



## The geography of large-scale land acquisitions: Analysing socio-ecological patterns of target contexts in the global South



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### A B S T R A C T

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This paper analyses local geographical contexts targeted by transnational large-scale land acquisitions (>200 ha per deal) in order to understand how emerging patterns of socio-ecological characteristics can be related to processes of large-scale foreign investment in land. Using a sample of 139 land deals georeferenced with high spatial accuracy, we first analyse their target contexts in terms of land cover, population density, accessibility, and indicators for agricultural potential. Three distinct patterns emerge from the analysis: densely populated and easily accessible croplands (35% of land deals); remote forestlands with lower population densities (34% of land deals); and moderately populated and moderately accessible shrub- or grasslands (26% of land deals). These patterns are consistent with processes described in the relevant case study literature, and they each involve distinct types of stakeholders and associated competition over land. We then repeat the often-cited analysis that postulates a link between land investments and target countries with abundant so-called “idle” or “marginal” lands as measured by yield gap and available suitable but uncultivated land; our methods differ from the earlier approach, however, in that we examine local context (10-km radius) rather than countries as a whole. The results show that earlier findings are disputable in terms of concepts, methods, and contents. Further, we reflect on methodologies for exploring linkages between socio-ecological patterns and land investment processes. Improving and enhancing large datasets of georeferenced land deals is an important next step; at the same time, careful choice of the spatial scale of analysis is crucial for ensuring compatibility between the spatial accuracy of land deal locations and the resolution of available geospatial data layers. Finally, we argue that new approaches and methods must be developed to empirically link socio-ecological patterns in target contexts to key determinants of land investment processes. This would help to improve the validity and the reach of our findings as an input for evidence-informed policy debates.

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### Introduction

Large-scale land acquisitions for agricultural purposes have become a pervasive topic in current debates on sustainable rural development in the global South. Focussing on issues such as food security, land governance, agricultural transitions, and access to resources, these debates involve a broad range of actors, including development practitioners, policymakers, investors, activists, and

researchers – all of whom are striving to understand the rapidly unfolding phenomenon. While many, especially in the policy and practitioner world, welcome foreign direct investment in land as an urgently needed input into otherwise neglected agricultural development (Deininger & Byerlee, 2011; FAO, IFAD, UNCTAD, and The World Bank Group, 2010), others raise important questions about its potential social, economic, and environmental consequences (Borras & Franco, 2012; Cotula, 2012; Von Braun & Meinzen-Dick, 2009).

Researchers seeking to further such debates with solid and timely evidence face considerable challenges. Data about transnational land deals are scarce and difficult to access, partly because of the high levels of secrecy around such deals (Cotula, Vermeulen, Leonard, & Keeley, 2009; Scoones, Hall, Borras, White, & Wolford,

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2013). Moreover, the acquisition and development of arable land is a highly dynamic process. It has grown exponentially since its emergence about a decade ago, and at the same time land deals undergo frequent change regarding their negotiation status (from intended to concluded or failed contract negotiations), areal extent (granted vs. allocated vs. cultivated area), and operational status (planned, started, cancelled, etc.) (Land Matrix Partnership, 2014).

Two prominent but distinct research approaches have evolved in response to these challenges (Messerli, Heinemann, Giger, Breu, & Schönweger, 2013). The first addresses the topic intensively and qualitatively, locating processes of transnational land acquisition within larger political-economic dynamics of agrarian change and using case studies set in specific geographical contexts. This research has begun to produce a wealth of results in the last few years, published among others in a special issue of the *Journal of Peasant Studies* (39: 3–4). A second approach has sought to use quantitative, global-scale inventories of land deals to characterise the scale and dimension of large-scale land acquisitions. There have been various initiatives to establish such inventories (Anseeuw et al., 2012; Cotula, 2012; Deininger & Byerlee, 2011; Friis & Reenberg, 2010; GIZ, 2009), as well as various efforts to link the data they provide – for example, on country-by-country locations of land deals – to relevant national indicators and global datasets (Arezki, Deininger, & Selod, 2011; Deininger & Byerlee, 2011). The World Bank, for example, examined potentials for large-scale land investments and identified 445 million hectares of land worldwide as unused but suitable, meaning that it is neither forested nor under protection and has a population density of fewer than 25 people per km<sup>2</sup> (Deininger & Byerlee, 2011).

Each of these approaches has limitations. In-depth case study research in specific local contexts can be accused of providing evidence at a slow pace, with limited geographical validity, and thus being unable to deliver urgently needed generalisations for policymaking at higher spatial levels. Regional and global inventories have been criticised in the other direction, in particular for trying to shortcut the arduous and labour-intensive process of rigorous data collection and analysis (Oya, 2013); as Edelman (2013, p. 489) notes, “many researchers acknowledge the obvious – that land deal [inventory] data are frequently problematical – but they then go on and analyse those data as if they were generated in a highly rigorous way.” Scoones et al. (2013) show that this criticism points not only to difficulties related to the open data sources on which such inventories normally depend (Anseeuw, Lay, Messerli, Giger, & Taylor, 2013), but also to outdatedness due to the perpetuation of faulty citations on the Internet, as well as to a misleading fixation on “killer facts” and inappropriate inferences when it comes to defining “available land” (Edelman, 2013; Oya, 2013).

The persistent difficulty of supporting current policy debates with scientific evidence shows that both research approaches are needed, and indeed need to be refined and combined. Future research on large-scale land acquisition must acknowledge and integrate both the importance of context and the need to detect patterns and generalise findings. As the editors of a recent special collection on land deal methodology wrote, the impetus now is to focus critically “on the methods used to identify, count, aggregate and understand land deals at global and continental scales, and also [to ask] how to link these macro-level insights to the burgeoning case study literature” (Scoones et al., 2013, p. 470).

This paper is intended as a contribution to such a new, combined approach. Land science and applied geography have much to offer when it comes to improving methodologies for linking patterns and processes related to land investments (Messerli et al., 2013). Place-based analyses which reveal local contexts' social and ecological characteristics are essential for assessing vulnerabilities to external influences, as well as for making decisions about

