A question of scale: the construction of marginal lands and the limitations of global land classifications

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A question of scale: the construction of marginal lands and the limitations of global land classifications

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Abstract

With the growth of the biofuel complex, the concept of "marginal land" has emerged as a term commonly associated with the promotion of agrofuels. Remote sensing and other data are used to globally characterize land as marginal based on predominantly biophysical features that render them "non-competitive" for the purpose of commercial agriculture. "Marginality" is a relative and non-static term, however, dictated by the economics of localities—the scale on which land use decisions are actually made. This paper: (i) questions the very notion of "marginal land" as a relevant and prescriptive concept given its inability to be uniformly operationalized across scales and (ii) advances the notion that "marginal land" is an artificial spatial construct that serves to re-frame land in a way that neglects socio-ecological processes in order to re-frame it in support of principles based in resource productivism.

With the continued promotion of agrofuels[1] as a partial solution to the world's carbon problem, concern has been raised as to whether it is ethically acceptable to support the commercial cultivation of fuel crops within hungry countries. To circumvent the food versus fuel debate, it has been suggested that agrofuels be dedicated only to what are being referred to as "marginal lands". For example, according a report issued by the Renewable Fuels Agency, an independent sustainable fuels regulator commissioned by the UK government, agrofuel policies should ensure that agricultural expansion is "directed towards suitable idle or marginal land, or utilizes appropriate wastes, residues or other non-crop feedstock" (Gallagher, 2008). What is meant by "marginal land", however, not precisely known. In their study attempting to estimate the extent of marginal lands in 19 countries, the Asia-Pacific Economic Cooperation (APEC) was right to point out that, indeed, the term seems to be used "quite loosely" and "without definition" (Millbrandt and Overend, 2009). A survey of the literature confirms this; it is not uncommon in studies discussing the energy potentials of various agrofuel crops for authors to acknowledge food security concerns by making a passing statement that marginal or degraded lands should be used for biomass cultivation without explicitly defining the term.

Historically, marginal lands have been discussed in a variety of different academic contexts and can be found in development and environmental literature as well as literature associated specifically with topics in agricultural development and agricultural economics. Topics range from examining land previously favored for agriculture that has been beset by biophysical "marginalization" (degradation) caused by land misuse/overuse as well as the exploration of the relationships existing between the degradation of vulnerable or fragile lands and poverty. (CGIAR TAC 2000). Lately, it is not only appearing more frequently in academic literature, but also increasingly featuring in non-academic contexts such policy briefs, governmental planning documents and in the media. To complicate matters further, states often their own nuanced language to refer to land with agrofuel potentialities that are, of course, relative and not linked to any broader standardized definition. These may include degraded, abandoned, idle, or wasteland, among others (Wiegmann et al 2008, Tang et al 2010). There is irony in that a term may seem at the same time ubiquitous yet even more difficult to pin down.

So while not new or confined to a specific discipline, there has been a rising interest in research that attempts to at last formally operationalize and somehow quantify marginal lands on a global scale. Rising commercial pressure on land resulting from a growing global population, changing diets, consumption patterns, and urbanization, among other factors most certainly have contributed to this and sparked incentive to refocus on marginal lands as a direct subject of study in order to frame it as a potential resource. But even the efforts that attempt to more concretely quantify marginal land employ different definitions and diverse methodology. For example, a frequently cited study assessing worldwide biomass potential attempts to remotely identify land "previously used for agriculture or pasture but that has been abandoned and not converted to forest or urban areas" assuming these would be the best areas for agrofuel crops since they are no longer cost-effective for most food crops (Field et al 2007). Others consider land marginal if it is biophysically characterized by variables that generally indicate low inherent productivity potential such as temperature, soil type, slope, and rainfall (Cai et al 2010).

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[1] The term agrofuel is used to distinguish highly capitalized, large-scale, first-generation biofuel projects typified by monoculture and often requiring inputs such as synthetic fertilizer and pesticides. These include fuel crops such as maize, corn, oil palm, soya, sugar cane, sugar beet, oilseed, rapeseed, canola, and jatropha.

