A draft concept note for developing a research project in collaboration with faculty and students at the Ostrom Workshop, by FMLT and ESB.

America's outbacks: governing vast open spaces in an overpopulated urban world

Dear Workshoppers,

This text is neither a fully elaborated proposal nor a typical paper. Like the title indicates, it is a draft concept note, which tries to piece together ideas for what has, we believe, the potential to become a research project (or multiple) within the Workshop's "natural resources governance" program. Most of it is conceptual, but the paper also includes preliminary empirical research developed at the Workshop and CASEL using available census and land cover data. At this point, the text lacks references and a broader engagement with the existing literature.

To be upfront [see footnote 1], we struggled with the title. We tried several alternatives, including 'Vast Empty Spaces'; hinterland; under-populated spaces; backlands, etc. We welcome your comments on this regard.

For those reasons, we will very much welcome suggestions, objections or criticism, and also proposals to collaborate on a future proposal. We hope we will be able to refine the idea and the text in preparation for a submission sometime in 2016.

Thanks in advance

FMLT and ESB

America's outbacks:

governing vast open spaces in an overpopulated urban world

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Three main asymmetries will shape the governance of natural resources and landscapes as climate change transforms the Americas during the next 50 years: the predominance of extensive underpopulated spaces in an over-populated urban world; the power differential which favors the latter against the former; and, as a result, the increasing disconnection between who governs and who inhabits sparsely populated spaces.

The Anthropocene concept suggests that we live a post-frontier world marked by the omnipresent influence of human activities in regional and global natural cycles. Yet, this influence comes from ever more disconnected settlements. Sparsely or unpopulated areas remain the dominant feature of the 21st Century, configuring immense regions in which space is more abundant than human beings, referred here as "outbacks", in reference to the Australian bushland, or "vast 'empty' spaces" (VES)[1]. For instance, 92% of Brazil and 73.5% of the US are occupied by only 5.9% and 3.9% of the total population, respectively. Ranging from pristine landscapes to agricultural monocultures to degraded lands, they constitute the other face of the ever-growing concentration of human population in an urbanized world. The interactions between urban areas and these outbacks remain poorly analyzed. New forms of resource chains and governance connecting these areas require new approaches and conceptual frameworks beyond classical analytical dichotomies, such as those related to urban and rural, or frontier and post-frontier environments.

Encompassing the majority of the continents biomes, these vast areas are where climate change impacts and mitigation, such as related to the provisioning of water, food and energy to cities, will be most negotiated during the coming decades. Addressing the so-called food/energy/water nexus requires fundamental attention to the complex network of relationships between densely populated urban areas and these vast landscapes. Further, attention to these relationships brings to fore other equally important nexuses such as those related to mining, waste, and conservation. In some ways, the outbacks are at the same time the problem and the solution for a number of urban problems, depending on how governance arrangements and policies define these relationships. Attention to the configuration, evolution, and implications of these dynamics reveals an array of new research questions, including those still overlooked in current research agendas prioritizing the analysis of the food/energy/water nexus and urbanization.

[1] Despite an extensive literature review, finding a terminology which would fit the underlying concept was difficult. In French "grands espaces" conveys at the same time the idea of "vast open spaces" but also the idea of a relatively small human presence. Possible substitutes in English were "backlands", "hinterland", "backcountry" or more technical description which we will use throughout this text like "low density spaces" or "vast empty spaces". The reference to the Australian bushland, using the plural in order to indicate that there are several types of them, is at the same time illustrative and provocative and seemed a good way to label it, but suggestions are welcome on this point!

The aim of this preliminary proposal is to scope an idea for a long-term research project (or a suite of research projects) based at the Ostrom Workshop dedicated to study the interaction between vast empty spaces and densely populated urban areas, and the ensuing governance challenges; as mentioned above, this topic is still overlooked within emerging research agendas. The scope proposed here aims at bringing together a complex systems perspective to governance analysis as applied to the relationship between different scales. We ask questions about the overlaps of governance of these 'outbacks' and their linkages to urban areas; about resources chains between both types of regions and emerging trends in the competition around natural resources. Building upon collaborative work among faculty at IU and collaborating institutions in France, the USA, and Brazil, and including training of graduate students and post-doctoral scholars, we propose to develop a (or several) proposal(s) that articulates questions spanning from national/continental to sub-regional to local levels.

I. America's outbacks

1. From rural to outback: how to account for what is not 'urban'?

According to the UN, the world's population turned urban in its majority in 2009, and it is expected that urban populations will grow by 84% until 2050. In great part, this is a result of rural to urban migration (including circulation). In the American continent, the transformation from rural to urban societies has been quick and massive. At a continental scale, urban populations now account for more than 75% of the total population[2]. While North America experienced early urbanization, with urban population overpassing rural population in the 1930s, Latin America has experienced similar trends in the 1960s.

Other changes are linked with, or reflected by changes in rural/urban proportions. Until the second half of the XXth century, rural populations were predominantly involved in farm activities, which implied a direct connection to the landscape. Today, less than 2% of the US population live in farms, and probably a lesser share make a living from farming. In Brazil the number of persons involved in the primary sector fell from 32 % in 1980 to 15 % in 2006 and will continue declining sharply in the next decades. The concentration of population in cities and urban areas has a variety of consequences, some less understood than others, for instance the changing relationship between people and landscapes, and the growing disconnection between confined densely populated urban areas and immense rural and wilderness areas inhabited by a very small fraction of the population. The classical rural/urban division does not seem operative nowadays to account for such distribution of people and territories.

In effect, on the one hand, the limit between urban and rural areas seems to have been further and considerably blurred. In many parts of the continent, until few decades ago cities have been characterized by high population concentration, secondary and tertiary activities, and soil artificialization. The countryside was a place of sparser settlements, activities and landscapes linked to agricultural production and in many cases only indirectly connected to other parts of the world. Today, the limits of urban areas are very difficult to perceive as urban inhabitants reside in rural areas, eventually maintaining the landscape, but having jobs or activities totally connected with the urban world. Outside the suburbs, spaces where population concentration decreases rapidly,

[2] United Nations, Urban and Rural areas, 2009

geographers and demographers now identify in the US an "exurbanization" front which is a mixture of rural and urban features exist clearly linked to urban economies (Theobald, 2002). In Brazil, the expansion of "sítios" around the main cities [termed by some as the 'new rural'] could be compared to the "ranchettes" phenomenon of the US West (Travis, 2007). At the same time, a great part of the rural population is now involved in economic activities which are totally disconnected from the agricultural production or from the landscape in general: as Schaefer et al. (2013) mention, "*even in the most rural counties the average employment share of manufacturing […] exceeds and the average share of services is several times that of agriculture*.". These processes of social transformation (with major environmental consequences) have been documented in Africa, Asia, and parts of Latin America as 'de-agrariazation' and 'de-peasantrization'.

On the other hand, in the case of "high amenity areas", the landscape has now acquired other values with the development of tourism. What counts is no more what can be produced on this landscape, but its esthetical value *per se*. In such areas, secondary homes may at times be more numerous than primary residences. Also, retirees from the city may settle in such places with significant consequences to the local population, including an area's demographic composition. As A. Berque notes such moves blur the distinction between rural and wild. According to this author, the Roman Empire, predominantly rural, identified four categories of land: *urbs* (city), *ager* (country), *saltus* (rangeland) and *silva* (wilderness). Each of these categories could be linked to a degree of human presence and human intervention on the landscape. Since the XIXth century, with the emergence of the cities as center of population and power, this system was simplified in the rural/urban difference (or city/non city). What retirees seek when they go to the high amenities area is exactly the "non-city" side, which in general is thought about as "nature." Yet, the latter encompasses a gradient from heavily transformed agricultural[3] areas to pristine landscapes. They therefore incorporate "rural", "rangelands" and "wild" in the same category, exemplifying the fact pointed out by some studies that "rural" is a social construction more than a tangible reality (Woods, 2009).

Today, the notable differences in landscape which were formerly associated with rural/urban categories cannot any more be linked to economic activities or a specific lifestyle, as the emergence of another concept, the "rurban" shows (Antrop, 2000). However, they persist and the expansion of urban areas must not conceal the fact that unconstructed areas are still the dominant feature of our world. Inside those areas, people have specific lifestyles, worldviews and sense of place or place attachment (Tuan, 1974; Lewicka, 2011) in which the relationship with the surrounding environment is different from that of urban population's, including a strong sense of ownership which may conflict with external influences and ideas about how these spaces should be used. Such relationship with "wild" or "natural" space is an important driver in the US society, as pointed out by Meinig (1979) among others.