sustainability issues more generally (Abson, Dougill, & Stringer, 2012; Heinemann et al., 2013; Hett, Heinemann, Epprecht, Messerli, & Hurni, 2012; Huby, Owen, & Cinderby, 2007). This paper offers both thematic and methodological contributions in pursuit of these objectives. Thematically, we challenge the narrative which locates land deals on so-called “idle” or “unused” land, whether in theory (Deininger & Byerlee, 2011; Fischer, Hiznyik, Priler, Shana, & van Vethuizen, 2002) or in practice (see policies and spokespeople paraphrased or quoted in e.g., Borrás, Fig. & Suárez, 2011; Cotula et al., 2009; Oberndorf, 2012; Rice, 2009). We do so first by analysing the socio-ecological characteristics of land deal target contexts using localised data on land cover and population density; we then show that this results in a very different picture of land deal target contexts than using national-scale data. Our approach thus improves methodologically on research that has used national (rather than locally specific) information to evaluate the development potential of large-scale land deals. In doing so, it also improves on the georeferencing available in the Land Matrix database, currently the most extensive inventory of large-scale land acquisitions available.<sup>2</sup> Making these improvements allows us to overlay more accurately georeferenced land deal locations with other globally available spatial data, and thus to test the hypothesis that transnational land deals are competing with various other claims on land, including pre-existing land uses in relatively accessible and populated areas. This hypothesis has been put forward before (Anseeuw et al., 2012; Cotula et al., 2009; Nalepa, 2011) and has been substantiated in a number of case studies (Borrás, Fig. et al., 2011; Dwyer, 2013a; Nalepa & Bauer, 2012; Schoneveld, German, & Nutakor, 2011; The Oakland Institute, 2011). We take this earlier work a step further by offering additional empirical support for the hypothesis that it is mainly the good land, rather than the marginal land, that large-scale land deals target, and by offering policymakers and the concerned public a greater evidential basis on which to act.

## Materials and methods

### *Data on large-scale land acquisitions*

The Land Matrix Partnership (Anseeuw et al., 2013), a joint initiative of several research and development organisations, has been collecting data on transnational land deals since 2009. The effort focuses on land deals that 1) involve sale, lease, or concessions, 2) entail a transfer of user rights from smallholders and communities to commercial users, 3) cover an area greater than 200 ha, and 4) have been announced or concluded since the beginning of this millennium (Anseeuw et al., 2012). An open-access online database ([www.landmatrix.org](http://www.landmatrix.org)) was launched in 2012, with contents initially compiled from data collection campaigns among members of the International Land Coalition (ILC) and its partners, from publicly available research and media reports, and from the two online portals run by ILC and by the non-governmental organisation GRAIN. This Land Matrix database covered over 1200 announced, intended, or concluded agricultural land deals. The beta version launched in April 2012 was used for an initial analysis of the phenomenon of large-scale land acquisition at a global scale (Anseeuw et al., 2012), while a crowdsourcing

<sup>2</sup> The Land Matrix initiative is coordinated by five main partners: ILC (International Land Coalition), CIRAD (Centre de coopération internationale en recherche agronomique pour le développement), CDE (Centre for Development and Environment, University of Bern), GIGA (German Institute of Global and Area Studies), and GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH).

campaign generated feedback and comments from an interested public.

Based on this feedback and building on the criticisms mentioned in the introduction, the Land Matrix Partnership has since invested considerable resources to improve the dataset's reliability and breadth. It also has stepped up efforts to better distinguish the different stages in the granting process of land deals and indicate data sources in its public interface (Anseeuw et al., 2013) in order to provide a refined and more differentiated picture. As a result, in October 2013 the number of land deals shown in the default view of the Land Matrix public interface was reduced from over 1200 to around 850, with concluded deals totalling an area of around 32 million hectares.

One challenge that remains is consistent and accurate georeferencing. For the present study we sought to address this by scrutinising all available information on the geographical location of land deals in the Land Matrix database. Georeferences and indicated levels of spatial accuracy were verified and, wherever possible, improved by reanalysing the source data and through visual inspection using publicly available geoportals such as Google Earth and Google Maps. On this basis, we classified the accuracy of every land deal location either as “local” (accuracy < 10 km), “regional” (accuracy 10–100 km), or “country” (host country indication only).

Given that the Land Matrix database is an interactive platform and subject to continuous updates, it is important to note that the dataset we used in this study was exported on 7 April 2013. We limited the dataset to agricultural land deals that involved international investors and for which the negotiation status had been reported as “intended” (expression of interest or contract under negotiation) or “concluded” (contract signed or oral agreement). Deals that had failed or had been confirmed as incorrect or dubious were excluded from the analysis.

Of the total 892 deals included in the dataset, 139 deals had spatially highly accurate location data that were classified as “local” (<10 km). For 408 deals, the spatial references were of intermediate accuracy and classified as “regional” (10–100 km). For the remaining deals only the host country was known. This paper focuses on the deals for which the location data proved to be highly accurate and meaningful at the local scale. These 139 deals cover a total area of 3.02 million hectares; their median size is 7881 ha. The vast majority (121 deals) have been concluded, with contracts signed for 115 deals. They are spread across all continents of the global South, with a high concentration in Africa (Fig. 1).

### Geospatial datasets

Understanding the geographical contexts targeted by large-scale land acquisitions is a prerequisite for addressing related sustainability issues. No policies can be devised without knowing the answers to questions such as: What is the pre-existing land cover in the area? How densely is the area populated? How easily accessible is it? Do planned deals affect any protected areas? We sought to obtain the answers from a number of global geospatial datasets as follows:

- Land cover was analysed using GlobCover 2009. This dataset has a spatial resolution of 300 m and was processed from MERIS Full Resolution data collected between 1 January 2009 and 31 December of 2009. Land cover is classified according to the United Nations Food and Agriculture Organization (FAO) classification system (Arino, 2010).
- Population density was analysed using the latest edition of the ORNL (Oak Ridge National Laboratory) LandScan™ database. With an approximate resolution of 1 km at the equator, this

product offered the highest available resolution for global population distribution data (ORNL, 2013).

- Accessibility was analysed using the global dataset generated by Uchida and Nelson (2008) at the Global Environmental Monitoring Unit, part of the European Commission's Joint Research Centre. This dataset indicates the average travel time from any given location to the closest city with more than 50,000 inhabitants in the year 2000 based on a cost–distance model that takes into account the available transportation network, slope and travel speed, as well as off-road surfaces. Seasonal variations and differences due to vehicle type are not considered. The spatial resolution is approximately 1 km at the equator.
- Yield gaps were analysed using the latest freely available dataset generated by IIASA (International Institute for Applied Systems Analysis). It was generated based on the global agro-ecological zoning (GAEZ) method (Fischer et al., 2002) and indicates the gap between actual rain-fed yield and potential yield for five major crops, taking into account local agroecological conditions. The spatial resolution is approximately 10 km. Unfortunately, we had to use the dataset for the year 2000, as no newer version was available at the time we conducted our analysis (IIASA, 2010).
- Furthermore, we downloaded the latest available global dataset on agriculturally cultivated land per pixel and datasets on the suitability for rain-fed cultivation of five important crops (wheat, oil palm, sugarcane, soybean, and maize) from the GAEZ Data Portal. They were used to generate a spatial dataset on the actual availability of currently uncultivated land suitable for rain-fed agriculture in areas that have a population density of fewer than 25 people per km<sup>2</sup> and are not listed in the world database on protected areas (WDPA, 2013).

