

CHAPTER 1

Constructing the concept of climate-change governance

INTRODUCTION

Historically, governance has been defined in different ways. Its definition has modified from conceiving governance as social actors creating networks, to understanding it as an institutionalization of the international agenda, or as a synonym of government. However, there are some approaches in between that need to be explored. The redefinition of concepts as authority, policy processes, norms, and institutions are useful for theories that are in this middle range. One of the virtues of the concept of *governance* is its flexibility, which allows scholars to build on former definitions for constructing new ones. Yet, this ambiguity can also lead to conceptual flaws where parts of the problem could be left aside.

Therefore, the objective of this chapter is to present a discussion of the concept of governance and find elements that develop a useful intellectual tool to work with. To operate the universal concept of governance, in Chapter I, I pretend to narrow it down and find the link with climate change. In this sense, climate-change governance will be used as a radial concept composed by different parts that form an essential piece.¹ In this part, I will assume that governance can be understood as a conceptual tool for measuring policy in a

¹ For a deeper understanding of this methodology to create concepts, see Collier and Mahon, 1993

results-based approach.² As a result of the high costs of command-and-control environmental policies, a new generation of approaches has been emerging. One of this is the results-based approach. For climate change governance, this seems to suit quite well when addressing many diffuse and heterogeneous sources of GHGs. This approach includes other actors, chances to establish comprehensive and complementary policies, and situate pollution geographically (Kettl 2002; Knopman and Fleschner 1999).

The results can appear as policy results or as specific issue-area results (as in the case of environmental governance). This is particularly important for the provision of public goods, which is one of the main goals of governance schemes. To obtain this double-track results approach, the construction of governance rules would need to be different from what climate-change governance has performed to date. Other actors, besides states and international institutions, need to be involved in this task. This aim implies a conceptual redefinition of governance design and scope. In order to finish the task of creating a radial concept, I will widen the scope of climate-change governance by adding up the global factor. I will emphasize that climate-change governance is a global issue.

In the second part of the chapter, I will assume that, while the concept of governance derives from a liberal tradition, for global environmental problems the concept would have to deal with social commitment to preserve and provide global public goods. Then, I will argue that climate-change global governance refers to the way the provision of public global goods is addressed. This argument opens the door for the third section of this chapter, where I will detail what kind of global public good is clean air. This will allow me to explain in a scientific basis and in more detail how air pollutants and green-house gases

² Durant et al, 2004; Commission on Global Governance, 1995

(GHG) impact the climate, and how global and accumulative is the problem. I will conclude this section by exploring the main sources of GHG emissions. The analysis of energy production and consumption will occupy almost all of this part.

1. THE CONCEPT OF GOVERNANCE

The concept of governance was born under the theoretical approach of Liberalism, but as mentioned before, it has gone beyond some of its traditional principles such as state-to-state cooperation and formal integration. The concept of *governance* can be traced back to the moment of disruption with state-dominated social and economic models from 1950 to 1970-1980.³ Theoretically, *governance* appeared as contesting the International Relations theory of Realism and created debates or complemented some of the Liberal theories at the time. Some theories in which governance builds on are neofunctionalism, transnationalism, interdependence, regimes, and neoinstitutionalism.⁴

Building on a multiplicity of liberal theories, a wide range of authors redefined the concepts of authority and power applying them to the concept of governance. There was no longer room for the old theoretical debate, where “Realism was long on structure but short on process, domestic politics, and ideas,”⁵ and where Classic Liberalism forgot the emerging actors within emerging agendas; both theories were state-centered. New problems started to catch the attention of the international community; there were problems that needed a collective solution with actors that were different or complementary to the

³ Weiss, 2000:796

⁴ For a brief review of these theories see Viotti and Kauppi 2010

⁵ Keohane, 2002:6

State that could link domestic politics with global issues such as environmental protection or humanitarian aid.

Since then, a set of definitions of governance have deal with this issue. Some of these definitions have explored how power and authority are exercised in the policy process, usually in an international-domestic relationship. In general, international institutions as the World Bank, the United Nations Development Program, the Organization for Cooperation and Economic Development, and some national institutions have followed this path.⁶ Also, the United Nations Framework Convention for Climate Change (UNFCCC) of 1992—basis for climate-change negotiations and the Kyoto Protocol—followed this logic. Governance has been understood as the institutionalization of international environmental agenda by the United Nations, international corporations, and states.⁷ Additionally, the concept of governance has also been linked to a political neoliberal program expressed as corporate governance and the minimal state.⁸

Authors as Elke Krahnmann argue that this phenomenon appeared in the decade of 1970 in Europe, when the European Union emerged as an alternative political authority that discharged the national bureaucracies of certain duties. The “privatization” of the provision of public goods occurred when in the 1990s the International Monetary Fund started to condition aid to national governments and categorized countries into moral parameters of good or bad governance practices.⁹ In both cases, the welfare state was under question due to its bureaucracy. This concept of *governance* was preceded by new-right ideologies in the 1980s, especially in the U.S., when it appeared necessary to introduce

⁶ Weiss, 2000; Douglas, 1999

⁷ Mingst, 2004

⁸ Rhodes, 1996; Mittelman, 1996

⁹ Krahnmann, 2003:326

market principles into public administrative systems and business management into public sector. Later, new trends of privatization started to develop worldwide.¹⁰

If one considers governance to be characterized as I mentioned before, one can find that these definitions have been deeply contested. One of the major criticisms to the concept is ideological. Governance has been viewed as a global political program related with “good” or “bad” governance practices. This situation led some authors to call this moral qualification a mechanism of domination of the Western ideology legitimized globally. Some authors call it *governmentality*.¹¹ Expanding the concept to neoliberal institutions, governmentality would mean that there is a moral judgment of the conditions imposed by world leaders to standardize political practices and regularize frequencies, timing and norms of states.¹² Good governance would assume that the goal is to regulate steadily the conditioned interaction between states, markets and civil society, as it would happen in developed economies.¹³ Nevertheless, this kind of governance can be “a form of violence disguised in the promotion of security”¹⁴ and other global-agenda topics.

Some other authors explain that good governance was an important component of globalization and meant the enhancement of representation, democracy, and market efficiency at national levels, yet conditioned by international institutions as the World Bank, the International Monetary Fund and at certain point the United Nations.¹⁵ In this

¹⁰ Privatization would also include outsourcing, co-production, and public-private partnerships. Business management includes also competitive tendering, performance incentives, and internal auditing within a decentralized and customer-oriented structure for increasing accountability, transparency and civil society participation. Krahnemann, 2003:327.

¹¹ As mentioned in the introduction, the original term of governmentality was coined by Michael Foucault in 1975. However, some authors have taken this concept and contextualized it into globalization. See Ole Jacob Sending and Iver B. Neumann, 2007; Mitchell Dean, 1999; Wendy Larner and William Walters, 2004.

¹² Zanotti, 2005

¹³ Elsenhans, 2001:34-5

¹⁴ Douglas, 1999:135-8

¹⁵ Weiss, 2000; Boas et al 2005

sense, governance linked two levels of government (international and national), based on the formal relations between states and markets, where state institutions should guarantee accountability and effectiveness of policies for the market to operate. Philip Cerny suggests that globalization has impacted governance “by altering the deeper structures which underlie governance processes and mechanisms.”¹⁶ This argument represents the ontologically pretended universalism of the concept of governance.¹⁷ The “universalization” of global governance policies has been criticized because in this context, ‘power’ itself inevitably becomes more diffuse, diffracted through and increasingly complex, prismatic structure of socio-economic forces and levels of governance.¹⁸

As authority is diffused, accountability is diffused. This leads us to another critique that deals with the lack of mechanisms of social participation or the deficit in implementation mechanisms. Some others address the sovereignty of states which sometimes helps governments to agree on binding conventions that global governance institutions design.¹⁹ One final critique comes from those who preferred to see governance as social networking outside the state and apart from international institutions.²⁰ This approach proposes a relation among informal interactions amongst civil society to organize the public realm.²¹ In this sense, social networking or the “privatization” of authority - led by civil society - was the instrument for contesting the State.²²

¹⁶ Cerny, 1999:188

¹⁷ Mol, 2002; Litfin, 2000

¹⁸ Cerny, 1999:190

¹⁹ Jagers and Stripple, 2003

²⁰ Kooiman, 2000

²¹ Boas et al, 2005; Sikkink, 2003:317

²² Biersteker and Bruce 2002; McAdam, Tarrow, Tilly 2001. See also Ayres and Macdonald 2009.

As presented here, the concept of governance can mean different things, can be addressed by different approaches and performed by different actors. In the following part of this section, I will present some elements of the different concepts of governance that were defined above that will help develop my own conceptual construction.

1.1. Governance as policy processes

Robert Keohane and Joseph Nye, fathers of the Liberal theory of Complex Interdependence, established that interdependence used to mean linkages generally at regional or international levels. However, the concept needed to be redefined and inscribed into an era of increasing globalism, with high density of networking, institutional velocity, and with transnational participation.²³ In this sense, the concept of interdependence evolved into *governance*, understood as “the process and institutions, both formal and informal that guide and restrain the collective activities of a group within increased globalism”²⁴ In other words, governance could mean the set of rules of the game.²⁵

Governance can be formal or informal, being this dichotomy the first element of debate for constructing my concept of governance. The dichotomy *formal-informal* speaks of the emerging groups that could create agreements within legal institutions or within simple social practices.²⁶ *Informality* means that certain actors can organize to pursue a common goal. The results of this interaction are rules based on implicit understandings and not accessible through written documents or necessarily sanctioned through formal

²³ Keohane and Nye, 2000:2-9

²⁴ Keohane and Nye, 2000:12

²⁵ Hart and Pakrash, 1999:2

²⁶ Keohane and Nye, 2000; Rosenau, 1992:7-9

positions.²⁷ Informal agreements are enforced by the same organization actors.²⁸ In the international arena, forms of governance without the presence of formal institutions or the state appear constantly. This phenomenon has created diverse patterns of interaction and responses to authority and government.²⁹ In this sense, Hart and Pakrash propose that institutions may operate successfully without formal organizations and one should not assume a one-to-one correspondence between them.³⁰

Formality refers to explicit rulings generally expressed in institutions like agreements or treaties - usually with states as main performers.³¹ The main difference in this kind of relations is that “informal governance-mechanisms are based on trust in persons, rather than on a formal contract.”³² Formal rulings define certain goals and compliance mechanisms to actors (public or private) giving a ruling framework for them to interact and to solve conflicts. Following this argument, *governance* would be defined as to how the formal and informal rules interact and are managed and enforced. In other words, how power and authority are exercised within this interaction.³³

However, “rules in a piece of paper do not constitute social institutions or particular promises.”³⁴ In this sense, the logic of formal-informal dichotomy needs to be tested by effectiveness in pursuing goals. Thus, effectiveness would constitute the second element for constructing the concept of governance as a policy process.