As discussed, most of the existing classifications do not capture the relationship we are interested in examining. In this sense, we consider demographic density as a good first proxy to classify land occupation. This indicator gives us a new way of distinguishing between urban contexts and low density areas.

[3] Here we refer to the transformation of the natural environment and not to the mechanization. For instance open Alpine landscapes in Europe are often viewed as a model of desirable "natural" landscape, but they are the sub-product of the dairy industry installed over the centuries. They are thus a completely transformed rural landscape.

2. At a continental scale

Taking demographic density as a parameter, the Americas are emblematic of the governance challenges shaping the relationship between vast empty spaces and the metropoles. Space is abundant, since the continent has nearly 30 % of the world's lands for only 13 % of the global population. As illustrated in Figure 1, preliminary research carried out at the Ostrom Workshop and CASEL at IUB shows that at a continental level, almost 57 % of the lands – or 22.7 millions sq. km - have a population density inferior to 1/km² (2.5/sq. m.), and 87 % - or 35.1 millions sq. km - a population density inferior to 15/km² (36/sq. m.). Pristine or unoccupied areas define many parts of the Amazon, the Andes, the American West, the Canadian North, and semi-deserts regions. Also, transformed and economic active landscapes with scarce human presence are abundant, such as the American Midwest, the Central Brazil, the Pampas or the Canadian prairie.

Contrary to what one could expect with the expansion of agricultural commodities production and trade, according to census data agricultural areas are shrinking in many places: the total farmed area was reduced by 20.4 % in the US from 1950 to 2007, and by 11 % in Brazil since 1985. Furthermore, in many regions of the continent rural areas experiencing further decrease in population, leading to decreasing densities (Cromartie et al., 2013), as is the case of 1097 rural counties in the USA in 2010. In the recent years and for the first time, the rural population declined in every category of settlement in the US, despite the migration towards rural space linked with suburbanization or exurbanization[4]. The "densification" (Fonseca and Wong, 2000) process of the US, despite the urban sprawl, thus seems to continue.

But even if scarcely populated, those areas are not disconnected from urban areas. On the contrary, increasingly complex economic and governance networks and relations exist between these areas, including those governing and pressing a wide array of ecosystem services provision, resource extraction, waste disposal, and growing mining and energy industries. Vast empty spaces provide food, fuel, energy power and/or water to urban populations, and increasingly are central to climate change mitigation plans. Their role as conservation areas, recreation, and tourism continue to expand.

These trends and dynamics in settlement, resource use, and conservation often, and arguably, are increasingly leading to conflicts involving different interest groups and stakeholders connected or disconnected in different ways to these landscapes. For example, cities are increasingly dependency on ever more remote regions for water, both influencing and suffering the impacts of events like [distant] droughts or management decisions affecting the environment. The apparent demographic unbalance between urban areas and vast empty spaces is contributing to new forms of projecting power and governance from the former on the latter. New forms of property regimes are emerging as interest groups and governments move to exert control not only on resources, but also on the landscapes themselves. In a significant portion of these regions, Indigenous populations and local communities have experienced both, often simultaneously, new types of land and resource rights and new types of outside pressure for mining resources and land.

[4] USDA, Rural America at a Glance, 2014 Edition

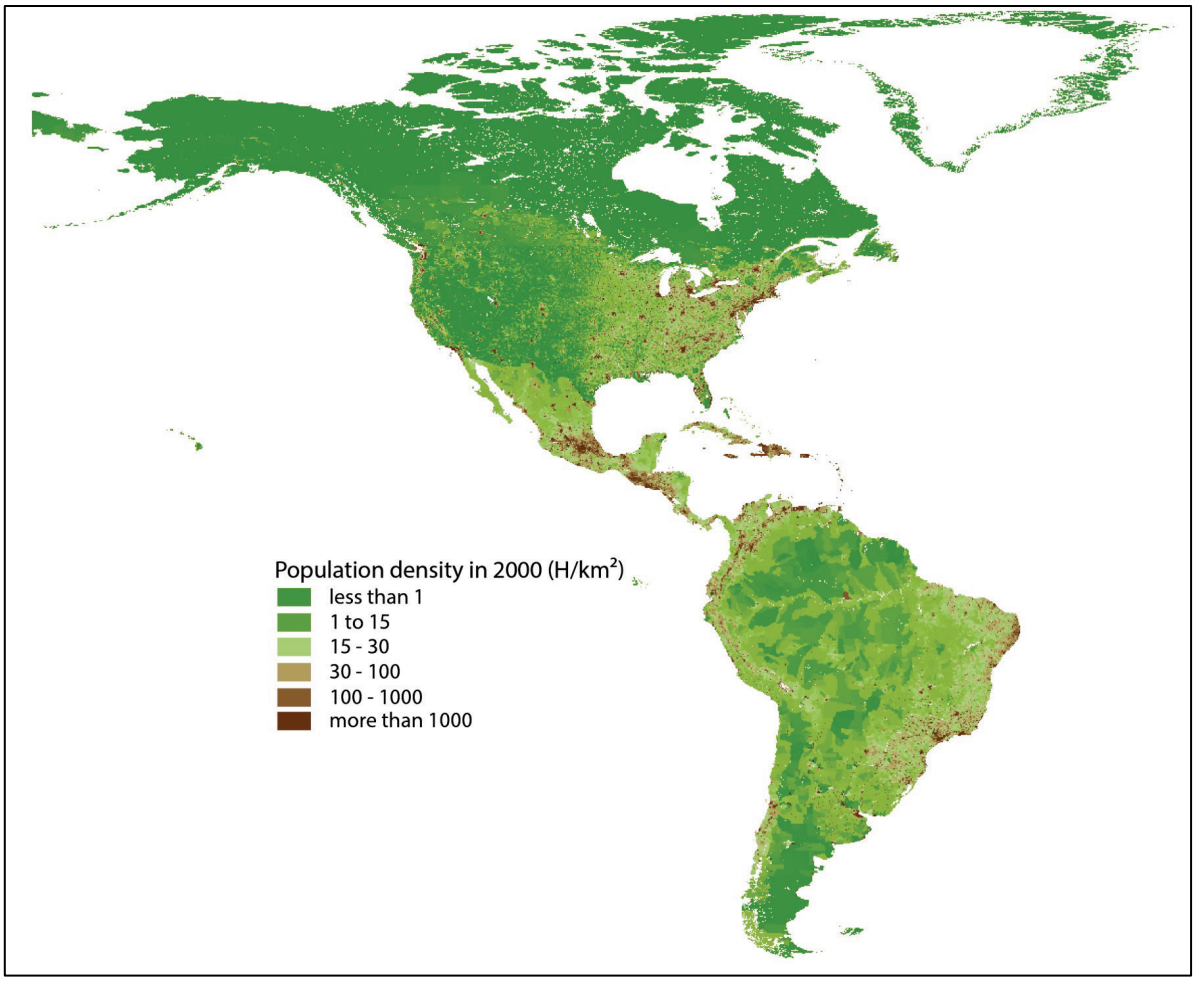

Figure 1: Population density in the Americas (2000).
Map prepared by FMLT at the Ostrom Workshop and CASEL, IUB (data source SEDAC).

Within this reality, the United States and Brazil are emblematic of the trends and the challenges involving in governing vast and low population density landscapes. Both countries have been studied extensively from the perspective of frontier and post-frontier theories; governments in both countries still own enormous extensions of both agricultural and wild areas; and, urban populations dominate both countries.

3. Low density spaces account for the vast majority of Brazil and the USA

Brazil and the USA (we will here deal only with the 48 conterminous states) are comparable in size (8.6 M km² for Brazil and 7.6 for the USA) and in population 189 M in Brazil and 306 M for the US in 2010. The disproportion between densely and sparsely populated areas is spectacular in both countries and may be pointed out by projecting population figures at a much disaggregated geographical scale, i.e. census blocks groups in the USA (215,837 units for the 48 conterminous states) and the census blocks in Brazil (316,575 units). Census blocks are not primarily designed as meaningful units on a geographical point of view. They are primarily designed as basic working units for the census agents and thus are shaped in order to contain a number of households that one agent is supposed to survey. For that reason they tend to be very small in size in cities and much bigger in rural areas, where population is less concentrated. Their limits however are determined so as to match administrative boundaries such as counties or states (and also in many cases protected

areas, military bases, etc.). As those units show a much disaggregated view of the territory of both countries, the may be considered as much more uniform in their characteristics than larger units such as census tracts or counties, which makes the comparison of demographical densities between census blocks or blocks group meaningful[5].