### Geospatial analysis

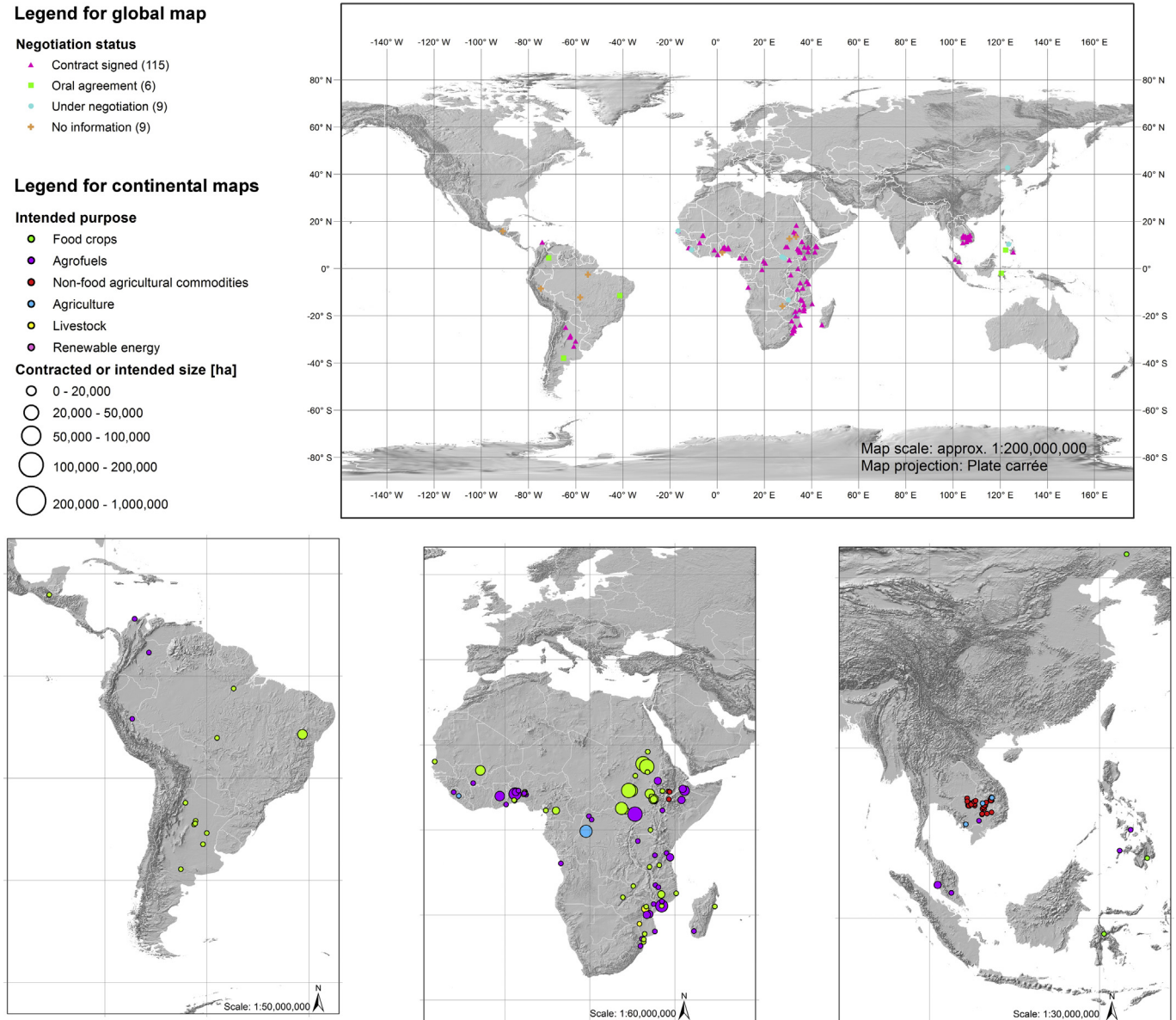
All analyses of geospatial data were performed using ESRI's ArcGIS Version 10.0. The Land Matrix data first had to be converted from tabular format into a geospatial dataset. In line with their accuracy, the locations of land deals were buffered by 10 km, resulting in a circular buffer area of around 31,000 ha per deal. This was done to take account of the fact that the influence of large-scale land acquisitions normally extends beyond the actual area under contract, in the form of competition for land and other resources. The buffer also mitigates the problem that location data in the Land Matrix database do not consist of the exact polygons (boundaries of land acquired) but only of a single point in space, often the location of the farm operation's main buildings, near roads or settlements.

Spatial statistics were calculated for all thematic datasets described in previous section and all buffered sub-datasets. This included frequency statistics for all datasets, as well as percent shares of nominal classes for datasets containing nominal data (e.g. land cover).

### Limitations

In line with our methodological objective of assessing opportunities and constraints of using the Land Matrix database to explore socio-ecological patterns characterising target contexts of large-scale land acquisitions, we list some noteworthy limitations of the approach below. They are further reflected on in the Discussion section, when evaluating the insights gained from our study.

- *Limitations inherent in the Land Matrix database:* Anseeuw et al. (2013) provided a comprehensive overview of challenges related to the Land Matrix data. These challenges are also