Whatever the method, all to some extent rely on some combination of remote sensing, global datasets and spatial tools like GIS in order to remotely identify lands that are not conducive to cultivating competitive food crops or those that are not being currently used for this purpose. Marginal in this sense is consistent with its standard definition as "something on the outside; on the border or edge" in that these lands can be framed as existing outside the current commercial and capitalist agricultural paradigm. It can be assumed that these studies and the attendant marginal land narrative as it applies to agrofuels serves as an prescriptive effort to locate these lands that are "other" to fold them back into framework of resource productivism by commoditizing them for agrofuels. If land is to be viewed as an economic resource, however, "marginal lands" should be considered within an economic context for which a global or even national scale is an inappropriate frame of reference. Land use decisions in agriculture are made on a local scale and determined not only by the biophysical fitness of the land itself but by wide variety of shifting socioeconomic factors that determine the best alternative for the owner at any given time. Moving from local to static global characterizations of land suitability, prescriptive relevance is lost since "marginal land" can only understood within the context of a specific and clearly defined situation.

As a corollary to the establishment of these "other" lands, a new culture of people who are characterized by their dependence on these low-valued lands emerges-- their "marginality" not contingent upon their relative position to a physical center, but upon the fact that they are dependent on these disparate, decentralized, rural in-between places that are biophysically deemed as "other". Many have questioned this conceptualization of "marginality" given that any non-market value that this land may hold is simply not considered. For example, even though classified as abandoned or unsuitable for competitive food crop production, the land still may be in use by some groups for medicine, building materials, fuel, subsistence farming, and grazing among others. More to the point: for whom are these lands marginal? (Pinar, 2009). The resolution of satellite imagery does not routinely register small-scale mixed farming and subsistence agriculture nor tell the whole story about how lands are being used by local people. Though reflecting on the marginal lands narrative in this way doesn't move us any closer to a definitively operationalizing the term, it begs the question of how socio-ecological processes are considered and reflected within a problematique discursively framed on a global level.

The overarching goal of this paper is to problemitize the concept of marginal lands through the lens of scale. Marginal lands operationalized and quantified from a global scale may effectively reflect land parcels that are currently excluded from the capitalist food/biofuel regime, but they are an artificial and spatio-temporally static construct that, on their own, have little practical relevance for guiding socially or ecologically sound land use policy. This is partially due to the fact that marginal lands identified based mostly on biophysical characterizations are a non-sequiter for identifying economically marginal land on the ground, and partly because global models cannot completely characterize how the land is actually being used.

Despite this, the notional language of global models continues to be used resulting in the conflation of suitability and availability. When used in a politicized context, it also gives a false sense that these land classifications are ontological and have provided a foolproof tool by which agrofuel investments can be ethically sanctioned. Co-opted on a national level, this narrative also provides colloquially vague terminology that is used to justify land allotment in countries seeking investment without completing due process in regard to land inventories and environmental impact assessments. Framed at the global level, this sociospatial ordering of marginal lands is in itself an express form of power-knowledge that feeds the collective northern imagination that there is still surplus land yet undefined by endemic socio-ecological relationships waiting to be commoditized for agrofuels. In this way, “marginal lands” have been established as the first contemporary, post-scarcity resource imaginary that has emerged with the recent concomitant food-fuel crisis, and one that will continue to co-evolve with increasing global commercial pressures on land.

Agrofuels and rising commercial pressures on land

In the mid-2000s, optimism ran high regarding the potential of agrofuels to redress a host of global concerns such as greenhouse gas emissions, energy security, and rural development (Gallagher 2008). Since that time however, concerns have been raised that large-scale agrofuel projects may have adverse environmental, social and economic impacts. On the environmental front, these include water stress and soil erosion as well as concerns that upon complete life cycle analysis, agrofuels may only compound the problem they are ostensibly intended to ameliorate: namely carbon debt (Fargione et al 2008, Scharlemann, 2008). The food-fuel crisis of 2007-08 also sparked speculation about the contribution of agrofuels expansion to soaring food prices. During this time, the term “global land-grabbing” emerged to refer to reports that large parcels of arable land were being transferred between sovereign states often in an *ad hoc*, non-transparent, and sometimes legally questionable manner. In light of these facts, original claims that agrofuels were the answer to jumpstarting stagnating rural economies began to be seriously questioned as the social costs of these projects became apparent including the displacement and lost livelihoods of small farmers and other vulnerable populations in countries characterized by insecure land tenure rights and poor governance (Cotula et al 2008, World Bank 2010). Many projects ended up experiencing delays or have been shelved due to lower oil prices and the fervor around agrofuels seemed to have abated.