BRAZIL 2010	**< 1**	**1 to 10**	**10 to 100**	**More than 100**	**TOTAL**
Area	5045293	2857821	625138	77997	8606265
Pop. 2010	1232553	9975474	13047199	165482703	189790211
Mean Pop. density	0,24	3,49	20,87	2121,65	22,05
Pct (%) Area	58,62	33,21	7,26	0,91	100
Pct (%) Pop	0,65	5,26	6,87	87,19	100
USA 2010	**< 1**	**1 to 10**	**10 to 100**	**More than 30**	**TOTAL**
Area	2932188	2697363	1647960	375270	7653005
Pop. 2010	1100839	10864288	47431204	247221824	306675006
Mean density	0,38	4,03	28,78	658,78	40,07
Pct (%) Area	38,31	35,25	21,53	4,90	100,00
Pct (%) Pop	0,36	3,54	15,47	80,63	100,00

Table 1: area and population in Brazil and in the US by categories of population densities[6]

For comparative purposes, we have chosen to classify both samples across four classes of density: 1 or less inhabitant per km², 1 to 10 inhabitants per km², 10 to 100 inhabitants per km² and more than 100 inhabitants per km². As a reference, Manhattan has a population density of 27,330 inhabitants per km². As table 1 shows, the two lower categories of population density occupy most of both countries territories: almost 92% of Brazil and 73.5% of the US. In contrast, they group a very small fraction of both countries' populations, respectively 5.91 and 3.9%. At the end of this scale, high-density areas (cities and metropolitan areas) assemble the vast majority of the population (>80%) on very small surfaces, as we aim to represent in the conceptual framework presented in figure 2. The concentration shows however two different patterns, being much more pronounced in Brazil than in the USA. The average density in this category (>100 inhabitants/km2) is over 2100 in Brazil and 650 in the US. This reflects the importance of the 'neighborhood verticalization' in the case of Brazil and urban sprawl in the USA.

The analysis of the spatial distribution of population density in both countries was complemented by an analysis of land use, which we used as a proxy for type of human presence and the degree of artificialization of the environment[7]. We defined a typology with four categories from this dataset: "untransformed" or "pristine" areas, mixed natural and agriculture areas (including grasslands, areas for extensive ranching, etc.), agricultural areas (from small scale agriculture to large scale mechanized farming) and impervious surfaces (from dense suburbs to completely transformed urban areas).

[5] Any calculation of density implies to project uniformly the population on a geographical unit whereas we know that in reality the repartition is not uniform. However, when the units or the population groups are small enough, this distortion is less disturbing.

[6] Source of data US Bureau of census and IBGE; processing by FMLT at the Ostrom Workshop

[7] We chose to correlate census geographic units to the global land cover classification produced by the FAO[7], which is built upon classes which may be more easily translated in terms of a gradient of environmental artificialization.

The results of this second analysis are presented in table 2 and figure 2. They show the same disproportion in the repartition of population between sparsely populated and dense areas, which is [dramatically] shown in figure 2 displaying population per land use categories. This figure provides at the same time a clear view of differences between Brazil (where both population and area repartitions are hyperbolic, although in opposite directions) and the US (where the repartition of the area does not match the repartition of the population curve). This pattern may be another indication of the phenomenon of urban sprawl in the US. Both figure and table corroborate that the vast majority of both countries is occupied by a very small fraction of their population.

BRAZIL, km²	***Population desert***	***Low density***	***Medi density***	***High density***	***TOTAL***
Untransformed	3512043	1091785	185118	33308	***4822254***
Mixed nature / agriculture	1231180	1197059	272815	17806	***2718861***
Agricultural	301969	568955	167103	22640	***1060667***
Artificialized	82	22	102	4242	***4448***
TOTAL	***5045274***	***2857821***	***625138***	***77997***	
USA, km²	***Population desert***	***Low density***	***Medi density***	***High density***	***TOTAL***
Untransformed	1847779	1017048	366399	57578	***3288804***
Mixed nature / agriculture	529208	678730	643118	68759	***1919814***
Agricultural	554408	993303	595930	92150	***2235791***
Artificialized	793	8282	42513	156784	***208372***
TOTAL	***2932188***	***2697363***	***1647960***	***375271***	

Table 2: area in Brazil and in the US by categories of population densities and land use (gray shaded categories correspond to VES).[8]

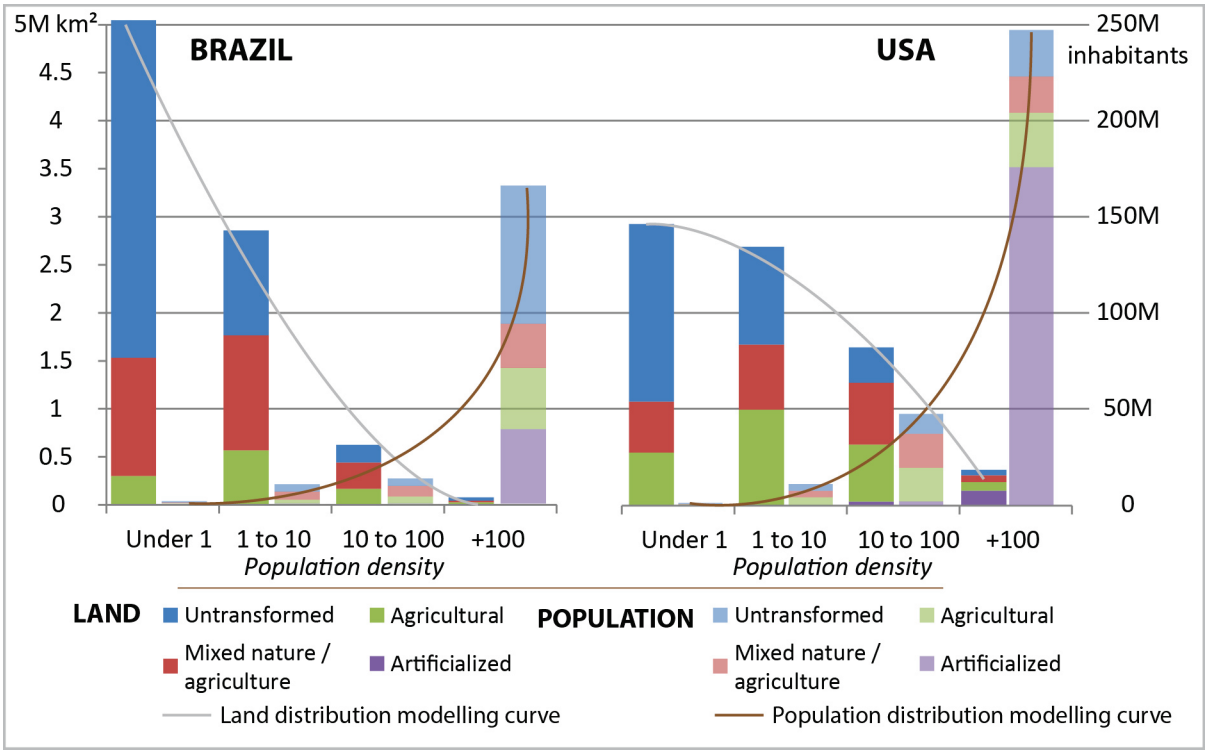

Figure 2: area and population repartition in function of density and land transformation categories[9].

[8] Source of data US Bureau of census and IBGE; processing by FMLT at the Ostrom Workshop.

The upper left cells for each country in table 2 (shaded in gray) may be considered as the "outbacks", which are the object of this proposal. They cover very expressive proportions of both countries. In Brazil, above 5 Mi km² are "population deserts", and more than 2.85 M km² have low population density. Brazil's "outbacks" thus account for 92% of its territory. Regarding the USA, more than 2.9 M km² can be considered as "population deserts", and almost 2.7 M km² have low population density. The US' "outbacks" represent about 65% of the country. As the figure shows, the repartition between the categories of land transformation is different between both countries, leading to interesting research questions, especially prospective ones. Will these countries follow similar trajectories in patterns of land occupation? How will climate change and shifting global resource markets affect the governance of these areas?

Regarding the repartition between the land use categories, 53% of Brazil and 37% of the US are categorized as areas with natural vegetation with very low population density, while 1.5 million km² in Brazil and 1.07 million km² in the US are categorized as "mixed nature/agriculture" or "agricultural" areas but have population densities inferior to 1 inhabitant per km².

II. Conceptual framework: the asymmetries between sparsely and densely populated spaces

1. Defining the first approximation of a conceptual framework

For the purpose of this conceptual note, land may be classified according to a gradient of human presence ranging from unoccupied natural vegetation areas to dense urban centers with a population density of several thousands people per square mile. Both cases are extreme, but nonetheless widely encountered worldwide. They allow us to define two opposite patterns of human occupation: on the one hand sparsely populated areas and on the other hand densely populated areas. The difference between both is grounded on a first and constitutive asymmetry. In the first case, space is very abundant while human beings are not; in the second, small spaces are occupied by a very high number of people.