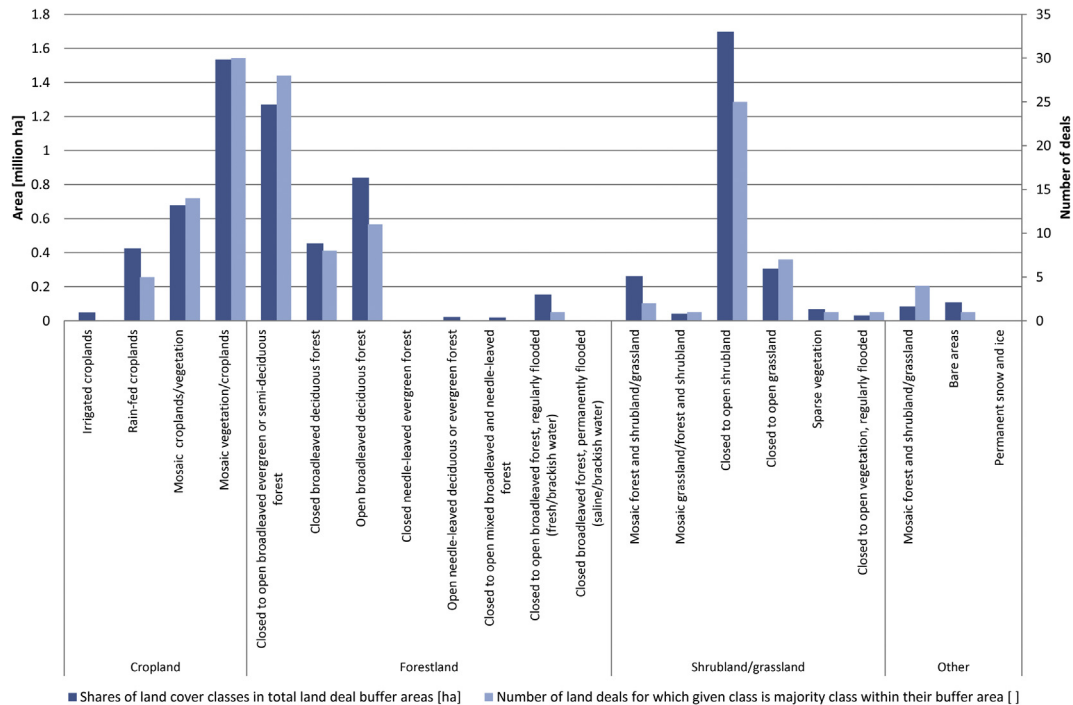


**Fig. 1.** The global map gives an overview of the large-scale land acquisitions documented in the Land Matrix database (situation in April 2013) with a spatial accuracy of <10 km. Coloured symbols indicate the negotiation status of these land deals. The more detailed continental maps also provide information about intended purposes and size of the deals.

relevant to the present study. Apart from the difficulties of capturing a highly dynamic phenomenon and dealing with data that must be gradually improved by triangulating information from different sources, a few other key issues are worth recalling. 1) We take into account only transnational land acquisitions; in some countries, these might be outnumbered by domestic investments. 2) Some deals were recorded in the database based on rumours, and others were cancelled long time ago. We took account of these dynamics by providing information about the negotiation status (Fig. 1) and by excluding deals that failed or were cancelled, or for which the information recorded was dubious or incorrect. 3) The dataset may be biased in the sense that its geographical coverage might reflect the strengths of partner networks reporting land deals, the openness of data providers, or even unbalanced media interests in certain regions. The high density of cases in Africa (Fig. 1) might hence be a reality, revealing Africa as the preferred target

continent for large-scale land acquisition (Cotula et al., 2009; Deininger & Byerlee, 2011); but it might also be the result of methodological biases. As this will remain difficult to determine, we refrain from making any statements about total incidence of deals per region and do not differentiate between geographical contexts by continent. Instead, we focus on general patterns emerging from the total sample.

- **Limitations related to geospatial datasets:** It is obvious that using satellite imagery and global datasets to approximate local geographical contexts has huge limitations – despite the crucial advantage of ensuring global comparability of the selected indicators. Various studies have aptly described the pitfalls of using global spatial data to describe local land use (Nalepa & Bauer, 2012; Rindfuss, Walsh, Turner, Fox, & Mishra, 2004); their insights have been carefully taken into account. Another limitation concerns the datasets' spatial resolution. While the GlobCover dataset with its 300-m resolution provides fairly



**Fig. 2.** Shares of land cover classes in total land deal buffer areas [ha] and number of land deals mainly affecting each class within their buffer area [ ]. *N* = 139. Land cover classes were grouped into four broader types: cropland, forestland, shrubland/grassland, and other land. Based on GlobCover 2009 data.

accurate information on land cover, other agricultural information such as yield gap, percentage of agriculturally cultivated land, or suitability for rain-fed agricultural cultivation with its resolution of 10 km is very coarse, assigning the same value to every point within an area of 100 km<sup>2</sup>. The relevance of these limitations is taken into account in our discussion of findings (Section Discussion).

**Results**

We can neither assess the sustainability of large-scale land acquisitions nor devise policies on them without referring to the specific socio-ecological contexts in which they are being implemented. With this paper, we aim to complement the growing number of case studies offering knowledge about specific local contexts, by providing evidence of general socio-ecological patterns characterising target contexts of large-scale land acquisitions worldwide. To detect these patterns, we linked the best available set of georeferenced data on land deals – comprising information on 139 deals – with selected geospatial indicators that we consider useful proxies for socio-ecological characteristics of land deal target contexts. These indicators include land cover, population densities, and accessibility. In addition, we also replicated existing country-level global assessments of agricultural potential based on yield gaps and availability of suitable but uncultivated land at high spatial resolution.

*Land cover, population density, and accessibility*

Fig. 2 presents land cover classes targeted by the large-scale land acquisitions in our dataset, based on analysis of GlobCover 2009 data. Even though some of the land deals in our sample

(18 of 139) were signed prior to 2009, this year is nonetheless a good point in time for assessing land cover conditions prior to the commencement of large-scale operations. The process of land development is usually lengthy and uncertain; we know that most of the area covered by these specific deals was not yet developed in 2009.<sup>3</sup> Thus, while the GlobCover 2009 data do not represent a literal baseline snapshot, they have the advantage of being relatively close in time to the beginning of many projects' operational periods.

For 35% of the land deals, the most important land cover classes within the buffer area are mixed mosaics of cropland and vegetation, as well as rain-fed cropland. These classes indicate that the land was being used for farming; hence it seems very likely that these deals create considerable competition for land. In this context it is worth noting that agriculture in the relevant countries is predominantly small-scale. Various types of forest are the main land cover classes targeted in 34% of the cases, with closed to open broadleaved evergreen or deciduous forests being the most affected. Apart from deforestation and forest degradation as a possible land conflict, it is important to consider that forested landscapes in the relevant countries often ensure the livelihoods of shifting cultivators, forest dwellers, and other users. The third-most affected land cover class is closed to open shrubland, with almost 26% of deals occurring predominantly on such land; these deals might affect pastoralist communities. "Other land", including bare areas, is the main land cover type targeted by approximately 3% of all land deals analysed.

We also examined whether land deals affect protected areas, and found that 34% of the deals had buffer areas that overlapped with protected areas. Of these, 14 deals had more than half of their buffer area in a protected area. Such overlaps require further investigation and raise concerns about possible conflicts between conservation organisations, local people with curtailed land use rights, and new private investors.

The issue of land cover classes affected is closely related to questions of how densely the relevant areas are populated and how

<sup>3</sup> Although these 18 pre-2009 deals comprise a significant area (773,000 ha), most of this is made up by a single deal (600,000 ha, signed in 2008) that remained non-operational into 2011 (Deng, 2011). Most of the remaining deals were signed in 2007 or 2008.

easily they can be accessed from the nearest cities. In view of numerous reports of local populations being evicted or losing access to land, population density might yield an approximate assessment of the number of people potentially affected. Analysis of population densities and accessibility within the 10-km buffer radius around each land deal's location provides a more accurate picture than national averages. Table 1 shows that 52% of the studied land deals occur in areas with population densities above 25 people per km<sup>2</sup>, and 22% even in highly populated areas with more than 100 people per km<sup>2</sup>. Conversely, about 48% of the deals are located in more sparsely populated areas.

