

PERI-URBAN AGRICULTURE: lessons learnt from Jakarta and Addis Ababa

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Typical mixed urban and rural land uses (*Desakota*) in the Jakarta Metropolitan Area - ©Didit O. Pribadi

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The 21st century has been called the urban century, as most of the human population is now living in urban areas. Current and future urbanization is mostly taking place at great speed in the Global South. The challenges are enormous and request different models of urbanization as developed in the Global North. High levels of informality and poverty will not go away in the decades to come, while capacity will remain limited to adequately provide urban dwellers with basic infrastructure and economic opportunities. Grave economic shocks and environmental disasters such as experienced in both the Jakarta and Addis Ababa urban regions are likely to remain features of these regions. Therefore, it is of utmost importance to strengthen the resilience of these cities in the best possible ways. The continued existence of agriculture in and near urban areas is an important means for this purpose that, however, is still poorly, or at best intermittently, acknowledged by politicians and urban planners, who are inspired by visions of “modern” cities where agriculture is rather a negligible activity.

INTRODUCTION

In the year 2050, 7 out of 11 billion people are expected to be living in urban areas (UN, 2018a). The Global South will absorb 90% of future urban population growth, notably in Asia and Africa. Annual rates of population increase of 5% are not an exception in the cities of these regions, meaning that the population doubles within approximately 14 years. To cope with these pressures would be an incredible challenge for any city, but it is overwhelming for many African and Asian cities where urban institutional capacities are mostly limited, governance mechanisms inefficient and urban growth is not accompanied by corresponding economic growth (Parnell & Walawege, 2011). Consequently, poverty levels are high and nearly 60% of the urban population in sub-Saharan Africa, and around 30% in Asia, are living in slums with poorly built homes and a scarcity of basic infrastructure such as electricity, water and sanitation (UN, 2018b).

In this situation, local provision of food, medicines, fibers and timber is a sheer necessity for the survival of many. Moreover, agricultural land can provide environmental, social and economic benefits such as generating fresh air that cools hot inner cities, offering places for recreation as well as opportunities for the generation of income and entrepreneurial activities in a mostly informal economy. However, the pressures of urban growth make it difficult to conserve farmland; but what is perhaps more problematic is that decision-makers and planners apparently still fail to recognize its value.

The following two stories of the city regions of Jakarta, Indonesia, and Addis Ababa, Ethiopia, will give insights into the current dynamics and the importance of agriculture in large urbanizing areas in the Global South. Based on

our recent research findings, we will show how urban agriculture in peri-urban areas, i.e., the zones around and in-between the settlements in urban regions, can support the livelihood of citizens and strengthen the resilience of urban systems in times of economic, social and environmental crisis. Furthermore, we will explore the impacts of different scenarios for urban development on peri-urban agriculture and its societal benefits. The modeling approach can provide foresight information that is much needed to better conserve and integrate peri-urban agriculture into strategies for future urbanization in the Global South.

AGRICULTURE IN URBAN REGIONS AND LIVELIHOOD IN ECONOMIC CRISES: AN INSIGHT FROM THE JAKARTA REGION

JABODETABEK METROPOLITAN AREA, A RAPIDLY DEVELOPING CITY REGION

Jabodetabek Metropolitan Area (JMA) has emerged as the biggest urban agglomeration in Indonesia. *Jabodetabek* is an acronym for Jakarta, the capital city of Indonesia, surrounded by Bogor, Depok, Tangerang, and Bekasi as its hinterland. With a population of around 30 million, this area has been considered as the second largest megacity in the world (RIHN, 2014). If population growth continues as predicted, the merging of the JMA with the neighboring region of Bandung metropolitan may lead in the coming decades to the formation of the largest megacity in the world, which will be called the Jakarta-Bandung Mega Urban Region.

