Modelling environmental pressures for a better law compliance

Profa. Dra. Cristiane Derani
Visiting Scholar Cambridge Centre for Environment, Energy and Natural Resource Governance (C-EENRG) at Cambridge Research Institute

Arthur R. Dalmarco
Master Candidate Law School Federal University of Santa Catarina Brazil

Abstract: Brazil is one of the biggest food producers in the world. This position nonetheless has a huge environmental cost. On the economic side, selling food doesn't bring significant comparative advantage in the global market. Global economic relationships don't take into account the natural capital that is essential for food production which directly hampers environmental protection and environmental norms enforcement. Environmental law consists of duties and limits of action and prohibitions. It is founded in juridical values as well as in environmental ones, whose statements go beyond the legal text, searching its meaning in the concrete relationship between natural elements and human behaviour. Nonetheless, the importance of present data analysis to the correct assessment of different future scenarios is crucial for modelling compliance behavior to environmental protection norms. Hence, we argue that an *ex-ante* modelling inclusive of threats to water, biodiversity, soil integrity and energy, are essential to elaborate consistent policy and law-making, compliance, and adequate enforcement.

1. INTRODUCTION

Law, understood in a normative perspective, is a social product that operates over reality – modifying, stabilizing and consolidating reality itself. Whether under Law's formation or enforcement process, the adequate assessment of relevant issues to be regulated is a fundamental problem, which cannot be disregarded or neglected. Nevertheless, there is a persistent difficulty regarding not only the identification of a universal core object for environmental law, but also the unification of multiple meanings that 'environmental protection' might assume in a given context – when taken into account the complex set of production, fruition, and habitation relations' that exist between human action and the environment.

A parallel fact to be considered is the usual need for a clearly defined object of study from sciences in general. Environmental law stands in a rather unstable ground bearing in mind this particular consideration. It's object is not only complex, but contains many different approaches to similar problems as well. Hence, environmental law does not restrain itself to specific sectors of social life, neither has it suffered from limitations involving exclusively particular sets of subjects (private, public, entrepreneurial, or collectives), territories (national, foreign, common, or immaterial), or activities (production, habitation, alimentation, infrastructure, scientific, artistic, and so forth).

This perception does not debunk the importance of legal protection of the environment through environmental law, neither does it require that this protection is to be extended to all the different relations' subsets whenever it's 'core object' is somehow offended. However, the comprehension that this web of interdependent relations exists is vital to achieve consistent results in legal enforcement.

we argue that environmental law protection cannot be narrowed to a simple consideration of whether a certain legal command has been respected or not. That is to say that the juridicity of particular action regarding the environment ought to be assessed through both the sets of complex relations already mentioned, as well as the modelling of possible impacts of different legal mechanisms in a given context. For a law expert it is not easy to make an assumption related to environmental damage on some ongoing activity. How can one assert that some activity will bring a damage to the environment or not, without a previous assessment? And also, in regards to the assessment itself, how can it be possible to assess the environmental consequences of an activity? The assessment requires a particular kind of forecast, which in a complex situation requires the design of virtual possibilities or models.

This *ex ante* approach is more and more required for legal compliance. In fact, legal compliance may assume diverse shapes, assessing quantity, quality and monetary impact values to possible decisions. The modelling of scenarios and fine-tuning of legal mechanisms stand at the center of a necessary shift to identify key elements of future legal design. Notwithstanding, we argue that at least three premises need to be taken into consideration:

1. Global production and commercial relations comply with a complex network of supply chain distribution, based on the availability of natural resources and its appropriation;

2. The environment is transformed and the natural resources are consumed in great proportion to enable the production of commodities. Verifying the extension of that consumption and transformation shall generate the opportunity to truly assess the measure of "legality" involving the economic activity. Projected scenarios that clearly show the consumption rate of natural resources and ecosystem's resilience are necessary to determine that particular aspect (legal) of international economic practice;

3. Monetary value's relations should also uphold the possibility to attribute monetary value to consumed natural resources, including global commons, in addition to costs already accounted as production investment and subtracted to commodities' sales value.