Despite a decidedly more cynical approach on behalf of many investors, government, and policy organizations, agrofuels still very much remain part of the portfolio of assumed solutions to the carbon problem and the expansion of agricultural land dedicated to this purpose is imminent. For example, though the UK dropped their initial objective regarding the contribution of agrofuels to the country’s fuel mix by 2020 to 10 percent in response to concerns over potential impacts on food prices, they simply do not have the resources to be able to meet even this goal through domestic production alone (Gallagher 2008). Part of the persistence of agrofuels may be due to momentum established in the wake of this last crisis-- a period characterized by the establishment of increasingly sophisticated and intricate corporate-state arrangements referred to as the “emergent biofuel complex”. This complex serves agricultural and energy industries faced with the pressure of rising costs and thinner margins and shows little signs of slowing down (Borras Jr. et al 2010, Neville and Dauvergne 2010).

So while only about 14 million ha (one to two percent of the world’s arable land) is currently devoted to agrofuels, a mid-range estimate of 500 million additional ha will be required by 2020 to meet agrofuel ojbectives and could potentially require up to 20 percent of all arable land by 2050 (Gallagher 2008, Liversage 2010). This is in addition to the 280 million ha that the FAO projects will be required by 2030 for expanded food production in order to satisfy burgeoning middle class appetites and an increasing global population (Wirsenius et al 2010). Though demand forecasts are subject to a considerable amount of uncertainty due to the sheer number of parameters of socio-economic and biophysical (the aforementioned model generated by Wiresenius and colleagues contained 1700 parameters and 170 physical flows for each discrete geographical region described). For the purposes of this paper, however, it is enough to know that even if a significant portion of land dedicated to food production could simultaneously produce second generation (lignocelluiosic) agrofuels, some extent of agricultural expansion will be necessary if we are to meet our demands for both food and fuel. The question becomes: where is this surplus land to be found and how can it be identified?

Modern solutions to scarcity: from 'surplus' to 'marginal' land

Databases that formed the basis of subsequent cultivable land inventories were created in the 1970s. They were then brought together in the 1980s to create some of the first global scale assessments and have continued to evolve since that time (Young 1999). Currently, remote sensing and spatial tools such as GIS are the means by which land is being classified, characterized and assessed for its biophysical fitness (or lack thereof) in supporting competitive agriculture on a global level. For example, the International Institute for Applied Systems Analysis (IIASA) along with the Food and Agricultural Organization (FAO) have been instrumental in developing the contemporary incarnation of what are referred to as Agro-Ecological Zones (AEZ): a standardized framework for characterizing climate, soil, terrain, and other biophysical conditions relevant to agricultural production based on a combination of global datasets. Building on this framework, The World Bank recently concluded the amount of the remaining arable, or "surplus land" that is uncultivated, not forested, and with population densities less than 25 persons per square kilometer that could be dedicated to the five rain-fed crops of sugarcane, wheat, maize, oil palm and soybean is estimated to be roughly 445 million ha[2] (World Bank 2010). Most of this land is distributed among a small handful of lesser developed countries regions and some transition economies with Sub Saharan African and Latin America ranking at the top of the list (World Bank 2010).

The concept of 'surplus land' (also referred to as 'land reserve', 'available land' or 'land balance') carries with it a sort of reassurance that there will be plenty of land to meet future global demands (Young 1999). This has become a problematic concept for a couple reasons. First, it violates the Law of Ricardian Rent, one of the most established principles of economic theory. This law dictates that the best land will be used first since its cultivation relative to poorer quality land results in lower production costs and higher yields. Socio-economic factors of course may alter land use decisions and land productivity but Ricardian rent assumes that land quality is an inherent and quasi-permanent characteristic that will render certain areas better suited for agriculture than others. Put simply, if there were the amount of quality surplus land that some estimates claim, farming on poorer quality soils would not exist to the extent that it does.