For formal rules, measuring effectiveness does not present obstacles. The compliance of the own system, agreed rules, and goals would be enough to incorporate a

²⁷ Boesen, 2006:3

²⁸ Farrell and H eritier 2003

²⁹ Boas et al, 2005:4

³⁰ Hart and Pakrash 1999:2

³¹ Boas et al, 2005:4

³² Boesen, 2006:3

³³ Boesen, 2006

³⁴ Hasenclever *et al*, 1997:20

revision, reform, or change to the policy process.³⁵ This process would be performed with certain control under the own rulings. However, for areas such as environment, effectiveness can be measured in terms of policy outcomes or environmental results—especially in informal relations, where usually there is no policy outcome but social practices. Because informal rulings are not clear to everyone within or outside the collectivity and rely in incomplete information, one cannot assert on their degree of compliance. Thus, one can only see if they have the expected results or not. Some authors propose several characteristics that limit or enforce effectiveness in compliance in formal and informal relations that are shown in Table 1 below.

Table 1: Formal and Informal Rules³⁶

Informal (Relation-based)	Formal (Rules-based)
1. Relying on private and local information	1. Relying on public information
2. Complete enforcement possible	2. Enforcing a subset of observable agreements
3. Implicit and non-verifiable agreements	3. Explicit and third-party verifiable agreements
4. Person-specific and non-transferable contracts	4. Public and transferable contracts
5. High entry and exit barriers	5. Low entry and exit barriers
6. Requiring minimum social order	6. Requiring well-developed legal infrastructure
7. Low fixed costs to set up the system	7. High fixed costs to set up the system
8. High and increasing marginal costs to maintain	8. Low and decreasing marginal costs to maintain
9. Effective in small and emerging economies	9. Effective in large and advanced economies

Informal governance would imply that there is no formal authority to restrain relations, yet effectiveness can be achieved. In fact, scholars as Ronald Coase have proposed that this kind of informal governance is more effective than when formal authorities (e.g. governments) interfere.³⁷ In the next section of this chapter, a discussion of this approach for the provision of global public goods will be presented. For the moment, I will focus on

³⁵ Hall and Thelen, 2009

³⁶ Author's elaboration building on ideas of Boesen 2006; Li et al 2003

³⁷ Coase, 1993

the effectiveness of both systems of rules and their linkage, based on how compatible their goals can be between formal and informal sets of norms.

In this sense, governance can indicate the intersection of different forms of relations between different authorities, resulting in a range of transnational structures. Gretchen Helmke and Steven Levitsky propose that there are four ways in which these sets of norms can relate: complementation, accommodation, substitution, and competitiveness.³⁸

Table 2: Relations between formal and informal norms³⁹

	Effective Governance	Ineffective Governance
Compatible Goals between informal and formal norms	Complementary	Substitutive
Conflicting Goals between informal and formal norms	Accommodative	Competitive

A *complementary* interconnection would mean that informal mechanisms would fill the gap of the formal ones and vice-versa. In an *accommodative* relation, informal norms could be viewed as

a ‘second best’ strategy for actors who dislike outcomes generated by the formal rules but are unable to change or openly break those rules. They violate the spirit, but not the letter of the formal rules, generally by tempering or modifying the *effects* of those rules. In so doing, they often help reconcile key actors’ interests with existing formal institutional arrangements. Hence, although accommodating

³⁸ Helmke and Levitsky, 2003:9

³⁹ In the original text, the headings for each column accounted for “Effective Formal Governance” and “Ineffective Formal Governance” presenting a typology of informality. However, there is a misconception in the comparison if other two headings for effectiveness in informal governance are not present, or if another relation is not established for effectiveness in formal governance relations. I use the general methodology, but to be more precise in the comparison, I generalized the concept to include both, formal and informal. Conceptually this means that the kind of relations can be viewed from either side, the formal and the informal.

informal institutions may not be efficient- or performance enhancing, they at times...enhance the stability or sustainability of formal institutions by dampening demands for change.⁴⁰

A *competing* relation implies that to comply with one rule, actors must violate another. A *substitutive* relation is created or used when informal relations are created by actors who seek to achieve results that formal institutions were expected, but they have failed to generate.⁴¹ In all of these relations, the key to effectiveness is explained by the authors to be the weakness of informal norms. If the informal system is strong, effectiveness is achievable and vice-versa.

At this point it turns useful to explore the third element of the discussion about formality and informality, the role of *institutions and norms*. According to Douglas North, institutions are structures that constrain behavior.⁴² To complement this definition, Peter Hall and Kathleen Thelen tell us that institutions are “a set of regularized practices with a rule-like quality in the sense that the actors expect the practices to be observed, and which in some but not all cases are supported by formal sanctions.”⁴³ In this sense, institutions can be considered as instruments of governance.⁴⁴ As mentioned before, institutions would need to be effective. In addition, there is a need to incorporate dynamism to institutions. This can be achieved by exploring the concept of *resilience*, understood as the degree of capacity adaptation and the dynamism of institutions in the face of changes--internal, external, of leadership, of goals, etc. In other words, how robust and solid are institutions in

⁴⁰ Helmke and Levitsky, 2003:10

⁴¹ Helmke and Levitsky, 2003:10-11

⁴² North, 1990

⁴³ Hall and Thelen, 2009

⁴⁴ Hart and Pakrash, 1999

facing time and change.⁴⁵ There are three possible ways in which institutions may change: reform, defection, and reinterpretation.⁴⁶ Reform involves a change in the main rulings with the support of members. The reform of governance institutions needs to express, in a flexible manner, the changing number of actors and the degrees of attachment to common values in the medium and long-run.⁴⁷ On the contrary, defection would require disintegrating the institution and building a new one. Reinterpretation means that the institutions' actors change principles and beliefs but without dismantling the institution. In this sense, institutionalization can be defined as the structure of how values are allocated in specific contexts.⁴⁸

The *role of norms/rules* is another important element for the concept of governance. Norms that can be widely accepted among actors of institutions are one of the bases for the deep interconnection process.⁴⁹ In this sense, institutions are the grantees of norms and perform more than bargaining forums. Examples where bargaining has taken place are international environmental institutions and diverse set of norms.⁵⁰ In climate change topics, this bargaining has had a cornerstone - the scientific knowledge. Science has provided the legitimization negotiation table in order for actors to debate norms within environmental institutions, whether global, transnational, national, regional, or local. However, there seems to be an inconsistent logic between the legitimacy of global agenda issues—based on knowledge and science—with the real implementation of norms.⁵¹ For example, for climate change, there was a scientific consensus about the anthropogenic

⁴⁵ Hasenclever et al, 1997

⁴⁶ Hall and Thelen, 2009

⁴⁷ Keohane and Ostrom, 1995

⁴⁸ Clark, 2002; Myint, 2007

⁴⁹ Keohane and Nye, 2000:19; Rosenau, 1992:4

⁵⁰ Hass, 1992

⁵¹ Litfin, 2000

dimension of the problem;⁵² yet, the implementation of these norms was less than successful. The legitimacy of implementation of global rules seems to be working with a different logic. In general, institutional norms on climate change did not take into account the logic of the economy. In Chapter 2, I will present the debate on the legitimacy and effectiveness of global climate change institutions.

The fourth element to construct my concept of governance under the formal-informal discussion will be *accountability*. For the formal norms and institutions, it is easier to verify behaviors regarding to budgets, project designs, and results. There is a clear leader of the institution or governance scheme that would respond. In addition, there are different levels in the policy process that can be also accountable. On the contrary, in informal policy relations there is ambiguity in many areas of the process, yet as Boesen and Coase suggest there can be a complete enforcement of agreements. Nonetheless, there are no verifiable mechanisms of rule enforcement and the failure of results. If informal institutions try to make the state or other actor accountable, the task would be very difficult because the relations within the policy process usually are personal and not confirmed by anyone else. To be clear, there would be no legal mechanism to make the authority accountable, but probably there can be political ones. Guillermo O'Donnell points out that informal mechanisms usually cohabit with formal ones in developing societies,⁵³ being the first the ones that dominate. He situates the policy process in a “gray area,” where both norms

⁵² Consensus over the “anthropogenic” character of climate change was not fully achieved. Some scientists still claim that climate change is a natural geological episode in earth’s history. However, when the IPCC published the three scientific reports in 2006, consensus was almost achieved among the epistemic community.

⁵³ Furthermore, informal ties are also present in developed countries through technological advances, presenting sometimes the same accountability problems.

live together.⁵⁴ In other words, the interaction between formal and informal institutions may actively reconfigure competing norms into more compatible ones.⁵⁵ However, the necessary condition for interactions (formal-informal) needs to be law-enforcement. This would imply that the formal part of it should be dominant in the policy process.

1.2 RELOCATION OF AUTHORITY: DIVERSITY OF ACTORS

In order to continue with the discussion on how formal and informal sets of norms interrelate in governance processes, the role of authority needs to be explored; thus, it will constitute my fifth element. It is “through the exercise of authority that decisions are made and implemented and the coherence of collectivities thereby preserved.”⁵⁶ I will use the Weberian broad concept of authority defined as the power accepted as legitimate by other subjected to it. This means that an important part for authority deals with *legitimacy*.

Although the rules and procedures for exercising control may be codified and cited as the ‘authority’ for policies pursued, this is only a shorthand and legalistic way of referring to complex relational processes...authority is maintained only to the degree that the membership continues to treat the leadership as having the right to lead [where] legitimacy is the acceptance attached to the actions by the membership.⁵⁷

⁵⁴ Guillermo O’Donnell frames this assertion in an analysis of democracies. He proposes that some democracies do not follow in the traditional category of representative democracy—especially in the region of Latin America. He calls this new categorization “delegative democracies”, which account with elements of traditional authoritarian practices but combine them with elements of transition to representative and liberal democracies. O’Donnell 1993.

