI, Wool D. Sampling Bias in Roadsides: The Case of Galling Aphids on Pistacia Trees. Biodivers Conserv. 2006;15:2109–21.

47. Samways MJ, Osborn R, Carliel F. Effect of a highway on ant (Hymenoptera: Formicidae) species composition and abundance, with a recommendation for roadside verge width. Biodivers Conserv. 1997;6:903–13.

48. Wilkaniec B, Borowiak-Sobkowiak B, Wilkaniec A, Kubasik W, Kozłowska M, Dolańska-Niedbała E. Aphid migrant activity in refuge habitats of the Wielkopolska agricultural landscape. J Plant Prot Res. 2015;55:69–79.

49. Fleishman E, Austin GT, Brussard PF, Murphy DD. A comparison of butterfly communities in native and agricultural riparian habitats in the Great Basin, USA. Biol Conserv. 1999;89:209–18.

50. Houston WA, Wormington KR, Black RL. Termite (Isoptera) diversity of riparian forests, adjacent woodlands and cleared pastures in tropical eastern Australia. Austral Entomol. 2015;54:221–30.

51. Schipper AM, Wijnhoven S, Leuven RSEW, Ragas AMJ, Jan Hendriks A. Spatial distribution and internal metal concentrations of terrestrial arthropods in a moderately contaminated lowland floodplain along the Rhine River. Environ Pollut. 2008;151:17–26.

52. Brunzel S, Elligsen H, Frankl R. Distribution of the Cinnabar moth *Tyria jacobaeae* L. at landscape scale: use of linear landscape structures in egg laying on larval hostplant exposures. Landsc Ecol. 2004;19:21–27.

53. Vermeulen HJ. Corridor function of a road verge for dispersal of stenotopic heathland ground beetles Carabidae. Biol Conserv. 1994;69:339–349.

54. Tagwireyi P, Sullivan SMP. Riverine landscape patch heterogeneity drives riparian ant assemblages in the Scioto River Basin, USA. PloS ONE. 2015;10:e0124807.

55. Munguira ML, Thomas JA. Use of Road Verges by Butterfly and Burnet Populations, and the Effect of Roads on Adult Dispersal and Mortality. J Appl Ecol. 1992;29:316–29.

56. Verboven HAF, Uyttenbroeck R, Brys R, Hermy M. Different responses of bees and hoverflies to land use in an urban–rural gradient show the importance of the nature of the rural land use. Landsc Urban Plan. 2014;126:31–41.

57. Dallimer M, Rouquette JR, Skinner AMJ, Armsworth PR, Maltby LM, Warren PH, et al. Contrasting patterns in species richness of birds, butterflies and plants along riparian corridors in an urban landscape. Divers Distrib. 2012;18:742–53.

58. Magierowski RH, Davies PE, Read SM, Horrigan N. Impacts of land use on the structure of river macroinvertebrate communities across Tasmania, Australia: spatial scales and thresholds. Mar Freshw Res. 2012;63:762–79.