



## **Bridging the rural-urban dichotomy in land use science**

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*Published in:*  
Journal of Land Use Science

*DOI:*  
[10.1080/1747423X.2020.1829120](https://doi.org/10.1080/1747423X.2020.1829120)

*Publication date:*  
2020

*Document version*  
Version created as part of publication process; publisher's layout; not normally made publicly available

*Citation for published version (APA):*  
van Vliet, J., Birch-Thomsen, T., Gallardo, M., Hemerijckx, L-M., Hersperger, A. M., Li, M., ... van Rompaey, A. (2020). Bridging the rural-urban dichotomy in land use science. *Journal of Land Use Science*, 15(5), 585-591. <https://doi.org/10.1080/1747423X.2020.1829120>



### **Bridging the rural-urban dichotomy in land use science**

Journal:	<i>Journal of Land Use Science</i>
Manuscript ID	Draft
Manuscript Type:	Debate
Keywords:	Rural-urban gradient, Rural urbanization, Agricultural transition, Land use planning, Settlement systems

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Manuscripts

# 1 Bridging the rural-urban dichotomy in land use science

## 2 3 **Abstract**

4 Rural and urban areas are often conceptualized as two separate entities and studied accordingly.  
5 However, in reality, they are related in multiple ways. Here we explore this relation between rural and  
6 urban areas from a land use perspective. We argue that land should be characterized along a gradient  
7 from rural to urban. Further, we argue that land use along this gradient typically combines both rural  
8 and urban functions. Finally, we point at the complex patterns of migration and mobility between  
9 different types of settlements, which is a multidirectional process that further blurs the distinction  
10 between rural and urban areas. These propositions are supported by examples from recent research  
11 and suggest the need for a more inclusive approach towards the analysis of rural and urban land use  
12 systems, as well as plans and policies that target these systems.

## 13 14 **Keywords**

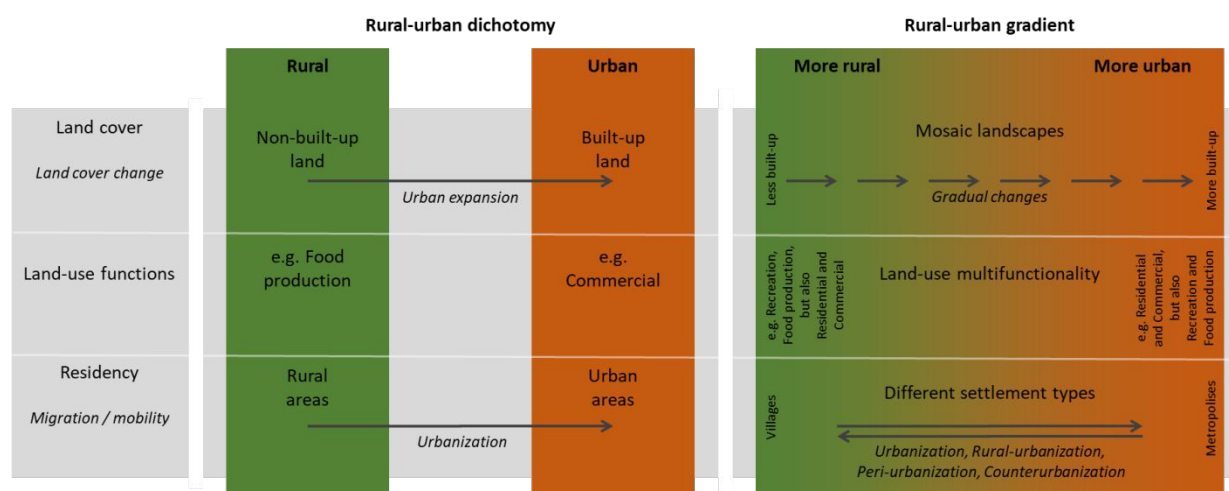
15 Rural-urban gradient; Rural urbanization; Agricultural transition; Land use planning; Land use science

## 16 17 18 **1 Introduction**

19 The vast majority of the Earth's land surface can be considered rural, including both agricultural areas  
20 and natural areas. These rural areas are the main source for our food, and the key employment and  
21 income strategy for many people, especially in the Global South. At the same time, agriculture is directly  
22 related to the global decline of biodiversity, as well as a range of other environmental impacts (Clark and  
23 Tilman, 2017). Urban areas, in contrast, occupy only a small part of the land surface: van Vliet et al.  
24 (2017) estimated that about 2% of the terrestrial land can be characterized as urban, including both  
25 built-up and non-built-up land in urban areas. Yet, these urban areas contain more than half of the  
26 global population and this share is expected to increase in the near future (UN-Habitat, 2019). In  
27 addition, the vast majority of all economic activities take place in cities, and cities are responsible for  
28 more than 60% of the use of natural resources (UN-Habitat, 2019). Therefore, understanding both rural  
29 and urban areas is pivotal towards sustainable land use development.