The rapid urban growth has put great pressure on the surrounding landscape, particularly agricultural land. Urban land use increased from just 9,373 hectares to 223,953 hectares between 1972 and 2012, with an average annual growth rate of 8.2% (Pribadi and Pauleit, 2015). In the same period, 178,509 hectares of farmland were lost. The problem is becoming more complex as labor-intensive farming such as rice fields is dominant. Therefore, urban expansion has occurred in already densely populated agricultural areas. The distinctive mix of urban and rural land uses has been termed *desakota* (McGee, 1991), derived from the Indonesian words *desa*, meaning village, and *kota*, meaning city. While some scholars have regarded *desakota* as a temporary phenomenon that will vanish after the completion of urban transformation, farmland in the JMA still persists as a dominant land-use type, even after four decades of rapid urbanization (Pribadi and Pauleit, 2015). A closer look at the dynamics of land-use change in peri-urban areas reveals that some farming types have even benefitted from urbanization while others have not been able to resist its pressures. This has important implications for issues such

Urban agriculture seems to have been regarded as a safety net in the emergency situation of the food crises, but it is again neglected under "normal" situations

as food security, employment opportunities and ecosystem services provided by farming.

AGRICULTURAL CHANGES IN JMA AND THEIR ENVIRONMENTAL IMPACTS

Interestingly, agricultural land in peri-urban JMA has persisted in recent decades despite the huge expansion of urban land. As time-series of satellite image data revealed in our study, losses have been partly compensated for by the conversion into agricultural land of woodlands in remoter, hilly areas further away from the city center (Pribadi and Pauleit, 2015). Even so, fragmented farmlands have also survived closer to the urban cores. These agricultural lands are occupied by different types of farming. Distinctive distribution patterns indicate their varying capacity to adapt to the urban environment.

Cultivation of fruits and vegetables and inland aquaculture have been favored by the proximity of markets in nearby urban areas and the ability to produce on small parcels of land. Other farming types such as paddy fields, dry land agriculture and livestock are unable to compete with urban land uses and have been pushed out to remoter areas. In particular, the expansion of dry land agriculture has threatened remnant forests in upstream areas of the three major watersheds in JMA of the Ciliwung, Ciasadane, and Kali Bekasi rivers (Pribadi et al., 2018). Consequently, the percentage cover of woodlands declined from 34.4% in 1972 to 10.1% in 2012. As a result, environmental risk in Jabodetabek is increasing as the incidences of flooding and landslides have become more intense over time (Rustiadi et al., 2015).

THE ROLE OF AGRICULTURE IN TIMES OF ECONOMIC CRISIS

The overall contribution of agriculture in the JMA fell from 6.5% to 3.0% of GDP between 1993 and 2010. For a long time, this phenomenon was considered by policy makers as a normal consequence of urbanization as JMA was projected to become the biggest economic growth engine in Indonesia. In this situation, it was thought preferable to transform a low-value-added sector such as agriculture into high-value-added sectors such as industry and services. However, the sudden and strong economic crises in 1997-1998 and 2007 revealed the importance of agriculture in the JMA when food prices soared and unemployment was high.

Many industries and services collapsed during these crises. At the same time, food prices rose by 74% in 1998 (Studdert et al., 2001). While farmers benefitted from this situation, high food prices had serious implications for the affordability of food for the poor. Therefore, a policy was established in 1998 that allowed farmers to extend farmland by cultivating vacant land temporarily. There was a lot of vacant land at that time as many developers had occupied large tracts of land as an



Paddy fields adjacent to built-up areas - ©Didit O. Pribadi

investment for profitable future real-estate development. Since then, the agricultural sector's Gross Domestic Product, which had steadily declined since rapid urban development in JMA started in the 1970s, began to increase concurrently with other sectors and has continued to do so until recently (Pribadi and Pauleit, 2015). Our detailed analysis has shown that local agriculture is in particular connected to smaller, informal economic activities such as small-scale industries, stalls, and food-stall running by informal workers who do not have permanent jobs or regular salary.