⁵⁵ Helmke and Levitsky, 2003:13

⁵⁶ Rosenau, 1990:186

⁵⁷ Rosenau, 1990:190

Some authors see authority as a function of governance for establishing and implementing collectively binding decisions, as well as limiting.⁵⁸ When relating authority to the concept of governance, it seems to derive in two directions. On one hand, there are those like James Rosenau that argue that it is a system of rule that works only if accepted - without any central authority.⁵⁹ Krahmman agrees with Rosenau and defines governance as the structures and processes that enable governmental and non-governmental actors to coordinate their interdependent needs and interests through the making and implementation of policies in the absence of a unifying political authority.⁶⁰ On the other hand, there are those who assert that an authority is needed to perform governance, either in the form of hegemony or of a paymaster that counts with legitimate authority.⁶¹

The leadership of the paymaster in formal schemes would normally imply that authority rests in states, and it is performed by governments.⁶² In informal schemes, this leadership can be exercised by anyone; however, even in non-hierarchical regulation processes “the shadow of [state] hierarchy” is present.⁶³ Also, this would be assumed for providing global public goods, where having a paymaster would tend to avoid free-riding due that one actor has the legitimate authority to punish defectors and to absorb the majority of transaction costs.

In this scenario of diffused authority among different actors in the governance process, who could perform as paymasters? There are some scholars that plea for not

⁵⁸ Draude, 2007

⁵⁹ Rosenau, 1992:2-9

⁶⁰ Krahmman, 2003:330

⁶¹ The proposal that a regime would need to have one member to become hegemony was discussed by Stephen Krasner in his theory of regimes. Oran Young elaborated on that idea, and proposed three categories of leadership: negotiated, imposed and spontaneous. In the imposed and negotiated, a leader would be present. See Krasner 1983 and Young 1982.

⁶² Weiss, 2000:801

⁶³ Draude, 2007

leaving the State aside governance processes.⁶⁴ Their main argument is that the State has authoritative capacity to enforce rules to give stability to transnational complexity, where there is overlapping of interests, levels, structures, and actors.⁶⁵ For others, governance can be understood as a complex set of governing structures and processes that goes beyond governments of States.⁶⁶ In this approach, formal relations would include governments but not as centralizers of authority. In other words, governance includes governments, but as another channel of flow for commands to reach goals and policies;⁶⁷ not necessarily the ones in possession of the relocated authority which guarantee results.

This diffusion of authority and the debate about the role of the States has resulted in the emergence of different ranges of authority, legitimacy and influence, with local, national, transnational, or global scope. Groups in civil society as non-governmental organizations, local, regional and global governance institutions, and firms have taken advantage of this situation. The diversity of actors interacting into a governance process can be immense, and the kind of actors can be heterogeneous.⁶⁸ As Elinor Ostrom suggests, it is not important the number of actors but the strength of the understandings of common interests, the way they share the costs for cooperation, and their assets—information, decision-making structures, and authority.⁶⁹

Among the multiplicity of actors, the role of the State in governance processes is still important for some authors. Some authors tend to give it central importance over other actors, yet with its authority being eroded. Thomas Weiss establishes that the link that relates “governance patterns with national and global levels lies in solving the collective

⁶⁴ Draude, 2007:7; Cerny, 1999:197

⁶⁵ Cerny, 1999:197

⁶⁶ Weiss, 2000:795

⁶⁷ Rosenau, 1992:2-4

⁶⁸ Keohane, 1995:6

⁶⁹ Ostrom, 1990; Keohane and Ostrom, 1995:7

action puzzle to provide public goods.”⁷⁰ Some others intend to minimize the importance of the State in governance processes and in the provision of public goods;⁷¹ others plea for transforming the state into a competitor⁷² or even into an efficient, innovative and profitable corporation.⁷³

Hart and Pakrash have suggested that the state needs to rearticulate itself to continue providing and redistributing services. One of the ways to do it would be “to co-produce collective goods with their citizens [and] to include civil society in institutional design and implementation.”⁷⁴ Thus, the State would obtain legitimacy by redistributing gains for winners and losers. An interesting view is that of Evans, who notes that either states become more repressive to provide collective goods or they start, as mentioned before, including society in the decision making.⁷⁵ However, if we understand governance as a policy multilayer process, the separation between public and private is no longer clear due to the fact that nowadays,

public authorities engage directly in economic activities through state-owned or controlled companies and private firms take on public functions such as setting standards or providing health care. The rise of the “competition state” and the dramatic expansion of the social responsibilities of business firms have blurred the once clear line between public and private sectors.⁷⁶

⁷⁰ Weiss 2000:807

⁷¹ Weiss, 2000:807

⁷² Cerny 2006:379

⁷³ Turnbull, 2002

⁷⁴ Hart and Pakrash, 1999:15-16

⁷⁵ Evans, 1997

⁷⁶ Kobrin 2008:4

This mix in agency will be explored in the next section, where public and private (what) will find intermediate areas, especially for climate change topics. Nonetheless, for governance to be operable, I argue that public authority is needed for certain aims: 1) to internalize, regulate, and implement global governance issues and agreements; 2) to design the mix of policy mechanisms and coordinate them by using budget resources; 3) to correct market failures in providing public goods (national or global); 4) and to create incentives for other actors through policy and sanctions for the failure of accomplishing goals.

1.3 The Scope of Governance

The discussion about the state's role in governance processes leads us to the debate about the scope of governance. How wide is it, how wide should it be? Some authors see governance as a process of coordination between levels of formal authority: global, multinational (regional), national, and local (or sub-national).⁷⁷ To talk about levels gives the idea of hierarchy, where the global level is above the multinational (regional) and the national ones. However, to talk about levels would mean that there is a separation between global- regional- national agendas, objectives, and goals. Yet, for environmental protection and climate change this process of differentiation is not always as clear as it may seem.

Isidro Morales explains that multi-layered governance architecture is more accurate to explain new power relationships within a globalization framework among states, markets, institutions, and non-government actors. Layers can be conceived as spheres of authority well differentiated, in spite of being intertwined with the state.⁷⁸ This vision

⁷⁷ Krahmman, 2003

⁷⁸ Morales, 2008:20-1

encompasses more actors and goes beyond the hierarchy of the level approach,⁷⁹ and it transcends formal links. It also allows the construction of governance institutional structures that not just belong to one of the levels but overlap them in a transnational form. Finally, this approach clarifies the confusion between governance and government (especially at the national level). Government would represent a central public authority only under a national level or state while governance would represent a fragmented combination of public and private actors at different levels.⁸⁰ Thus, governments would be the main tool of the State. To further clarify the relation between governance and government, Fabio Masini suggests that to speak of multi-layers implies addressing institutional governance structures that can be composed by levels of cooperation,⁸¹ in other words levels of government.

1.4 A Redefined Concept of Governance

Governance could be understood as *processes of coordination among different actors and government levels in diverse constructed formal and informal relations expressed in multiple layers, with a leader that is granted with legitimate authority. In the case of environmental governance, the purpose is generally to provide public goods.*

At this point, it appears necessary to explore the elements of this definition. In the first place, *coordination* will be conceived as a relational process that performs in different ways. Coordination can occur within layers, and among levels or actors; it can occur also among different layers of authority for different topics. These spheres of authority, although

⁷⁹ Lisbet Hooghe and Gary Marks (2003) use the term “multi- or polycentered” governance to describe what in this thesis is called multi-layer governance. This also reflects that governance processes not necessarily have hierarchical authority.

⁸⁰ Krahnemann, 2003:326-30

⁸¹ Masini, 2011

having frontiers (sectors, issues, problems), are flexible enough to change and incorporate other issues and other actors. This characteristic is achieved through cooperation and operated through regulation.

Multi-layer coordination normally happens within a transnational scope, where the relational process is in hands of governance institutions, but the implementation of policies needs governmental appropriation. In this sense, governance institutional structures and government operations cannot be completely separated. To make governance operable, centrality at certain layers needs to be present. This would be true if we define governance not as lacking public authority, but as one expression of it. This does not mean that international organizations or national governments would be left aside. In fact, “states could reinforce their governance capabilities by delegating authority and power to sub-nation units, transnational institutions, and/or supranational ones.”⁸² States could also reinforce their capabilities by taking advantage of other actors’ trends, norms, and rules to extend them in a nation basis or incorporate them into national policies. As Kal Raustiala notes, international organizations also reinforce the governance scheme in topics as environment.⁸³ This is true for the case of climate-change governance in North America, where “global trends, despite of operating in the supra-territoriality of flows, concentrate and operate within territorialized and delimited spaces.”⁸⁴

In this coordination scheme, Jan Aart Scholte suggests that regulation in a post-sovereign world has mainly occurred in a bureaucratic way⁸⁵ and tends to facilitate governance processes. However, diverse processes coexist within multi-layer governance,

⁸² Morales, 2008:22

⁸³ Raustiala, 1999

⁸⁴ Morales, 2008:16

⁸⁵ Scholte, 2000: 157

one that represents status quo and situates the State as the main regulator, and another that presents a variety of actors that can play the role of regulators. Scholte notes that “the irruption of the global era does not mean that everything is moving and changing. There are in fact various elements of continuity from the ‘old’ order and the new emerging one.”⁸⁶ In other words, the flexibility of bureaucratic principles makes continuity and change to coexist.

Within the continuity-and-change discussion, multi-layer governance also implies that traditional territorial approaches cohabit with new forms of institutionalizing territorial regulation and governance. One example is regionalization trends within a multi-layer framework, where traditional territories within the state become territories beyond state borders or where they are transformed into virtual regions. Associations of communities (either neighboring or not), transnational institutions, or telecommunication interconnections facilitate this process.

Traditionally, the concept of coordination would be inscribed into federalist theoretical frameworks.⁸⁷ Coordination would take the federalist principle of “shared and self rule,” usually expressed by levels of government where each one has certain autonomy in policy making.⁸⁸ However, in a multi-layer framework, coordination happens when one issue needs to be dealt by different orders of government and other actors. For example, there are several forms of regulating coordination. *Co-operation* is one that provides

⁸⁶ Scholte, 2000: 157

⁸⁷ Theory of federalism notes that there can be different types of relations among federated units and national governments. This usually implies a clear hierarchy in policy making. There are a lot of scholars who have been discussing federalism; among the most relevant in terms of theoretical debate, see Elazar, 1987; Kincaid, 1998; Brown, 2002; Watts, 1999.