The second constitutive asymmetry between both cases is about power. Almost in every country, and in particular in 20th and 21st century democracies, densely populated areas have a greater power than the sparsely populated ones. This is due to a combination of majority-rule political systems, absolute wealth and economic capacities. Therefore, the former tend to impose their views and management expectations on the latter, even if not without conflict and resistance. We call the influence of high-density areas on distal lands as "telegovernance." Its influence may vary during distinct historical periods of time. The clash between this telegovernance and local expectations may lead to profound conflicts and be interpreted locally as a kind of colonialism even within the borders of a same country. Yet, there are many examples where areas of low population density and indigenous and traditional population groups have successfully maintained their territorial claims, resource rights, and views of governance, nonetheless in close association with external actors.

Increasing demand for natural resources and food on the part of densely populated urban areas creates a third constitutive asymmetry, the drainage of resources and commodities from scarcely populated areas. This drain is realized through many channels, including in cooperation with the local

[9] Idem.

societies and stakeholders who may benefit from employment, local economic activities, and/or rent and fees.

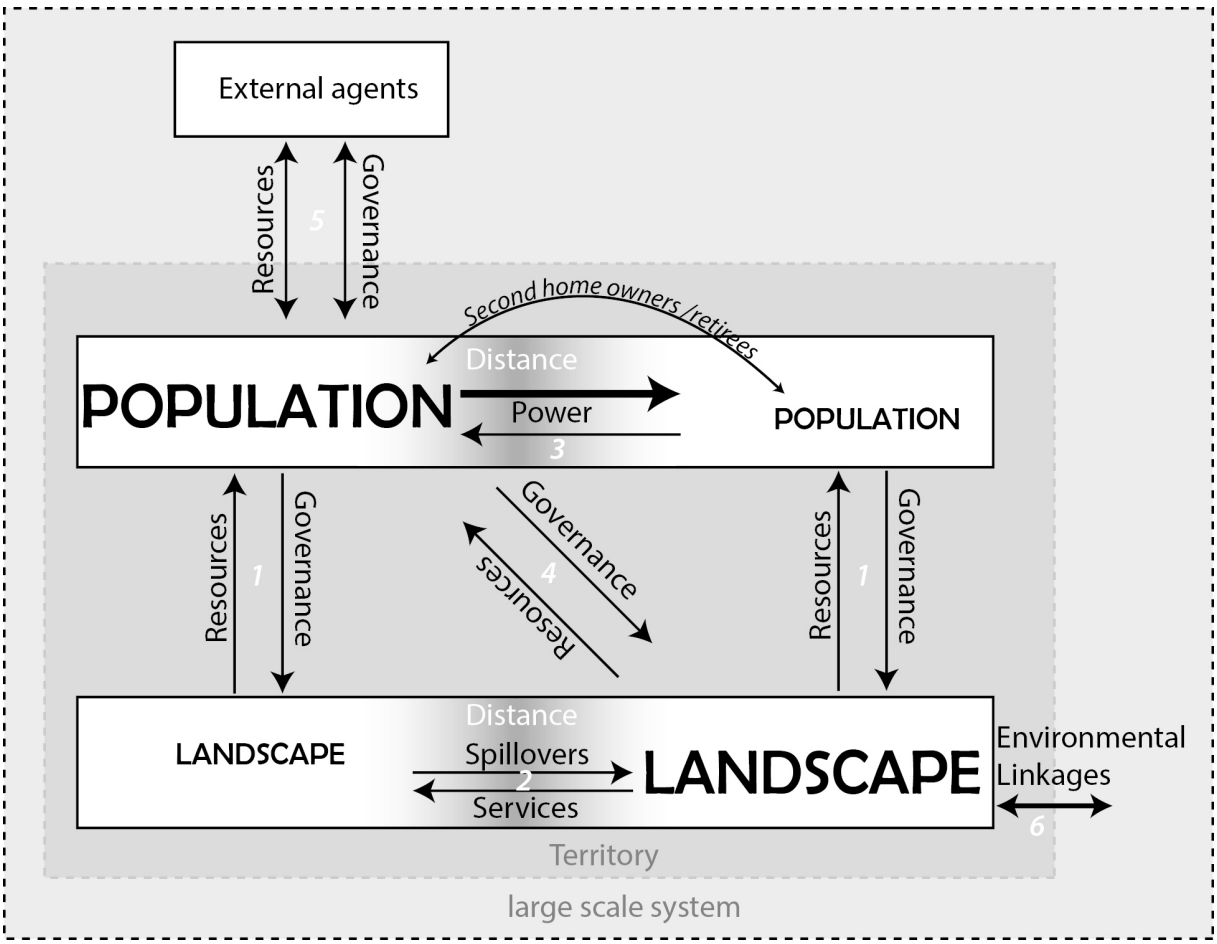

Figure 3: An initial conceptual framework for the study of 'wide empty spaces'

The Figure 3 diagram sums up the relationships and the asymmetries between both patterns. First, it stages two core pairs of relationships, which are present both in sparsely and densely populated areas (1). In each case, landscape and society are connected. We call "resources" all the types of relations in which the human societies are using their landscapes: direct resource extraction (oil, gas, timber, mining, etc.), food production, water consumption, and recreation. We call 'governance' the rules that the society creates in relation its resources. Those rules may favor certain types of uses against others, prohibit all uses or allow any type of exploration. Both spaces are interconnected through various types of telecoupling (Liu et al., 2015) and as parts of states and countries.

At the landscape level, the two types of regions are also interrelated because lands are physically connected (2). This connection creates potential spillovers from densely populated areas to the sparsely populated areas, like air pollutions, acid rains, water contamination by industrial activities and urban waste, etc.. On the other hand, sparsely populated areas deliver environmental services to the densely populated ones, like freshwater, climate stabilization, or as a source of biodiversity.

The second and third asymmetries are created by the relationship between densely populated areas and resources in sparsely populated ones. Politically, the former tends to have greater power than the latter (as indicated by the thickness of arrows) (3). However, the relation is not completely asymmetric since most political systems provide for certain types of correction (like the number of

Senate seats, for instance) and since sparsely populated regions also provide necessary resources to the populated ones, which gives them some economic or political leverage. Furthermore, both types of regions are also connected through circulation and second residencies of urban households, affecting directly or indirectly, political arrangements and expectations.

Finally, at the center of the diagram, the governance/resource relationship represents a third type of asymmetry (4). Densely populated areas tend to have the political, economic and technological power to drain resources from the lands of sparsely populated areas. The reverse relation is not true however. At the same time, densely populated areas also tend to impose and in many cases control governance arrangements in distant sparsely populated lands, favoring perceived needs or dominant worldviews about development or conservation. Political conflicts often occur, like when national authorities and interest groups impose commodity expansion projects or environmental protection measures, which are not supported locally, or, on the contrary, block the exploitation of natural resources in name of environmental conservation.

Urban influence on the economy, land use, and governance of sparsely populated areas varies greatly depending on distance and types of resource. This requires attention to the articulation of spatial and temporal scales, and spatial and temporal lags. These relationships also vary in relative term. For instance, at a very local level, a small village may play the role of a densely populated area against the surrounding rural area. Both may in turn be considered as the sparsely populated area if a wider region is considered. Repeating the exercise at a state and national levels may allow for a nested view of such relationships and consideration for their insertion into global systems. External agents then have influence on local territories, through resources chains (ex. commodity export), rules (e.g., conservation), worldviews (e.g., development programs), and incentives (e.g., promoting tourism). (5). They may even have a direct connection with local stakeholders and therefore influence political balance. At the same time connections exist with the biophysical landscape, which is also embedded in more global systems and share environmental linkages with it (6).

The thresholds which determine the categories of sparsely or densely populated patterns depend on many factors like scale and the context in which the areas are inserted, which make relative the use of absolute values. Finally, it is important to note that sparsely populated areas are not necessarily associated with pristine environments. Many heavily explored and transformed environments are linked very small permanent human presence, like large scale mechanized agricultural regions or mega mining areas. On the contrary, under distinct cultural and technological paradigms, relatively important human groups may be inserted into functional ecosystems without destroying them.

Under current trends in urbanization and resource use, the three core asymmetries that we are pointing out here will probably grow in the future. This evolution makes all the more important their analysis. In fact, the constitutive asymmetry between densely populated urban areas and sparsely populated regions is valid, arguably, throughout the world, albeit with distinct thresholds and values.

In the next section, we provide a few examples of how we may apply this analysis empirically in the US and in Brazil.