Further policies introduced later to better conserve farmland and promote farming activities were poorly implemented after the end of the crises. Urban agriculture seems to have been regarded as a safety net in the emergency situation of the food crises, but it is again neglected under "normal" situations. Hitherto, agriculture is still projected to be lost in urban development scenarios (Hudalah and Firman, 2012).

Not all farming has the ability to support the urban market and urban food security (Pribadi and Pauleit, 2016). For instance, agriculture in the southwest of Jakarta is mostly for subsistence due to poor access to Jakarta and other cities in the JMA. Also, in the hills to the north, which are far from Jakarta, farming is mostly carried out by poor farmers and the harvest is only sold locally. Even so, it still helps poor people to get daily food. Agriculture in the surrounding

areas east and southeast of Jakarta, on the other hand, is important to supply staple food for the urban market. Considering these different potentials of farming types and regions, it will be important to craft future policies for land management that are responsive to local contexts and thus increase the resilience and sustainability of the JMA.

KEY FACTORS FOR VIABLE AGRICULTURE IN URBAN REGIONS

We held interviews with farmers in a subcatchment of the Ciliwung river to gain further insights into their motivations and better understand the supporting and hindering factors for their business (see Pribadi et al., 2017). In particular we explored whether a diversification of farming activities, for instance by offering opportunities for recreation on farmsteads, could be a way forward to increase their viability under the pressures of urbanization.

Results showed that there are four main factors that influence the viability of different farming activities in the Jabodetabek region:

1. Access to markets
2. Economic revenues
3. Socio-demographic factors
4. Land tenure

A farming type like horticulture persists close to the cities to gain higher economic revenues through proximity to



Densely populated agricultural areas in peri-urban Jakarta Metropolitan Area - ©Didit O. Pribadi

the markets. Farmers even dare to take a risk by investing higher capital, particularly for renting the land for farming. Cultivation of fruits and vegetables is mostly run by the younger generation as it is a profitable but also risky business. Conversely, paddy fields still exist as landowners let farmers continue to farm normally without any formal agreement. As the land might be taken any time, farmers reduce this risk by lessening input and productivity. Mostly older farmers do not work fulltime in farming, but generate their main income as construction workers, traders, etc. Still, the farmers continue to cultivate paddy fields or dry lands for preserving their daily food needs. In addition, paddy fields are important for stormwater retention. Even so, these types of farming are particularly vulnerable to urbanization.

FUTURE POLICIES

The JMA has experienced economic crises that raised the awareness of the government and society concerning food security as an important issue in urban policy-making. However, there is still no single policy instrument that can effectively protect farmland. Although some districts in the JMA have established food-crop protected areas in their spatial planning policy, urban expansion seems unstoppable and is continually converting the area.

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This situation highlights the importance of integrating agriculture into urban agendas instead of treating it as a restricted area disconnected from urban land-use dynamics. Agriculture should be considered as an element of urban land use and its value should be fully recognized in supporting food, alleviating poverty, creating jobs, generating income, and improving environmental quality as well as reducing the risk of natural hazards such as floods and landslides.

Most of all, the government needs to improve access to markets, increase economic revenues, and secure land tenure. Local agricultural products coupled with programs to support the production of fresh and healthy commodities should be promoted to increase the competitive advantages of agriculture in the JMA in the markets.

Moreover, non-commodity products and services such as agro-tourism should be developed and the provision of non-marketable public benefits (i.e., flood mitigation, reducing erosion, etc.) should be paid for to increase economic revenues of farming as a multifunctional activity. This strategy needs supporting policies mainly to: (1) develop the non-food markets and non-marketable public benefits of PUA, (2) improve farmers' capacity to manage multifunctional farming in producing food and

non-food products and services, (3) enhance access to land, as farming is not only expected to produce food but also increase employment opportunities and ecosystem services, which are long-term objectives.