⁸⁸ Brown, 2002

mechanisms for achieving shared goals that would be very difficult to treat individually, for example border issues.⁸⁹

Coordination also performs in a *competitive* manner. Some of the actors within or outside governance structures sometimes compete with each other. In fact, there are some governance schemes that give incentives for this competition, for example in market issues. Nonetheless, sometimes the problem of overlapping appears when actors address the same policy issue simultaneously but in with different strategies.⁹⁰

These forms of coordination are possible because of the different scales of regulation. Regulation can adopt several forms. The first one is *convergence*. Convergence will be understood as the trend of policies to look alike regarding their structures, processes and performance.⁹¹ The drivers of this convergence can be ideological, economical, external (contextual), or internal (within the actor or layer).⁹² The second one is *harmonization*, which will be simply defined as standardization of policies or processes generally through specific institutions;⁹³ the third one is *linkage*, which would deal with establishing certain instruments for linking governance processes with no institutional building.⁹⁴

In a regulatory scheme, governance can be performed at subsidiary layers, especially for providing public goods. John Ferejohn and Barry Weingst state that in order to decide about subsidiarity it means which jurisdiction will be more capable of providing

⁸⁹ Brown, 2002

⁹⁰ These three characteristics, coordination, cooperation and competition are part of a framework analysis sketched by Douglas Brown, 2000

⁹¹ Drezner, 2001

⁹² Drezner, 2001

⁹³ Tuerk et al, 2009: 343

⁹⁴ World Business Council for Sustainable Development, 2007

public goods. However, this depends on their characteristics.⁹⁵ Next section will explore these characteristics by arguing that climate change policy, as a global public good, would be better provided by local governments.

2. GLOBAL PUBLIC GOODS IN CLIMATE-CHANGE GOVERNANCE

2.1 GLOBAL PUBLIC GOODS/BADS: CLEAN AIR AND CLIMATE CHANGE

The main problem with climate change is that air (or the atmosphere) has been filled with pollutants that absorb and retain heat. Heat will produce changes in temperature and precipitation, affecting climate. Assuming this is true, the main object for climate-change governance would need to be the air and the policies for cleaning it. In this section, I propose that clean air (and consequently the tackling of climate change) needs to be considered a global public good, not an environmental private commodity. I will start this section by defining a global public good and establishing the difference between these and private ones. For so doing, I will define the three characteristic parts of the concept: the *globalism*, the *publicness* and what is understood as *good* (or “*bad*”). Then I will then analyze how in environmental issues, instead of public goods, we generally find public “bads” (or externalities) in need to be corrected. These externalities are inscribed into market failures due, in many occasions, to incomplete markets; which is also a characteristic of environmental issues. The second part will explain who provides the corrections and the prevention of externalities. I will finish this section analyzing climate

⁹⁵ Ferejohn and Weignst 1997:xiii

change, the provision of clean air under the former concepts, and useful instruments for addressing the problem.

Understanding the three elements of Global Public Goods

I will start the conceptualization by presenting the differences between public and private goods. The first one is given by the classic definition of public goods (or “collective” goods) that establishes that they are non-rival and non-exclusive.⁹⁶ **Non-rivalry** means that one person does not compete with another for the use of the public good, because one’s use does not reduce other’s use. **Non-exclusivity** refers to the fact that no one can be excluded from using it, because it would be extremely costly or technically impossible.⁹⁷ For example, public *goods* can be 1) tangible, as roads, infrastructure, clean air; 2) intangible as knowledge, security, peace; and 3) policy outcomes such as environmental protection.⁹⁸ In contrast, private goods are excludable in benefits or costs and rival in consumption.⁹⁹ The reason for this is that the private ones have clear property rights and can enter, then, to the market. In other words, there is the ability of the market to allocate resources efficiently in the case of private goods.¹⁰⁰ For public goods—especially environmental ones—the market is unable to allocate resources in an efficient way, so a market failure occurs (or to say, the market is lacking elements, turning it incomplete).¹⁰¹ This means that in the process of production of a private good, private producers pay the costs, but a divergence between private costs and social costs occurs as society as a whole pays for the damage. Example of this would be pollution resulting from industrial processes.

⁹⁶ Samuelson, 1954:1

⁹⁷ Hanley et al, 1997:37

⁹⁸ Kaul et al, 2003:15-7

⁹⁹ Kaul and Mendoza, 2003:79

¹⁰⁰ Kahn, 2005:14

¹⁰¹ Hanley et al, 1997:22

Market failure occurs when markets are not complete; in other words when they lack clear property rights necessary for exchange.¹⁰² This situation has obliged governments to correct these market failures and act as grantors of property over these assets¹⁰³ for its provision. A counter-argument can be found in the Coase Theorem, developed in 1960. Ronald Coase pointed out that private partners would reach a Pareto¹⁰⁴ efficient solution regardless of the party to whom property rights have been assigned—assuming there were no transaction costs.¹⁰⁵ However, this assumption does not take into account that transaction costs¹⁰⁶ have to be paid by someone. Garret Hardin’s arguemen that “freedom in commons brings ruin to all”¹⁰⁷ would support that if talking about public goods (“commons”), society as a whole would pay the cost of private actions or bargaining. In other words, public goods are subject to underprovision due to open access.¹⁰⁸ Coase recognizes that there are limitations in his theory. First, although the main premise is that the market will resolve disputes, he accepts that “there is no reason why, on occasion, such governmental administrative regulation should not lead to an improvement in economic efficiency.”¹⁰⁹ In this sense, Hardin suggests that the tragedy of the commons could be prevented by coercive laws or taxing devices that make it cheaper for the polluter to treat these pollutants than not to treat them.¹¹⁰ But there is a possibility that transaction costs can be so high that the existing law might not be changed to allocate property rights.¹¹¹ Elinor

¹⁰² Hanley et al, 1997:24

¹⁰³ Hanley et al, 1997:25

¹⁰⁴ An allocation is Pareto efficient or optimal when there is an impossibility of relocating resources to make one person in the economy better off without making someone else worse off. See Hanley et al, 1997:24

¹⁰⁵ Coase 1993:116-119

¹⁰⁶ Transaction costs are the costs of devising, monitoring and enforcing rules to a particular objective. See Keohane and Ostrom, 1995:2

¹⁰⁷ Hardin 1993:9

¹⁰⁸ Keohane and Ostrom, 1995:4

¹⁰⁹ Coase, 1993:122

¹¹⁰ Hardin, 1993:11

¹¹¹ Coase, 1993:123

Ostrom points out that sometimes government investment has disrupted local institutions and practices, which has caused that incentives for cooperation vanish.¹¹² However, if we think of public goods as environmental assets, there would be an enormous social cost if property rights were *only* privately allocated. Due to this, in general, environmental property rights are in hand of authorities or in a combination between the public domain and privates. Examples of this situation can be found all over the world, but specifically in the three countries of North America where environmental assets are either owned completely or partially by local authorities as in Canada and U.S. or by federal ones as in Mexico. Environmental assets in some localities are managed in a communitarian manner, dividing the property rights between private individuals, a collectivity (the community) and the local authority. Examples of communitarian management are Mexican Protected Natural Areas or some collective forestry enterprises in Oaxaca and Michoacán. Finally, although the process for proving a global public good (or transforming a bad one into a better one) could be priced, the outcome (public good) would not be owned by anybody that the price becomes very high. Example of this characteristic is clean air, where transaction costs of transforming polluted air into clean air are high and not equally paid by all. Then, the problem of free-riding appears due that there are no incentives to reduce pollution, as there are no visible individual costs or benefits from doing it.¹¹³ For global public goods, dealing with free-riding at a global scale has challenged the task of producing and providing them.

The second difference between public and private goods is that for private ones it is known how consumers behave, because when they pay for the good, they are already

¹¹² Ostrom, 1995: 125-7

¹¹³ Stern, 2007:27; Kaul, et.al, 2003:ii-iii; Hanely, et al, 1997:43

making preferences. For public goods, non-excludability makes difficult for consumers to reveal their preferences. Due this, there is no mechanism to price them correctly and imperfect information arises.¹¹⁴ For example, markets of energy, land use, or water do not reflect the consequences of different consumption and investment choices for the climate.¹¹⁵ These characteristics apply regularly to pure public goods¹¹⁶ as national defense or climate. However, there are certain cases where exclusion and rivalry can be applied to them as a policy decision. An example of exclusion would be when there are charges (pricing schemes) for the public good; an example of rivalry when consumers are limited by groupings, so that the public good would reach differently to different people.¹¹⁷ Rivalry would not be a problem for abundant resources as oxygen, but probably for scarce ones as water. Example of this partiality in rivalry and exclusion are fossil-fuels. Fossil fuels are not a global public good but a private one (in hands of private or public actors). Leaving for later discussion the debate about who can own and exploit these fuels, I assert that they need to be addressed as partial public goods due to their impacts. In these sense, they can be easily overused or appropriated by privates with no responsibility for their impacts to commons, which constitutes social free-riding. In a globalizing world “it has become more difficult to exclude non-paying users (free-riders) from outside national boundaries from benefitting from nationally-provided collective goods.”¹¹⁸ This kind of resources that compose the *common natural pool*¹¹⁹ of humanity, generally are in this gray area of quasi private in origin (or in production) and quasi public in impact (or in

¹¹⁴ Kahn, 2005:17; Kaul and Mendoza; 2003:80

¹¹⁵ Stern, 2007:27

¹¹⁶ Hanley, et al, 1997:42

¹¹⁷ Kaul, et al, 2003:iii

¹¹⁸ Cerny, 1999:200

¹¹⁹ The theory of “common-pool resources (CPR)” was drafted by Robert Keohane and Elinor Ostrom. They defined CPR as the natural resources humanity has, but different to a pure global public good in that they are sometimes object to rivalry or excludability in consumption or impacts.

consumption/environmental degradation).¹²⁰ How public a good is and what range of action do benefits and costs reach need to be addressed in a more precise manner. Generally, these private-in-origin and public-in-impact goods are found in the public domain—not necessarily of state domain—with no or unclear property rights.¹²¹

What is then “public” in these goods? Their “publicness” as Philip Cerny suggests is essentially normative; it denotes matters that people think ought to be treated as common or collective concerns.¹²² But, who represents this collectivity? The public would include every person, group, civil organization, business¹²³ or family, as well as states and markets.¹²⁴ In other words, “public goods are the public’s goods”¹²⁵ or everyone’s goods. The public domain depends of two criteria. First, how public and participatory is the decision-making process; second, how equally the benefits are distributed into the public.¹²⁶

These two ways of categorizing public goods will be explored in this section. The first one deals with normative characteristics. Cerny establishes that there are four characteristics to normative public goods: they are regulatory, productive, distributive and redistributive.¹²⁷ The second deals with human activities over history, where two kinds of goods have existed simultaneously: the natural public goods and the human-made public goods, such as infrastructure and security systems. Yet, these last ones can impact the natural public goods, creating public “bads.”¹²⁸ When these public “bads” impact other people different than the ones who caused the damage, an external damage occurs.