Empirical regional validation strengthens this supposition. In contrast to models that have predicted a cultivable lands balance, the reality reported from researchers doing fieldwork and ethnically grounded studies paints a vastly different picture (Young 1999). For example in 1998,

[2] Note that most of these crops can be used as agrofuel feedstock as well as food

FAO/IIASA carried out a global 'land balance' study where the percent of cultivated land to total cultivable land was 43:57 and 45:55 in Ethiopia and Malawi, respectively (Fischer and Heilig 1998, Young 1999). Aerial photographs capturing the entirety of Malawi over the years spanning 1958-62 had already revealed the more fertile regions of the country to be 100% cultivated along with some lesser quality land fallowing on long rotations. Roughly fifteen years later, the population had grown from 3 to 5 million and cultivation had crept up the hillsides and agriculture extended further onto less suitable lands. A similarly competitive agricultural situation was also observed in Ethiopia during this time period (Young, 1999).

Even if contemporary surplus land estimates such as the aforementioned World Bank assessment acknowledge that there is much less land available in these countries now (it is difficult to imagine any surplus land to be found in a place like Malawi which, as of 2009, has topped 15 million inhabitants), these numbers might yet still be overestimated. Land reported to be "surplus" may be based on unreliable national statistics or its status determined remotely without being validated on the ground. Moreover, it is generally unknown how much of this identified surplus land is cost-effective to develop—it may be prohibitively far from market, located in malaria-ridden lowlands, or contaminated through mining activities. These are just a few examples of specific circumstances that may complicate estimates when the viability of these land parcels are actually evaluated on the ground.

This is not a trivial matter since the perceived availability of land appears to be one of the most important factors in determining the probability of being a destination country for large-scale land acquisition [3] and many countries seeking investment tout the existence of surplus land within their borders. For example, the government of Mozambique has stated that only approximately 9 percent of the county's arable land is currently in use while in 2009, Reuters quoted the Zambian Agricultural Minister saying that Zambia was using less than 15 percent of its land and that more than 30 Mha were "begging to be utilised [sic]" (Cotula and Dyer et al 2008, Tostevin 2010). The 2010 Annual World Bank Conference on Land Administration and Policy seemed to serve as much as a platform for many states' representatives to advertise the availability of cultivable land (while downplaying social and environmental assessments), as it was to discuss some of the major concerns with the scale and speed of recent land transfers.

The latest trend of transnational investments predicated largely upon the presumed availability of surplus cultivable land has troubling implications for a couple reasons. First, investors bringing more land into agricultural production instead of working with existing farmers to increase productivity on currently farmed areas will increase competition for either additional fertile land or land that suddenly becomes cost-effective to farm due to irrigation projects or other technological improvements. There is a danger that local food farmers will be pushed farther onto lower quality land with any remaining favored land being awarded to investors. This not only poses a potential threat to rural livelihoods, but also has implications for food security. An estimated 20 percent of land conceded globally over the last couple of years has been destined for biofuel projects[4] with European investors having already acquired more than five million

[3] Statistically significant result at $P < 0.01$

4 Distinguishing between plans for food and fuel is challenging due to the fact that the same crop may be used for both or plans may evolve during project duration (Cotula et al 2009).

hectares of (mostly fertile) land across the Global South (Borras Jr. et al 2010, World Bank 2010). The destinations of these investments are often food insecure regions raising concerns that fertile land is being diverted to fuel crops. For example, countries like Sudan, DRC, Mozambique, Madagascar, and Zambia all have a prevalence of undernourishment that is between 22 percent and 69 percent yet have been targets for agrofuel investment (FAO 2010.) Prices also matter; economic models indicate a modest US $20/ton carbon tax in combination with improved technology for the production and processing of cellulosic biomass could lead to a massive conversion of farmland from food production and grazing lands to cultivating fuel crops (Field and Campbell 2007).