These particular economic considerations should, above all, be able to quantify environmental costs within the assessment of sustainability of the economic activity.

The ability to present answers to these minimum requirements is to be expected in a future legal analysis process, since the usual *ex post* legal control cannot prevent possible environmental harm from happening. Without properly projecting environmental impact through modelling, particularly with agricultural production, negotiated economic value, and natural resource consumption, it is not possible to gather the necessary information to analyze the *real* legality of the production process.

2. Law action and natural resources consumption in the agriculture chain

One interesting condition that is not fully embraced by environmental law in general are the side effects of certain economic production options as pressure over different ecosystems. As glimpse of that reality, it's appropriate to mention the concept of water footprint related to grain and food production.

Water is a necessary good in virtually all the segments of the production process, directly or indirectly. If a country exports a product that uses water in an intensive manner, this country is in fact exporting water in a virtual way. Hence, some countries bear other countries' needs for water. To some of these countries – mostly the ones with severe water access restrictions –, it is arguably attractive to secure their water needs by importing all the goods that are water intensive, instead of producing the goods by themselves. On the other hand, countries that possess a large amount of water available are supposed to take advantage of their abundance through exports that require such resources.

The amount of data regarding the phenomenon of water consumption exports that tag along with food and other goods is considerable[1]. In concrete terms, agriculture is the most intensive water use activity, demanding around 70% of the available water in the country (Brazil) considering both domestic and external demand for food production (as a noticeable example, soy production has become one of the world's largest crops, representing 75% of all the source for livestock feeding).

The Food and Agriculture Organization of the United Nations points that, if a human being demands 3 liters of water per day to survive, the same person will require around 3 thousand liters to produce the necessary amount of calories of a sufficient diet – raising the water consumption arguably to a standard of 3 to 4 thousand liters per day, per person[2].

Therefore, the correct equation of commercial surplus, in the soy case, for example, needs to account over the value of that commodity the environmental costs, tradeoff

[1] See, for instance, M. M. Mekonnen and A. Y. Hoekstra, *National Water Footprint Accounts: the green, blue, and grey water footprint of production and consumption*, UNESCO-IHE Institute for Water Education, 2011, at http://waterfootprint.org/media/downloads/Report50-NationalWaterFootprints-Vol1.pdf.

[2] See FAO's *Key Facts on Water*, at http://www.fao.org/water/en/.

opportunities for different investments regarding the same natural resources, and the risks to health caused by herbicides and other additives necessary to farming. A correct calculation should be able to express the deductions derived from irreversible loss of natural resources, health risks, and the exclusion of alternative activities equally advantageous for the involved population.

Consequently, it is arguable that some countries could be able to produce agricultural products that, today, are imported. However, their importation is economically advantageous, not by their apparent costs, but by their real and concrete difference between the exploration and exhaustion costs of their scarce natural resources and the costs of virtually importing those resources – which contain water and many others, such as soil, ecosystem degradation, space and forests. In synthesis: food exporting countries export more than the essential to their buyers – they export the essential to the maintenance and equilibrium of their ecosystems and regions.

Additionally, besides the conclusion above, it is interesting to notice that modelling such scenarios may enable not only a correct assessment of liabilities, risks and pressure over natural resources, but also both the improvement of legal instruments related to environmental protection and the capability to stablish a new dynamic to information input in international commerce.

Thus, the inevitable loss of a natural resource is an evident social cost, whatever the nature or extent that loss may represent. Furthermore, a social cost may present itself in different steps of the global production chain, aside from the final results of it. A good example to outline is the deliberate choice for certain energy resources, which count for approximately 2 trillion dollars a year in subsidies by governments, according to the IMF[3].

In addition, the Brazilian National Assessment Report on climate change[4] indicates that the rise on temperatures, on different climate regions in Brazil, will imply a major loss on water access on the years to come. That raises many questions about the Brazilian options for hydropower as a dominant element in its energy matrix, and the impacts this reality may have on intensive agriculture.

Considering that very little can be done regarding past options, it is clear that a shift in environmental law is expected to occur aiming at future results, mostly based on experts' evaluations on these complex matters. Differentiated from past reasoning patterns in Law, current conditions demand clear objectives to be stablished as well as damage control measures targeted at the effects already being felt by society.