¹²⁰ Lipschutz and Fogel, 2002

¹²¹ Kaul, et al, 2003:7

¹²² Cerny, 1999:199

¹²³ Business is usually seen as a private actor, but when the sector acts as public citizen, for example, when they participate in the stock exchange, they can be considered part of the public domain.

¹²⁴ Hoppkins, 1999

¹²⁵ Kaul et al, 2003:14

¹²⁶ Kaul and Mendoza, 2003:85

¹²⁷ Cerny, 1999:200-203

¹²⁸ Kaul et al, 2003:7

Externalities are understood as side-effects or spill-overs (can be damaging or beneficial) resulting of market transactions, generally not intentional.¹²⁹ If the spill-over of effects of one jurisdiction to another is harmful, as in the majority of the cases of environmental pollution, there would be an extra cost of preventing others' pollution processes.¹³⁰ In externalities or public “bads,” as climate change or polluted air, the damage to one person does not reduce the damage to others not even to the person who in the first place polluted the environment. This characteristic confirms that there is nonexcludability and nonrivalry of impacts and consumption.

A public “bad,” as polluted air and climate change, can also operate as a dynamic externality. This occurs when, for example, air pollutants as persistent organic pollutants (POPs), pesticides, radioactive wastes, or chlorofluorocarbons (CFCs) tend to accumulate over time causing persistent damage for the future and enormous social costs for next generations.¹³¹ There is also a need to consider that polluted air and climate change are externalities that bear the burden of uncertainty about the potential size, timing, location of impacts, and future costs.¹³²

For some environmental public bads as oceanic depletion, water contamination, or air pollution the scope of publicness is generally wider in spatial range than other environmental issues as controlling solid wastes or pesticides in agriculture. Although some public goods are constructed global, such as security, some are essentially global.

The nature of public goods can be understood to come from globalization and the provision of them being one of its key goals. “Indeed, the clamor against globalization can

¹²⁹ Kahn, 2005:21; Baumol and Oates, 1988:17

¹³⁰ Kaul, 2003: xv).

¹³¹ Stern, 2007:28; Kahn, 2005:31

¹³² Stern, 2007:28

be interpreted as a call for better provision of global public goods.”¹³³ “Globalism” of public goods/bads means that they span across different levels and layers of governance schemes all over the world. The recipients of the global public good/bad are basically world population, transnational actors, non-state and nonprofit actors, and states. In other words, a *global* public good is one that its benefits or impacts extend to many people, countries, and generations;¹³⁴ it transcends time and territorial space. Although air circulates freely all over the planet, it is *clean air* that can be understood as a global public good that should be provided by climate-change governance. Consumption of clean air is not exclusive and benefits are also available to all consumers.

2.2 WHO CAN PRODUCE AND PROVIDE GLOBAL PUBLIC GOODS?

Either public authorities or private markets can provide public goods.¹³⁵ However, for producing *global* public goods, some authors suggest that it is not enough that nations sum up efforts; it is necessary that common research, knowledge, and surveillance be in hands of global institutions.¹³⁶ In other words, the first element for the production of global public goods is an institutionalized political and policy process, “where regulations of private activities [with a global scope] are the primary means to produce some types of public goods.”¹³⁷ Institutional arrangements need to exist to create incentives to provide them, through such means as linking private with public goods or the activities of political

¹³³ Kaul, 2003:4

¹³⁴ Kaul, et al, 2003:10-23

¹³⁵ Kahn, 2005: 18; Kaul, et al, 2003:9

¹³⁶ Kaul, et al 2003:12

¹³⁷ Smith, Shwabe and Mansfield, 2004:2

entrepreneurs.¹³⁸ Yet, authors, such as Kahn, prevent us to be careful with governmental intervention. Sometimes governments instead of correcting divergences between private and social costs, they make them wider causing distortions.¹³⁹ The second element would be financing the provision of global public goods, which requires an adequate allocation of resources. The last element would be management to implement this provision in the best and the most efficient manner.¹⁴⁰

The scale of provision of public goods depends on the range of benefits. Environmental public goods with a narrow range of benefits, as cleaning of lakes or rivers, endemic species conservation, etc. need to be provided locally. The ones with nation-wide scope should be provided centrally, and those with global range, globally.¹⁴¹ To assure that global public goods are provided, there is the assumption that nation-states alone cannot provide them adequately. Thus, they require global solutions through cooperation for them to be provided locally.¹⁴² Even though the public-goods theory has been state-centered, there is a need to redefine institutional interactions and spatial management through policy entrepreneurship to truly understand global public goods.¹⁴³

Some authors suggest that the concept of *subsidiarity* be used to implement global norms into local regulation. For example, to produce a global public good in a regional basis, jurisdiction would need to be established or created clearly. Some authors claim that if the benefits/impacts of regional provision spill over to the next jurisdiction, then the issue should be globally treated and provided. “The more global is the region over which the

¹³⁸ Keohane and Ostrom, 1995:13

¹³⁹ Kahn, 2005:20

¹⁴⁰ Kaul, et al 2003:15

¹⁴¹ Kaul, et al 2003: xiii-xiv

¹⁴² Stern, 2007:xiii; Kaul, et al 2003:12; Keohane and Ostrom, 1995:11

¹⁴³ Kaul, et.al, 2003:5-6

benefits extend, the greater is the need for global policy instruments.”¹⁴⁴ The local (regional) under-provision of a global public good can be felt everywhere in the world.

For example, although some environmental public goods are in general global, the impacts of not having them are very different and specific according to the regional particularities and circumstances.¹⁴⁵ In other words, in spite of their “globalism,” responses have had territorial and administrative bases that have tried to be coherent with the same territory and activities developed. An example of this is that actors of multi-layer governance have sometimes voluntarily accepted global norms and common environmental standards, and they have tried to adapt them into their territories.

These responses have been thought under a regional and national results base. This offers the opportunity to situate localism not as the antithesis of globalism, but as one dimension of global processes and relations where new institutional arrangements are created among different actors with different goals based on different types and power relations, and with the participation of different levels of authority¹⁴⁶ or layers of governance. Some authors claim that provision of global public goods do not need to only be in the hands of one actor. If it relies only on markets, it would certainly cause unequal distribution of benefits.¹⁴⁷ If it relies only in governments, costs would not be taken into account. Sverker Jagers agrees with this assertion and notes that global environmental public goods should not only be the object of national policies but of other authorities and actors.¹⁴⁸ Global environmental provision rules need to be internalized partially or

¹⁴⁴ Kaul, 2003:xiv

¹⁴⁵ Cohen et al 2004; Kaul et al, 2003

¹⁴⁶ Hocking, 1999; and Duchacek, 1988

¹⁴⁷ Ibarrarán, 2007; Kaul et al, 2003

¹⁴⁸ Jagers & Stripple, 2003

completely by different actors in different ways.¹⁴⁹ Contemporary states have had the ability to adapt into a world where they are allowed to enter into durable and enforceable—“credible”—commitments about the common resolution of global public goods.¹⁵⁰ States have been “playing safe” into global ruling systems, especially in the environmental aspect. Yet, Cerny perceives the need to escape this pernicious dynamic by understanding global environmental governance—specifically for climate change—as a “three-level” strategy,

which include not only firm-to-firm diplomacy, but also transgovernmental networks and policy communities, internationalized market structures, transnational cause groups, and many other linked and interpenetrated markets, hierarchies, and networks.¹⁵¹

In other words, for the provision of global environmental public goods, it would be necessary to adopt a multi-layer governance approach that can design organizations and regulations operated by formal institutionalization and that can relocate authority.

2.3 CLEAN AIR AS A GLOBAL PUBLIC GOOD - GREENHOUSE GAS EMISSIONS AS GLOBAL PUBLIC BADS

For the problem of climate change there are different elements worth categorizing. Bringing up the idea above presented, I will establish that clean air is the basic global public good at stake to be recovered—to regain stable temperatures, avoid warming, and

¹⁴⁹ This “double-level” strategy between global and national institutions has been used by actors of global governance especially for climate change. See Agrawala et al, 2001.

¹⁵⁰ Cerny, 1999:191

¹⁵¹ Cerny, 2006:383

return to stabilized¹⁵² climate patterns. In addition, I will establish that the global public bad, or the object for policy design, is the cutting and management of greenhouse-gas emissions and adaptation to its impacts.

Air (or the atmosphere) can be placed as a pure global public good with nonexclusivity and nonrivalry. If we talk about greenhouse-gas emissions or air pollution in general, clean air would be in the way to become a global public bad. Kaul and Mendoza established that this transition explicitly leads to conceive it as partial global public good.¹⁵³ For example, pollution permits or cap-and-trade systems are property rights that basically allow someone to pollute the atmosphere and compensate for that, granting some sort of exclusivity in its use.

However, polluted air would be essentially nonrival in the sense that pollution permits do not make air owned by someone (characteristic of a private good), but only limit the actors' right to use it in a certain way; in this case, to pollute it.¹⁵⁴ When greenhouse gases (public bads) are emitted to the atmosphere, pollution's impacts have social costs to the entire world. These impacts depend on the mitigation and adaptation conditions available in different societies. For instance, they would be very costly for poor societies and less for rich ones though GHG were mainly emitted by rich ones.¹⁵⁵ For policy design, the costs of emissions, mitigation and adaptation are certainly rival and excludable, making GHGs a *partial* global public bad.

There can be two approaches for policy design of partial global public bads. The first is to focus on GHG sources to *mitigate* them and either to pay for prevention or for

¹⁵² According to The Stern Review, stabilizing the GHG levels in the air would require to maintain between 450 and 550ppm CO₂e. The current levels are at 430ppm and rising 2ppm each year. So stabilization means to bring down emissions to 80% below current levels annually. See Stern, 2007:xvi.