The data on population densities enabled us to make further calculations, taking into account 105 georeferenced land deals for which we had precise information about the actual area under contract. Excluding 14 statistical outliers with more than 500 people per km<sup>2</sup>, we estimate that the remaining 91 land deals might affect a total of 3.1 million people. If we extrapolate this result proportionally for all land deals reported as concluded in the Land Matrix database – which cover 32 million hectares of land – we arrive at an estimated 33 million people worldwide who are potentially affected by the large-scale (>200 ha) transnational land acquisitions inventoried to date.

Are investors targeting easily accessible areas to reduce operational costs and facilitate market access? Or can land deals be an opportunity for bringing road infrastructure to remote areas and covering part of the maintenance costs? These are hotly debated questions, and we believe that our analysis of accessibility contributes relevant insights. As shown in Table 1, more than half of all land deals studied lie within 6 h of the nearest city with 50,000 or more inhabitants; approximately 30% lie within 3–4 h. These figures show clearly that investors do not explicitly target remote land on agricultural frontiers; rather, they prefer easily accessible land with pre-existing infrastructure to reduce production and marketing costs. Accordingly, investors' contributions to major infrastructure projects such as road construction and maintenance in remote rural areas do not seem to be a major development factor.

Having analysed land cover, population density, and accessibility as separate geographical features, we then examined these data jointly to reveal general patterns in the socio-ecological characteristics of land deals. Fig. 3 gives a synoptic overview of the three proxy indicators. Accessibility and population density are indicated by the *x*- and *y*-axes, respectively; the contracted or intended area of each of the 139 land deals is depicted by the size of the filled bubbles; and bubble colours indicate the main land cover preceding establishment of each deal. The correlation between

accessibility and population density is obvious; unsurprisingly, we observe that population density decreases with growing travel time to the nearest city. More importantly, despite considerable variation, we see that cropland affected by land deals is generally fairly easily accessible and fairly densely populated, whereas shrubland, grassland, and forests affected by land deals tend to be more remote and less densely populated. Important exceptions to these trends are densely populated and easily accessible forests and grasslands in Mozambique (MOZ), Sudan (SDN), Ethiopia (ETH), and Senegal (SEN); conversely, remote and weakly populated cropland has been targeted by some deals in Argentina (ARG) and Ethiopia (ETH). Nonetheless, the median values – represented by broken-lined circles – reveal the general patterns. On one end of the spectrum, land deals affecting cropland (35% of all deals studied) have a median accessibility of only 4.2 h and a population density of 81 people per km<sup>2</sup>, indicating strong competition with other claims on this land. On the other end of the spectrum, land deals in forests (34%) are often found in relatively remote areas with low population densities. However, even if this suggests that these deals compete mainly with the provision of global environmental goods and services such as carbon sequestration or biodiversity, the multiple local claims on these resources from the average 11 people per km<sup>2</sup> are nonetheless considerable and need to be factored in. Situated in the middle of this spectrum, land deals in shrubland and grassland (26%) have a median accessibility of 5.5 h and a median population density of 24 people per km<sup>2</sup>.

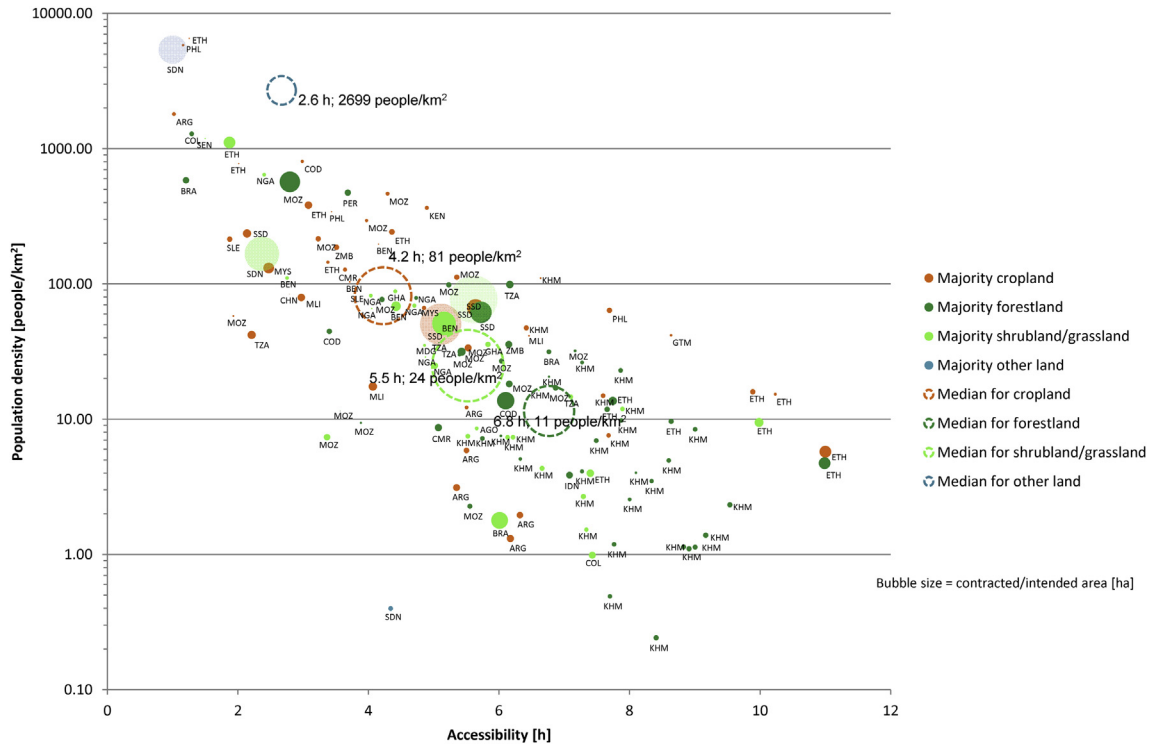
#### Agricultural potential

From a development perspective, investments can be most beneficial if they help to tap the land's agricultural potential more fully. Two key indicators of agricultural potential are the so-called “yield gap” – the gap between potential and actual yields – and the availability of land that is suitable for cultivation but not actually being cultivated. Accordingly, land deals have the greatest potential for advancing development if they help to close yield gaps and occur in areas where suitable but uncultivated land is available (Arezki et al., 2011; Deininger & Byerlee, 2011). A wide yield gap means that the agricultural potential of the land in question is not fully exploited due to a lack of agricultural inputs, inappropriate technologies, and similar constraints. One argument in favour of transnational land deals is, therefore, that foreign investments might help to enhance productivity and close yield gaps by supplying agricultural inputs, know-how, technology, and sometimes even irrigation (Anseeuw et al., 2012). The International Institute

**Table 1**  
Frequency counts of land deals and descriptive statistics regarding mean accessibility [hours] from nearest city with 50,000 or more inhabitants and mean population density [people per km<sup>2</sup>] within the land deal buffer areas.