By that perception, we intend to argue that it would be illogical and preposterous to wait for the complete depletion of natural resources to conclude for the illegality of the actions that

---

[3] B. Clements, D. Coady, S. Fabrizio, B. Shang, A. Kangur, M. Nozaki, I. Parry, V. Thakoor, L. Sears, L. Nemeth T. Alleyne, M. Villafuerte, C. Josz, S. Singh, E. Ruggiero, A. Bauer, C. Sdralevich, O. Demirkol, K. Krishna, L. Moers, D. Ostojic, Y. Zouhar, S. Gupta, R. Nord, and D. Gressani, *Energy Subsidy Reform: Lessons and Implications*, International Monetary Fund, 2013, at http://www.imf.org/external/np/pp/eng/2013/012813.pdf.

[4] T. Ambrizzi, and M. Araujo (eds.), *First National Assessment Report on Climate Change*, 2015, at http://www.pbmc.coppe.ufrj.br/pt/noticias/82-destaque/440-painel-brasileiro-de-mudancas-climaticas-divulga-o-primeiro-relatorio-de-avaliacao-nacional-completo.

leaded to that result. Conversely, it is not yet possible to define for how long a human action that is already defined as highly prejudicial to climate stabilization should be allowed or not.

Finally, as obvious as it may be, it is necessary to notice that, in this particular case, Law is not allowed to assume a position of mere *ex post facto* element of intervention, based exclusively on a simple responsibility/reparation assessment mechanism – since such restoration may prove to be impossible.

3. Modelling for the efficacy of environmental law

To stablish a realistic set of parameters of sustainability is crucial for an improved assessment of economic viability – that is, to consider the relation between private profit, externalities and transaction costs. In that sense, it is intriguing to wonder about the legality, within environmental law, of a given economic practice that converts forests, loss in biodiversity, soil contamination and desertification, river and groundwater poisoning, governmental subsidies and indigenous conflicts, into agricultural input.

Regarding the complex relations above mentioned, we likewise argue that modelling has a central role in assessing and providing future scenarios on aspects such as the impacts of particular crop choices by acre, in opposition to the pressure imposed on natural resources. That possible methodology, that far exceeds a common cost-benefit analysis, may provide a secure path for legal compliance and evaluation[5] – especially regarding the three aspects mentioned in the introduction. This methodology has a superlative importance when we consider the necessary integration between the *Nexus*[6] and Law.

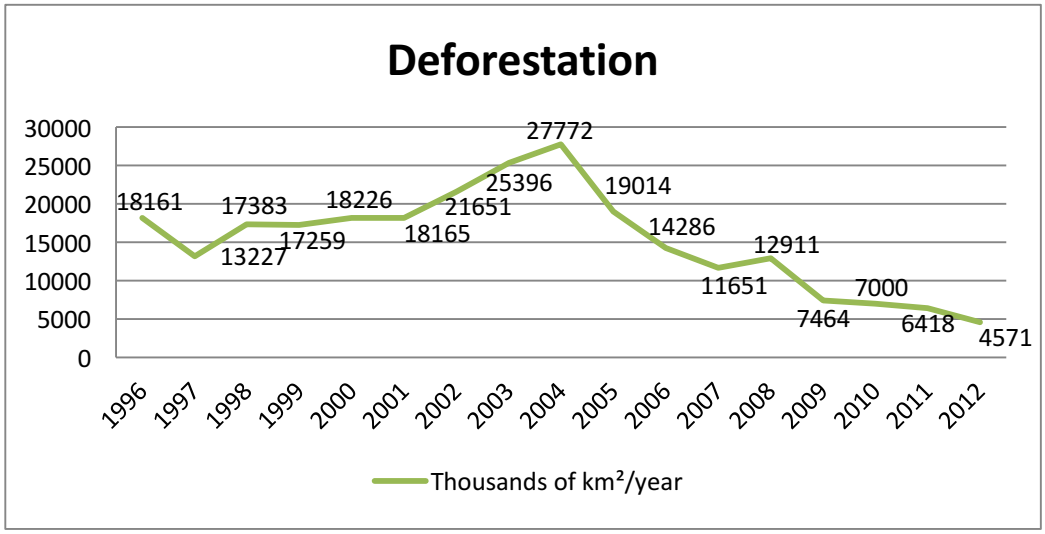
A long-term possibility of development can only be possible if the choices regarding capital use are properly coordinated, whether industrial or natural capital. This configures what is defined as *demand for sustainability*. The GDP relationship with the environment is a very intimate one. Be it in the process of appropriation and destruction of natural resources, or the political option to derive part of the national wealth to harmful and not innovative activities, that relationship always produces effects on wealth creation decision-making. On the other hand, these decisions are often taken within a certain range of expected impacts, which might put more or less pressure over the related natural resources. Furthermore, when the expected impacts are negative ones, they usually appear as such through GDP measurement in both medium and long-term reports, once short-term impacts are to be expected on rare occasions in which the political decisions are of a "high pressure" nature.