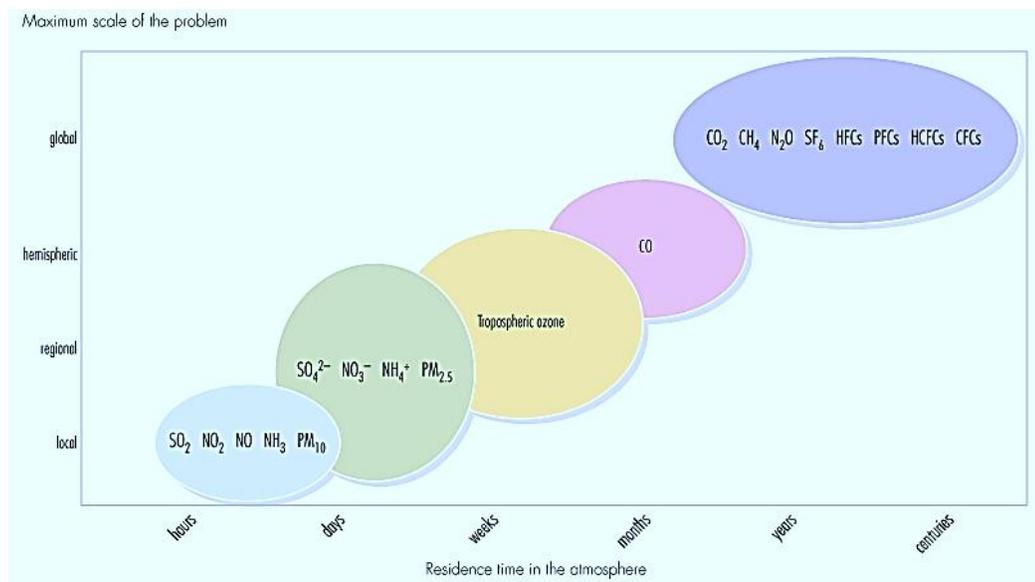
¹⁵³ Kaul and Mendoza, 2003:83

¹⁵⁴ Kaul and Mendoza, 2003:84

¹⁵⁵ Stern, 2007:31-4

pollution. The second would be to address their consequences by *adaptation*. For the choice of prevention, it is necessary to accept that the global public bad (polluted air) came from human-induced GHG emissions in a private and differentiated way. In this sense, the provision of a solution would deal with designing policies for cutting private GHG emissions (an accountable and tangible asset) to avoid externalities. GHG emissions usually accumulate in time and can be conceived as dynamic externalities.

Figure 1: Selected pollutants, their average residence times in the atmosphere and maximum extent of their impact¹⁵⁶



Any strategy would then need to take into account that “it is longer possible to prevent the climate change that will take place over the next two or three decades, but it is still possible to protect our societies and economies from its impacts to some extent.”¹⁵⁷ If we chose to simply pay for the right to pollute, we would only be bargaining for

¹⁵⁶ United Nations Environmental Program-GEO 4, 2007

¹⁵⁷ Stern, 2007:xvi

externalities and transferability, forgetting the global social cost. A transferable externality implies each individual protects himself from external damages “by simply transferring an environmental risk through space to another location or through time to another generation”¹⁵⁸ An example of this was registered when the United States Midwestern industrial states reduced regional air pollution problems (SO₂ depositions) by building taller stacks for emissions. Air currents transported these emissions to the northeastern states and to eastern Canada.¹⁵⁹ Sometimes, environmental policies that allow unilateral transfers of pollution instead of encouraging cooperative solutions will result in expenditures on self-protection that will be very high.¹⁶⁰ In this sense, the bargaining scheme of Coase would appear complicated, because “the spatial dimensions of the environmental resources link private activities to the public good matter.”¹⁶¹

When pollution permits are used, governance and authority institutions (usually governmental ones) are created to take into account this social cost. For example, even with these exchange institutions, environmental damage caused by one person could damage an entire ecosystem. In this sense, it would be very difficult to measure how much of polluted air every person makes or transfers per day and what percentage of eco-systemic damage would this represent. This leads to the problem of pricing for damages and the way these costs would be exchanged. In this sense, market mechanisms appear to be the most useful instrument.

Adaptation is the other policy approach. Whatever the mitigation focus one country chooses, “a ton of carbon emitted anywhere on earth has the same effect as a ton emitted

¹⁵⁸ Hanley et al, 1997:33

¹⁵⁹ Smith, Shwabe and Mansfield, 2004:7; Hanley et al, 1997:33; Dorfman and Dorman, 1993:439

¹⁶⁰ Hanley et al, 1997:36

¹⁶¹ Smith, Shwabe and Mansfield, 2004:8

anywhere else.”¹⁶² This means that everyone would need to adapt to nonexclusivity and nonrivalry of impacts of GHGs. Adaptation can be understood as the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”¹⁶³ There are three approaches to adaptation. First, there is the concept of adaptation under the UNFCCC where there is a need to provide reliable assistance for high-priority implementation projects. The second one is adaptation integrated with development, and the third one appears as climate insurances to compensate for vulnerability.¹⁶⁴ In general, there are some sectors more vulnerable than others, as health, agriculture, water, and biodiversity. In addition, there are societies more vulnerable than others due to its geographical location and low levels of development.¹⁶⁵ In this sense, markets would find it difficult to address vulnerability. The social cost of climate change would need to address adaptation as any other social policy.

Whatever approach (mitigation or adaptation) is taken or a combination of them, in the short run, the costs of not addressing this situation correctly will become more and more expensive over time. For Schelling, the costs of reducing emissions of CO₂ would cost hundreds of billions in perpetuity.¹⁶⁶ A more precise analysis was presented by Nicholas Stern in 2006.¹⁶⁷ In his report, Stern pointed out that

if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more. In contrast, the cost of action—reducing greenhouse gas emissions

¹⁶² Schelling, 1993:468

¹⁶³ Intergovernmental Panel on Climate Change, 2007

¹⁶⁴ Ian Burton et al, 2006

¹⁶⁵ UNDP-GEO4, 2007

¹⁶⁶ Schelling 1993:468

¹⁶⁷ The “Stern Review Report” was launched in 2006, but published until 2007.

to avoid the worst impacts of climate change—can be limited to around 1% of global GDP each year.¹⁶⁸

In this sense, the report emphasizes that the world does not need to choose between tackling climate change and promoting growth and development. Instead, addressing climate change can become a “pro-growth strategy”¹⁶⁹ with the combination of mitigation and adaptation strategies.¹⁷⁰ In fact, this combination could represent that other actors participate in the provision of the global public good, they are becoming leaders of growth and development; the price to be paid might be to decrease the state’s autonomy for an increase in problem-solving capacity and legitimacy.¹⁷¹

¹⁶⁸ Stern, 2007:xv

¹⁶⁹ Stern, 227:xvii

¹⁷⁰ Van Kooten 2004

¹⁷¹ Börzel and Rise 2002

3. THE SCIENCE OF CLIMATE CHANGE

The 4.5 billion year history of the Earth has been characterized by constant change. Change in its orbit and rotational movement, change in the shape, size and location of the continents, change in the composition of the atmosphere and in oceanic circulation, change in the type of species inhabiting the biosphere, and of course, change in the distribution of climatic patterns. Climate, as weather, is far from static. Just like weather changes from day to day, climate changes too but in different time scales, from years, decades and centuries to millennia or even longer, which correspond to the geological history of the Earth.

Climate has swung dramatically, from glacial to interglacial episodes of the Pleistocene (most of the past 2 million years), and from the much earlier periods of the so-called snowball Earth to the global sauna of the mid-Eocene (roughly 50 million years ago). Organisms had either responded to these changes through adaptations or extinction.¹⁷² This constant change eventually gave place to the conditions that rule our planet and allowed our species to develop. Most importantly, over the past 10,000 years (an interglacial period called the Holocene) climate has been relatively stable and favorable for human civilizations to flourish and prosper.

Even during this stable period, there have been regional climatic fluctuations produced by natural forcing, such as the so-called Little Ice Age (AD 1600-1800), when Europe experienced unusually cold conditions, or between AD 800 and AD 1000 where there were a series of droughts in the Yucatan Peninsula.¹⁷³

Modern climatic records have shown that the average surface air temperature of the Earth has increased approximately 0.6 °C over the past century and by about 0.2 °C to 0.3 °

¹⁷² Lomolino, 2006

¹⁷³ Bradley, 2008

C over the last 40 years. Studies of the statistical significance of the global surface air temperature trend over the last century have detected a significant change and have shown that the observed warming trend is unlikely to be entirely natural in origin.¹⁷⁴

History has taught us that variations in the Earth's climate have had considerable impact on society. But just as organisms are affected by climatic conditions, organisms can act as “ecosystem engineers” also affecting their environment. Some species do it locally, in small scale such as beavers. Others can have profound effects, as cyanobacteria that changed the composition of the atmosphere (producing oxygen) over millions of years. Now human race is altering the composition of the atmosphere, first in a local scale, and since the industrial revolution at the end of the XIX Century, at a global scale.

How is this new anthropogenic forcing going to affect climate variability? And most importantly, what effects would such climatic variation have on the planet? Predicting the effects that, e.g. a global increase in temperature could have on our lives is no simple task. Thus, we need a better understanding of how the climate system operates globally and regionally.

3.1 THE CLIMATE SYSTEM

In order to understand global climate change, we must first define global climate and the way it operates. Climate acts as the primary control for ecosystem distribution.¹⁷⁵ The physical conditions that make life possible on Earth are determined on our planet's location relative to the sun and the greenhouse effect of its atmosphere.

¹⁷⁴ Bertrand and Berger, 2002

¹⁷⁵ Bailey, 1998

Climate is conventionally defined as the long-term statistics of the weather (e.g., temperature, cloudiness, precipitation). These physical processes within the atmosphere are affected by several factors, such as ocean circulation, the reflectivity of the Earth's surface, the chemical composition of the atmosphere, and vegetation patterns. However, the driving force that controls these conditions is energy. There are three main sources of energy: (1) solar radiation providing heat and light, (2) the kinetic energy of the rotation and orbit of the Earth, and (3) internal forces of both heat and kinetic energy.¹⁷⁶

The solar radiation the Earth receives is continuous. Some of this energy is absorbed at the Earth's surface or by the atmosphere, while some is reflected back to space. At the same time, the Earth and its atmosphere emit energy to space, resulting in a balance between energy received and energy lost.¹⁷⁷

The energy arriving to the Earth comes in different forms, such as ultra-violet and visible radiation. The Earth emits back terrestrial radiation in the form of infra-red energy. These two major energy fluxes must balance, in other words, stay in equilibrium. The Earth's atmosphere, however, affects the nature of this energy balance. The greenhouse gases allow the shortwave solar radiation to pass through unimpeded, whilst trapping (absorbing) most of the long-wave terrestrial radiation. Consequently, the average global temperature is 15°C; 33°C warmer than the Earth would be without an atmosphere. This process is popularly known as the *greenhouse effect*.¹⁷⁸ A latitudinal interchange of heat also exists from the tropics to the poles. If this energy transfer did not occur, the equator

¹⁷⁶ Bailey, 1998

¹⁷⁷ Jacobs, 2005

¹⁷⁸ Buchdahl, 2002

would be 14° C warmer on average than it is now, while the North Pole would be 25° C colder.¹⁷⁹

The atmosphere does not behave as an isolated system. Transfers of energy take place between the atmosphere and the other parts of the climate system. The most important of these include the world's oceans. Surface ocean currents assist in the latitudinal transfer of heat. Warm water moves towards the poles, while cold water returns towards the equator. Energy is also transferred via moisture. Water evaporating from the surface of the oceans stores heat which is subsequently released when the vapor condenses to form clouds and rain. The surface ocean currents form part of a wider global ocean circulation system, with deep water currents also transferring energy across the Earth. This system is called the global thermohaline circulation, which means that it is driven by differences in temperature and salinity.¹⁸⁰

The second element of energy flux that drives climate is Earth's rotation. As a result of the way the Earth revolves about the sun and rotates on its axis, the low latitudes or tropics receive more solar radiation than do middle and higher latitudes. Only about 40% of solar energy is received above the poles compared to the equator. To balance this energy, there is a large-scale transfer of heat to the poles, which is accomplished through atmospheric and oceanic circulation. The frictional effects of the rotating Earth's surface on air flow cause the circulations to be relatively complex. Nevertheless, the solar energy and atmospheric and oceanic circulations are distributed over the Earth in an organized manner.