Lastly, secure land tenure is a prerequisite for the uptake of such mid- and longer-term agricultural programs. Poor governance in land management should be improved to hinder the occupation of farmland by urbanites who want to make property investments (Mokkonen, 2013). Not least, agricultural research and education is important to innovate farming. All these strategies are necessary to make the farming business more attractive to the younger generation.

THE NEED FOR COMPACT CITY DEVELOPMENT: ADDIS ABABA AND THE SURROUNDING REGION

THE IMPACT OF URBANIZATION ON AGRICULTURE IN PERI-URBAN AREAS

Globally, the rate of increase in urban land cover is predicted to be at its highest in Africa until 2030 (Seto et al. 2012). Urban expansion will be concentrated in five regions of which “the greater Addis Ababa” region in Ethiopia is one. Addis Ababa has already experienced a rapid rate of urban growth over the past decades. This expansion has mostly taken the form of spontaneous growth through legal landowners, land developers, and informal settlement dwellers. Due to the lack of appropriate government policy and strategy, which role is to guide these new developments on vacant land and to ensure that the urbanized land is fully used, the expansion of the city is leading to a loss of highly fertile agricultural land and green areas losing their valuable ecosystem services. Consequently, 24% of the farmland in Addis Ababa was lost in the short period between 2006 and 2011 (Woldegerima et al., 2017).

These losses have severe social and economic impacts for a significant part of the population living in Addis Ababa and the surrounding towns, as urban agriculture is still considered a significant means of livelihood for urban households in Africa and one of few stable income sources for farmers with limited qualifications (Zezza and Tasciotti 2010, Drechsel and Dongus 2010). More than 50% of the field crops and 70% of the vegetable production within Addis Ababa are used for household consumption (CSA, 2002), thus contributing to a balanced diet.

Vegetable production located in the peri-urban regions is valuable due to its proximity to cities and consequently, transportation costs are relatively low when compared to rural areas (Smit, Nasr & Ratta, 2001). In cases of high

food price crises or rises in oil prices, the role of vegetable production becomes even more valuable as the local inhabitants usually have irregular and inadequate access to food and insufficient purchasing power. Costs for food supply and distribution from rural areas to the urban areas, or to import food for the cities, are continuously increasing (AAOIDP, 2013; Tolossa, 2010).

FUTURE DYNAMICS IN ADDIS ABABA AND THE SURROUNDING REGION

The population of Addis Ababa is expected to increase in the next 15 years at an average annual growth rate of approximately 4%, reaching almost 9 million people in 2035 (UN, 2018a). However, not only is Addis Ababa expanding at a rapid pace, but growth is also taking place along the major outlets of the city into the surrounding region (Kassa, 2013). This growth is expected to translate into an expansion of settlements in the city and into the surrounding areas. Consequently, farmland will continue to decline in the city’s surrounding area for urbanization and industrial development (AAOIDPP, 2013). The amount of farmland lost and the impacts on food supply, local livelihoods and the environment will very much depend on the mode of future urban development.

In the framework of the EU-funded project “Climate Change and Urban Vulnerability in Africa,” a modeling approach, Urban Spatial Scenario Modeling (USSDM), was developed and employed to explore the consequences of two different scenarios of urban development for the conservation of agricultural land (Abo-El-Wafa et al. 2017): a scenario of continuing low-density urban sprawl corresponding to a business-as-usual scenario, and a high-density scenario that reflects the density of new residential developments of condominium housing that are implemented by the city government.

We simulated the future settlement expansion in the surrounding region of Addis Ababa until 2038. We then overlaid the simulated expansion on agricultural suitability maps, which served as spatial indicators for food provisioning. These indicators provide an insight into the productivity of land and its ability to produce different crops that are deemed important for the local population as being major constituents of the local diet, having an economic support role for urban farmers, and having high potential for import substitution. The selected crops were vegetables (cabbage), cereal crops (teff and bread wheat), and oilseeds (nigerseed).