In that sense, we state that the gathering and assessment of data to enable a *driver-threat dynamic analysis*, related to data-driven mapping of threats to water, biodiversity, soil integrity

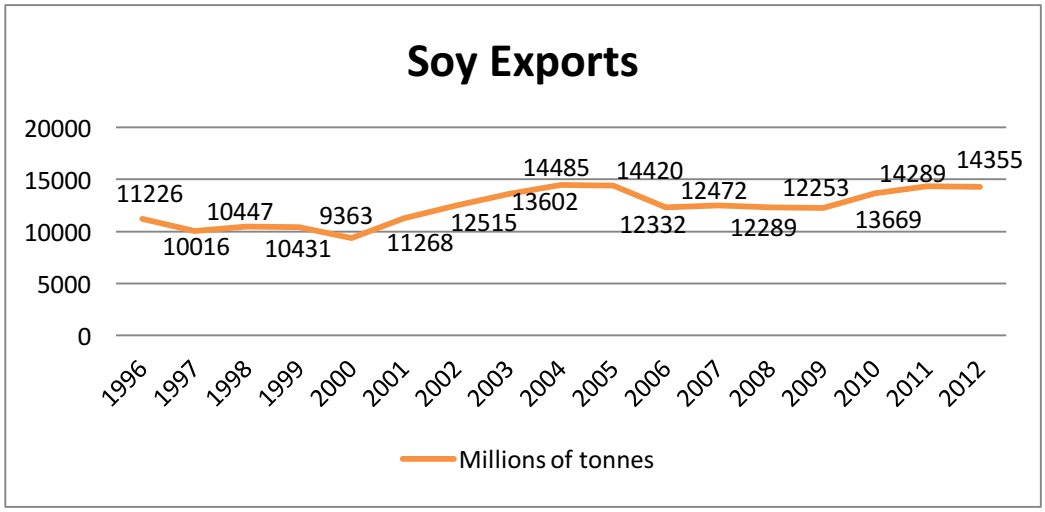
[5] See, as an appropriate example of complex modelling and Law, J-F. Mercure, H. Pollitt, A. M. Bassi, J. Viñuales, N. R. Edwards, *Modelling complex systems of heterogeneous agents to better design sustainability transitions policy*, Global Environmental Change, Elsevier, 2016, Vol. 37, March, p. 102-115.

[6] *About Water, Energy Food Nexus, see The Water - Energy –Food Nexus: A new approach in support of food security and sustainable agriculture,* FAO 2014. Available at http://www.fao.org/nr/water/docs/FAO_nexus_concept.pdf