Decreasing or non-existent remaining, sustainably cultivable land along with evidence that agriculture for fuel and agriculture for food will directly compete with one another for land has created the need to evolve from the surplus land narrative. Here, the emergent construction of 'marginal land' has become remarkably useful—its ostensive purpose to distinguish land not suitable for food crops yet still viable for energy crops. When identified remotely, however, quantifying marginal land is met with many of the same complications that arise in assessing surplus land. The following section explores the challenges in distinguishing land that is both suitable and available from a remote perspective and discusses the limited application of a strictly biophysical characterization of marginal land in understanding how land use choices are actually made on the ground.

Marginal land: limits to biophysical characterization

The term marginal land as it is used in the context of the 'global land rush' generally refers to land that is arable yet difficult to farm. This is largely determined by biophysical characteristics such as soil profile, temperature, rainfall and topography, etc. and many studies may consider the marginal status of any given parcel of land to be determined through biophysical characteristics alone. For example, one of the most recent estimates of marginal land in Africa, China, Europe, India, South America and the continental United States uses fuzzy logic classification techniques combined with remote sensing data to categorize land into areas of low, medium, and high productivity based on physical conditions of the land such as a general soil rating for plant growth, land slope, and climate (Cai et al 2010). Though a biophysical characterization is indeed the first step in determining the potential productivity of a land parcel, more nuanced approaches (usually building on the AEZ framework) recognize marginal is a relative term, and land must be established as biophysically marginal in relationship to a specific reference crop (or group of crops with essentially the same requirements). These considerations are especially important for studies that aim to rule out land that can be dedicated to specific food crops.

Precision is a concern since global land suitability assessments combine various datasets of mixed resolutions; e.g. a soil database at one scale, precipitation data at another, and terrain data at still another. For the sake of tractability, variables will be aggregated to the coarsest resolution represented in the dataset the largest of which generally is a 5 arc minute yielding cells of roughly 10 km on a side (9.3 km at the equator). This means that every point within the 100 km^2 land area of will carry with it the same value for any one variable. Moderate resolution land cover data (pixel size of approximately 250m to 1 km side) is then overlaid onto productivity results allowing for the exclusion of urban landscapes, areas that are currently cultivated, and land that should not be developed for other reasons. This discounts areas crucial for maintaining biodiversity or supporting valuable ecosystem services such as forestlands, wetlands and protected areas. It is at this step when *available* land needs to be distinguished from land that is merely *suitable* for agrofuels (i.e. NOT fit for competitive agriculture) the scale of the assessment becomes a limitation. Land cover data simply does not sufficiently reveal how people are interacting with their physical environment to the degree of specificity required to determine availability in most cases. The conflation of land cover and land use, although often used interchangeably, is not appropriate in this context given that people often have intentions behind land use that that cannot be deciphered remotely.

For example, in areas categorized as grassland, it is not possible to conclude with certainty that the land is idle and not being used by nomadic pastoralists and smallholder livestock grazing without local validation. Determining pastureland within grassland ecosystems is a formidable challenge for those modeling land use; a distinction not inconsequential considering that in Africa, an estimated 50 million pastoralists and up to 200 million agro-pastoralists live across the drylands that constitute 43 per cent of Africa's inhabited surface (IIED/SOS Sahel UK, 2010). Land use may be inferred through the application of proxies such as demographic data and other national statistics to estimate the amount of livestock present in an area but these are inexact.

Insert figure 1: illustration—distinguishing grassland vs. pastureland (managed system)

Another issue is that land that is actually cultivated may be overlooked and rolled into available marginal land estimates because the resolution of the land cover data is too coarse to detect it. Moderate resolution remote sensing data is generally adequate for capturing cultivated cropland in developed countries where managed agricultural systems are represented in large blocks and easily identified. They are monocropped cultivars that "green up" at predictable times during the growing season-- a phenomenon that can be detected through Normalized Vegetation Index (NDVI). Many countries, however, still have very large rural populations where farm sizes are much smaller than a pixel. For example, in Ethiopia, 64.5 percent of cultivated farms occupy less than one hectare and 40.6 pecent are on land parcels of 0.5 ha or less (Gebreselassie 2006). Even data of a smaller resolution (30 arc second) and measuring roughly 1 km on a side will not necessarily capture many of these rural farms or communities. Many of these smallholders intercrop year round and/or rely on subsistence agriculture so the growing and harvesting of such a small area of a particular crop may remain unaccounted for in NDVI assessments. To accurately assess availability for prescriptive purposes, data of a finer scale is required. Images of much higher resolution (1-4 m) can be created from orbiting satellites such as SPOT or IKONOS but data is private, not routinely collected, and inappropriate for using in modeling large-scale estimates. The sum of these overlooked lands may not seem substantial considering that the magnitude of estimated marginal land varies on the order of hundreds of millions of ha between studies, but it must be acknowledged that 1.2 billion people on the planet are already eeking out a living on less favored lands which are currently not discounted from global assessments of "available" land for agrofuels.