	Classes	Count	%		Classes	Count	%
Accessibility [hours travel time] (n = 139)	1–2	12.0	8.6	Population density [people per km <sup>2</sup> ] (n = 130) <sup>a</sup>	<25	62.0	47.7
	2–3	14.0	10.1		25–50	18.0	13.8
	3–4	16.0	11.5		50–75	11.0	8.5
	4–5	16.0	11.5		75–100	10.0	7.7
	5–6	22.0	15.8		100–125	3.0	2.3
	6–7	21.0	15.1		125–150	3.0	2.3
	7–8	20.0	14.4		150–175	1.0	0.8
	8–9	9.0	6.5		175–200	0.0	0.0
	>9	9.0	6.5		>200	22.0	16.9
	Total	139.0	100.0		Total	130.0	100.0
Mean	5.4		Mean	261.7			
Median	6.0		Median	33.3			
Min.	1.0		Min.	0.0			
Max.	11.0		Max.	6524.7			

<sup>a</sup> Data on population density were not available for 9 deals.



**Fig. 3.** General socio-ecological patterns characterising target contexts of large-scale land acquisitions. Accessibility and population density are indicated on a logarithmic scale along the x- and y-axes, respectively; the contracted or intended area of each land deal is depicted by the size of the filled bubbles; and bubble colours indicate the majority land cover type within a 10-km buffer around each deal's location. Target countries are labelled with acronyms following the ISO 3166-1 Alpha-3 standard. Broken-lined circles represent median values for the different land cover types.  $N = 139$  (necessary data available for all deals in sample).

for Applied Systems Analysis has estimated yield gaps at the global level, based on various parameters (IIASA, 2010).

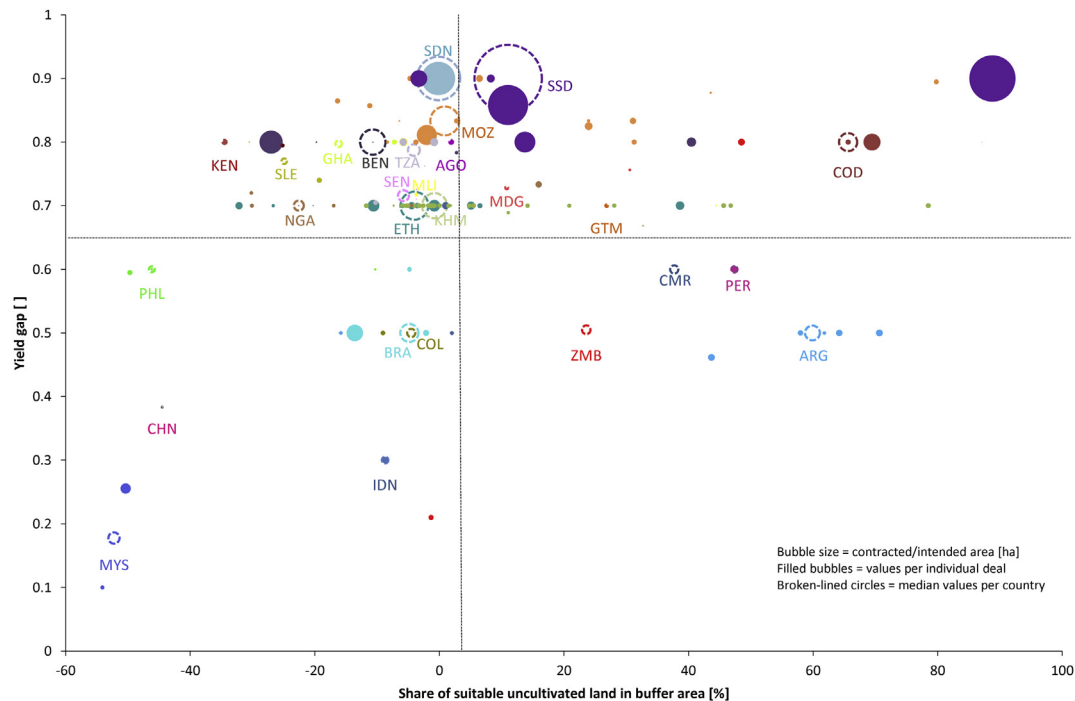
Although the concept of yield gap is generally well-established, there are several things that need to be taken into account when interpreting results. First, more intensive production systems face considerable challenges related to environmental, social, and economic sustainability (IAASTD, 2008). Second, yield indices based on major food crops do not adequately represent the various products emerging from complex small-scale farming systems such as agroforestry or shifting cultivation (Fischer et al., 2002). Third, the many and often “invisible” products of subsistence systems are not adequately captured in agricultural statistics. Accordingly, attempts to close the yield gap by intensifying cultivation practices can lead to loss of the land’s multifunctionality, including its functions as a source of alternative foods, medicine, or building materials (Rerkasem et al., 2009). We use the yield gap concept mainly to engage with the above-mentioned debates on agricultural production potentials; but we emphasise that any related insights must be interpreted with care.

In Fig. 4, we visualise our sample of land deals according to yield gaps and availability of suitable but uncultivated land in their target context (i.e., within the 10-km buffer radius around their location). In doing so, we follow a typology proposed by Deininger and Byerlee (2011), which enables us to compare our results to these authors’ global assessment of where large-scale land deals ought to occur. The x-axis shows the percentage of land that is suitable for rain-fed cultivation but uncultivated within a deal’s buffer area. Small values thus indicate scarcity of land suitable for farming, whereas high values indicate availability of such land; negative values indicate cultivation of land unsuitable for rain-fed farming (e.g. using irrigation). The y-axis displays yield gaps for the 10-km buffer around each deal prior to the deal’s establishment; high

values indicate a wide gap between potential and actual yields. We were able to generate the necessary data for 129 out of 139 deals.

Following the typology proposed by Deininger and Byerlee (2011) and further developed by Anseeuw et al. (2012), land deals can be grouped into four types, corresponding to the four quadrants in Fig. 4:

- *Type 1: Little suitable but uncultivated land available, low yield gap* (lower left quadrant). Land deals of this type concern areas that have scant reserves of suitable but uncultivated land and a low potential for increasing yields. Our analysis of land deals at the local level shows that 12% of all cases and 7% of the total contracted or intended area of all deals fall within this type. These results differ from previous findings, as many target countries attributed to this type by Deininger and Byerlee (2011) may have shifted to other types in our local-level analysis. Anseeuw et al. (2012) found land deals amounting to 17% of the total land deal area to belong to this type, which is significantly more; the difference between their findings and ours, however, may also partly be due to the fact that their analysis included a number of large deals in Pakistan and Indonesia that were not georeferenced and hence not included in our sample. Even if this confounds our ability to interpret the differences to other studies, the fact that a significant share of land deals still falls within this type is alarming. At an average size of 15,151 ha, these land deals targeting areas with little uncultivated land available and little potential for increasing yields are an indicator of highly problematic land allocation practices.
- *Type 2: Suitable but uncultivated land available, low yield gap* (lower right quadrant). This type accounts for only 5% of land deals and 2% of the total contracted or intended area of all deals in the sample. The average size of type 2 land deals is only



**Fig. 4.** Typology of large-scale land acquisitions in terms of availability of suitable but uncultivated land (x-axis) and yield gap (y-axis). Yield gap values represent the majority value within the 10-km buffer around each land deal's location, based on IIASA (2010). Bubble sizes represent the contracted or intended area of each land deal. Colours and acronyms indicate target countries, and broken-lined circles show median values per country.  $N = 129$  (data on agricultural potential not available for remaining 10 deals).