According to the model’s outputs, most of the settlement expansion (an average of 76% of future settlements) in the region would be located on land of relatively low agricultural suitability (marginal and very marginal suitability). At first glance, this might show a contradiction to the idea that urban expansion is mostly happening on

In cases of high food price crises or rises in oil prices, the role of vegetable production becomes even more valuable as the local inhabitants usually have irregular and inadequate access to food and insufficient purchasing power



Condominium housing development in the eastern part of Addis Ababa, Ayat area - ©Hany Abo El Wafa

fertile land. However, this is due to the fact that the areas with low suitability dominate the study area. The scarcity of land that is moderately suitable for cultivation gives it an even higher importance due to its higher productivity (Radcliffe & Bechtold, 1989). More than half of all crops (16 out of 30) cultivated in the area would be threatened by future settlement development as more than 50% of the future settlement development would be located in suitable land for cultivating crops.

We observed dramatic losses of agricultural land in the low-density scenario as compared to the high-density scenario. Land moderately suitable for cultivating bread wheat and teff in the low-density scenario suffered higher losses of 467% and 174% respectively compared to the high-density scenario. This indicates the vulnerability of moderately suitable land for cultivating these two crops when compared to cabbage and nigerseed, which would have a moderate increase of 50% and 80% respectively. The modeled settlement expansion has occurred on land suitable for cultivating vegetables that are important for local consumption and provide economic support for urban farmers. On the other hand, the losses of marginally and very marginally suitable land for cultivating high-value crops would increase by 160% and 200% respectively in the low-density scenario.

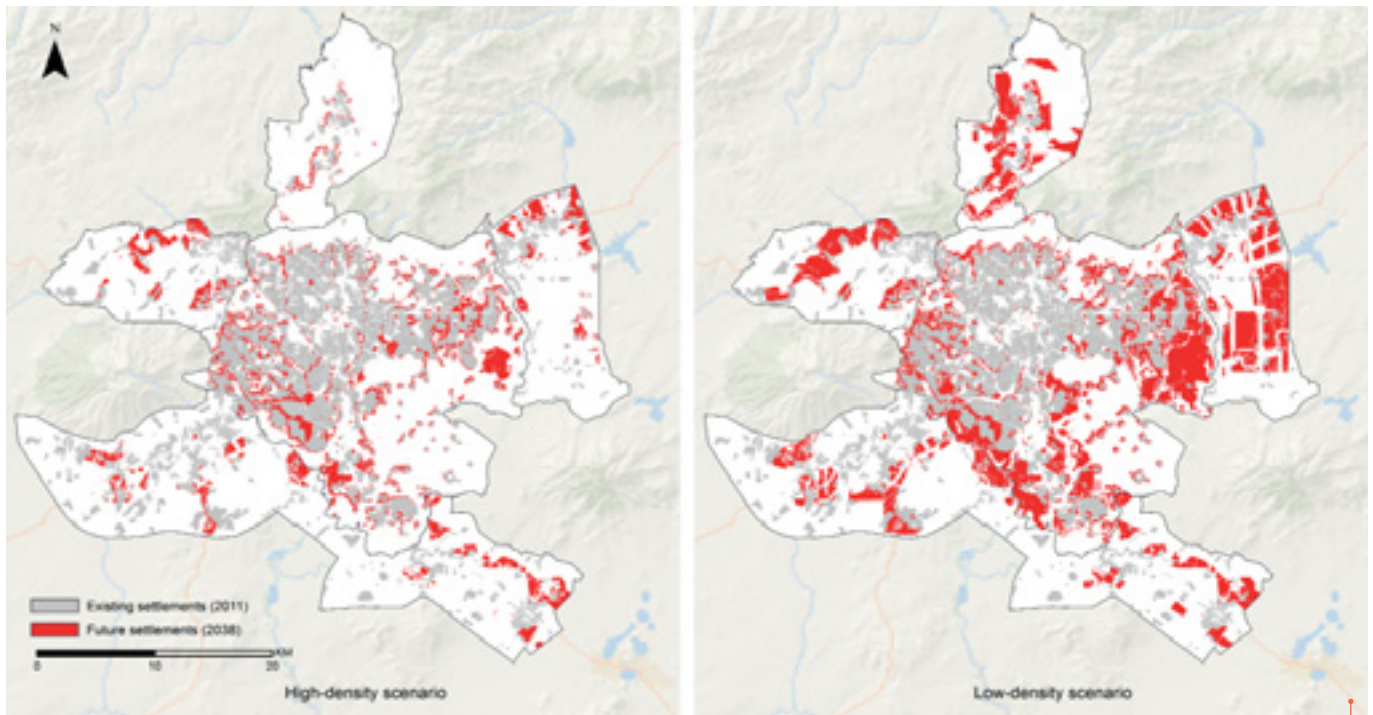
Products obtained from those agricultural lands are especially important for the poorest households, who are