30 Our understanding of both rural and urban land systems has increased greatly in recent decades.  
31 However, this understanding is typically based on analyses of rural or urban systems in isolation, where  
32 one is at best a boundary condition to the other. In this traditional conceptualization, rural areas and  
33 urban areas are distinct entities, and their main connections in terms of land use is via flows of  
34 agricultural products from rural areas to urban areas (Seto et al., 2012).

In this paper, we argue that this distinction does not reflect reality, and that rural and urban land use systems need to be studied in conjunction to understand land use change processes as well as to support sustainable development. Specifically, we argue that 1) rural and urban land are two extremes of a gradient with many landscapes being mosaics that combine rural land urban land, 2) locations at different points along the rural-urban gradient provide a range of different land-use functions, and 3) rural and urban areas are inextricably linked through complex migration patterns between different types of settlements and in ways that further blur the distinction between both systems (See figure 1).



**Figure 1:** Conceptual differences between the rural-urban dichotomy and the more nuanced representation as a rural-urban land-use gradient. Arrows represent the relations between (more) rural and (more) urban parts of the landscape, while the respective changes are indicated in *italics*.

## 2 The not-so-clear differences between rural and urban land use systems

### 2.1 A gradient from rural to urban land

Land change analyses often characterize rural and urban areas as mutually exclusive, despite many acknowledgements that in reality there is a gradient between both (e.g. Kroll et al., 2012; Radford and James, 2013). An important contributor to this persistent dichotomy are the land cover maps derived from remote sensing imagery that are underlying a large number of analyses. Remote sensing image classification typically assigns all pixels that are predominantly covered with impervious surface to the class of built-up land, and all other pixels to one or more classes of non-built-up land. Using the increasing availability of remote sensing imagery, a growing body of literature has documented urban development processes based on the conversion of non-built-up areas to built-up areas (e.g. Grădinaru et al., 2015).

On scales that are meaningful for the analysis of land use systems, many locations can be placed somewhere in between both extremes of the conceptual rural-urban gradient. These mosaic landscapes have been referred to, among others, as territories-in-between and as peri-urban areas (Wandl et al., 2014). Peri-urban areas are increasingly important in terms of ongoing land-use change processes.

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3 62 Greater Cairo is a prime example of this process. For example, Salem et al. (2020, this issue) analyze land  
4 63 use change since the 2011 revolution and find that the largest increase in built-up land was observed in  
5 64 the peri-urban areas surrounding Cairo, even though the largest increase in population was observed  
6 65 within the city itself. This process was at least partly driven by high land and house prices in the city,  
7 66 leading to inhabitants looking for residency elsewhere. Another way to look at the mix of rural and  
8 67 urban land is by considering the interface between both, as this will be large in mosaic peri-urban  
9 68 landscapes. An analysis of this interface in the Netherlands shows that a very large part of the  
10 69 population lives near this interface (Broitman, 2020, this issue), indicating that the direct environment of  
11 70 this part of the population exists of both rural and urban land.

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15 71 Peri-urban areas are often in the hinterland of larger cities (Fertner et al., 2016; Vermeiren et al., 2012).  
16 72 Yet, it is increasingly acknowledged that smaller cities and towns, located in otherwise rural areas, play  
17 73 an important role in urban land use development. For example, in China, the development of new built-  
18 74 up land in village landscapes exceeds the development of built-up land in large urban centers between  
19 75 1990 and 2010 (Li et al., 2019). Consistently, Conrad et al. (2015) found that building area in rural  
20 76 settlements in Uzbekistan increased with about 20% between 2006 and 2011 indicating the importance  
21 77 of urban development outside large city centers. Also in Europe the majority of the built-up land is  
22 78 found in areas that are predominantly rural, i.e. with more than half of the area categorized as non-  
23 79 built-up areas (van Vliet et al., 2019). Based on these observations, we argue that pixels with one  
24 80 homogenous land cover type are not the right unit of analysis for these processes and that landscapes  
25 81 should be characterized as heterogeneous units along the rural-urban gradient (see e.g. Schug et al.,  
26 82 2020). These observations thus call for mapping land use systems based on fractional cover as well as  
27 83 with land use intensities, in order to represent and analyze change processes along the rural-urban  
28 84 gradient. An example of this is presented in Wang et al. (2019), who present different classes along the  
29 85 rural-urban gradient. Scenario results thus show a land sparing effect as a result of urban intensification,  
30 86 while urban expansion leads to much larger rural land losses.