Insert figure2: land cover resolution vs. average farm size

Available marginal land analyses have also incorporated estimates of previously cultivated land that has been abandoned with the assumption that it has been degraded to the status of no longer favored land. To know that land has been abandoned, there must be a way to establish it was once used for agriculture. In one oft-cited study, the authors calculate abandoned crop area in each grid cell (5 minute arc resolution) as the difference between the maximum crop area (from 1700 to 2000) and the crop area in 2000 if the difference was positive (Campbell et al 2008, Field and Campbell 2008). Since the vast majority of this time period falls before the advent of remote sensing technology and digital record keeping, estimates of past- cultivated land need to involve proxy measures—in this case, population (Goldewijk 2001). Using moderate resolution landcover data, previously cultivated land that had been converted to forest and urban areas was able to be discounted. These were the only landcover features that were excluded from the estimate meaning all other land was classified as abandoned. Even though the authors concede that some of the abandoned cropland in their assessment is probably currently used as pasture (unable to be distinguished from other grasslands via satellite landcover data), the very term "abandoned" carries the connotation that these identified lands are both unused and available which, of course, is not necessarily the case.

Moreover, the authors point out that their global abandoned land estimate of 386 Mha is subject to the substantial measure of uncertainty of 50% or more (Field and Campbell 2008). Despite this imprecision and the inherent challenges in estimating abandoned land on a global scale, the term continues to be used. For example, in the aforementioned marginal lands assessment by Cai et al, the authors state that they have identified 320-702 million hectares of available marginal land if "only abandoned and degraded cropland and mixed crop and vegetation land, which are usually of low quality, are accounted". Abandoned lands are mentioned repeatedly even though the authors state that they confined their methodology to using strictly biophysically-based indicators of productivity to determine 'marginality' because previous estimates (including the Field and Campbell assessment) are "subject to uncertainty and incompleteness due to the data sources" (Cai et al 2010).

Availability issues aside, it is not always certain which agrofuel crops the land may support if, indeed, these less favored lands are conducive to any type of agriculture. Others may only support one or two types of crops, but viability does not imply productivity. Any ascertained potential for energy crops needs to have been determined with a specific cultivar (or cultivars with similar growing conditions) in mind, yet the biophysical conditions or thresholds conducive to successful biodiesel or second-generation stocks haven't been comprehensively researched and their productivity in regionally specific growing conditions not empirically tested.

Even if a parcel of land was thought to be able to support modest agrofuel feedstock yields based on known or approximated biophysical parameters, it doesn't necessarily mean that its conversion to agrofuel feedstock will be cost-effective. Land far from markets or other infrastructure would be prohibitively expensive to develop. A 2008 study considered saline land, bareland, marshland, reed swamp and tidal flats lands suitable for agrofuels though these lands may not be economically or environmentally feasible to develop (Yan et al 2008). These lands and others on hillsides prone to serious erosion may constitute a significant amount of the 23 Mha of marginal land Chinese officials claim to acceptable for energy crops (Naylor et al 2007). This brings us to another limit of global assessments: if the point is to identify less favored land as an potential economic resource, biophysical characterizations are not sufficient to determine the marginality of one parcel of land relative to another since there are other factors that influence land's productivity value that can only be determined in a local setting.