2. Examples of tentative applications of the framework

<u>Water management in the US West</u>

The American west has been undergoing significant demographic growth for three decades (Boquet, 2008). Most of this growth was realized in urban areas, with the expansion of cities such as Las Vegas, Phoenix, Denver, Salt Lake City, Boise and others. In the arid context of the US West, such expansions pose the problem of water supply. As there are few local sources, cities must seek reliable supplies in remote areas, modifying their ecological balance and influencing their activities.

Metropolitan areas tend to draw water resources from low-density areas. This relationship however involves other resource uses such as wood, energy, mining, and recreational activities. The governance of low density areas is much affected by the demands of metropolitan areas drawing not only water used for activities such as urban supply and irrigation, but modifying ecosystems and a variety of economic activities. External actors tend to press for new norms in order to ensure water supply of good quality, further limiting local options. All of these factors configure "telegovernance" situations between metropolitan areas and low density spaces. Conflicts may and do occur in such situations, as well as transactions over fees payed for the water and reorganization of economic activities. Water provisioning thus create a social-ecological system in which both parts are distant and loosely connected by road networks. In the case of Denver, for instance, part of the water is even captured in a watershed which is not connected with the hydrographic system of the city's area.

Indigenous lands in Brazil's Amazonia

The recognition of Indigenous lands in Brazil offers an interesting example of the scale interplay suggested by the framework presented above. At a regional level, during the 1970s and 1980s, the frontier of natural resources exploration and agropastoral expansion entered a number of indigenous territories. Even if relatively small in absolute numbers, colonists and ranchers, supported by the development of the urban network, were invading Indigenous lands held in customary rights. Their symbolic and political connections with the external (national and international) actors allowed them to reverse these pressures and gain rights over important portions (but not all) of their traditional territories.

This example illustrates the application of the framework at two different scales. At a regional level, dense urban areas in the Amazon contrast with the low-density territories of Indigenous communities. At a national level, the Amazon region as a whole represents a low density area in relation to the southern part of the country where wealth and power are concentrated. These southern regions may therefore impose goals and worldview conflicting with local interests (e.g. the respect for Indigenous rights).

Farming and rules in the US Midwest and in the Brazilian Central-West

Today, farming activities in central-west Brazil are largely mechanized requiring very little labor. This type of farm shows an upward trend, not different from the growth of "kilofarms" in the US (Fraser Hart and Linberg, 2014). Great agriculture regions, like the Great Plains in the US or the Central-west region in Brazil are therefore good examples of agriculture expansion that contributes to the formation of "vast empty spaces". They are founded on totally domesticated environments occupied by very few people. Local societies are focused on agriculture production and often struggle to maintain it as a feasible activity. Under the current situation of global market competition, they have to invest in mechanization and production maximization irrespective of environmental impact.

While these types of productions systems are aimed at the provisioning of urban areas, they are also the source of impacts affecting urban populations, such as in terms of pollution, inadequate water supply and/or a degraded environment. Respect for environmental rules is uneven at best. In many cases, political mobilization may favor the development of new legislation and enforcement of good management practices. But the policies originated from Matropolitan areas may be conflictive, for instance at the same time pressing for more environmental rules and adopting biofuel policies which resut in more intensification in rural areas.

For their part, farmers are usually organized in political lobbies, like the "*bancada ruralista*" [alliance of representatives of the agropastoral sector in Brazilian Congress], which has been effective in resisting the pressure and rewriting the rules of environmental legislation. The resulting landscape management is a compromise between different stakeholder groups, involving also external agents like international markets, and the international negotiations on climate change emissions, which tend to put pressures on environmentally insensitive practices.

This example is interesting as the governance pressures and responses involve both political and market-driven approaches. Their consequences in terms of landscape change are dramatic.

Environment protection and local societies: the Yellowstone park and its surroundings

The Yellowstone Park is a good example of telegovernance as it has been imposed, by the Federal government, on two local societies – Indigenous peoples and Montana and Wyoming pioneers, which had each a specific vision of the local land uses. Today, the region around the park, especially on its Northern border, has attracted a number of new residents in the search of "amenities" which were considered as disadvantageous previously, such as solitude, snow and isolation from the city. These distant views on the environment and desirable land-uses are frequently not in line with that of the local population.

This may be seen, for instance, in relation of wildlife management (Lavigne 2002). Newcomers would tend to favor the possibility of bison migration outside of the park, whereas old timers and local state authoriies prefer enforcing strict control on boundaries. The fear of the latter is related to the potential contamination of their cattle with brucellosis transmitted by bisons, which would therefore compromise Montana's dairy and meat industry.

Such a conflict of interests and potentially worldviews can be analyzed through the framework presented above.

The issue of wildlife is obviously only one of the redefinitions and conflicts faced in this area as it becomes closely connected, but politically separated from urban and metropolitan areas.

III Research questions and methodology

Considering the persistence and importance of outback areas in Brazil and in the US, the current proposal aims at studying how their governance is the result of the telegovernance with urban centers having decision power and holding specific types of expectations. A comparative study between the US and Brazil would allow for an analysis of the co-evolution of physical and institutional landscapes in both countries and would eventually permit a generalization of the findings is both evolutions are coherent.

1. *Global questions*

Building upon previous research and focusing on the United States and Brazil as focal points, we are considering questions along six main line of inquiries (Table 1): policy and governance systems, demographic dynamics, economy, behavioral changes & psychology of the environment, landscape configurations, and ecological constraints. These global questions will be refined for specific analysis of each domain and specific research sites.

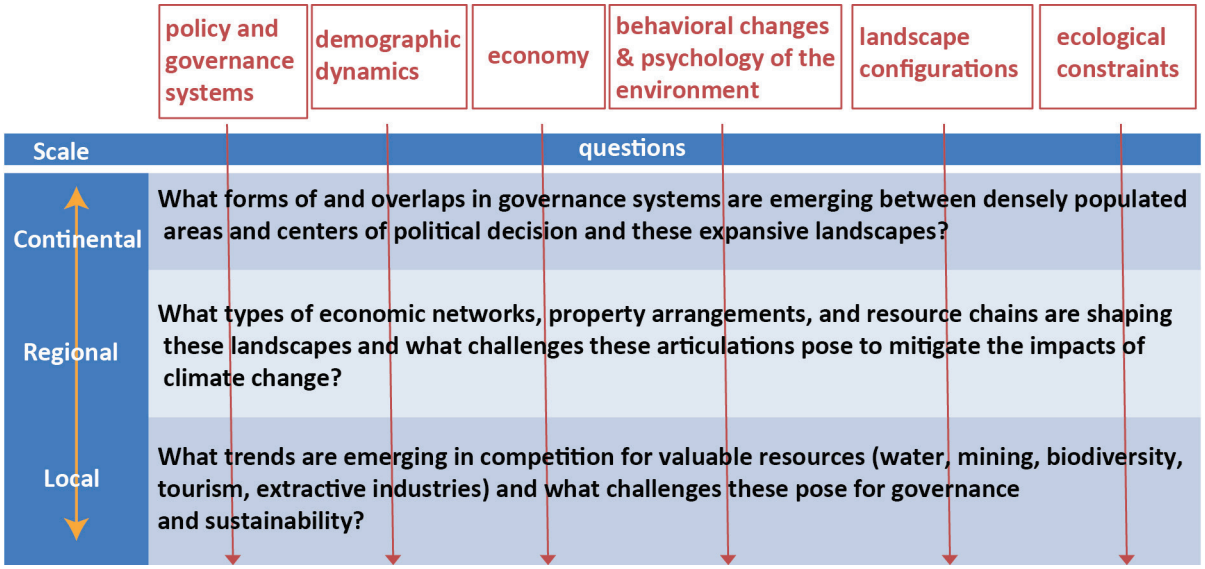

Table 3: Proposed lines of inquire and illustrative questions

For regional and local cases, a common analytical SES framework will be developed. The proposal(s) will be built around several emblematic regional cases where the types of nexus between urban areas and vast empty spaces are manifested in distinct ways as a function of scales, forms of governance, and types of ecosystem/environmental change (table 4); these cases will also allow to examine parallels within and between both countries using a common analytical framework. Our preliminary selection of regional cases includes areas with at least one dominant type of dynamics (i.e., water protection, mechanized agriculture expansion, environmental protection, indigenous management, etc.). These regions will be chosen so that their boundaries are consistent with watersheds, as well as because of eventual contradictions between the socio-economic dynamics and the environmental dynamics.

2. *A methodology based on comparative case-study analysis*

We intend to use a combination of secondary or existing data, as well as fieldwork and regional meta-analysis.