¹⁷⁹ Buchdahl, 2002

¹⁸⁰ Buchdahl, 2002

These controls produce recognizable world patterns of temperature and precipitation, the two most important climatic elements.¹⁸¹

The third element is the balance among energy fluxes. Despite the complexity of the climate, the essentials are simple and can be easily understood with basic knowledge of stocks and flows. In this sense, the Earth receives a continuous influx of energy from the Sun. Some of this energy is absorbed at the Earth's surface or by the atmosphere, while some is reflected back to space. At the same time, the Earth and its atmosphere emit energy to space, resulting in an approximate balance between energy received and energy lost.¹⁸² The warmer the Earth, the greater the flow of energy radiated back into space. Incoming solar energy heats the earth until it is just warm enough for the energy radiated back to space to balance the solar energy input. The amount of energy radiated back into space depends on the composition of the atmosphere.¹⁸³

3.2 ATMOSPHERE AND THE GREENHOUSE-GAS EFFECT: CLIMATE CHANGE

The atmosphere is a mixture of different gases and aerosols (suspended liquid and solid particles). The two most abundant gases are nitrogen (78% by volume) and oxygen (21% by volume). However, it is the so-called greenhouse gases (GHG), despite their relative scarcity, that play a more determinant role in the regulation of the atmosphere's energy budget. These include carbon dioxide (364 parts per million volume-PPMV), methane (1720 parts per billion volume-PPBV) and nitrous oxide. In addition, water vapor makes up about 2% of the global atmosphere, and is itself the most important of the natural

¹⁸¹ Bailey, 1998

¹⁸² Jacobs, 2005

¹⁸³ Sterman and Sweeney, 2002

greenhouse gases.¹⁸⁴ The following table shows the natural and the synthetic GHGs, as well as the type of products in which can be found.

Table 3. Greenhouse Gases, Sources and Warming Potential¹⁸⁵

	Gases	Fuentes	Potencial de Calentamiento
Gases de origen natural	Bióxido de carbono (CO₂)	Quema de combustibles fósiles (carbón, derivados de petróleo y gas), reacciones químicas en procesos de manufactura; (como la producción de cemento y acero) cambio de uso de suelo (deforestación).	1
	Metano (CH₄)	Descomposición anaerobia (cultivo de arroz, rellenos sanitarios, estiércol), escape de gas en minas y pozos petroleros.	21
	Óxido nitroso (N₂O)	Producción y uso de fertilizantes nitrogenados, quema de combustibles fósiles.	310
Gases antropogénicos	Hidrofluorocarbonos (HFCs)	Emitidos en procesos de manufactura y usados como refrigerantes.	140-11,700
	Perfluorocarbonos (PFCs)	Emitidos en procesos de manufactura y usados como refrigerantes.	6,500-9,200
	Hexafluoruro de Azufre (SF₆)	Emitido en procesos de manufactura donde se usa como fluido dieléctrico.	23,900

It is worth to note that these gases account with different warming potential. Although CO₂ has the minimum warming potential, it is the most abundant. In the contrary, SF₆ is scarce, but one unit would warm 23,900 times what one unit of CO₂. GHGs are very efficient at absorbing the longer wavelengths of infrared radiation emitted by the Earth and kept in the atmosphere. Trapping of heat by these gases controls the Earth's surface temperature, despite their presence in only small concentrations in the atmosphere. Certain atmospheric gases absorb radiation at some wavelengths but allow radiation at other wavelengths to pass

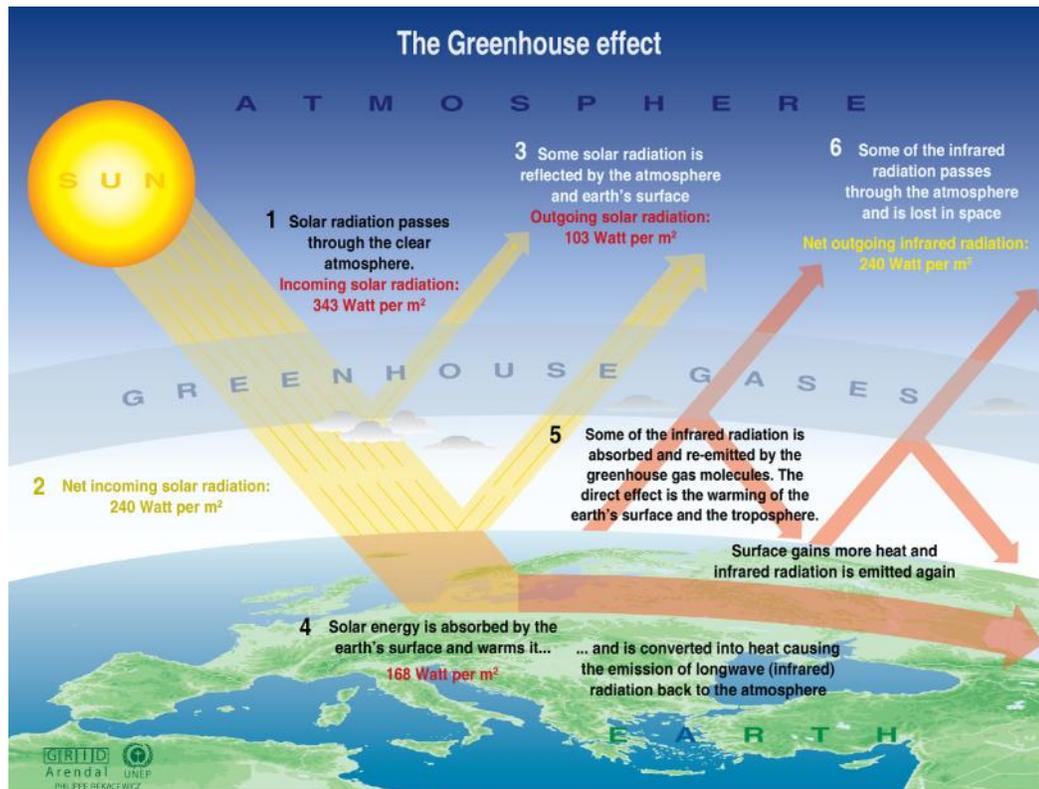
¹⁸⁴ Buchdahl, 2002. Water vapor, the most abundant greenhouse gas, is thought to increase in concentration in response to increased concentrations of the other greenhouse gases as a result of feedbacks in the climate system. See Jacob, 2005. However, water vapor was not included into the 6 GHGs dealt with in the UNFCCC, due to the fact that it is not a pollutant gas and to the difficulty to address the responsibility for its emission (that can be natural or human).

¹⁸⁵ Instituto Nacional de Ecología, 2011

through unimpeded. The atmosphere is mostly transparent (little absorption) in the visible part of the spectrum, but significant absorption of solar ultra-violet radiation by ozone, and terrestrial infra-red radiation by water vapor, carbon dioxide and other trace gases occurs.¹⁸⁶

The absorption of terrestrial infra-red radiation is particularly important to the energy budget of the Earth's atmosphere. Such absorption by the GHGs heats the atmosphere, and so the Earth stores more energy near its surface than it would if there was no atmosphere. Consequently the temperature is higher by about 33° C. This process is popularly known as the greenhouse effect. Glass in a greenhouse is transparent to solar radiation, but opaque to terrestrial infra-red radiation. The glass acts like some of the atmospheric gases and absorbs the outgoing energy. Much of this energy is then re-emitted back into the greenhouse causing the temperature inside to rise, as shown in the image below.

¹⁸⁶ Buchdahl, 2002

Figure 2. The Greenhouse-gas Effect¹⁸⁷

Thus an increase in GHGs causes the earth to warm. Naturally occurring greenhouse gases—including water vapor—reduce the emissivity of the atmosphere enough to warm the surface of the earth (including the oceans) to a life-sustaining average of about 15°C (59°F). Without GHGs in the atmosphere, global temperature would be about -17°C (0°F) and a blanket of ice would perpetually cover the Earth.¹⁸⁸

3.3 CLIMATE CHANGE AND CLIMATE VARIABILITY

Both natural and anthropogenic forcings play a role in explaining the overall global warming of the last 150 years. This must be kept in mind when trying to project future

¹⁸⁷ United Nations Environmental Program and GRID-Arendal, 2002

¹⁸⁸ Sterman and Sweeney, 2002

climate changes resulting from human activities. They need to be set in the context of what has happened in the past. In a century-basis scale, changes in solar irradiance have played an important role in the temperature variations of pre-industrial times. They have the potential to account for climates as cold as the Little Ice Age or as warm as the Medieval epoch.¹⁸⁹

However, the relatively short instrumental record of climate clearly does not represent a steady background against which future variations can be gauged. Human-induced change will be difficult to assess unless the long-term natural variability of the climate system can be characterized. Natural variations with time scales of decades to centuries may well be masking anthropogenic climate changes that have already been in place—and will continue to do so. We must be able to recognize natural variability and its results if we are to make reasoned estimates as to whether a particular climate perturbation or trend is likely to have been induced by human activities, or simply represents a natural variation.¹⁹⁰ Whatever anthropogenic effects there are on climate in the future, they will be superimposed on the underlying background of “natural” climate variability which varies on all timescales in response to different forcing factors.¹⁹¹

Although a few instrumental meteorological measurements can be traced back to the 17th century, no extensive network of data exists prior to the mid-19th century. The record of large-scale (hemispheric or global) temperature extends back only 150 years. Even the longest instrumental records barely cover 300 years.¹⁹² Hence, although we may have a 300 year record of climate at a few specific locations, we have only approximately 150 year

¹⁸⁹ Bertrand, 2002

¹⁹⁰ Climate Research Committee, 1995

¹⁹¹ Bradley, 2000

¹⁹² Bradley, 2000

perspective on the spatial-temporal variability of the Earth's climate system as a whole. Unfortunately, the time for which we have detailed instrumental records happens to coincide with the time when human activities have increasingly polluted the atmosphere on a global scale. If we want to understand the relationship between any underlying “natural forcing” and climate variability we must probe further back in time, and for this we must rely on paleoclimate archives (called climate proxies).¹⁹³

The identification of the characteristics of climate variability involves several issues. Differentiating climate "change" from climate "variability" is a matter of the time scale. What appears to be a trend, in a single decade's recording, may reveal itself as fluctuating variability over a period of a century. The Dust Bowl period in the central United States in the 1930s represents a short, decadal-scale natural variation in climate for a specific region. In contrast, the "little ice age", which lasted from the 1400s to the 1800s, represents a variation on a time scale of centuries.