Marginal land: a socioeconomic characterization

In an economic context, marginal land is defined through the extensive margin of production where revenue is just equal to costs of production (Peterson and Galbraith 1932). Rational land-use decisions will be based on and respond to changes on the extensive margin since it is the point at which a different land use becomes more profitable than the existing use (USDA 2011). This margin is not determined only by characteristics of the land itself, but also influenced by technological, legal, institutional, and marco-economic conditions. Credit accessibility, restrictive land tenure policies and small landholdings also play a role (Wiegmann et al 2008, CGIAR TAC 2000).

Land that is "marginal" is subject to frequent change as a shift in any one of these factors (or the increase in the price of agrofuels) may affect the extensive margin of production pushing landholders to adopt the next best opportunity (James 2010). This also includes the movement of farmers from food crops into agrofuel stock on favored lands if there are no policies discouraging this from happening. Thus the "marginality" of a land parcel can only be determined in reference to the particular economic opportunities offered by the array of land use choices available at that moment and in a localized context and cannot be determined by analyzing land suitability for a single productive use. This is a dynamic characterization that captures how land management and land use decisions are actually made distinct from the global perspective where marginal lands' quasi- permanent status allows for a fixed inventory of generally 'low productivity land' which may or may not be economically or environmentally desirable to dedicate to agrofuels. So while there is no doubt that local agricultural markets can be heavily impacted by external factors and often distant actors, these forces ultimately play out in the local context where remotely fixed categories lose their relevance in the face of ever-changing landscapes.

Macro-scale framing of the marginal lands quest may just be the expected discursive response to what are seen as global problems e.g. "global land grabbing" and "global commercial pressures on land", "global warming". It may be argued that results attempting to remotely identify abandoned land or create suitability classes based on global datasets are not intended to be prescriptive since they do not provide sufficient detail about human-environment relationships on the ground to make land policy and management decisions. Their main application is to create agricultural and natural resource baselines, enable comparative regional analysis, and promote an enhanced level of resource literacy (IIASA, 2010). Authors will often acknowledge limitations in global assessments pointing out that not all the estimated land may be usable and that "trade-offs may exist between the present environmental and ecological value of MAL [sic] and the potential value for biofuel production" (Cai et al, 2010). Caveats state that "final land availability will be affected by not only the physical feasibility factors…but also global energy and food markets, technological innovations, social and institutional adaptations and accommodations, engineering infrastructural support, and resources availability (e.g., water for refinery industry" (Cai et al, 2010).

Indeed, validation is always a significant concern in any remote-sensing-based analysis, especially one performed at global scale (Zhang et al 2006). All estimates also need to be refined and interpreted on a localized level if they are to serve as building blocks for land use planning. To serve this end, many platforms have been developed as extensions of basic land productivity assessments. Here socioeconomic information can be more effectively integrated and support decision makers in performing multi-criteria analysis on a sub-national level. But this begs the question: if options are available to combine biophysical land profiles with local conditions in order to maximize utility across a multi-objective resource planning scenario, why exactly are global assessments necessary and what is their role if they lack the descriptive power to be relevant on the ground?

Reimagining landscapes: marginal land as the new "resource imaginary"

Categorizing the material environment through sociospatial ordering is an active process that is never value neutral. For example, when used to demarcate particular spaces, words like 'rural' and 'marginal' often carry the connotation that they are supplementary in relation to a more dominant central core (Bryant et al, 2011). The socially and environmentally heterogeneous spaces that make up the composite supplementary space do not necessarily share any unifying characteristics or identity. Hence, they are distinguished more through what they are not rather than what they are (e.g. 'rural' is first and foremost non-urban, as defined most often through population measures). 'Marginal land' is also a supplemental space though not defined through a relationship to a physical core, but rather to a central ideological tenant: land is either currently cultivated and therefore already functioning inside the capitalist, agricultural paradigm, or it is non-commoditized and marginal--the value of the land expressed as its ability to be eventually folded into that paradigm. The marginal lands narrative is an expression of selective geographical knowledge that reflects a bias toward resource productivism by taking disparate lands with their own distinct socio-natures and crafting an aggregated, static, newly minted commodity supply zone.