13,298 ha. Argentina is the country with the most deals of this type. Its vast land reserves and perceived good investment climate appear to make this country an attractive target for investors despite relatively low yield gaps.

- **Type 3: Little suitable but uncultivated land available, high yield gap** (upper left quadrant). The 2012 Land Matrix analysis (Anseeuw et al., 2012) found a number of West African countries' land deals, as well as those in Ukraine, Cambodia, and Morocco, to be of this type (only 13% of the area of land deals). By contrast, our analysis shows that 57% of all deals and 43% of the total intended or contracted area of all deals in our sample belong to this type. With a mean size of 23,369 ha, type 3 land deals are much smaller on average than type 4 deals, likely indicating competition for land – and the competing interests that often accompany different forms of agricultural production – in areas with greater land scarcity. By definition, type 3 land deals create particularly intense competition for land with the local population; the large number of these deals in our sample indicates that even as land deals occur in countries that may have large supplies of suitable but uncultivated land at the national level, these deals are not actually occurring in areas where uncultivated land is abundant.
- **Type 4: Suitable but uncultivated land available, high yield gap** (upper right quadrant). This type makes up 26% of all cases and 48% of the total intended or contracted area in the sample. Anseeuw et al. (2012) found an even larger share of total land deal area to belong to this type (58%). Again, the difference is likely a result of our looking at the local, rather than the national level. The fact that approximately one quarter of all deals make up half of the total area of all deals can be explained by the fact that deals of this type are generally quite large: their average contracted or intended area is 58,709 ha.

Overall, large-scale land acquisitions tend to target contexts where suitable but uncultivated land is scarce and yield gaps are

high (type 3). This matches the pattern presented earlier (*Land cover, population density, and accessibility*), where cropland mosaics – mostly indicating multifunctional smallholder agriculture – manifest high population densities and fairly easy accessibility. Type 3 accounts for the majority of land deals in our sample. As their average size is only half that of large deals in geographical contexts with more suitable but uncultivated land, they add up to about half of the total contracted or intended area of all deals in our sample. The fact that our findings diverge from the results of previous analyses using aggregated national-level data shows that spatial accuracy is crucial. Even if investors target countries with vast areas of suitable but uncultivated land and high yield gaps, they frequently end up in areas where land is scarce, and – as case studies confirm – where competition with pre-existing land uses is more likely.

## Discussion

As outlined in the introduction, two objectives guide this paper. First, we intend to challenge narratives maintaining that large-scale land acquisition mainly targets so-called “idle” or “unused” land and thus represents long-awaited investment in agricultural productivity. We pursue this objective by providing systematic evidence that supports an alternative hypothesis put forward in numerous local case studies: that large-scale land acquisition accentuates competition for land and results in conflicts over land in developing countries. Second, we intend to explore the methodological opportunities and constraints of using global datasets, and especially the Land Matrix database, to detect general patterns in large-scale land acquisition which can, in turn, be linked to the substantial case study literature on this topic.

Analysis of the socio-ecological contexts of land deals based on proxy indicators provides, for the first time, a more systematic overview of expected competition over land. The significance of these findings is discussed below based on the three major patterns



of competition over land that are implied by our results. Moreover, the three patterns are discussed in terms of their possible links to processes described in case study research.

- a) *Land acquisition targeting densely populated and easily accessible areas with cropland mosaics*: This pattern applies to about one third of land deals in our sample and substantiates case study-based criticism that the assumption about land deals targeting mostly “idle” or “unused” land is fundamentally flawed (Borras, Fig. et al., 2011; Cotula et al., 2009). Land in this type of context is scarce, causing large-scale land acquisitions to compete with multifunctional smallholder agriculture (Cotula, Vermeulen, Mathieu, & Toulmin, 2011; Matondi, Havnevik, & Beyene, 2011), often under vastly unequal power relations. This competition is reflected in negative impacts of land deals on livelihoods (Schoneveld et al., 2011), gender equality (Julia & White, 2012), and existing property and resource entitlements (Borras & Franco, 2012; Dwyer, 2013a, 2013b; Ito, Rachman, & Savitri, 2014; Schneider, 2011). In short, case study research related to this pattern shows that the negative impacts of such land deals not only outweigh their benefits but also threaten – and in many cases, actually bring – a profound transformation of social relations, often with a strong class dimension. Accordingly, policy debates need to focus not just on the relative costs and benefits of different business models, but on their social and geographical distribution, both within project-area landscapes and on a global scale.
- b) *Land acquisition targeting moderately accessible and moderately populated shrub- or grassland*: About one quarter of the analysed land deals follow this pattern. In many cases, this type of land is used as rangeland under pastoral systems, but it also includes fallow agricultural land. It is often managed as a common-pool resource. From a purely economic perspective, such land may appear underused and be seen as offering considerable potential for development. Even if explicit case study research is still scarce, it has been shown that the establishment of monoculture and mechanised large-scale farms in this type of socio-ecological context involves important trade-offs (The Oakland Institute, 2011). According to this report, pastoralists are often marginalised and ignored in decision-making processes, and at the same time they are particularly vulnerable to loss of land rights and to disregard for their specific claims on socio-ecological functions of land. What is more, environmental risks related to water stress and desertification are considerable (Woodhouse, 2012). Initiatives that specifically address land acquisition in rangelands are currently being established (Land Portal, 2014).
- c) *Land acquisition targeting largely remote and sparsely populated forestland*: This pattern again applies to one third of the studied land deals, and it contrasts with the competitive situation found in densely populated and easily accessible croplands. Case studies have described two relevant processes that relate to this pattern. Firstly, research has shown that land acquisition is often used as a means of securing access and control over natural resources such as forests and water (Borras & Franco, 2012). Control over forests is an important incentive for investors, as logging may compensate for initial capital investments (Schneider, 2011; Vrieze & Naren, 2012). Moreover, forest-related land use systems such as shifting cultivation lend themselves to rapid transformation, as they are widely viewed as backward and economically unproductive (Heinimann et al., 2013; Hurni, Hett, Heinimann, Messerli, & Wiesmann, 2013; Van Vliet et al., 2012). Secondly, studies have found neoliberal tendencies in initiatives to conserve natural resources. Conservation agencies who acquire land for purposes of environmental protection or carbon sequestration have been accused of contributing to “green grabbing”, as their initiatives

also deprive local people of access to land (Benjaminsen & Bryceson, 2012; Fairhead, Leach, & Scoones, 2012; Leach, Fairhead, & Fraser, 2012).