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## 38 88 **2.2 Land use multifunctionality**

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41 89 Land use at a given location is often characterized as monofunctional and associated with the  
42 90 predominant land cover. This focus confirms or even reinforces the perceived separation between rural  
43 91 and urban land, as it suggests different and clearly separable functions. For example, crop production is  
44 92 a land use associated with cropland and thus typical for rural areas. Conversely, commercial land use is  
45 93 associated with built-up land and typical for urban areas. This distinction is reflected in analyses of land  
46 94 use change drivers, as rural land use changes for example related to the demand for agricultural  
47 95 products, while urban change is for example related to economic development. However, in reality, land  
48 96 use multifunctionality is often the rule, rather than the exception (Willemen et al., 2008), and this  
49 97 multifunctionality blurs the line between urban and rural functions.

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53 98 An important example in which urban functions are provided in otherwise rural landscapes is in  
54 99 recreation, as urban dwellers increasingly visit nearby rural areas for leisure and thus use recreation  
55 100 functions of these landscapes (Zasada et al., 2013). A recent review of peri-urban change processes in

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3 101 Europe even found that changes in land use functions preceded change in land cover about as often as  
4 102 the other way around (Shaw et al., 2020). This suggests not only that rural areas provide essential  
5 103 functions for urban areas, but also that change processes along the rural-urban gradient are affected by  
6 104 these functions. The agent-based model adopted by Beckers et al. (2020, this issue) demonstrates the  
7 105 role of especially recreation services on rural land use changes for Belgium. In their scenarios, urban  
8 106 expansion initially leads to a conversion of agricultural parcels. Yet, remaining agricultural land,  
9 107 especially when fragmented and enclosed by urban land, is also increasingly used for hobby farming and  
10 108 other recreational purposes. This effect thus adds to the decline in food production, despite the parcels  
11 109 remaining agricultural in use.

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15 110 Off-farm employment is another example that illustrates this point, as many off-farm jobs are not  
16 111 related to agricultural production (Barrett et al., 2018). Conversely, agricultural production in urban  
17 112 areas has gained attention recently. Even though the total production is small as compared to  
18 113 predominantly rural areas, it can make important contributions locally (Badami and Ramankutty, 2015).  
19 114 These examples illustrate that multifunctionality often include traditional urban functions in otherwise  
20 115 rural areas and vice-versa. Hence, understanding multiple different land-use functions is required to  
21 116 identify social, economic and ecological drivers that together shape both rural and urban areas.

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### 26 27 118 **2.3 Migration as a rural-urban connection**

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29 119 Urbanization, the demographic process by which an increasing share of the population lives in urban  
30 120 areas, is based on a sharp distinction between rural and urban areas by its very definition. In the context  
31 121 of urbanization, migration is typically depicted from rural to urban only, fueled by the availability of  
32 122 employment opportunities as well as other advantages associated with urban areas such as education  
33 123 facilities and health care services (Sabates-Wheeler et al., 2008). This discourse fits the predominant  
34 124 land use activities in both rural and urban areas: rural areas are mainly agricultural while urban land is  
35 125 used for commercial and industrial purposes, in addition to its residential function.