the first ones affected by food-price shocks. Moreover, farming activities provide sources of income for those dependent on the population's urban and peri-urban agriculture (Egziabber, 1994). Given increasing population growth and the high amount of poor people depending on the informal economy, this situation is not expected to change any time soon. This highlights the role of urban and peri-urban planning that should intervene to address this challenge and to achieve sustainable future development ensuing from such explosive urban population growth.

STRATEGIES FOR COMPACT URBANIZATION AND GREEN INFRASTRUCTURE PLANNING TO BETTER PROTECT PERI-URBAN AGRICULTURE

Urban planning must promote the resilience of cities and achieve environmental sustainability in order to meet the challenges of urban transition caused by settlement expansion (Dyachia, Permana, Ho, Baba & Agboola, 2017).

We found that the densification of the existing built-up area and the adoption of a new model for compact development of new urban extensions that protect and integrate farmland would greatly increase urban resilience and food security. Implementing such strategies would lead to much lower losses of green infrastructure and its ecosystem services such as food provisioning, reducing the urban heat island effect and the risk to flooding during rainstorms.



Modelled future settlements in Addis Ababa and surrounding region in high-density and low-density scenarios (illustration: Hany Abo El Wafa, data sources: CLUVA project and USSDM results, Basemap: Ocean Basemap, Arcmap 10.4.1, ESRI)

Despite the existence of challenges to applying densification measures to other African cities, evidence from South Africa shows that densification and the more effective use of both vertical and horizontal space in a city are feasible (Pieterse & Fataar, 2016). Authorities in South Africa promote densification programs in residential areas that are accessible to employment opportunities with the aim of improving urban sustainability and integration after apartheid (Williams, 2000).

However, densification and high-density settlement expansion strategies have to be complemented by other measures that promote green and open space development inside the new expansion areas and give considerable weight to preserving and managing urban green spaces (Pauleit et al., 2005). This is important in order to alleviate other negative effects that could result from high-density settlements such as air pollution, reduced quality of life, reduced urban resilience and reduction of open-space areas for recreation (Haaland & van den Bosch, 2015).

The research also indicates that developing high-density settlement areas should not only be limited to the inner city (where land price is usually high). Horizontal development in smaller towns of the surrounding Oromia region would lead to large losses of suitable farmland in peri-urban areas.

Tools such as our scenario modeling approach have provided useful information for local administrations and decision-makers to develop land-use policies and planning that would be in favor of reducing the adverse effects of urban growth on the environment. As we noticed in workshops, it also acts as a platform for scientists,

planners, policy-makers and the public to communicate, which would facilitate the integration of different stakeholders and enhance participatory urban planning and decision-making.

CONCLUSION

Local agriculture is crucial to provide urban and peri-urban dwellers with food, fibers and medicine for their own supply or local sales that increase their incomes and thus make them less vulnerable to economic crises and natural disasters. Moreover, this agriculture can bring important environmental benefits, such as retention of stormwater.