Together, these three patterns provide a general, but nonetheless differentiated picture of the type of socio-ecological context in which large-scale land acquisitions most frequently occur. We also think that meaningful relations can be established between these patterns, on the one hand, and evidence of certain processes and causal relations from the case study literature, on the other. Our findings expose substantial shortcomings in previous global assessments: correlations between the occurrence of land deals per country and agroecological indicators of these countries have led to faulty conclusions that land deals mainly target “idle” or “marginal” land, where investments in agriculture are urgently needed (Arezki et al., 2011; Deininger & Byerlee, 2012). Our research has shown that analysing these characteristics with a spatial accuracy of less than 10 km leads to contradicting results. This might be explained by insufficient quality of indicators and data or by the level of aggregation, thus distracting from the fact that a country’s “available land” is not the land that is acquired through large deals. More importantly, however, our results show that the opportunity to help improve agricultural productivity is not the primary reason why land deals occur in countries with low productivity. Investors’ interest in countries with low national agricultural productivity must hence be explained differently. Is it possible that investors turn precisely to the above-mentioned global agroecological assessments for guidance? After all, they offer access to the “best available” data. Another reason might be that governments in countries with low productivity seek to attract investments in the agricultural sector by means of favourable policies. Finally, we also need to recall that the indicators used in the said global assessments reflect purely economic valuations of land, disregarding social and environmental functions that are highly valued by stakeholders from the local to the global levels.

Based on these insights, three methodological issues warrant discussion. First, we have seen how important it is to georeference large-scale land acquisitions in global databases. Knowing the exact location of the land acquired is a prerequisite for understanding a land deal’s geographical context – and this, in turn, is key in assessing a deal’s sustainability. However, despite intensive cross-checking and additional inquires we succeeded in georeferencing only 139 of 892 deals with an accuracy of less than 10 km; another 408 deals could only be located with an accuracy of 10–100 km. High-quality analysis depends on larger samples. Information on locations hence needs to be systematically integrated into data collection mechanisms. The Lao concession inventory is an example of an attempt to collect information about the location of all land concessions in a country along with detailed data on various other parameters of the deals (Schönweger, Heinimann, Epprecht, Lu, & Thalongsechanh, 2012).

Second, available global datasets have considerable limitations, as discussed in above (see *Limitations*). Besides known trade-offs between global comparability of indicators and inherent technical and methodological limitations, our experience underlines the importance of ensuring that the spatial resolution of data layers corresponds to the accuracy of data on land deal locations. We believe that in our case this was fulfilled for land cover, population density, and accessibility data. By contrast, yield gap data had such a low level of spatial differentiation that they enabled only very rough estimations of agricultural potentials. Given the high number of land deals georeferenced with only regional spatial accuracy (10–100 km), it remains to be demonstrated whether these deals could be used for geospatial analyses at higher levels of scale. The usefulness of such generalised data layers could be assessed based

on a careful comparative analysis of evidence created at different spatial levels.

Third, we should recall an important conceptual and methodological limitation on linking complex processes of land acquisition with general patterns of geographical and socio-ecological contexts in which land deals occur. Among the key factors that various case studies have described as influencing the outcomes of land acquisitions, only few can actually be represented or approximated by means of spatio-temporal datasets. Furthermore, a mere correlation between large-scale land acquisitions and geographically traceable phenomena such as resource degradation or eviction may also suggest inaccurate causal relations, as illustrated in various case studies (Dwyer, 2013a; Hought, Birch-Thomsen, Petersen, de Neergaard, & Oelofse, 2012). Further research and meta-analysis of case studies is hence needed to identify such key factors, describe recurrent causal linkages among them, and explore their spatial signatures. Such approaches will be needed for testing the validity and the reach of case study findings in view of scaling up and scaling out evidence for policy.

### Conclusions and outlook

Research on large-scale land acquisition in the past five years has been confronted with substantial challenges. It has had to respond to a fast-moving context, and at the same time has been expected to provide urgently needed evidence for policy and operate in real time. In-depth case studies seeking to understand the complex processes in concrete geographical contexts have been accused of being too slow and of limited validity when it comes to scaling up or scaling out findings (Anseeuw et al., 2012; Heinimann & Messerli, 2013; Messerli et al., 2013), while endeavours to aggregate hectares and describe the overall scale of land deals have been struggling with data quality, triangulation methods, unclear definitions, and rapidly changing figures (Anseeuw et al., 2013; Edelman, 2013; Oya, 2013; Scoones et al., 2013). In light of these criticisms, and encouraged by the attention and commitment that the debate has received from many different actors, some authors have called for a new phase of research: one that should be devoted to reflection, analysis, and to gaining deeper understandings of investments in land (Scoones et al., 2013).

This paper is intended as a contribution to such a new phase of research. We have analysed the socio-ecological characteristics of contexts targeted by large-scale land acquisitions, using the largest available sample of georeferenced land deals, in order to understand how emerging patterns can be related to processes of land investment. Reflecting on this intention, we arrive at three conclusions.

First, three distinct socio-ecological patterns emerge from the analysis. Two of them account each for about one third of the land deals studied: densely populated and easily accessible croplands, and more remote and sparsely populated forestlands. Another quarter of the land deals in our sample occur in moderately accessible and moderately populated shrub- or grassland. Each of the three patterns involves a distinct type of competition over land, between its various functions and related stakeholder claims. In light of these results, country-level assessments that correlate land investments with indicators of agricultural potential seem disputable in terms of concepts, methods, and content.

Second, we conclude that place-based analysis by land scientists and geographers has considerable potential for exploring general patterns in large-scale land acquisition. In order to enlarge the samples available for such analysis, geographical information needs to be integrated more systematically into data collection mechanisms. At the same time, scales of analysis must be chosen with care so as to ensure compatibility between the spatial accuracy of data

on land deal locations and the resolution of available geospatial data layers.

Third, we have shown that socio-ecological patterns in large-scale land acquisition can be related in a plausible way to processes of land investment described in the case study literature. Nonetheless, it remains challenging to empirically link these mostly process-based insights with place-based analysis of socio-ecological contexts. We hence need to refine approaches and methods for linking the two perspectives. Bringing them together more consistently will help to increase the validity and the reach of our findings in terms of a contribution to evidence-informed policy debates.

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### Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.apgeog.2014.07.005>.

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