For each of the studied sites, a GIS database will be organized in order to allow a characterization of the site, an analysis of landscape and land-use history derived from existing databases[10] or remotely-sensed image analyses and mapping of local institutional arrangements (land tenure regimes and levels of governance). Key stakeholders will be identified as well as critical sub-areas where conflicts or contradictions between the governance levels are most obvious. The GIS database will also include

[10] Many counties or regions have developed extensive GIS databases for their own use. The project will try when possible to bring together existing datasets instead of re-doing them.

a module of flows between reference high-density areas and the studied region. In general, the most up to date available information (demographic and economic data, ecological indicators, etc.) will be collected and compiled in the database, as well as historical data. The analyses will aim at detecting if historical changes in the local economic, demographic or social profiles may be linked to shifts in governance systems, and if such shifts are locally or externally driven.

Fieldwork-based research will incorporate three distinct activities. The first one is the collection of data through local surveys, in order to study the relationship between local population and their landscapes, focusing on their activities, governance and sense of place. Those surveys will be completed by additional qualitative data gathered through semi-structured interviews. The second front will include qualitative and semi-structured interviews with key stakeholders (decision makers, community leaders, institutions' representatives) in order to gain a fine-grain understanding of the local governance and the distinct levels of influence it undergoes. Finally, the third front of fieldwork will include qualitative and semi-structured interviews in high-density areas or cities, which are linked to study areas. These interviews will focus on perceptions and expectations regarding local landscapes, and the governance issues associated with them.

The last stage of the project will focus on linking the analysis of landscape change to field data (using methodology of coupled humans and natural systems, see Li et al., 2014), thus aiming at deriving comparative insights and theory from different case studies. Local prospective scenarios will also be developed with local stakeholders.

IV Potential Research areas

A set of seven sets of potential research areas has been assembled, each emblematic of a dominant dynamic (notwithstanding the presence of other nexuses), as shown in table 4. In order to incorporate the most relevant ecological factors, the chosen areas correspond to river basins as well as having distal or close connections to cities and metropolitan areas.

Dominant dynamics	**Brazil**	**USA**	**Primary and secondary nexuses involved**
Mountains / water protection	Paraopeba river (MG)	Fraser river basin ?	**Water, conservation/recreation** Energy/mining
Plains / mechanized farming	Teles Pires river basin (MT)	Lower Wabash	**Food, energy** Water, waste
Untransformed spaces / biodiversity protection	Oyapock river watershed (AP/GF)	Yellowstone river basin	**Conservation/recreation** Energy/mining
Indigenous management / indigenous islands / pressues	Upper Xingu river (MT)	Puerco river basin	**Conservation/recreation, waste, Energy/mining** Food
Degraded lands/restauration	Rio das Almas (GO)	Beaver river valley	**Food, conservation/recreation** Water, waste
Water dams and inflluence areas	Sobradinho dam and São Francisco River (BA)	Upper Columbia river	**Energy,** food, recreation
Mining and energy	Urucu River Basin	Mouse river	**Mining**

Table 4: Preliminary selection of potential study regions

Figure 4: potential study sites in Brazil and in the USA[11]

1. Mountains and water protection providing for large cities

High-density areas need to draw water supply from distant; these sources are rarely available locally. These areas need to both draw substantive amounts of water as well as "ensure" that quality water is preserved through some type of governance mechanisms. Among many examples of such situations, the Fraser river basin (CO), in the US, seems particularly interesting. In spite of its localization on the West side of the continental divide, it is used as one of the main provisioning sources for the Denver metropolitan area (3 Mi inhabitants). This situation has raised numerous questions about the local impacts of water provisioning, and the necessary mitigation and compensation mechanisms to be put in place. Furthermore, this situation also affects recreational and other types of uses.

Figure5: left: Fraser river basin; right: Paraopeba river basin

[11] Source for this map and remaining figures: Googleearth, ANA and USGS, maps prepared by FMLT at the Ostrom Workshop

In Brazil, the Paraopeba river basin is one of the major sources of water for the city of Belo Horizonte, a state capital with a population of 5.7 Mi inhabitants. It faces the same issues as the Fraser river as far as local governance is concerned in addition to problems related to large scale mined and related hazards (as the accident related to the rupture of a large mining dam for toxic waste in October 2015 near the city of Mariana in the state of Minas Gerais).

2. Mechanized farming and low density areas

As we pointed out, many highly productive and mechanized agricultural areas endure population decrease and low or very low population densities. This is the case of the lower Wabash river basin in Indiana and of the Teles Pires in Mato Grosso, Brazil. But this small human presence is linked to intense environmental transformations and important consequences in terms of water pollution, biodiversity reduction and soil erosion. The focus on such areas is to see how their local governance and landscape respond to different kinds of external influences like market incentives or environmental regulations. The latter usually result from pressures from environmental movements in metropolitan areas in distant regions.

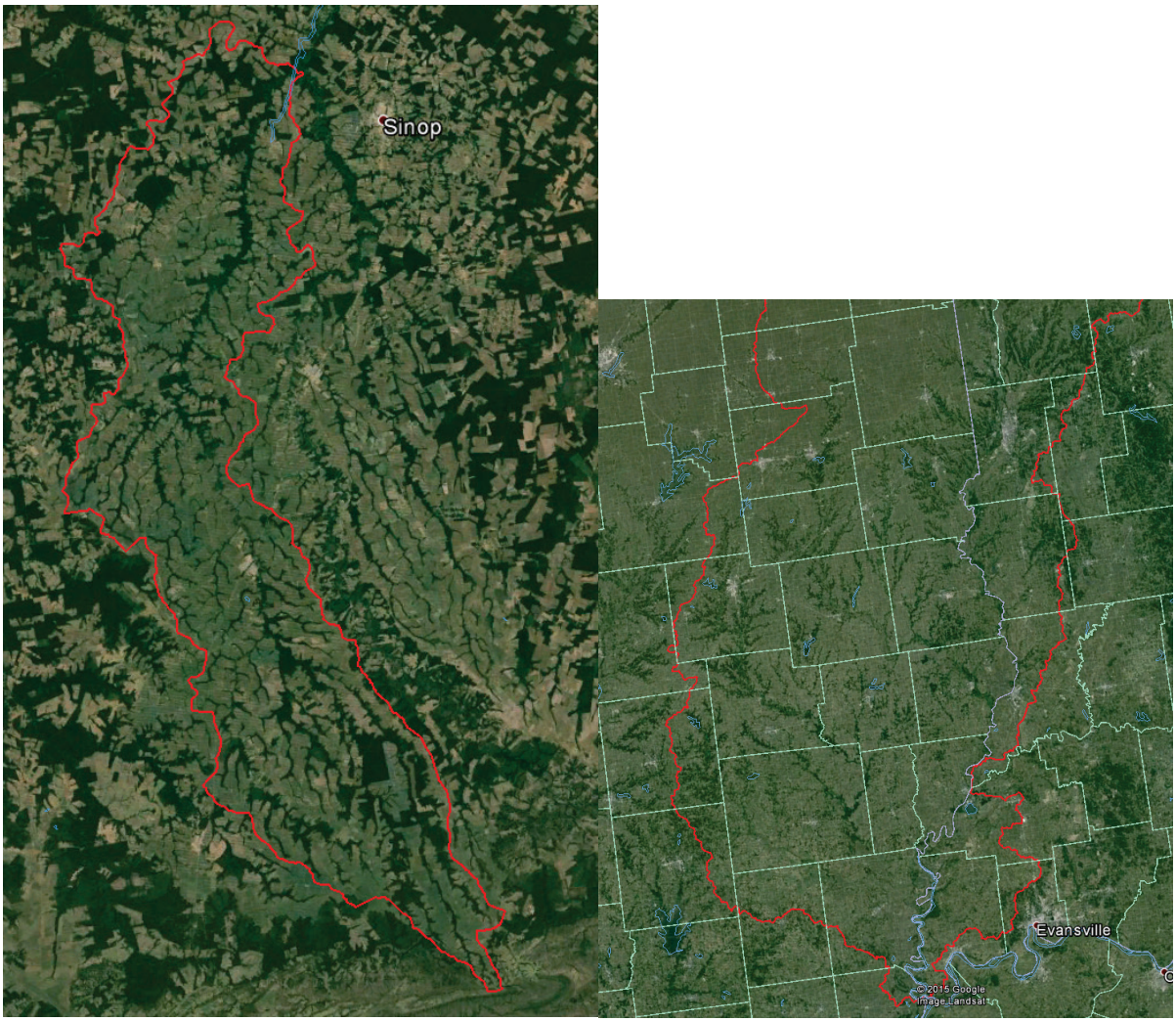

Figure 6: left: Teles Pires river basin; right: Lower Wabash river basin

3. Untransformed spaces and environmental protection

In parts of the region, remote areas have been set aside for environmental protection, in general by the decision of federal governments under pressure from civil society movements. Local populations, however, do not always support limits imposed to their activities due to conservation goals, especially the impossibility to explore natural resources. At the same time, conflicts may occur locally between segments of local populations benefited in different ways by external projects. In Brazil (and partially in the French Guyana), the Oiapoque river basin is a good example of such situations. The creation of the huge Tumucumaque Mountains National Park has made gold panning virtually impossible in spite of its central relevance as a regional activity. If local populations resented the creation of the park, against which they are still fighting, Indigenous population has favored it as a way to obtain land rights and protection. This echoes the situation of the Yellowstone river (which was already alluded to in section II.2), although the outcomes there have been different for Indigenous peoples. Also, the Yellowstone basin faces another interesting phenomenon with urban-like encroachments by people seeking the region's amenities.