However, some particular farming types with high social and environmental co-benefits, such as paddy rice farming in the Jakarta region, have low profitability and demand a lot of space. Therefore they cannot resist the pressure from urbanization.

To better integrate agriculture into urban regions in the Global South, it is crucial to implement policies that support farming economically and enhance its multifunctionality, i.e., its capacity to provide co-benefits to urban society. The latter will provide strong arguments for preserving agriculture in urban regions that are increasingly vulnerable to economic and natural disasters, which will become more frequent under climate change.

Experience has shown that comprehensive master planning is not a successful approach in such cases of rapid and – to a great degree – informal growth because

it is too slow, too complex and tries to coordinate and steer too many things at the same time. Therefore, urban planning should concentrate, on the one hand, on devising and implementing strategic key measures at city and regional scales, such as allocating urban centers and infrastructure as well as outlining where green infrastructure needs to be conserved as a lifeline. On the other hand, governments should significantly strengthen the capacity of local administrations in urban planning. These local stakeholders, who work on the ground, should be empowered to adequately address their respective challenges, which they know better than remote city governments. Lastly, as counterintuitive as it may seem,

more compact urban development is needed in urban regions of the Global South. Even though pictures of crowded slums in Asian and African cities convey a different message, the reality is often that of sprawling low-density urban areas consuming enormous amounts of productive land. As the two contrasting scenarios for the Addis Ababa region indicate, an increase of density would have a positive effect on the preservation of farmland, and hence support a large part of the urban population with food and vital ecosystem services, and thus constitute an investment with long-term sustainability gains.