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39 126 The complex reality is that migration is not confined to people moving from rural to urban areas, but  
40 127 also includes rural-to-rural, urban-to-urban, and urban-to-rural migration, and that it involves a wider  
41 128 range of drivers than strictly economic ones (Milbourne, 2007). On top of the arbitrary threshold  
42 129 between rural and urban areas, these processes presents an intricacy to their traditional distinction  
43 130 based on the principal difference in terms of their land use and associated livelihoods. Migration within  
44 131 rural areas and from urban to rural areas is also often caused by perceived socio-economic advantages  
45 132 of the destination area (Zulu et al., 2011). Moreover, many migrants residing in urban areas retain  
46 133 strong links with their rural origin and transfer remittances. These remittances are often used beyond  
47 134 household subsistence and support investments in, for example, small business enterprises (de Haas,  
48 135 2006). Conversely, while economic incentives are still the predominant driver for rural-to-urban  
49 136 migration in the Global South, opposite movements have been reported in many regions in the US and  
50 137 Europe, for example in France (Détang-Dessendre et al., 2008) and Germany (Bernt, 2018). This process  
51 138 of rural urbanization represents a transformation of rural spaces to communities with urban values and  
52 139 lifestyles, often made possible by commuting. In the Global South context, emergence of small urban

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3 140 service centers often lead to increased number of multi-local of households making benefit of both the  
4 141 rural and urban sphere through circular mobility (Ørtenblad et al., 2019). The resultant spatial and socio-  
5 142 economic transformations impact the rural ways of life and influence changes in the rural landscapes.  
6 143 This process contributes to consolidation or abandonment of the agricultural land in pursuit of urban  
7 144 lifestyles, and thus further mixing land use and land use functions.  
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### 11 12 146 **3 Implications and conclusion**

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14 147 We discussed the relation between rural and urban areas from a land use perspective, and argue that  
15 148 both are strongly related, while this relation is only rarely reflected in land use science. Instead, land use  
16 149 science has traditionally focused on rural areas, while urban areas have mostly been treated as  
17 150 exogenous entities affecting land use directly or indirectly via rural-urban teleconnections (Verburg et  
18 151 al., 2015). Yet, the examples presented in the previous section demonstrate that rural and urban are  
19 152 only two extremes of a rural-urban continuum, and that many regions fall somewhere in between, with  
20 153 mixed land uses, land-use functionalities, livelihoods, and lifestyles. As a result, there is a need for a  
21 154 more inclusive approach to studying land use change processes, where urban land is included as an  
22 155 integral part of the land use matrix.

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26 156 Consistently, the interconnected nature of rural and urban areas is also relevant for land use planning  
27 157 and policy making. Although there are large variations between places, urban expansion is usually  
28 158 addressed at the municipal level, and to a lesser degree at the regional and national level (Hersperger et  
29 159 al., 2019). Conversely, agricultural changes are mainly affected by agricultural policies, while agricultural  
30 160 trade is typically included in economic policies, both of which are normally addressed at the national  
31 161 level. Migration is often directly targeted by regional development policies and can be indirectly  
32 162 affected by economic and spatial policies, but also by agricultural policies and related subsidy schemes  
33 163 (Byerlee et al., 2005). These generalizations illustrate that planning and policy making mostly addresses  
34 164 rural and urban areas separately, under the responsibility of different administrative levels, and also  
35 165 sometimes by different departments within the same level (e.g. see Ariti et al., 2019 for an elaboration  
36 166 of this phenomena for Ethiopia). This set-up thus ignores the intrinsic relatedness of rural and urban  
37 167 areas. In a Global South context, where small and intermediate urban centers are rapidly emerging in  
38 168 otherwise rural area, this is often reported as a hindrance for fully exploiting the development potentials  
39 169 of rural-urban linkages (Lazaro et al., 2019). We argue that in order to better plan for the complex rural-  
40 170 urban continuum, a comprehensive approach towards planning is required, which would allow  
41 171 addressing the rural-urban relations explicitly. However, while planning is frequently suggested as a tool  
42 172 to control urban development, it's effectiveness is not clear (Gallardo and Martínez-Vega, 2016), and  
43 173 neither are potential side-effects of proposed plans (Hersperger et al., 2020, this issue). Moreover,  
44 174 economic strength differs greatly between urban activities and rural ones, hampering such integrated  
45 175 approach. Comprehensive planning - on a level playing field - is only possible in circumstances where  
46 176 institutions are strong and where the value of rural land agricultural activities is acknowledged by and  
47 177 shared among all stakeholders.

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3 179 **Acknowledgements**  
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5 180 The authors would like to thanks the KU Leuven for supporting the workshops on which this debate  
6 181 paper is based. JvV was supported by the Netherlands Organization for Scientific Research NWO (Grant  
7 182 No VI.Vidi.198.008). This research contributes to the Global Land Programme ([www.glp.earth](http://www.glp.earth)).  
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