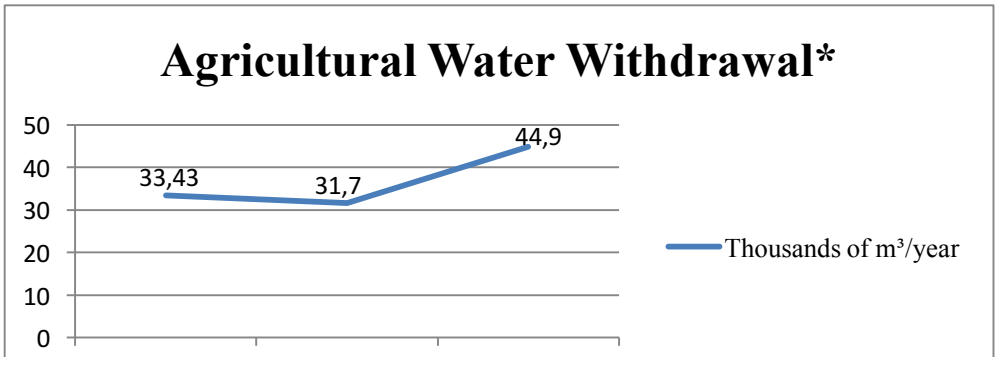
and energy, are essential to elaborate consistent policy and law-making, compliance, and efficient enforcement. As a simple indicative, we gathered a still raw set of data regarding deforestation, agricultural water consumption and amount of soy exports in Brazil. Knowing that future developments on modelling will require the cooperation of different databases and emulator efforts, we intend to outline the importance of a clear view of complex and interrelated problems through tendencies and reciprocal influences that might be detected through proper data analysis.



Source: Brazil's Environment Ministry.



Source: USDA and Brazilian National Soy Exporters Association (adapted).



Source: FAO Aquastat Database.

According to the graphics, a first superficial analyses demonstrates that although deforestation declined, exhibiting a clear trend of potential improvement in environmental law compliance, the agricultural water withdraw[7] has dramatically increased, approximately 41,6% in a small window of time. As for soy exports in Brazil, it is noticeable that the periods of time in which historical maximums are reached coincide with the high pressure input on water usage. Regression analyses, based on the data abovementioned, are relevant instruments for the appropriate assessment of environmental law compliance in such complex contexts. Nonetheless, only adequate modelling may reveal how the data, in a precise and nuanced manner, can draw a picture of legality assessment in resource intensive specific economic activities. As for how legal aspects are to be coordinated with such efforts, we think it is yet to be fine-tuned, since this has only been subject to a broad conceptualization thus far.

Having that stated, we find it useful to outline that the national environmental law brings, within itself, the same structure of objectives, principles of action and values that constitute international environmental law. Away from separating that heritage, we think that this connection is able to build a new way to construct sustainability as an element of Law facticity and validity.

Setting aside the necessary aspect of compensation and reparation of Law, it is undeniable that there is still an aspect that resonates from Law as an instrument of policy-making, cohesion and social appeasement. Regarding globalization and the irreversibility of climate change, it seems appropriate – and perhaps obvious – to mention the unavoidable utility of data gathering and analysis to provide policy input directed towards concrete results.

The reality of environmental equilibrium and sustainability on the usage of natural resources can only be defended *in concreto*, given its characteristics, from appropriate mapping of data related to natural resources' resilience and regeneration capabilities. Bearing that in mind, it will be possible to (i) project future impacts with accurate degrees of certainty, (ii) enable policy and law-makers to consistently *shape and design* the appropriation of natural resources, and (iii) ultimately adapting the expected behavior of agents towards environmental protection goals in an efficient manner.

[7] Annual quantity of self-supplied water withdrawn for irrigation, livestock and aquaculture purposes. It can include water from primary renewable and secondary freshwater resources, as well as water from over-abstraction of renewable groundwater or withdrawal from fossil groundwater, direct use of agricultural drainage water, direct use of (treated) wastewater, and desalinated water. Water for the dairy and meat industries and industrial processing of harvested agricultural products is included under industrial water withdrawal.

As aforementioned, this method seems more adequate from a new Law standpoint, to deal with the concrete appropriation and transformation of natural resources, in face of the principles from both international and domestic environmental law.

Finally, we do not think it is possible anymore to admit arguments about the supposed fallibilism of environmental norms on the basis of their generality. Assuming that every valid legal norm is mandatory, its detailing arises from the wide array of concrete contexts, given the correct mapping of threats to the appropriated natural resources. That approach has a strong possibility of changing a more rhetoric pursuit for results, for a strong reality-driven one – that measures and adapts its mechanisms to concrete problems.