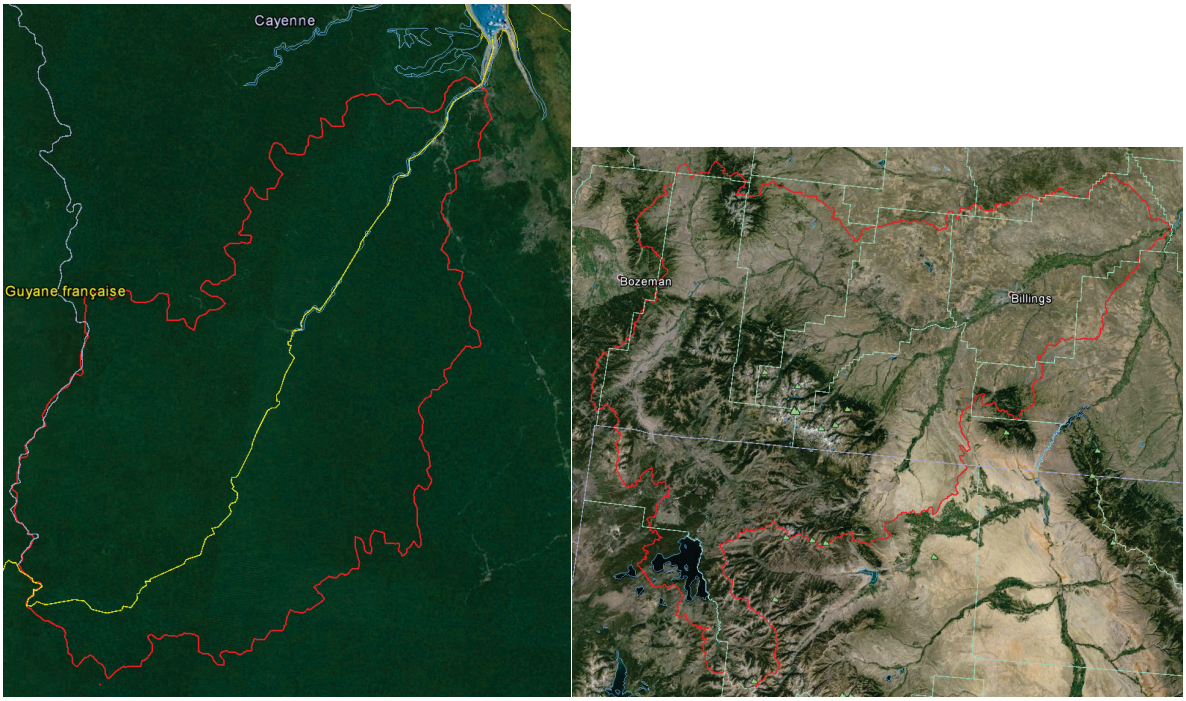

Figure7: left: Oiapoque river basin; right: Yellowstone river basin

4. Indigenous management and external pressures

An important proportion of America's is occupied by Indigenous peoples, and many of those territories, in the US or in Brazil, are officially recognized and legally preserved. Their governance, however, is not fully independent as federal governments in general retain rights on the subsurface resources. Also, at a regional level, there may be pressures on natural resources, encroachment, invasions or pollution spillovers. The Puerco river basin (including part of the Upper Rio Grande basin) is a good example of such dynamics. Its area is covered by a complex mosaic of Indigenous reserves and other types of land arrangements, with complex interactions between them. It has also been the site of uranium extraction during decades, and resulting pollution and spillovers from those activities. In Brazil, the Upper Xingu basin has similar characteristics. Pressure on natural resources,

including mining, has been strong despite the creation of the Xingu Indigenous Park over 50 years ago. At the same time, as the upper part of the tributaries of the Xingu river are located outside the park, spillover and pollutions from the heavily mechanized agricultural areas have a direct impact inside the part (Brondizio et al 2009). Lastly, indigenous areas are increasingly affected by strict environmental regulations crafted to address national and global needs.

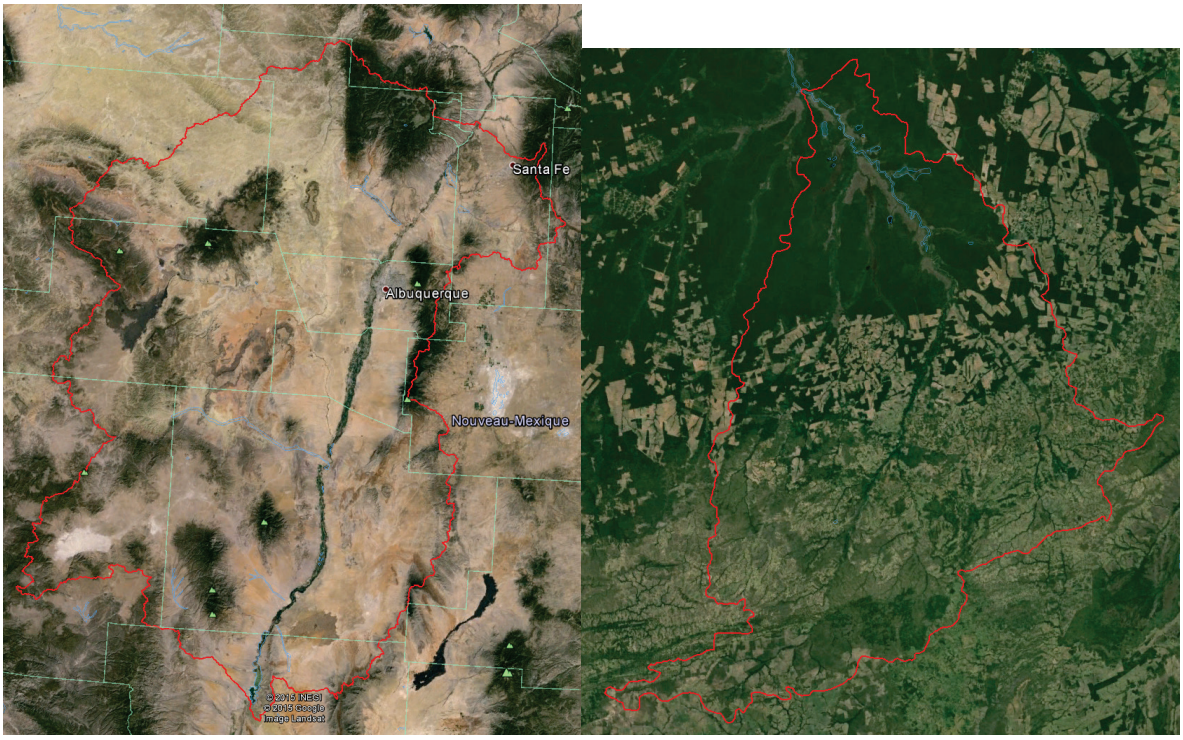

Figure8 : left: Puercos river basin; right: Upper Xingu river basin

5. Degraded lands and restauration

Intensive local land-use has in many cases contributed to the degradation of soils and the environment in general. Sometimes the external influence has permitted restauration efforts, with interesting influences in the modification of local practices. In the US, the aftermath of the Dust Bowl in the state of Oklahoma is a paramount example of such process. In Brazil, the question of areas degraded by unfit agricultural practices is a mounting issue and a national plan has been set up in order to help their restoration. Located inside an intensive area of agricultural production, the Rio das Almas water basin is an illustrative location to observe how such efforts are imposed in the outbacks and how they react to them.