An additional difficulty in assessing variability is that change and variation are often characterized by strong spatial dependency. That is, while some region or regions of the earth may be experiencing significant climate variation over a given period, other regions may show virtually no change. Similarly, a specific variable (e.g., global temperature) may show a marked change between decades, while another (e.g., global pressure fields) may not show any significant difference. Where and how climate is measured can influence the findings and conclusions.¹⁹⁴

¹⁹³ Bradley, 2000

¹⁹⁴ Jacob, 2005

3.4 THE ANTHROPOGENIC FACTOR IN CLIMATE CHANGE

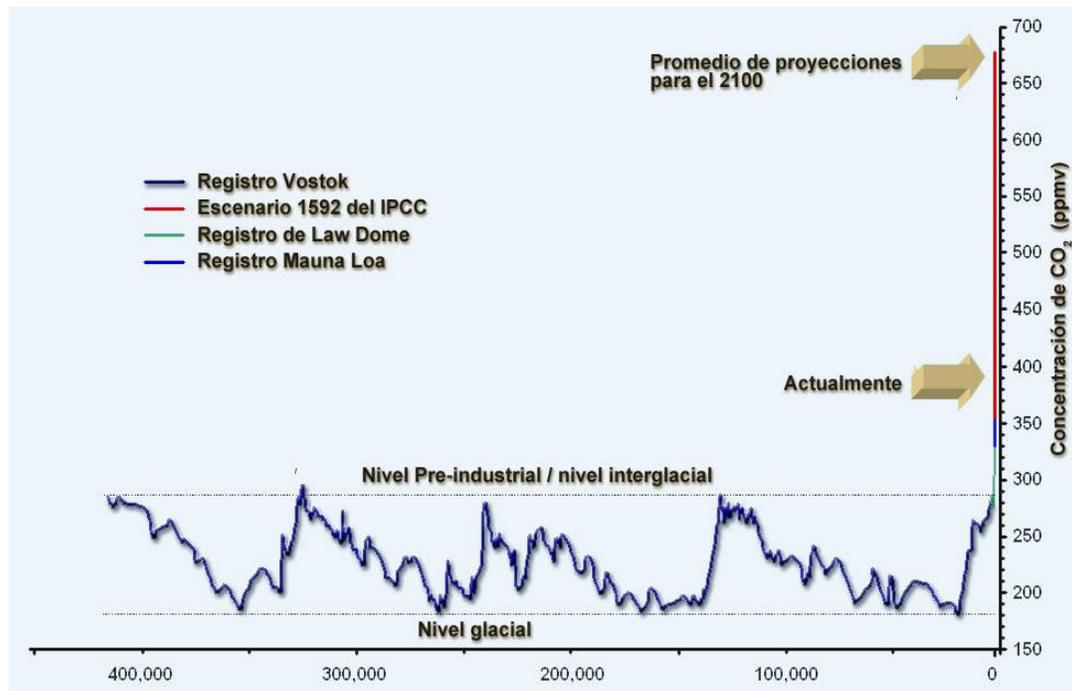
Natural biogeochemical processes have caused the concentration of carbon dioxide in the atmosphere to fluctuate over geological time, and surface temperatures have fluctuated with it. Human activity has now reached a scale where it affects these processes significantly. Anthropogenic GHG emissions have been growing exponentially since the beginning of the industrial age.

Industrial revolution in the 19th Century has allowed human population to grow from 1 billion people worldwide in 1800, to 2 billion people in 1930 and to almost 7 billion in 2011.¹⁹⁵ This has created the need for more production of goods and services with the consequent exploitation of natural resources and raw materials. Toxic substances are being poured into water streams; forests have been decimated all over the world and with them the services they provide; the extensive use of fossil fuels and the synthetic gases have produced an increase in the atmospheric concentration of GHGs.

Concentrations of CO₂ and other GHGs including nitrous oxide (NO₂), methane (CH₄), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorinated carbons (PFCs), and others have been growing exponentially. For 420,000 years of history, the preindustrial atmospheric CO₂ concentration was about 280ppm; today it is almost 450ppm and rising.¹⁹⁶

¹⁹⁵ United Nations Population Division, 2011

¹⁹⁶ International Energy Agency, 2010

Figure 3. Concentration of CO₂ in time¹⁹⁷

Concentrations of other important GHGs are also rising; for example, NO₂, and CH₄ concentrations are up by 17% and 151%, respectively, since 1750. Current greenhouse gas concentrations contribute about 2.4 watts per square meter of net radiative forcing, that is, incoming solar radiation exceeds outgoing radiation by 2.4watts/m². Consequently, mean global surface temperature has been rising.¹⁹⁸

Several scholars have concluded that the rise in temperature during the 20th century (particularly the late 20th century) is unprecedented, and the spatial pattern of warming cannot be explained by natural forcing alone; GHGs provide the necessary additional forcing to account for the recent changes in temperature.¹⁹⁹ Climate simulations have indeed shown that accounting for human activities, that modify the atmospheric

¹⁹⁷ Environmental Protection Agency, 2011

¹⁹⁸ Sterman and Sweeney, 2002; IPCC 2007

¹⁹⁹ Battarbee, 2008; Crowley 2000; IPCC, 2007

concentration of greenhouse gases (GHG) and of tropospheric sulphates, increases the models' ability to simulate the spatial and temporal pattern of the historical temperature record.²⁰⁰

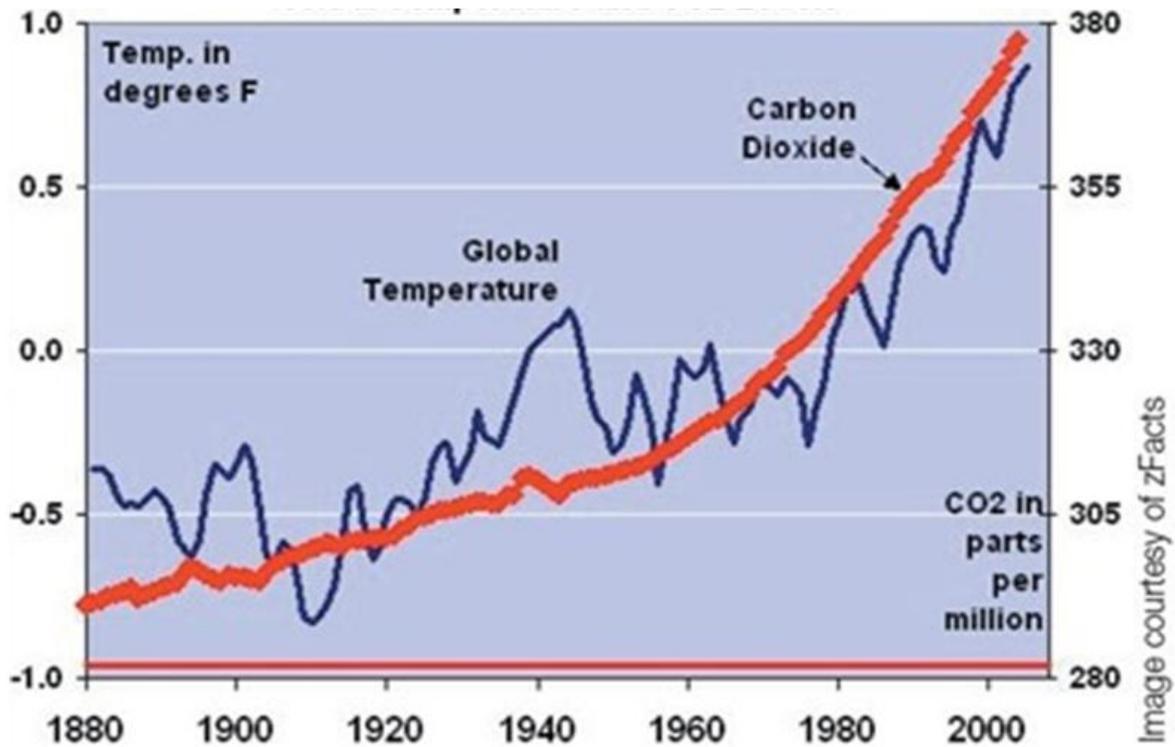
Today there is no doubt that the composition of the atmosphere and the reactions between the atmospheric chemical constituents are changing as a result of human activity. We have been burning organic carbon stored in the biosphere as coal and oil, which was deposited in past geologic times. As a consequence, the atmospheric concentration of CO₂ has been rising; basically because the rate of combustion of fossil carbon is higher than the rate of absorption by other compartments of the Earth's biogeochemical system.²⁰¹

Placing the short instrumental record of climate into a longer-term we can see that numerous paleotemperature records reveal that the 20th century has been exceptionally warm in the context of the last millennium, and perhaps many millennia. Furthermore, the coldest decades of the last century were among the coldest times in the late Holocene period (which is the contemporary one). Thus, the world has experienced both the warmest and the coldest extremes of the late Holocene within a brief interval of less than 200 years.²⁰²

²⁰⁰ Bertrand, 2002

²⁰¹ Schlesinger, 2000

²⁰² Bradley, 2000

Figure 4. Global Temperature and CO2 Levels²⁰³

As shown in the figure below, when overlapping the rate of CO2 emissions with the temperature, the data coincides and presents increases since the 20th Century. This overlapping has been the main argument for establishing climate change global governance and institutions such as the United Nations Framework Convention on Climate Change in 1992.

²⁰³ Environmental Protection Agency, 2011