REFERENCES

- Halloran, A., & Magid, J. (2013). Planning the unplanned: incorporating agriculture as an urban land use into the Dar es Salaam master plan and beyond. *Environment and Urbanization*, 25, 541–558
- UN (United Nations, Department of Economic and Social Affairs, Population Division) (2018). *World Urbanization Prospects: The 2018 Revision, Online Edition*. Available from <https://esa.un.org/unpd/wup/> Publications.
- UN (United Nations, Department of Economic and Social Affairs, Statistics Division) (2018). *The Sustainable Development Goals Report 2018, Online Edition*. Available from <https://unstats.un.org/sdgs/report/2018/>
- Brodjonegoro, B.S (2018). The 6th international conference of Jabodetabek study forum: “Urban-rural and upland-coastal connectivity in managing sustainable urbanizing world.” August 29, Bogor, Indonesia.
- Hudalah, D., & Firman, T. (2012). Beyond property: industrial estates and postsuburban transformation in Jakarta Metropolitan Region. *Cities*, 29, 40e48.
- Monkkonen, P. (2013). Urban land-use regulations and housing markets in developing countries: Evidence from Indonesia on the importance of enforcement. *Land Use Policy*, 34, 255–264.
- Pribadi, D.O., Vollmer, D., & Pauleit, S. (2018). Impact of peri-urban agriculture on runoff and soil erosion in the rapidly developing metropolitan area of Jakarta, Indonesia. *Regional Environmental Change*, 18, 2129–2143.
- Pribadi, D.O., Zasada, I., Müller, K., Pauleit, S. (2017). Multifunctional adaptation of farmers as response to urban growth in the Jabodetabek Metropolitan Area, Indonesia. *Journal of Rural Studies*, 55, 100–111.
- Pribadi, D.O., Pauleit, S. (2016). Peri-urban agriculture in Jabodetabek metropolitan area and its relationship with the urban socioeconomic system. *Land Use Policy*, 55, 265–274.
- Pribadi, D.O., Pauleit, S. (2015). The dynamic of peri-urban agriculture during rapid urbanization of Jabodetabek metropolitan area. *Land Use Policy*, 48, 13–24.
- Studdert, L. J., Frongillo Jr, E. A., & Valois, P. (2001). Household food insecurity was prevalent in Java during Indonesia’s economic crisis. *The Journal of nutrition*, 131(10), 2685–2691.
- AAOIDPP (2013). *Green space planning of Addis Ababa. Addis Ababa and Surrounding Oromia Integrated Development Planning Project. AAOIDP, 2013;*
- Abo-El-Wafa, H., Yeshitela, K., & Pauleit, S. (2017b). Exploring the future of rural–urban connections in sub-Saharan Africa: modelling urban expansion and its impact on food production in the Addis Ababa region. *Geografisk Tidsskrift-Danish Journal of Geography*, 117(2), 68–81.
- CSA (2002). *Agricultural Sample Enumeration - Area and production of crops and crop utilization 2001-2002 (1994 E.C). Agricultural Sample Enumeration 2001-2002*. Ethiopian Central Statistics Agency. Retrieved from - <http://213.55.92.105/nada4/index.php/catalog/170/download/520>
- Drechsel, P., & Dongus, S. (2010). Dynamics and sustainability of urban agriculture – examples from sub-Saharan Africa. *Sustainability Science*, 5(1), 69–78. doi - 10.1007/s11625-009-0097-x
- Dyachia, Z. S., Permana, A. S., Ho, C. S., Baba, A. N., & Agboola, O. P. (2017). Implications of Present Land Use Plan on Urban Growth and Environmental Sustainability in a Sub Saharan Africa City. *International Journal of Built Environment and Sustainability*, 4(2).
- Egziabher, A. G. (1994). Urban farming, cooperatives, and the urban poor in Addis Ababa. In A.G. Egziabher, D. Lee-Smith, D.G. Maxwell, P.A. Memon, L.J.A. Mougeot, & C.J. Sawio (Eds.), *Cities feeding people – an examination of urban agriculture in East Africa*, pp.85–104, Ottawa.
- Haaland, C., & van den Bosch, C. K. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. *Urban Forestry & Urban Greening*, 14(4), 760–771.
- Kassa, F. (2013). Conurbation and Urban Sprawl in Africa: The case of the City of Addis Ababa. *Ghana Journal of Geography*, 5(1), 73–89.
- Pauleit, S., Ennos, R., & Golding, Y. (2005). Modeling the environmental impacts of urban land use and land cover change—a study in Merseyside, UK. *Landscape and urban planning*, 71(2–4), 295–310.
- Radcliffe, D., & Bechtold, G. (1989). Assistance to land use planning Ethiopia. Land evaluation of Haykoch and Butajira Awraja (Shewa). FAO. Retrieved from http://www.fao.org/soils-portal/soilsurvey/soil-maps-and-databases/soil-legacyreports/jp/?page=16&ipp=10&tx_dynalist_pi%5Bpar%5D=YToxOntzOjE6IkwiO3M6MjoiMTAiO30=-
- Seto, K. C., Güneralp, B., & Hutyra, L. R. (2012). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences*, 109(40), 16083–16088
- Smit, J., Nasr, J., & Ratta, A. (2001). Where is farming found in the city? *Urban agriculture: food, resource and sustainable cities*, 1–30
- Studdert, L. J., Frongillo Jr, E. A., & Valois, P. (2001). Household food insecurity was prevalent in Java during Indonesia’s economic crisis. *The Journal of nutrition*, 131(10), 2685–2691
- Tolossa, D. (2010). Some realities of the urban poor and their food security situations: a case study of Berta Gibi and Gemechu Safar in the city of Addis Ababa, Ethiopia. *Environment and Urbanization*, 22(1), 179–198.
- Woldegerima, T., Yeshitela, K., & Lindley, S. (2017). Characterizing the urban environment through urban morphology types (UMTs) mapping and land surface cover analysis: The case of Addis Ababa, Ethiopia. *Urban ecosystems*, 20(2), 245–263.
- Zeza, A., & Tasciotti, L. (2010). Urban agriculture, poverty, and food security: Empirical evidence from a sample of developing countries. *Food policy*, 35(4), 265–273.