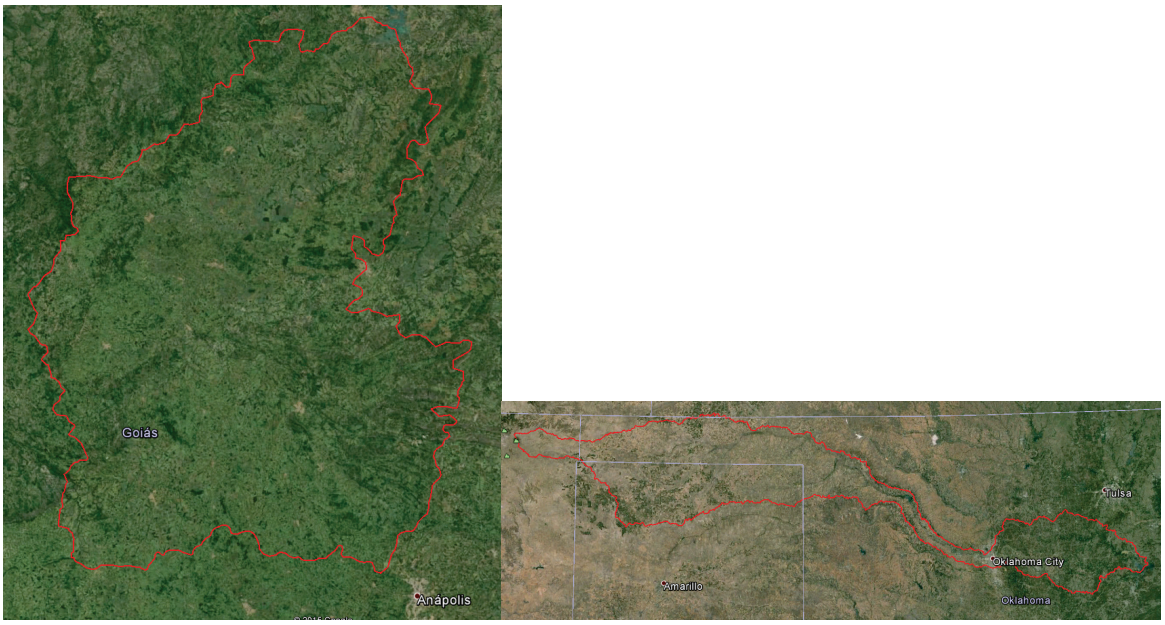

Figure 9: left: Rio das Almas river basin; right: Beaver river basin

6. Hydropower dams and their influence

Dams and hydropower facilities are frequently located in the outbacks, and they may be qualified as good examples of telegovernance since their role is essentially to provide power to high density areas at the expense of dramatic local transformations.

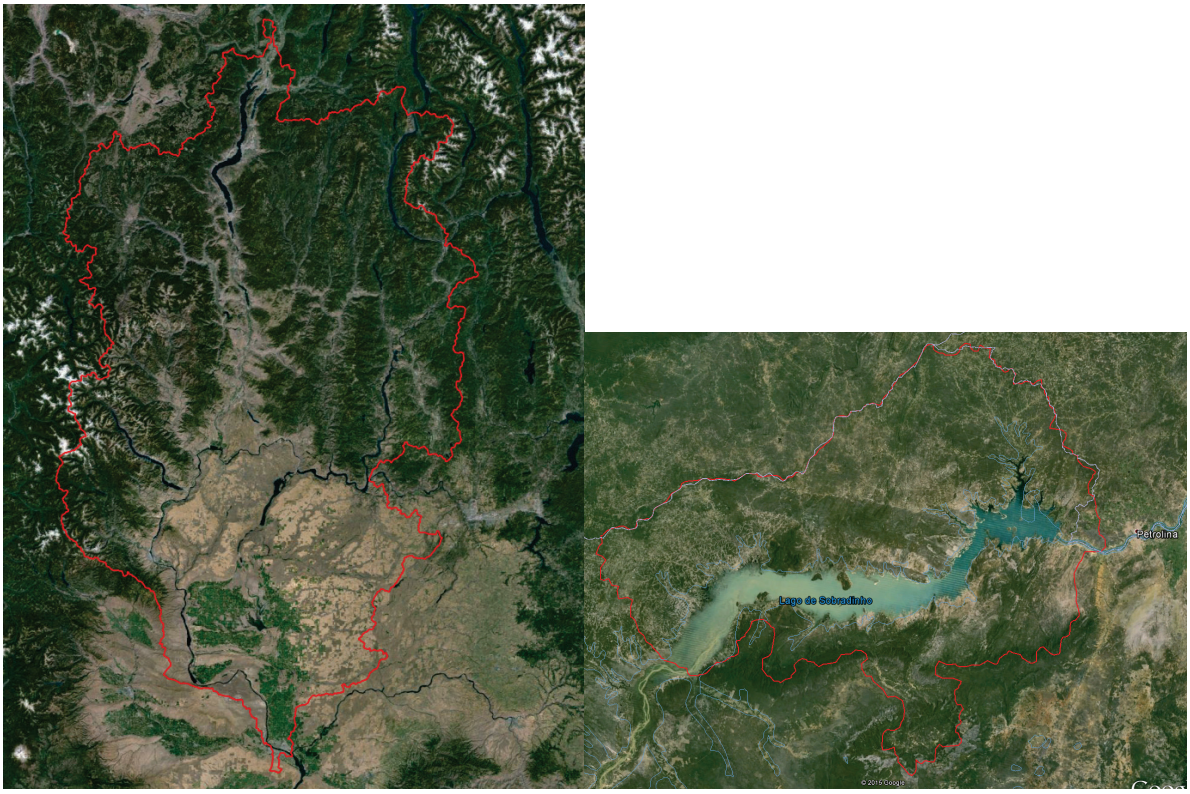

Figure 10: left: Upper Columbia river basin; right: Sobradinho dam and surroundings

It is thus interesting to see how outbacks areas react to such implantations and how they reconfigure the local landscape and governance. In the USA, among many examples, the Upper Columbia River valley (at the Canadian border) seems an important place to study because of the intensity of hydropower development in the area (72 dams in the whole Columbia river) and its vital importance as a power source in the region. In Brazil, the portion of the São Francisco River around the Sobradinho dam has seen dramatic transformations but it remains at the same time mostly a low density space similar to other areas of Brazil.

7. Mining and energy extraction in the outbacks

The extraction of natural resources, and particularly oil and gas, is an important activity for the economy of many low density spaces. They are also controverted because of their high environmental impact. In our framework, they are good examples of synergies and conflicts between urban areas, which consume the energy which is produced, and local societies, which are benefitted with employment and royalties but also bear the burden of environmental degradation.

The Mouse river basin, in North Dakota, is a low density area which has been transformed recently by the exponential development of shale oil and gas extraction. In Brazil, the Urucu river, in the Amazon, has been impacted by the exploitation of a gas reserve.

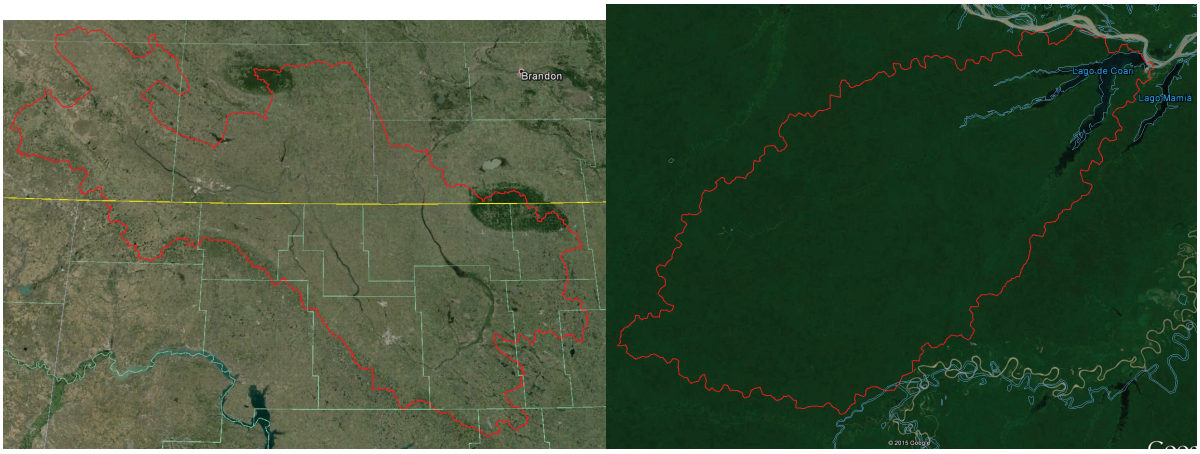

Figure 11: left: Mouse river basin; right: Urucu river basin

Next steps:

-work with collaborations

-refine research questions

-develop research design

-target proposal preparations

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