Once these spaces are homogenized as "other" and categorized for their perceived material potential, their availability needs to be confirmed and this is where the power of the narrative truly rests. A macro-scale assessment is extremely effective at subsuming the complexity of human-environment relationships and creating spaces that are at once seemingly asocial voids yet still have material potential. In this way, regions of the world have their histories and ecologies effectively minimized to 'mere space', or are at best only partially humanized (Bridge 2006).

This process sets the stage for the recasting and reinterpretation of that landscape in a manner that reflects the hegemonic economic framework. Historically, the discourse of depopulated areas was commonly employed to justify colonial conquest from the depiction of 'pristine environments' in Latin America (Denevan, 1992) or 'wastelands' in Asia (Gadgil and Guha, 1992, Bryant et al 2011). Africa has been the `continent of contradictions' where descriptions of underdeveloped and sparsely populated areas are juxtaposed with descriptions of resource abundance, geological potential, and opportunities for investment (Bridge 2001). The erasure and subsequent re-imagination of landscapes also enable post-scarcity narratives such as 'ghost acreage': a term originally used to describe a situation where a state 'claims' land in a foreign nation (either figuratively through trade or outright) in order to meet domestic food requirements

(Borgstrom, 1965). Remote sensing and other modern spatial analysis techniques are just the newest tools to be used in reinforcing and perpetuating this hegemonic bias by naturalizing the categorizations of world spaces by the potential they represent to be accumulated and commoditized for the "global good". In this way, "marginal land" lends itself well to replace "surplus land" as the new post-scarcity narrative enabling us to dispel our Malthusian concerns about the growing pressures on cultivable land by "growing our limits" rather than face potential limits to growth (Bridge, 2001).

Marginal land: a normative concept

Upon ground-truthing these so-called marginal lands, any power that the narrative holds as a global construct has the potential to be dispelled by the complexities of the socio-ecological relationships that are revealed to exist there. However, states targeted for agrofuel developments may embrace the notional and vague language of these biophysical models as it serves to direct the attention and activities of investors towards the "new" resource-- ostensibly for the sake of spurring rural development. It is here where the global and the local intermingle and 'marginal land' my be evoked to play a normative role in the sanctioning of land allocations and transfers in states that have not completed proper land inventories yet still seek investment.

For example, according to the former Ethiopian Ministry of Mines and Energy draft report issued in 2007-08, about 23 MHa of marginal land are potentially suitable for agrofuels development and though the report stresses that only marginal land is to be used, it does not include any specifics on these earmarked lands, nor does it disclose the means by which they were identified (MoME ,2007; Lakew and Shiferaw, 2008). The sheer scale of the estimate raises questions about actual land availability – shockingly the land deemed suitable for agrofuels in the Ethiopian region of Gambella actually exceeds its total land area. (MoME, 2007; CSA of Ethiopia, 2005; Aklilu, 2008). The region of Oromia supposedly has 17, 234, 523 Mha of marginal land available and since this represents approximately half of the region's total land area, quite obviously includes woodlands, bushlands, grasslands, bamboo forests, and pastures (Akililu, 2008). When questioned about land that had been recently been awarded to SunBiofuels, a UK company investing in a jatropha project in the regional state of Benshangul Gumuz, Ethiopian Mining and Energy officials called the land "unusable" and that it was "just marginal land." The district administrator responsible for the project went on to say that "the whole thing [sic] is nothing but positive" (Knaup 2008).

Methodological opacity when it comes to sorting out marginal vs. non-marginal landscapes on a sub-national level may be a moot point, however, given that many governments lack much more general knowledge about domestic land ownership and land use. In the most comprehensive assessment of large-scale land acquisitions for agriculture to date, the World Bank found that poor management of land information has resulted in an "astonishing lack of knowledge on behalf of land agencies and governments as to what is going on within their own borders" (World Bank 2010). Land being transferred in many cases cannot be categorized as marginal by any stretch of the imagination and if no policies (or enforced policies) exist to prevent investors from acquiring land for fuel crops, there would be no reason for them to direct attention anywhere other than fertile land in order to maximize yields. Given these circumstances, broad statements about marginal land availability seem dubious on the scale and with the amount of public confidence we have seen recently yet it is difficult to contest as the term that is so prone to conceptual drift.

Section to be added

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